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SERVOPACK Model: SGD7S Option Module Model: SGDV-OCA03A

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About this Manual

This manual provides information required to select Σ -7S Command Option Attachable-Type SERVOPACKs with INDEXER Modules for Σ -7-Series AC Servo Drives, and to design, perform trial operation of, tune, operate, and maintain the Servo Drives.

Read and understand this manual to ensure correct usage of the Σ -7-Series AC Servo Drives.

Keep this manual in a safe place so that it can be referred to whenever necessary.

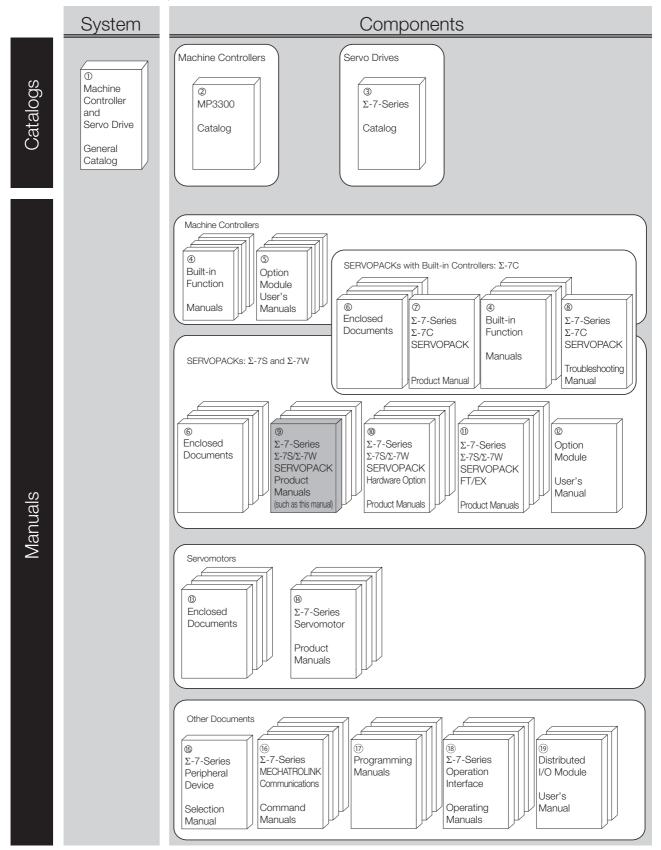
Outline of Manual

The contents of the chapters of this manual are described in the following table. Refer to these chapters as required.

Chapter	Chapter Title	Contents
1	Basic Information	Provides basic information, including an introduction to the INDEXER Module, the names of parts, and combinations with Servomotors.
2	Selecting a SERVOPACK	Provides information required to select SERVOPACKs, such as specifi- cations, block diagrams, dimensional drawings, and connection exam- ples.
3	Installation	Provides information on installing SERVOPACKs and INDEXER Modules in the required locations.
4	Wiring and Connecting	Provides information on wiring and connecting SERVOPACKs and INDEXER Modules to power supplies and peripheral devices.
5	Basic Functions That Require Setting before Operation	Describes the basic functions that must be set before you start servo system operation. It also describes the setting methods.
6	Application Functions	Describes the application functions that you can set before you start servo system operation. It also describes the setting methods.
7	Trial Operation	Provides information on the flow and procedures for trial operation and convenient functions to use during trial operation.
8	Tuning	Provides information on the flow of tuning, details on tuning functions, and related operating procedures.
9	Monitoring	Provides information on monitoring SERVOPACK product information and SERVOPACK status.
10	Fully-Closed Loop Control	Provides detailed information on performing fully-closed loop control with the SERVOPACK.
11	Safety Functions	Provides detailed information on the safety functions of the SERVO- PACK.
12	Settings for the INDEXER Module	Provides detailed information on movement methods and coordinate settings, reference settings, and origin settings.
13	Operation with Digital I/O	Provides detailed information on homing, positioning with a program table, registration, constant speed operation with a jog speed table, and ZONE outputs.
14	Operation with Serial Command Communications	Provides information on using serial commands to operate the INDEXER Module.
15	Maintenance	Provides information on the meaning of, causes of, and corrections for alarms and warnings.
16	Parameter Lists	Provides information on the parameters.
17	Appendices	The appendix provides information on compatibility between SERVO- PACK functions and SigmaWin+ functions, Digital Operator proce- dures, an alphabetized list of serial commands, and a table of corresponding parameter numbers.

Related Documents

The relationships between the documents that are related to the Servo Drives are shown in the following figure. The numbers in the figure correspond to the numbers in the table on the following pages. Refer to these documents as required.



Classification	Document Name	Document No.	Description
① Machine Controller and Servo Drive General Catalog	Machine Controller and AC Servo Drive Solutions Catalog	KAEP S800001 22	Describes the features and applica- tion examples for combinations of MP3000-Series Machine Control- lers and Σ -7-Series AC Servo Drives.
② MP3300 Catalog	Machine Controller MP3300	KAEP C880725 03	Provides detailed information on MP3300 Machine Controllers, including features and specifica- tions.
③ Σ-7-Series Catalog	AC Servo Drives Σ -7 Series	KAEP S800001 23	Provides detailed information on Σ - 7-Series AC Servo Drives, including features and specifications.
	Σ-7-Series AC Servo Drive Σ-7C SERVOPACK Motion Control User's Manual	SIEP S800002 03	Provides detailed information on the specifications, system configu- ration, and application methods of the Motion Control Function Mod- ules (SVD, SVC4, and SVR4) for Σ - 7-Series Σ -7C SERVOPACKs.
④ Built-in Function Manuals	Machine Controller MP3000 Series Communications User's Manual	SIEP C880725 12	Provides detailed information on the specifications, system configu- ration, and communications con- nection methods for the Ethernet communications that are used with MP3000-Series Machine Control- lers and Σ -7-Series Σ -7C SERVO- PACKs.
	Machine Controller MP2000 Series Communication Module User's Manual	SIEP C880700 04	
© Option Module User's Manuals	Machine Controller MP2000 Series 262IF-01 FL-net Communication Module User's Manual	SIEP C880700 36	Provide detailed information on th specifications and communica- tions methods for the Communica tions Modules that can be mounte to MP3000-Series Machine Con- trollers and Σ-7-Series Σ-7C
	Machine Controller MP2000 Series 263IF-01 EtherNet/IP Communication Module User's Manual	SIEP C880700 39	SERVOPACKs.
	Machine Controller MP2000 Series I/O Module User's Manual	SIEP C880700 34	
	Machine Controller MP2000 Series Analog Input/Analog Output Module AI-01/AO-01 User's Manual	SIEP C880700 26	Provide detailed information on the specifications and communica- tions methods for the I/O Modules that can be mounted to MP3000- Series Machine Controllers and Σ - 7-Series Σ -7C SERVOPACKs.
	Machine Controller MP2000 Series Counter Module CNTR-01 User's Manual	SIEP C880700 27	Continued on next page

Classification	Document Name	Document No.	Description
	Σ -7-Series AC Servo Drive Σ -7S, Σ -7W, and Σ -7C SERVOPACK Safety Precautions	TOMP C710828 00	Provides detailed information for the safe usage of Σ -7-Series SERVOPACKs.
	$\begin{array}{l} \Sigma \text{-V-Series} / \Sigma \text{-V-Series} \\ \text{for Large-Capacity Models} / \\ \Sigma \text{-7-Series} \\ \text{Safety Precautions} \\ \text{Option Module} \end{array}$	TOBP C720829 00	Provides detailed information for the safe usage of Option Modules.
	$\begin{array}{l} \Sigma \text{-V-Series} / \Sigma \text{-V-Series} \\ \text{for Large-Capacity Models} / \\ \Sigma \text{-7-Series} \\ \text{Installation Guide} \\ \text{Command Option Module} \end{array}$	TOBP C720829 01	Provides detailed procedures for installing the Command Option Module in a SERVOPACK.
© Enclosed Documents	$\begin{array}{l} \Sigma \text{-V-Series} / \Sigma \text{-V-Series} \\ \text{for Large-Capacity Models} / \\ \Sigma \text{-7-Series} \\ \text{Installation Guide} \\ \text{Fully-closed Module} \end{array}$	TOBP C720829 03	Provides detailed procedures for installing the Fully-closed Module in a SERVOPACK.
	$\begin{array}{l} \Sigma \text{-V-Series}/\Sigma \text{-V-Series} \\ \text{for Large-Capacity Models}/\\ \Sigma \text{-7-Series} \\ \text{Installation Guide} \\ \text{Safety Module} \end{array}$	TOBP C720829 06	Provides detailed procedures for installing the Safety Module in a SERVOPACK.
	$\begin{array}{l} \Sigma \text{-V-Series} / \Sigma \text{-V-Series} \\ \text{for Large-Capacity Models} / \\ \Sigma \text{-7-Series} \\ \text{Installation Guide} \\ \text{INDEXER Module} \end{array}$	TOBP C720829 02	Provides detailed procedures for installing the INDEXER Module in a SERVOPACK.
	$\begin{array}{l} \Sigma \text{-V-Series}/\Sigma \text{-V-Series} \\ \text{for Large-Capacity Models}/\\ \Sigma \text{-7-Series} \\ \text{Installation Guide} \\ \text{DeviceNet Module} \end{array}$	TOBP C720829 07	Provides detailed procedures for installing the DeviceNet Module in a SERVOPACK.
 Σ-7-Series Σ-7C SERVOPACK Product Manual 	Σ-7-Series AC Servo Drive Σ-7C SERVOPACK Product Manual	SIEP S800002 04	Provides detailed information on selecting Σ -7-Series Σ -7C SERVO-PACKs; installing, connecting, setting, testing in trial operation, and tuning Servo Drives; writing, monitoring, and maintaining programs; and other information.
 [®] Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual 	Σ-7-Series AC Servo Drive Σ-7C SERVOPACK Troubleshooting Manual	SIEP S800002 07	Provides detailed troubleshooting information for Σ -7-Series Σ -7C SERVOPACKs.

			Continued from previous page.
Classification	Document Name	Document No.	Description
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with MECHATROLINK-4 Communications References Product Manual	SIEP S800002 31	
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with MECHATROLINK-III Communications References Product Manual	SIEP S800001 28	
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with MECHATROLINK-II Communications References Product Manual	SIEP S800001 27	Provide detailed information on
9 Σ-7-Series Σ-7S/Σ-7W SERVOPACK Product Manuals	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with Analog Voltage/Pulse Train References Product Manual	SIEP S800001 26	selecting Σ -7-Series Σ -7S and Σ -7W SERVOPACKs; installing, connecting, setting, testing in trial operation, tuning, monitoring, and maintaining Servo Drives; and other information.
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK Command Option Attachable Type with INDEXER Module Product Manual	This manual (SIEP S800001 64)	
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK Command Option Attachable Type with DeviceNet Module Product Manual	SIEP S800001 70	
	Σ -7-Series AC Servo Drive Σ -7W SERVOPACK with MECHATROLINK-III Communications References Product Manual	SIEP S800001 29	
0 Σ -7-Series Σ -7S/ Σ -7W SERVOPACK with Hardware Option Specifications Product Manuals	 Σ-7-Series AC Servo Drive Σ-7S/Σ-7W SERVOPACK with Hardware Option Specifica- tions Dynamic Brake Product Manual 	SIEP S800001 73	Provide detailed information on
	Σ -7-Series AC Servo Drive Σ -7W/ Σ -7C SERVOPACK with Hardware Option Specifica- tions HWBB Function Product Manual	SIEP S800001 72	Hardware Options for Σ-7-Series SERVOPACKs.

Classification	Document Name	Document No.	Continued from previous page.
Classification	Document Name	Document No.	Description
© Σ-7-Series Σ-7S/Σ-7W SERVOPACK FT/EX Product Manuals	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with FT/EX Specification for Index- ing Application Product Manual	SIEP S800001 84	
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with FT/EX Specification for Track- ing Application Product Manual	SIEP S800001 89	
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with FT/EX Specification for Application with Special Motor, SGM7D Motor Product Manual	SIEP S800001 91	
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with FT/EX Specification for Press and Injection Molding Application Product Manual	SIEP S800001 94	
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with FT/EX Specification for Transfer and Alignment Application Product Manual	SIEP S800001 95	Provide detailed information on th - FT/EX Option for Σ-7-Series
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with FT/EX Specification for Torque/Force Assistance for Conveyance Application Product Manual	SIEP S800002 09	SERVOPACKs.
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with FT/EX Specification for Cutting Application Feed Shaft Motor Product Manual	SIEP S800002 10	
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with Three-Point Latching for Conveyance Application Product Manual	SIEP S800002 17	
	Σ -7-Series AC Servo Drive Σ -7S SERVOPACK with FT/EX Specification for Semi-/Fully-Closed Loop Control Online Switching for Conveyance Application Product Manual	SIEP S800002 27	
	Σ -7-Series AC Servo Drive Σ -7W SERVOPACK with FT/EX Specification for Gantry Applications Product Manual	SIEP S800002 29	Continued on part page

			Continued from previous page.
Classification	Document Name	Document No.	Description
® Option Module User's Manual	AC Servo Drives Σ -V Series/ Σ -V Series for Large-Capacity Models/ Σ -7 Series User's Manual Safety Module	$ \begin{array}{l} \Sigma \text{-V Series} \\ \text{for Large-Capacity Models/} \\ \Sigma \text{-7 Series} \\ \text{User's Manual} \end{array} \text{SIEP C720829 06} \\ \end{array} $	
0	AC Servo Drive Rotary Servomotor Safety Precautions	TOBP C230260 00	Provides detailed information for the safe usage of Rotary Servomo- tors and Direct Drive Servomotors.
Enclosed Documents	AC Servomotor Linear Σ Series Safety Precautions	TOBP C230800 00	Provides detailed information for the safe usage of Linear Servomotors.
	Σ-7-Series AC Servo Drive Rotary Servomotor Product Manual	SIEP S800001 36	
[®] Σ-7-Series Servomotor Product Manuals	Σ-7-Series AC Servo Drive Linear Servomotor Product Manual	SIEP S800001 37	Provide detailed information on selecting, installing, and connecting the Σ -7-Series Servomotors.
FIGULET Manuals	Σ-7-Series AC Servo Drive Direct Drive Servomotor Product Manual	SIEP S800001 38	-
© Σ-7-Series Peripheral Device Selection Manual	Σ-7-Series AC Servo Drive Peripheral Device Selection Manual	SIEP S800001 32	 Provides the following information in detail for Σ-7-Series Servo Sys- tems. Cables: Models, dimensions, wir- ing materials, connector models, and connection specifications Peripheral devices: Models, specifications, diagrams, and selection (calculation) methods
[®] Σ-7-Series MECHATROLINK Communications Command Manuals	Σ-7-Series AC Servo Drive MECHATROLINK-II Communications Command Manual	SIEP S800001 30	Provides detailed information on the MECHATROLINK-II communi- cations commands that are used for a Σ -7-Series Servo System.
	Σ-7-Series AC Servo Drive MECHATROLINK-III Communications Standard Servo Profile Command Manual	SIEP S800001 31	Provides detailed information on the MECHATROLINK-III communi- cations standard servo profile com- mands that are used for a Σ -7- Series Servo System.
	Σ-7-Series AC Servo Drive MECHATROLINK-4 Communications Standard Servo Profile Command Manual	SIEP S800002 32	Provides detailed information on the MECHATROLINK-4 communi- cations standard servo profile com- mands that are used for a Σ -7- Series Servo System.
[®] Programming Manuals	Machine Controller MP3000 Series Ladder Programming Manual	SIEP C880725 13	Provides detailed information on the ladder programming specifica- tions and instructions for MP3000- Series Machine Controllers and Σ -7-Series Σ -7C SERVOPACKs.
	Machine Controller MP3000 Series Motion Programming Manual	SIEP C880725 14	Provides detailed information on the motion programming and sequence programming specifica- tions and instructions for MP3000- Series Machine Controllers and Σ -7-Series Σ -7C SERVOPACKs.

Classification	Document Name Document No.		Description
$^{(i)}$ Σ -7-Series Operation Interface Operating Manuals	System Integrated Engineering Tool MPE720 Version 7 User's Manual	SIEP C880761 03	Describes in detail how to operate MPE720 version 7.
	Σ-7-Series AC Servo Drive Digital Operator Operating Manual	SIEP S800001 33	Describes the operating proce- dures for a Digital Operator for a Σ -7-Series Servo System.
	AC Servo Drive Engineering Tool SigmaWin+ Operation Manual	SIET S800001 34	Provides detailed operating proce- dures for the SigmaWin+ Engineer- ing Tool for a Σ -7-Series Servo System.
(9) Distributed I/O Module User's Manual	MECHATROLINK-III Compatible I/O Module User's Manual	SIEP C880781 04	Describes the functions, specifica- tions, operating methods, and MECHATROLINK-III communica- tions for the Remote I/O Modules for MP2000/MP3000-Series Machine Controllers.
	MECHATROLINK-4 Compatible I/O Module User's Manual	SIEP C880782 01	Describes the functions, specifica- tions, operating methods, and MECHATROLINK-4 communica- tions for the Remote I/O Modules for MP3000-Series Machine Con- trollers.

Using This Manual

◆ Technical Terms Used in This Manual

The following terms are used in this manual.

Term	Meaning
Servomotor	A Σ-7-Series Rotary Servomotor, Direct Drive Servomotor, or Linear Servomotor.
Rotary Servomotor	A generic term used for a Σ -7-Series Rotary Servomotor (SGM7M, SGM7J, SGM7A, SGM7P, SGM7G, or SGMMV) or a Direct Drive Servomotor (SGM7E, SGM7F, SGMCV, or SGMCS). The descriptions will specify when Direct Drive Servomotors are excluded.
Linear Servomotor	A Σ-7-Series Linear Servomotor (SGLG, SGLF, or SGLT).
SERVOPACK	A Σ -7-Series Σ -7S Command Option Module Attachable-Type Servo Amplifier.
Servo Drive	The combination of a Servomotor and SERVOPACK.
Servo System	A servo control system that includes the combination of a Servo Drive with a host controller and peripheral devices.
servo ON	Supplying power to the motor.
servo OFF	Not supplying power to the motor.
base block (BB)	Shutting OFF the power supply to the motor by shutting OFF the base current to the power transistor in the SERVOPACK.
servo lock	A state in which the motor is stopped and is in a position loop with a position reference of 0.
Main Circuit Cable	One of the cables that connect to the main circuit terminals, including the Main Circuit Power Supply Cable, Control Power Supply Cable, and Servomotor Main Circuit Cable.
SigmaWin+	The Engineering Tool for setting up and tuning Servo Drives or a computer in which the Engineering Tool is installed.

◆ Differences in Terms for Rotary Servomotors and Linear Servomotors

There are differences in the terms that are used for Rotary Servomotors and Linear Servomotors. This manual primarily describes Rotary Servomotors. If you are using a Linear Servomotor, you need to interpret the terms as given in the following table.

Rotary Servomotors	Linear Servomotors
torque	force
moment of inertia	mass
rotation	movement
forward rotation and reverse rotation	forward movement and reverse movement
CW and CCW pulse trains	forward and reverse pulse trains
rotary encoder	linear encoder
absolute rotary encoder	absolute linear encoder
incremental rotary encoder	incremental linear encoder
unit: min ⁻¹	unit: mm/s
unit: N·m	unit: N

Notation Used in this Manual

Notation for Reverse Signals

The names of reverse signals (i.e., ones that are valid when low) are written with a forward slash (/) before the signal abbreviation.

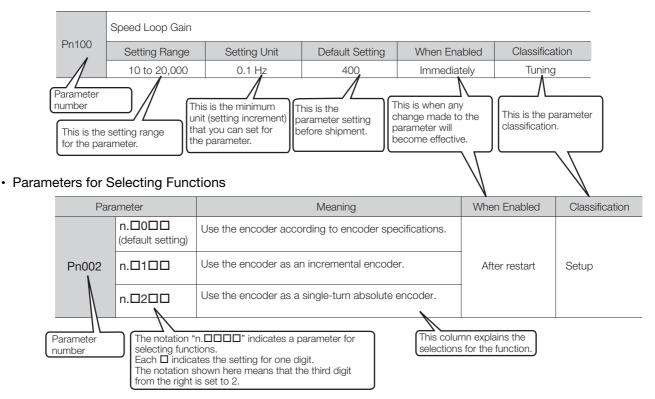
Notation Example

BK is written as /BK.

Notation for Parameters

The notation depends on whether the parameter requires a numeric setting (parameter for numeric setting) or requires the selection of a function (parameter for selecting functions).

Parameters for Numeric Settings







	Digit Notation		Numeric Value Notation	
n.0000	Notation	Meaning	Notation	Meaning
	Pn002 = n.□□□X	Indicates the first digit from the right in Pn002.	Pn002 = n.□□□1	Indicates that the first digit from the right in Pn002 is set to 1.
	Pn002 = n.□□X□	Indicates the second digit from the right in Pn002.	Pn002 = n.□□1□	Indicates that the second digit from the right in Pn002 is set to 1.
	Pn002 = n.□X□□	Indicates the third digit from the right in Pn002.	Pn002 = n.⊡1⊡⊡	Indicates that the third digit from the right in Pn002 is set to 1.
	Pn002 = n.X□□□	Indicates the fourth digit from the right in Pn002.	Pn002 = n.1□□□	Indicates that the fourth digit from the right in Pn002 is set to 1.

Engineering Tools Used in This Manual

This manual uses the interfaces of the SigmaWin+ for descriptions.

♦ Trademarks

- QR code is a trademark of Denso Wave Inc.
- Other product names and company names are the trademarks or registered trademarks of the respective company. "TM" and the ® mark do not appear with product or company names in this manual.

Visual Aids

The following aids are used to indicate certain types of information for easier reference.

Ĩ
Important

Indicates precautions or restrictions that must be observed. Also indicates alarm displays and other precautions that will not result in machine damage.



Indicates definitions of difficult terms or terms that have not been previously explained in this manual.

Example Indicates operating or setting examples.

Information Indicates supplemental information to deepen understanding or useful information.

Safety Precautions

♦ Safety Information

To prevent personal injury and equipment damage in advance, the following signal words are used to indicate safety precautions in this document. The signal words are used to classify the hazards and the degree of damage or injury that may occur if a product is used incorrectly. Information marked as shown below is important for safety. Always read this information and heed the precautions that are provided.

• Indicates precautions that, if not heeded, are likely to result in loss of life, serious injury, or fire.

• Indicates precautions that, if not heeded, could result in loss of life, serious injury, or fire.

• Indicates precautions that, if not heeded, could result in relatively serious or minor injury, or in fire.

NOTICE

• Indicates precautions that, if not heeded, could result in property damage.

◆ Safety Precautions That Must Always Be Observed

General Precautions

- Read and understand this manual to ensure the safe usage of the product.
- Keep this manual in a safe, convenient place so that it can be referred to whenever necessary. Make sure that it is delivered to the final user of the product.
- Do not remove covers, cables, connectors, or optional devices while power is being supplied to the SERVOPACK.

There is a risk of electric shock, operational failure of the product, or burning.

- Use a power supply with specifications (number of phases, voltage, frequency, and AC/DC type) that are appropriate for the product. There is a risk of burning, electric shock, or fire.
- Connect the ground terminals on the SERVOPACK and Servomotor to ground poles according to local electrical codes (100 Ω or less for a SERVOPACK with a 100-VAC or 200-VAC power supply, and 10 Ω or less for a SERVOPACK with a 400-VAC power supply). There is a risk of electric shock or fire.
- Do not attempt to disassemble, repair, or modify the product. There is a risk of fire or failure. The warranty is void for the product if you disassemble, repair, or modify it.

- The SERVOPACK heat sinks, regenerative resistors, External Dynamic Brake Resistors, Servomotors, and other components can be very hot while power is ON or soon after the power is turned OFF. Implement safety measures, such as installing covers, so that hands and parts such as cables do not come into contact with hot components. There is a risk of burn injury.
- For a 24-VDC power supply, use a power supply device with double insulation or reinforced insulation.

There is a risk of electric shock.

- Do not damage, pull on, apply excessive force to, place heavy objects on, or pinch cables. There is a risk of failure, damage, or electric shock.
- The person who designs the system that uses the hard wire base block safety function must have a complete knowledge of the related safety standards and a complete understanding of the instructions in this document.
- There is a risk of injury, product damage, or machine damage.
- Do not use the product in an environment that is subject to water, corrosive gases, or flammable gases, or near flammable materials. There is a risk of electric shock or fire.

NOTICE

- Do not attempt to use a SERVOPACK or Servomotor that is damaged or that has missing parts.
- Install external emergency stop circuits that shut OFF the power supply and stops operation immediately when an error occurs.
- In locations with poor power supply conditions, install the necessary protective devices (such as AC reactors) to ensure that the input power is supplied within the specified voltage range. There is a risk of damage to the SERVOPACK.
- Use a Noise Filter to minimize the effects of electromagnetic interference. Electronic devices used near the SERVOPACK may be affected by electromagnetic interference.
- Always use a Servomotor and SERVOPACK in one of the specified combinations.
- Do not touch a SERVOPACK or Servomotor with wet hands. There is a risk of product failure.

Storage Precautions

• Do not place an excessive load on the product during storage. (Follow all instructions on the packages.)

There is a risk of injury or damage.

NOTICE

- Do not install or store the product in any of the following locations.
 - Locations that are subject to direct sunlight
 - · Locations that are subject to ambient temperatures that exceed product specifications
 - Locations that are subject to relative humidities that exceed product specifications
 - · Locations that are subject to condensation as the result of extreme changes in temperature
 - · Locations that are subject to corrosive or flammable gases
 - · Locations that are near flammable materials
 - · Locations that are subject to dust, salts, or iron powder
 - Locations that are subject to water, oil, or chemicals
 - · Locations that are subject to vibration or shock that exceeds product specifications
 - Locations that are subject to radiation
 - If you store or install the product in any of the above locations, the product may fail or be damaged.

Transportation Precautions

- Transport the product in a way that is suitable to the mass of the product.
- Do not use the eyebolts on a SERVOPACK or Servomotor to move the machine. There is a risk of damage or injury.
- When you handle a SERVOPACK or Servomotor, be careful of sharp parts, such as the corners. There is a risk of injury.
- Do not place an excessive load on the product during transportation. (Follow all instructions on the packages.)

There is a risk of injury or damage.

NOTICE

- Do not hold onto the front cover or connectors when you move a SERVOPACK. There is a risk of the SERVOPACK falling.
- A SERVOPACK or Servomotor is a precision device. Do not drop it or subject it to strong shock. There is a risk of failure or damage.
- Do not subject connectors to shock. There is a risk of faulty connections or damage.
- If disinfectants or insecticides must be used to treat packing materials such as wooden frames, plywood, or pallets, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.

Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.

If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.

• Do not overtighten the eyebolts on a SERVOPACK or Servomotor. If you use a tool to overtighten the eyebolts, the tapped holes may be damaged.

Installation Precautions

 Install the Servomotor or SERVOPACK in a way that will support the mass given in technical documents.
 Install SERVOPACKs, Servomotors, regenerative resistors, and External Dynamic Brake Resistors on nonflammable materials. Installation directly onto or near flammable materials may result in fire.
 Provide the specified clearances between the SERVOPACK and the control panel as well as with other devices. There is a risk of fire or failure.
 Install the SERVOPACK in the specified orientation. There is a risk of fire or failure.
 Do not step on or place a heavy object on the product. There is a risk of failure, damage, or injury.
 Do not allow any foreign matter to enter the SERVOPACK or Servomotor. There is a risk of failure or fire.

NOTICE

- Do not install or store the product in any of the following locations.
 - Locations that are subject to direct sunlight
 - · Locations that are subject to ambient temperatures that exceed product specifications
 - Locations that are subject to relative humidities that exceed product specifications
 - · Locations that are subject to condensation as the result of extreme changes in temperature
 - · Locations that are subject to corrosive or flammable gases
 - · Locations that are near flammable materials
 - · Locations that are subject to dust, salts, or iron powder
 - Locations that are subject to water, oil, or chemicals
 - · Locations that are subject to vibration or shock that exceeds product specifications
 - Locations that are subject to radiation
 - If you store or install the product in any of the above locations, the product may fail or be damaged.
- Use the product in an environment that is appropriate for the product specifications. If you use the product in an environment that exceeds product specifications, the product may fail or be damaged.
- A SERVOPACK or Servomotor is a precision device. Do not drop it or subject it to strong shock. There is a risk of failure or damage.
- Always install a SERVOPACK in a control panel.
- Do not allow any foreign matter to enter a SERVOPACK or a Servomotor with a Cooling Fan and do not cover the outlet from the Servomotor's cooling fan. There is a risk of failure.

Wiring Precautions

• Do not change any wiring while power is being supplied. There is a risk of electric shock or injury.

- Wiring and inspections must be performed only by qualified engineers. There is a risk of electric shock or product failure.
- Check all wiring and power supplies carefully. Incorrect wiring or incorrect voltage application to the output circuits may cause short-circuit failures. If a short-circuit failure occurs as a result of any of these causes, the holding brake will not work. This could damage the machine or cause an accident that may result in death or injury.
- Connect the AC and DC power supplies to the specified SERVOPACK terminals.
 - Connect an AC power supply to the L1, L2, and L3 terminals and the L1C and L2C terminals on the SERVOPACK.
 - Connect a DC power supply to the B1/ \oplus and \ominus 2 terminals and the L1C and L2C terminals on the SERVOPACK.

There is a risk of failure or fire.

 If you use a SERVOPACK with the Dynamic Brake Hardware Option, connect an External Dynamic Brake Resistor that is suitable for the machine and equipment specifications to the specified terminals.

There is a risk of unexpected operation, machine damage, burning, or injury when an emergency stop is performed.

Wait for at least six minutes after turning OFF the power supply (with a SERVOPACK for a 100-VAC input, wait for at least nine minutes) and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the power supply terminals while the CHARGE lamp is lit after turning OFF the power supply because high voltage may still remain in the SERVOPACK. There is a risk of electric shock. Observe the precautions and instructions for wiring and trial operation precisely as described in this document. Failures caused by incorrect wiring or incorrect voltage application in the brake circuit may cause the SERVOPACK to fail, damage the equipment, or cause an accident resulting in death or injury. • Check the wiring to be sure it has been performed correctly. Connectors and pin layouts are sometimes different for different models. Always confirm the pin layouts in technical documents for your model before operation. There is a risk of failure or malfunction. Connect wires to power supply terminals and motor connection terminals securely with the specified methods and tightening torque. Insufficient tightening may cause wires and terminal blocks to generate heat due to faulty contact, possibly resulting in fire. • Use shielded twisted-pair cables or screened unshielded multi-twisted-pair cables for I/O Signal Cables and Encoder Cables. • The maximum wiring length is 3 m for I/O Signal Cables, and 50 m for Encoder Cables or Servomotor Main Circuit Cables. Observe the following precautions when wiring the SERVOPACK's main circuit terminals. • Turn ON the power supply to the SERVOPACK only after all wiring, including the main circuit terminals, has been completed. If a connector is used for the main circuit terminals, remove the main circuit connector from the SER-VOPACK before you wire it. • Insert only one wire per insertion hole in the main circuit terminals. When you insert a wire, make sure that the conductor wire (e.g., whiskers) does not come into contact with adjacent wires. Install molded-case circuit breakers and other safety measures to provide protection against short circuits in external wiring. There is a risk of fire or failure.

NOTICE

- Whenever possible, use the Cables specified by Yaskawa.
 If you use any other cables, confirm the rated current and application environment of your model and use the wiring materials specified by Yaskawa or equivalent materials.
- Securely tighten connector screws and lock mechanisms. Insufficient tightening may result in connectors falling off during operation.
- Do not bundle power lines (e.g., the Main Circuit Cable) and low-current lines (e.g., the I/O Signal Cables or Encoder Cables) together or run them through the same duct. If you do not place power lines and low-current lines in separate ducts, separate them by at least 30 cm. If the cables are too close to each other, malfunctions may occur due to noise affecting the low-current lines.
- Install a battery at either the host controller or on the Encoder Cable. If you install batteries both at the host controller and on the Encoder Cable at the same time, you will create a loop circuit between the batteries, resulting in a risk of damage or burning.
- When connecting a battery, connect the polarity correctly. There is a risk of battery rupture or encoder failure.

Operation Precautions

WARNING Before starting operation with a machine connected, change the settings of the switches and parameters to match the machine. Unexpected machine operation, failure, or personal injury may occur if operation is started before appropriate settings are made. • Do not radically change the settings of the parameters. There is a risk of unstable operation, machine damage, or injury. Install limit switches or stoppers at the ends of the moving parts of the machine to prevent unexpected accidents. There is a risk of machine damage or injury. For trial operation, securely mount the Servomotor and disconnect it from the machine. There is a risk of injury. • Forcing the motor to stop for overtravel is disabled when the Jog, Origin Search, or Easy FFT utility function is executed. Take necessary precautions. There is a risk of machine damage or injury. When an alarm occurs, the Servomotor will coast to a stop or stop with the dynamic brake according to the SERVOPACK Option and settings. The coasting distance will change with the moment of inertia of the load and the resistance of the External Dynamic Brake Resistor. Check the coasting distance during trial operation and implement suitable safety measures on the machine. • Do not enter the machine's range of motion during operation. There is a risk of injury. • Do not touch the moving parts of the Servomotor or machine during operation. There is a risk of injury. CAUTION • Design the system to ensure safety even when problems, such as broken signal lines, occur. For example, the P-OT and N-OT signals are set in the default settings to operate on the safe side if a signal line breaks. Do not change the polarity of this type of signal. • When overtravel occurs, the power supply to the motor is turned OFF and the brake is released. If you use the Servomotor to drive a vertical load, set the Servomotor to enter a zero-clamped state after the Servomotor stops. Also, install safety devices (such as an external brake or counterweight) to prevent the moving parts of the machine from falling. • Always turn OFF the servo before you turn OFF the power supply. If you turn OFF the main cir-

- cuit power supply or control power supply during operation before you turn OFF the servo, the Servomotor will stop as follows:
 - If you turn OFF the main circuit power supply during operation without turning OFF the servo, the Servomotor will stop abruptly with the dynamic brake.
 - If you turn OFF the control power supply without turning OFF the servo, the stopping method that is used by the Servomotor depends on the model of the SERVOPACK. For details, refer to the manual for the SERVOPACK.
 - If you use a SERVOPACK with the Dynamic Brake Hardware Option, the Servomotor stopping methods will be different from the stopping methods used without the Option or with other Hardware Options. For details, refer to the following manual.
 - Ω Σ-7-Series Σ-7S/Σ-7W SERVOPACK with Dynamic Brake Hardware Option Specifications Product Manual (Manual No.: SIEP S800001 73)
- Do not use the dynamic brake for any application other than an emergency stop. There is a risk of failure due to rapid deterioration of elements in the SERVOPACK and the risk of unexpected operation, machine damage, burning, or injury.

NOTICE When you adjust the gain during system commissioning, use a measuring instrument to monitor the torque waveform and speed waveform and confirm that there is no vibration. If a high gain causes vibration, the Servomotor will be damaged guickly. • Do not frequently turn the power supply ON and OFF. After you have started actual operation, allow at least one hour between turning the power supply ON and OFF (as a guideline). Do not use the product in applications that require the power supply to be turned ON and OFF frequently. The elements in the SERVOPACK will deteriorate quickly. • An alarm or warning may occur if communications are performed with the host controller while the SigmaWin+ or Digital Operator is operating. If an alarm or warning occurs, it may interrupt the current process and stop the system. • After you complete trial operation of the machine and facilities, use the SigmaWin+ to back up the settings of the SERVOPACK parameters. You can use them to reset the parameters after SERVOPACK replacement. If you do not copy backed up parameter settings, normal operation may not be possible after a faulty SERVOPACK is replaced, possibly resulting in machine or equipment damage. Maintenance and Inspection Precautions DANGER

• Do not change any wiring while power is being supplied. There is a risk of electric shock or injury.

• Wiring and inspections must be performed only by qualified engineers. There is a risk of electric shock or product failure.

• Wait for at least six minutes after turning OFF the power supply (with a SERVOPACK for a 100-VAC input, wait for at least nine minutes) and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the power supply terminals while the CHARGE lamp is lit after turning OFF the power supply because high voltage may still remain in the SERVOPACK.

There is a risk of electric shock.

 Before you replace a SERVOPACK, back up the settings of the SERVOPACK parameters. Copy the backed up parameter settings to the new SERVOPACK and confirm that they were copied correctly.

If you do not copy backed up parameter settings or if the copy operation is not completed normally, normal operation may not be possible, possibly resulting in machine or equipment damage.

NOTICE

 Discharge all static electricity from your body before you operate any of the buttons or switches inside the front cover of the SERVOPACK. There is a risk of equipment damage.

Troubleshooting Precautions

 If the safety device (molded-case circuit breaker or fuse) installed in the power supply line operates, remove the cause before you supply power to the SERVOPACK again. If necessary, repair or replace the SERVOPACK, check the wiring, and remove the factor that caused the safety device to operate.

There is a risk of fire, electric shock, or injury.

• The product may suddenly start to operate when the power supply is recovered after a momentary power interruption. Design the machine to ensure human safety when operation restarts. There is a risk of injury.

- When an alarm occurs, remove the cause of the alarm and ensure safety. Then reset the alarm or turn the power supply OFF and ON again to restart operation. There is a risk of injury or machine damage.
- If the Servo ON signal is input to the SERVOPACK and an alarm is reset, the Servomotor may suddenly restart operation. Confirm that the servo is OFF and ensure safety before you reset an alarm.

There is a risk of injury or machine damage.

- Always insert a magnetic contactor in the line between the main circuit power supply and the main circuit power supply terminals on the SERVOPACK so that the power supply can be shut OFF at the main circuit power supply.
 If a magnetic contactor is not connected when the SERVOPACK fails, a large current may flow, possibly resulting in fire.
- If an alarm occurs, shut OFF the main circuit power supply. There is a risk of fire due to a regenerative resistor overheating as the result of regenerative transistor failure.
- Install a ground fault detector against overloads and short-circuiting or install a molded-case circuit breaker combined with a ground fault detector.
 There is a risk of SERVOPACK failure or fire if a ground fault occurs.
- The holding brake on a Servomotor will not ensure safety if there is the possibility that an external force (including gravity) may move the current position and create a hazardous situation when power is interrupted or an error occurs. If an external force may cause movement, install an external braking mechanism that ensures safety.

Disposal Precautions

 Correctly discard the product as stipulated by regional, local, and municipal laws and regulations. Be sure to include these contents in all labelling and warning notifications on the final product as necessary.



General Precautions

- Figures provided in this document are typical examples or conceptual representations. There may be differences between them and actual wiring, circuits, and products.
- The products shown in illustrations in this document are sometimes shown without covers or protective guards. Always replace all covers and protective guards before you use the product.
- If you need a new copy of this document because it has been lost or damaged, contact your nearest Yaskawa representative or one of the offices listed on the back of this document.
- This document is subject to change without notice for product improvements, specifications changes, and improvements to the manual itself.
 We will update the document number of the document and issue revisions when changes are made.
- Any and all quality guarantees provided by Yaskawa are null and void if the customer modifies the product in any way. Yaskawa disavows any responsibility for damages or losses that are caused by modified products.

Warranty

Details of Warranty

Warranty Period

The warranty period for a product that was purchased (hereinafter called the "delivered product") is one year from the time of delivery to the location specified by the customer or 18 months from the time of shipment from the Yaskawa factory, whichever is sooner.

Warranty Scope

Yaskawa shall replace or repair a defective product free of charge if a defect attributable to Yaskawa occurs during the above warranty period.

This warranty does not cover defects caused by the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life.

This warranty does not cover failures that result from any of the following causes.

- Improper handling, abuse, or use in unsuitable conditions or in environments not described in product catalogs or manuals, or in any separately agreed-upon specifications
- · Causes not attributable to the delivered product itself
- Modifications or repairs not performed by Yaskawa
- Use of the delivered product in a manner in which it was not originally intended
- Causes that were not foreseeable with the scientific and technological understanding at the time
 of shipment from Yaskawa
- Events for which Yaskawa is not responsible, such as natural or human-made disasters

Limitations of Liability

- Yaskawa shall in no event be responsible for any damage or loss of opportunity to the customer that arises due to failure of the delivered product.
- Yaskawa shall not be responsible for any programs (including parameter settings) or the results of program execution of the programs provided by the user or by a third party for use with programmable Yaskawa products.
- The information described in product catalogs or manuals is provided for the purpose of the customer purchasing the appropriate product for the intended application. The use thereof does not guarantee that there are no infringements of intellectual property rights or other proprietary rights of Yaskawa or third parties, nor does it construe a license.
- Yaskawa shall not be responsible for any damage arising from infringements of intellectual property rights or other proprietary rights of third parties as a result of using the information described in catalogs or manuals.

♦ Suitability for Use

- It is the customer's responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
- The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
- Consult with Yaskawa to determine whether use in the following applications is acceptable. If use in the application is acceptable, use the product with extra allowance in ratings and specifications, and provide safety measures to minimize hazards in the event of failure.
 - Outdoor use, use involving potential chemical contamination or electrical interference, or use in conditions or environments not described in product catalogs or manuals
 - Nuclear energy control systems, combustion systems, railroad systems, aviation systems, vehicle systems, medical equipment, amusement machines, and installations subject to separate industry or government regulations
 - Systems, machines, and equipment that may present a risk to life or property
 - Systems that require a high degree of reliability, such as systems that supply gas, water, or electricity, or systems that operate continuously 24 hours a day
 - Other systems that require a similar high degree of safety
- Never use the product for an application involving serious risk to life or property without first ensuring that the system is designed to secure the required level of safety with risk warnings and redundancy, and that the Yaskawa product is properly rated and installed.
- The circuit examples and other application examples described in product catalogs and manuals are for reference. Check the functionality and safety of the actual devices and equipment to be used before using the product.
- Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

Specifications Change

The names, specifications, appearance, and accessories of products in product catalogs and manuals may be changed at any time based on improvements and other reasons. The next editions of the revised catalogs or manuals will be published with updated code numbers. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

Compliance with UL Standards, EU Directives, UK Regulations, and Other Safety Standards

Certification marks for the standards for which the product has been certified by certification bodies are shown on nameplate. Products that do not have the marks are not certified for the standards. Refer to the Servomotor manual for compliant standards of Servomotors.

North American Safety Standards (UL)



Product	Model	North American Safety Standards (UL File No.)
SERVOPACK	SGD7S	UL 61800-5-1 (E147823) CSA C22.2 No.274

EU Directives

CE				
Product	Model	EU Directives	Harmonized Standards	
	SGD7S	Machinery Directive 2006/42/EC	EN ISO 13849-1: 2015 EN IEC 62061 EN 61800-5-2	
SERVOPACK		EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)	
		Low Voltage Directive 2014/35/EU	EN 61800-5-1	
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000	

Note: 1. We declared the CE Marking based on the harmonized standards in the above table.

2. These products are for industrial use. In home environments, these products may cause electromagnetic interfer-ence and additional noise reduction measures may be necessary.

♦ UK Conformity Assessed (UKCA)



Product	Model	UK Regulations	Designated Standards
		Supply of Machinery (Safety) Regulations S.I. 2008/1597	EN ISO 13849-1: 2015 EN IEC 62061 EN 61800-5-2
		Electromagnetic Compati- bility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
SERVOPACK	SGD7S	Electrical Equipment (Safety) Regulations S.I. 2016/1101	EN 61800-5-1
		Restriction of the Use of Certain Hazardous Sub- stances in Electrical and Electronic Equipment Reg- ulations S.I. 2012/3032	EN IEC 63000

Note: We declared the UKCA marking based on the designated standards in the above table.

Safety Standards

Product	Model	Safety Standards	Standards
SERVOPACK	SGD7S	Safety of Machinery	EN ISO 13849-1: 2015 EN 60204-1
		Functional Safety	EN 61508 series EN IEC 62061 EN 61800-5-2
		Functional Safety EMC	EN 61326-3-1 EN 61000-6-7

Safety Parameters

Item	Standards	Performa	nce Level
Safety Integrity Level	EN 61508	SIL3	
Salety Integrity Level	EN IEC 62061	maximum SIL 3	
Mission Time	EN 61508	10 years	20 years
Probability of Dangerous Failure per Hour	EN 61508 EN IEC 62061	$PFH = 4.04 \times 10^{-9} [1/h]$ (4.04% of SIL3)	$PFH = 4.05 \times 10^{-9} [1/h]$ (4.05% of SIL3)
Performance Level	EN ISO 13849-1	PLe (Category 3)	
Mean Time to Dangerous Failure of Each Channel	EN ISO 13849-1	MTTFd: High	
Average Diagnostic Coverage	EN ISO 13849-1	DCavg: Medium	
Stop Category	EN 60204-1	Stop category 0	
Safety Function	EN 61800-5-2	STO	
Hardware Fault Tolerance	EN 61508	HFT = 1	
Subsystem	EN 61508	В	

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Revision History

Basic Information

This chapter provides basic information, including an introduction to the INDEXER Module, the names of parts, and combinations with Servomotors.

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1.1 The Σ -7 Series

The Σ -7-series SERVOPACKs are designed for applications that require frequent high-speed and high-precision positioning. The SERVOPACK will make the most of machine performance in the shortest time possible, thus contributing to improving productivity.

The Σ -7-Series Command Option Attachable-Type SERVOPACKs can be combined with Σ -V-Series Option Modules to achieve the required control capabilities.



This manual describes the application of a Command Option Attachable-type SERVOPACK used in combination with an INDEXER Module.

9

Note

1.2.1 Digital I/O

Introduction to the INDEXER Module

• An INDEXER Module with a firmware version of 3 or higher is required to use the INDEXER Module with a Σ -7-Series SERVOPACK.

An INDEXER Module can be attached only to a Command Option Attachable-type SERVO-PACK.

The INDEXER Module is a single-axis positioning device that is equipped with a program table operation function. The INDEXER Module is mounted to the side of the SERVOPACK.

The INDEXER Module has two reference methods: digital I/O and serial commands. These command methods are described in the following sections.

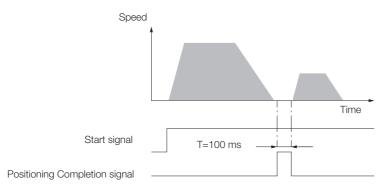
1.2.1 **Digital I/O**

Digital I/O is used with a program table (mode 0) or a jog speed table (mode 1). You can use a program table (mode 0) to execute the program steps that you select with I/O signal patterns (binary format). If the jog speed table (mode 1) is being used, the jog speed selected with the input signal pattern (binary format) can be executed.

Program Table

256
steps

	PGMSTEP	POS	SPD	RDST	RSPD	ACC	DEC	EVENT	LOOP	NEXT
(0	I+400000	2000	500000	1000	200	100	T5000	1	1
	1	l+100000	1000	200000	2000	100	50	IT0	1	END
-	:	÷	:	:	÷	:	÷	:	÷	÷
o ps <) n	I+400000	2000	500000	1000	100	50	IT100	1	n+1
ps .	n+1	l+100000	1000	200000	2000	:	÷	NT0	1	END
	:	:		:					:	:
	254	I+400000	2000	500000	1000	100	50	SEL3T200	1	127
	255	l+100000	1000	200000	2000	100	50	DT0	1	END

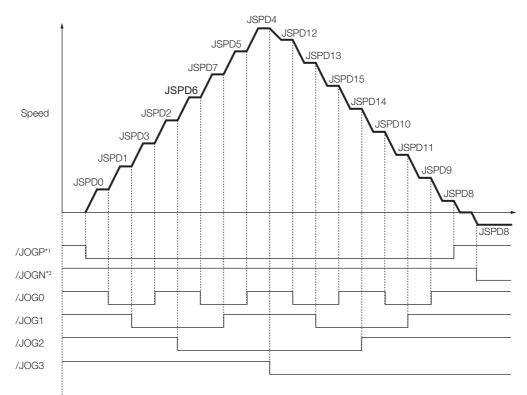


1.2.1 Digital I/O

• Jog Speed Table

JSPD	JOG3	JOG2	JOG1	JOG0	Jog Speed
0	0	0	0	0	1000
1	0	0	0	1	2000
2	0	0	1	0	4000
:	:	:	:	÷	:
:	:	:	:	÷	:
:	:	:	:	:	:
15	1	1	1	1	5500
	0 1 2 : : :	0 0 1 0 2 0 : : : : : :	0 0 0 1 0 0 2 0 0 : : : : : : : : :	0 0 0 0 1 0 0 0 2 0 0 1	0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 1 0 1 <th1< th=""> <th1< th=""> <th1< th=""> <th1< th=""></th1<></th1<></th1<></th1<>

Note: 1: Signal is ON (active), 0: Signal is OFF (inactive).



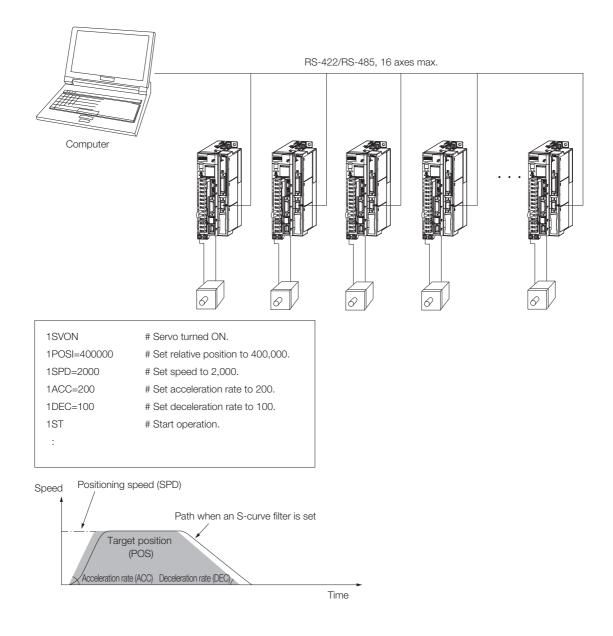
*1. Forward operation at the jog speed is performed while the /JOGP signal is ON.

 $\ast 2.$ Reverse operation at the jog speed is performed while the /JOGN signal is ON.

1.2.2 Serial Commands

1.2.2 Serial Commands

With serial commands, ASCII command strings are sent to the INDEXER Module through RS-422 or RS-485 communications and these commands are interpreted and executed immediately. You can use general-purpose serial communications (RS422/RS485) to perform independent control of up to 16 axes from one host controller (e.g., PC or HMI).

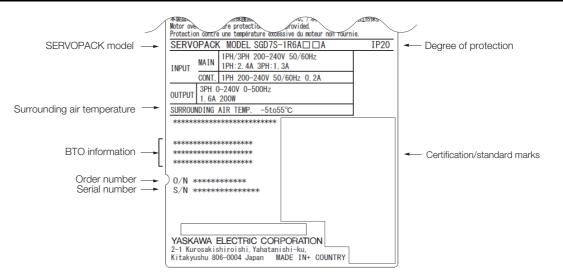


1.3.1 SERVOPACK Nameplate

1.3 Interpreting the Nameplate

The following basic information is provided on the nameplate.

1.3.1 SERVOPACK Nameplate

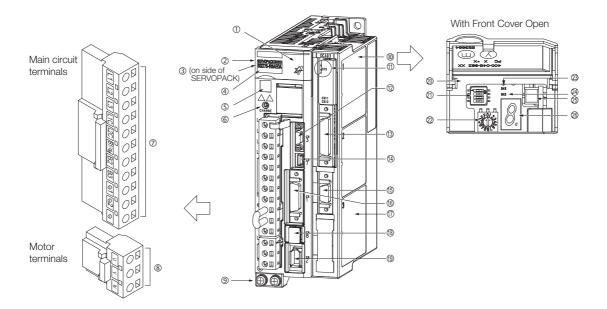


1.3.2 INDEXER Module Nameplate

Name Option Module model number Manufacturing number	SERVOPACK IP10 OPTION MODULE MODEL SGDV-OCAO3A KCC-REM-Yec-SGDVOCAO3-096 O/N O/N S/N YASKAWA ELECTRIC CORPORATION MADE IN JAPAN DG 2-1 Kurosaki shiroishi, Yahatani shi-ku, Kitakusha 806-0004 Japan	Certification/standard marks

1-7

1.4 Part Names



No.	Name	Description	Reference
1	Front Cover	_	_
2	Input Voltage	_	_
3	Nameplate	Indicates the SERVOPACK model and ratings.	page 1-5
4	Model	The model of the SERVOPACK.	page 1-12
5	QR Code	The QR code that is used by the MechatroCloud service.	-
6	CHARGE	Lit while the main circuit power is being supplied. Note: Even if you turn OFF the main circuit power supply, this indicator will be lit as long as the internal capacitor remains charged. Do not touch the main circuit or motor terminals while this indicator is lit. Doing so may result in electric shock.	-
Ø	Main Circuit Terminals	The terminals depend on the main circuit power supply input specifications of the SERVOPACK.	page 4-12
8	Servomotor Terminals (U, V, and W)	The connection terminals for the Servomotor Main Circuit Cable (power line).	page 4-26
9	Ground Terminal (🔔)	The ground terminals to prevent electric shock. Always connect this terminal.	-
10	INDEXER Module	_	_
1	Indicators	Light according to the status of the INDEXER Module.	page 1-13
(12)	Serial Communications Con- nector (CN3)	Connects to the Digital Operator (a peripheral device) or a computer (RS-422).	page 4-50
(13)	I/O Signal Connector (CN11)	Connects to sequence I/O signals.	page 4-40
(14)	Computer Connector (CN7)	A USB connector to connect a computer.	page 4-50
15	Serial Command Communi- cations Connector (CN12)	Used for serial command communications.	page 4-45
16	I/O Signal Connector (CN1)	Connects to sequence I/O signals.	page 4-36
(15)	Feedback Option Module Connector	Connects to a Feedback Option Module.	_
17	Fully-Closed Option Module	This Option Module is connected to perform fully-closed control.	_
(18)	Safety Connector (CN8)	Connects to a safety function device.	page 4-48
19	Encoder Connector (CN2)	 Rotary Servomotor: Connects to the encoder in the Servomotor. Linear Servomotor: Connects to a Serial Converter Unit or linear encoder. 	page 4-26
20	Serial Number	_	_

Continued on next page.

Continued from previous page.

No.	Name	Description	Reference
21	DIP Switch	Not used.	_
22	Rotary Switch	Not used.	—
23	PWR	Lights when the control power is being supplied.	_
24)	COM	Not used. (Always not lit.)	—
25	Analog Monitor Connector (CN5)	You can use a special cable (peripheral device) to monitor the motor speed, torque reference, or other values.	page 4-50
6	Panel Display	Displays the servo status with a seven-segment display.	-

1.5.1 Panel Display

1.5 Interpreting Panel Displays

1.5.1 Panel Display

You can check the Servo Drive status on the panel display of the SERVOPACK.

Also, if an alarm or warning occurs, the alarm or warning number will be displayed. However, if D-DD appears on the panel display, the display will indicate a SERVOPACK communications error. Replace the SERVOPACK.

Interpreting Status Displays

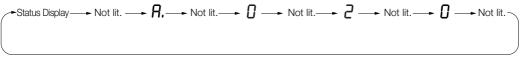
The status is displayed as described below.

Display	Meaning	Display	Meaning
	Rotation Detection Display Lit if the Servomotor speed is higher than the setting of Pn502 or Pn581 and not lit if the speed is lower than the setting. (The default set- ting is 20 min ⁻¹ or 20 mm/s.)	8	Reference Input Display Lit while a reference is being input.
\square	Base Block Display Lit during the base block state (servo OFF). Not lit while the servo is ON.		Reference Option Module Communications Status Display Lit while communications with the Reference Option Module are normal.

Alarm and Warning Displays

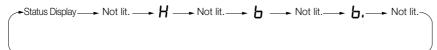
If there is an alarm or warning, the display will change in the following order.

Example: Alarm A.020



Hard Wire Base Block Active Display

If a hard wire base block (HWBB) is active, the display will change in the following order.



Overtravel and Software Limit Displays

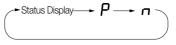
If overtravel has occurred or if a software limit has been reached, the display will change in the following order.

① Forward Overtravel (P-OT) or Forward Software Limit (P-LS)



 Reverse Overtravel (N-OT) or Reverse Software Limit (N-LS)

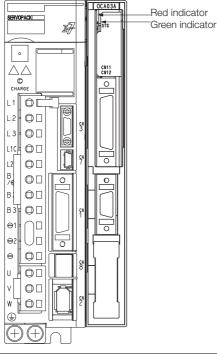
③ Forward and Reverse Overtravel



1.5.2 Indicators

1.5.2 Indicators

This section describes the indicator status on the INDEXER Module.



Status	Red indicator	Green indicator	
Control Power Supply OFF	Not lit	Not lit	
Control Power Supply ON	Not lit	Flashing	
Normal	Not lit	Lit	
Overtravel/Software Limit Activated		LIL	
Resetting			
Saving a Table		Flashing	
Initializing a Table	_		
Initializing Parameters			
Error	Flashing (2 seconds)	-	
Warning	Flashing	-	
Alarm	Lit	Not lit	

1.6.1 Interpreting SERVOPACK Model Numbers

Model Designations .6 Interpreting SERVOPACK Model Numbers 1.6.1 SGD7S 000001-0 А В А 4th digi st+2nd+3rd 5th+6th 7th 3th+9th+10th 11th+12th+13th Σ -7-Series diaits diaits diaits Σ-7S **SERVOPACKs** Maximum Applicable Hardware Options 8th+9th+10th digits Specification 4th digit Voltage 1st+2nd+3rd digits Motor Capacity Voltage Code Specification Code Specification Applicable Code Specification Models R70^{*1} 0.05 kW 200 VAC А None R90^{*1} 0.1 kW F 100 VAC Without options All models 000 1R6*1 0.2 kW SGD7S-R70A 2R8*1 0.4 kW 5th+6th digits Interface*3 to -330A **Rack-mounted** 3R8 0.5 kW Code Specification SGD7S-R70F 5R5*1 001 0.75 kW to -2R8F E0 Command option attachable type 7R6 1.0 kW SGD7S-470A Three-Duct-ventilated to -780A 120*2 1.5 kW Phase. 7th digit Design Revision Order 200 VAC 002 Varnished All models 180 2.0 kW А Single-phase, 200-VAC power supply input 008 200 3.0 kW SGD7S-120A 330 5.0 kW SGD7S-R70A 470 6.0 kW to -2R8A No dynamic brake 550 7.5 kW SGD7S-R70F 020*4 to -2R8F 590 11 kW SGD7S-3R8A External dynamic 780 15 kW to -780A brake resistor R70 0.05 kW Single R90 0.1 kW Phase, 2R1 0.2 kW 100 VAC 2R8 0.4 kW 11th+12th+13th digits FT/EX Specification Code Specification

14th d	igit BTO Specification*5
Code	Specification

None

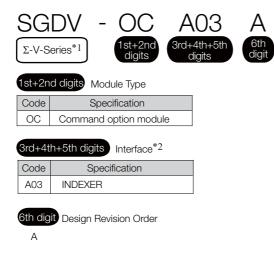
None

Code	Specification	
None	None	
В	BTO specification	

- *1. You can use these models with either a single-phase or three-phase input.
- *2. A model with a single-phase, 200-VAC power supply input is available as a hardware option (model: SGD7S-120A00A008).
- *3. The same SERVOPACKs are used for both Rotary Servomotors and Linear Servomotors.
- *4. Refer to the following manual for details.
 - Σ-7-Series AC Servo Drive Σ-7S/Σ-7W SERVOPACK with Dynamic Brake Hardware Option Specifications Product Manual (Manual No.: SIEP S800001 73)
- *5. The BTO specification indicates if the SERVOPACK is customized by using the MechatroCloud BTO service. This service is available on the e-mechatronics website. This service is available in Japan only. You need a BTO number to order SERVOPACKs with customized specifications. Perfort to the following catalog for details and the BTO appointed specifications.
 - Refer to the following catalog for details on the BTO specification.
 - $\label{eq:linear} \bigcap \quad \text{AC Servo Drives Σ-7 Series (Manual No.: KAEP $800001 23)}$

1.6.2 Interpreting INDEXER Module Model Numbers

1.6.2 Interpreting INDEXER Module Model Numbers



- *1. $\Sigma\text{-}V\text{-}Series$ Modules are used with $\Sigma\text{-}7\text{-}Series$ SERVOPACKs.
- *2. The same INDEXER Module is used for both Rotary Servomotors and Linear Servomotors.

1.6.3 Interpreting Servomotor Model Numbers

Interpreting Servomotor Model Numbers 1.6.3

This section outlines the model numbers of Σ-7-series Servomotors. Refer to the relevant manual in the following list for details.

Ω Σ-7-Series Rotary Servomotor Product Manual (Manual No.: SIEP S800001 36)

Ω Σ-7-Series Linear Servomotor Product Manual (Manual No.: SIEP S800001 37)

 \square Σ -7-Series Direct Drive Servomotor Product Manual (Manual No.: SIEP S800001 38)

Rotary Servomotors

SGM	□□ - 01	A F A 2 1	
Serie	es 1st+2nd digits	3rd digit4th digit5th digit6th digit7th digit	
Series	Σ-7 Series Servomotors	1st+2nd digits Rated Output	5th digit Design Revision Order
Code	Specification	3rd digit Power Supply Voltage	
SGM7M	Low inertia , ultra-small capacity	• 200 VAC	6th digit Shaft End Specification • Straight
SGM7J	Medium inertia, high speed	4th digit Serial Encoder Specification	 With key and tap
SGM7A	Low inertia, high speed		 With two flat seats
SGM7P	Medium inertia, flat	17-bit absolute encoder	
SGM7G	Medium inertia, low speed,	 20-bit absolute encoder 24-bit batteryless absolute encoder	7th digit Option Specification
SGIVITG	high torque	• 24-bit absolute encoder	 With 24-V holding brake
SGMMV	Low inertia, ultra-small capacity	• 24-bit incremental encoder	• With oil seal

S	SGM e	- C)2 E	3 3	С	1	1
	Series		+2nd 3r igits dig			6th digit	7th digit
	Series	Σ-7 Series Serv	omotors	1st+2nc	digits R	ated Torque	9
	Code	Specificati	on				
	SGM7E	Small capacity, co	oreless	3rd digit	Servom	otor Outer D	liameter
	SGM7F	Small capacity, w inner rotor	rith core	4th digit	Serial Er	ncoder Spec	cification
	SGIVI7F	Medium capacity inner rotor	, with core				
	SGMCV	Small capacity, w inner rotor	vith core				
	SGMCS	Small capacity, co	oreless				
	001000	Medium capacity inner rotor	, with core				

5th digit Design Revision Order

- 6th digit Flange Specification • Cable drawn to load side
- Cable drawn to non-load side

7th digit Option Specification

• High mechanical precision

1.6.3 Interpreting Servomotor Model Numbers

Line	ar Servomotors	5					
SG	iL 🗆 🗆 - 3	30	А	050	С	Ρ	
Serie	Series 1st 2nd digit 3rd digit on						
Seri	es Σ-7 Series Servomotors	(2nd dig	it Moving	Coil/Mag	netic \	Nay
1st d	igit Servomotor Type	Ī	Co	de Spe	cification		
ISI U	igit Servornotor Type		W	Movi	ng Coil		
Code	Specification		W2	2	ig oon		
G	Coreless models		М	Mag	netic Way		
F	Models with F-type iron core		M2	2			
Т	Models with T-type iron core						
			3rd c	digit on			

The specifications for the 3rd digit on depend on the Servomotor type.

1.7.1 Combinations of Rotary Servomotors and SERVOPACKs

1.7 Combinations of SERVOPACKs and Servomotors

1.7.1 Combinations of Rotary Servomotors and SERVOPACKs

Rotary Servomotor Model		Capacity	SERVOPACK Model
	I		SGD7S-
SGM7M	SGM7M-A1A	11 W	- R90A or R90F
(Low Inertia, Ultra- small Capacity),	SGM7M-A2A	22 W	
3000 min ⁻¹	SGM7M-A3A	33 W	1R6A or 2R1F
	SGM7J-A5A	50 W	R70A or R70F
	SGM7J-01A	100 W	R90A or R90F
SGM7J	SGM7J-C2A	150 W	1R6A or 2R1F
(Medium Inertia, Small Capacity),	SGM7J-02A	200 W	THUA OF ZITT
3,000 min ⁻¹	SGM7J-04A	400 W	2R8A or 2R8F
	SGM7J-06A	600 W	5R5A
	SGM7J-08A	750 W	31134
	SGM7A-A5A	50 W	R70A or R70F
	SGM7A-01A	100 W	R90A or R90F
	SGM7A-C2A	150 W	
	SGM7A-02A	200 W	
	SGM7A-04A	400 W	2R8A or 2R8F
	SGM7A-06A	600 W	5R5A
SGM7A	SGM7A-08A	750 W	JUDA
(Low Inertia, Small Capacity),	SGM7A-10A	1.0 kW	120A
3,000 min ⁻¹	SGM7A-15A	1.5 kW	120A
	SGM7A-20A	2.0 kW	180A
	SGM7A-25A	2.5 kW	200A
	SGM7A-30A	3.0 kW	2004
	SGM7A-40A	4.0 kW	330A
	SGM7A-50A	5.0 kW	330A
	SGM7A-70A	7.0 kW	550A
	SGM7P-01A	100 W	R90A or R90F
SGM7P	SGM7P-02A	200 W	2R8A or 2R1F
(Medium Inertia, Flat),	SGM7P-04A	400 W	2R8A or 2R8F
3,000 min ⁻¹	SGM7P-08A	750 W	5R5A
	SGM7P-15A	1.5 kW	120A
	SGM7G-03A	300 W	3R8A
	SGM7G-05A	450 W	JHOA
	SGM7G-09A	850 W	7R6A
	SGM7G-13A	1.3 kW	120A
SGM7G	SGM7G-20A	1.8 kW	180A
(Medium Inertia, Medium Capacity),	SGM7G-30A	2.9 kW ^{*1}	2204
1,500 min ⁻¹	SGM7G-44A	4.4 kW	330A
·	SGM7G-55A	5.5 kW	470A
	SGM7G-75A	7.5 kW	550A
	SGM7G-1AA	11 kW	590A
	SGM7G-1EA	15 kW	780A
SGMMV*2	SGMMV-A1A	10 W	
(Low Inertia, Ultra-	SGMMV-A2A	20 W	
small Capacity), 3,000 min ⁻¹	SGMMV-A3A	30 W	1R6A or 2R1F

1.7.2 Combinations of Direct Drive Servomotors and SERVOPACKs

- *1. 2.4 kW when using the Servomotor with a SGD7S-200A SERVOPACK.
- *2. The SGMMV Servomotor is an older model. When purchasing a new Servomotor, we recommend selecting a SGM7M Servomotor.

1.7.2 Combinations of Direct Drive Servomotors and SERVOPACKs

		Rated Torque	Instantaneous	SERVOPACK Mode	
Direct Drive S	ervomotor Model	[N·m]	Maximum Torque [N⋅m]	SGD7S-	
	SGM7E-02B	2	6		
	SGM7E-05B	5	15	2R8A or 2R1F	
	SGM7E-07B	7	21		
	SGM7E-04C	4	12		
SGM7E	SGM7E-10C	10	30	-	
(Small Capacity, Coreless,	SGM7E-14C	14	42	2R8A or 2R8F	
Inner Rotor)	SGM7E-08D	8	24	2R8A OF 2R8F	
	SGM7E-17D	17	51	-	
	SGM7E-25D	25	75	-	
	SGM7E-16E	16	48		
	SGM7E-35E	35	105	- 5R5A	
	SGM7F-02A	2	6		
	SGM7F-05A	5	15	2R8A or 2R1F	
	SGM7F-07A	7	21		
	SGM7F-04B	4	12	2R8A or 2R8F	
SGM7F	SGM7F-10B	10	30		
(Small Capacity, With Core,	SGM7F-14B	14	42	5R5A	
Inner Rotor)	SGM7F-08C	8	24	2R8A or 2R8F	
,	SGM7F-17C	17	51	5R5A	
	SGM7F-25C	25	75	7R6A	
	SGM7F-16D	16	48	5R5A	
	SGM7F-35D	35	105	7R6A* or 120A	
	SGM7F-45M	45	135	7R6A	
SGM7F	SGM7F-80M	80	240	1004	
(Medium Capacity,	SGM7F-80N	80	240	- 120A	
With Core,	SGM7F-1AM	110	330	180A	
Inner Rotor)	SGM7F-1EN	150	450	000.4	
	SGM7F-2ZN	200	600	- 200A	
	SGMCV-04B	4	12		
	SGMCV-10B	10	30	2R8A or 2R8F	
	SGMCV-14B	14	42	5R5A	
SGMCV (Small Capacity,	SGMCV-08C	8	24	2R8A or 2R8F	
With Core,	SGMCV-17C	17	51	5R5A	
Inner Rotor)	SGMCV-25C	25	75	7R6A	
	SGMCV-16D	16	48	5R5A	
	SGMCV-35D	35	105	7R6A* or 120A	

1.7.2 Combinations of Direct Drive Servomotors and SERVOPACKs

Continued from previous page.					
		Rated Torque	Instantaneous	SERVOPACK Model	
Direct Drive S	ervomotor Model	[N·m]	Maximum Torque [N·m]	SGD7S-	
	SGMCS-02B	2	6		
	SGMCS-05B	5	15	2R8A or 2R1F	
	SGMCS-07B	7	21		
	SGMCS-04C	4	12		
SGMCS	SGMCS-10C	10	30		
(Small Capacity, Coreless,	SGMCS-14C	14	42	2R8A or 2R8F	
Inner Rotor)	SGMCS-08D	8	24		
	SGMCS-17D	17	51		
	SGMCS-25D	25	75		
	SGMCS-16E	16	48	5R5A	
	SGMCS-35E	35	105	JUDA	
	SGMCS-45M	45	135	7R6A	
SGMCS	SGMCS-80M	80	240	1004	
(Medium Capacity,	SGMCS-80N	80	240	120A	
With Core,	SGMCS-1AM	110	330	180A	
Inner Rotor)	SGMCS-1EN	150	450	2004	
	SGMCS-2ZN	200	600	200A	

* Use derated values for this combination. Refer to the following catalog for information on derating values. \square AC Servo Drives Σ -7 Series (Catalog No.: KAEP S800001 23)

1.7.3 Combinations of Linear Servomotors and SERVOPACKs

1.7.3 Combinations of Linear Servomotors and SERVOPACKs

Linear Ser	vomotor Model	Rated Force [N]	Instantaneous Maximum Force [N]	SERVOPACK Mod SGD7S-	
	SGLGW-30A050C	12.5	40	R70A or R70F	
	SGLGW-30A080C	25	80		
	SGLGW-40A140C	47	140	- R90A or R90F	
	SGLGW-40A253C	93	280	1R6A or 2R1F	
SGLG (Coreless), Used	SGLGW-40A365C	140	420	2R8A or 2R8F	
with Standard-	SGLGW-60A140C	70	220	1R6A or 2R1F	
Force Magnetic	SGLGW-60A253C	140	440	2R8A or 2R8F	
Way	SGLGW-60A365C	210	660	5R5A	
	SGLGW-90A200C	325	1300	120A	
	SGLGW-90A370C	550	2200	180A	
	SGLGW-90A535C	750	3000	200A	
	SGLGW-40A140C	57	230	1R6A or 2R1F	
SGLG	SGLGW-40A253C	114	460	2R8A or 2R8F	
(Coreless), Used	SGLGW-40A365C	171	690	3R8A	
with High-Force	SGLGW-60A140C	85	360	1R6A or 2R1F	
Magnetic Way	SGLGW-60A253C	170	720	3R8A	
	SGLGW-60A365C	255	1080	7R6A	
	SGLFW-20A090A	25	86	1R6A or 2R1F	
	SGLFW-20A120A	40	125		
	SGLFW-35A120A	80	220		
	SGLFW-35A230A	160	440	3R8A	
	SGLFW-50A200B	280	600	5R5A	
	SGLFW-50A380B SGLFW-1ZA200B	560	1200	120A	
	SGLFW-1ZA380B	1120	2400	200A	
	SGLFW2-30A070A	45	135		
SGLF	SGLFW2-30A120A	90	270	- 1R6A or 2R1F	
With F-type Iron		180	540	3R8A	
Cores)	SGLFW2-30A230A*	170	500	2R8A or 2R8F	
	SGLFW2-45A200A	280	840	5R5A	
		500	1680	180A	
	SGLFW2-45A380A*	560	1500		
	SGLFW2-90A200A□1	560	1680	120A	
	SGLFW2-90A200A□L	896	1680	-	
	SGLFW2-90A380A	1120	3360	200A	
	SGLFW2-90A560A	1680	5040	330A	
	SGLFW2-1DA380A	1680	5040	200A	
	SGLFW2-1DA560A	2520	7560	330A	

Continued on next page.

1.7.3 Combinations of Linear Servomotors and SERVOPACKs

Continued from previous page.					
		Rated Force	Instantaneous	SERVOPACK Model	
Linear Serv	vomotor Model	[N] Maximum Force [N] [N]		SGD7S-	
	SGLTW-20A170A	130	380	3R8A	
	SGLTW-20A320A	250	760	7R6A	
	SGLTW-20A460A	380	1140	120A	
	SGLTW-35A170A	220	660	5R5A	
	SGLTW-35A170H	300	600	JUDA	
	SGLTW-35A320A	440	1320	120A	
SGLT (With T-type Iron	SGLTW-35A320H	600	1200	120A	
Cores)	SGLTW-35A460A	670	2000	180A	
,	SGLTW-40A400B	670	2600	TOUA	
	SGLTW-40A600B	1000	4000	330A	
	SGLTW-50A170H	450	900	5R5A	
	SGLTW-50A320H	900	1800	120A	
	SGLTW-80A400B	1300	5000	330A	
	SGLTW-80A600B	2000	7500	550A	

* The force depends on the SERVOPACK that is used with the Servomotor.

1.8 Functions

This section lists the functions provided by SERVOPACKs. Refer to the reference pages for details on the functions.

• Functions Related to the Machine

Function	Reference
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Automatic Detection of Connected Motor	page 5-14
Motor Direction Setting	page 5-15
Linear Encoder Pitch Setting	page 5-16
Writing Linear Servomotor Parameters	page 5-17
Selecting the Phase Sequence for a Linear Servomotor	page 5-21
Polarity Sensor Setting	page 5-23
Polarity Detection	page 5-24
Overtravel Function and Settings	page 5-27
Holding Brake	page 5-31
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Resetting the Absolute Encoder	page 5-48
Setting the Origin of the Absolute Encoder	page 5-51
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Setting the Motor Maximum Speed	page 6-14
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Current Control Mode Selection	page 8-70
Current Gain Level Setting	page 8-70
Speed Detection Method Selection	page 8-71
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Safety Functions	page 11-1

• Functions Related to the Host Controller

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Servo Alarm (ALM) Signal	page 6-3
Warning (/WARN) Signal	page 6-7
Servo Ready (/S-RDY) Signal	page 6-8
Positioning Completion Output (/INPOSITION) Signal	page 6-9
Encoder Divided Pulse Output	page 6-15
Selecting Torque Limits	page 6-22
Vibration Detection Level Initialization	page 6-32
Alarm Reset	page 15-48
Replacing the Battery	page 15-3
Setting the Position Deviation Overflow Alarm Level	page 8-7

• Functions to Achieve Optimum Motions

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Autotuning without a Host Reference	page 8-23
Autotuning with a Host Reference	page 8-34
Custom Tuning	page 8-41
Anti-Resonance Control Adjustment	page 8-49
Vibration Suppression	page 8-54
Gain Selection	page 8-64
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Gravity Compensation	page 8-69
Backlash Compensation	page 8-71
Model Following Control	page 8-81
Compatible Adjustment Functions	page 8-84
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• Functions for Trial Operation during Setup

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Software Reset	page 6-30
Trial Operation for the Servomotor without a Load	page 7-6
Program Jog Operation	page 7-13
Origin Search	page 7-19
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Monitoring Machine Operation Status and Signal Waveforms	page 9-7

• Functions for Inspection and Maintenance

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Write Prohibition Setting for Parameters	page 5-6
Initializing Parameter Settings	page 5-10
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Monitoring Product Information	page 9-2
Monitoring Product Life	page 9-2
Alarm History Display	page 15-50
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• Operation with Digital I/O

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Homing	page 13-4
Positioning with a Program Table	page 13-9
Registration	page 13-10
Constant Speed Operations with a Jog Speed Table	page 13-44
ZONE Outputs	page 13-52

Function	Reference
Homing	page 14-12
Positioning, Jog Operation, and Registration with Serial Commands	page 14-15
Positioning with a Program Table	page 14-24
Editing a Jog Speed Table	page 14-29
Editing a ZONE Table	page 14-29
Editing Parameters, Monitoring, and Utility Func- tions	page 14-30

•	Operations	with Serial	Command	Communications
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Selecting a SERVOPACK

This chapter provides information required to select SERVOPACKs, such as specifications, block diagrams, dimensional drawings, and connection examples.

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2.1.1 Ratings

2.1 Ratings and Specifications

This section gives the ratings and specifications of SERVOPACKs.

2.1.1 Ratings

Three-Phase, 200 VAC

N	lodel SGI	D7S-	R70A	R90A	1R6A	2R8A	3R8A	5R5A	7R6A	120A	180A	200A	330A
Maximum Applicable Motor Capacity [kW]		0.05	0.1	0.2	0.4	0.5	0.75	1.0	1.5	2.0	3.0	5.0	
	uous Outp t [Arms]	out	0.66	0.91	1.6	2.8	3.8	5.5	7.6	11.6	18.5	19.6	32.9
	aneous M Current [/		2.1	3.2	5.9	9.3	11	16.9	17	28	42	56	84
	Power S	upply				200 V/	AC to 2	40 VAC	, 50 Hz	/60 Hz			
Main Circuit	Permitte Fluctuati	d Voltage on					-15	% to +1	0%				
Onoun	Input Cu [Arms]*	rrent	0.4	0.8	1.3	2.5	3.0	4.1	5.7	7.3	10	15	25
	Power S	upply		1		200 V/	AC to 2	40 VAC	, 50 Hz	/60 Hz		1	
Con- trol	Permitte Fluctuati	d Voltage on		-15% to +10%									
	Input Current [Arms]*		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.25	0.25	0.3
Power [kVA]*	Supply Ca	apacity	0.2	0.3	0.5	1.0	1.3	1.6	2.3	3.2	4.0	5.9	7.5
	Main Ciro Loss [W]	cuit Power	5.0	7.0	11.9	22.5	28.5	38.9	49.2	72.6	104.2	114.2	226.6
Power	Control Circuit Power Loss [W]		12	12	12	12	14	14	14	15	16	16	19
Loss*	Built-in Regenera- tive Resistor Power Loss [W]		-	_	-	_	8	8	8	12	12	12	36
	Total Pov [W]	wer Loss	17.0	19.0	23.9	34.5	50.5	60.9	71.2	97.6	136.2	146.2	281.6
Rege	Built-In Regen-	Resis- tance $[\Omega]$	-	-	_	_	40	40	40	20	12	12	8
nera- tive Resis-	erative Resis- tor	Capacity [W]	-	_	-	-	40	40	40	60	60	60	180
tor	Minimum External tance [Ω		40	40	40	40	40	40	40	20	12	12	8
Overvo	Itage Cate	-		1	1	1	1		1	1	1	1	L

* This is the net value at the rated load.

2.1.1 Ratings

	Model SGD7S-	470A	550A	590A	780A
Maximum Applic	able Motor Capacity [kW]	6.0	7.5	11	15
Continuous Outp	out Current [Arms]	46.9	54.7	58.6	78.0
Instantaneous M	aximum Output Current [Arms]	110	130	140	170
	Power Supply	200) VAC to 240 V	/AC, 50 Hz/60	Hz
Main Circuit	Permitted Voltage Fluctuation		-15% to	o +10%	
Onoun	Input Current [Arms] ^{*1}	29	37	54	73
	Power Supply	200) VAC to 240 V	/AC, 50 Hz/60	Hz
Control	Permitted Voltage Fluctuation				
	Input Current [Arms] ^{*1}	0.3	0.3	0.4	0.4
Power Supply Ca	apacity [kVA] ^{*1}	10.7	14.6	21.7	29.6
	Main Circuit Power Loss [W]	271.7	326.9	365.3	501.4
	Control Circuit Power Loss [W]	21	21	28	28
Power Loss ^{*1}	External Regenerative Resistor Unit Power Loss [W]	180 ^{*2}	350 ^{*3}	350 ^{*3}	350 ^{*3}
	Total Power Loss [W]	292.7	347.9	393.3	529.4
	Resistance $[\Omega]$	6.25 ^{*2}	3.13 ^{*3}	3.13 ^{*3}	3.13 ^{*3}
External Regen- erative Resistor Unit	Capacity [W]	880 ^{*2}	1760 ^{*3}	1760 ^{*3}	1760 ^{*3}
	Minimum Allowable External Resistance [Ω]	5.8	2.9	2.9	2.9
Overvoltage Cate	egory		l		

 $\ast 1.$ This is the net value at the rated load.

*2. This value is for the optional JUSP-RA04-E Regenerative Resistor Unit.

*3. This value is for the optional JUSP-RA05-E Regenerative Resistor Unit.

Single-Phase, 200 VAC

	Model SGD7S	-	R70A	R90A	1R6A	2R8A	5R5A	120A		
Maximum App	olicable Motor Capa	acity [kW]	0.05	0.1	0.2	0.4	0.75	1.5		
Continuous O	utput Current [Arm	s]	0.66	0.91	1.6	2.8	5.5	11.6		
Instantaneous	Maximum Output	Current [Arms]	2.1	3.2	5.9	9.3	16.9	28		
Power Supply				200 VAC to 240 VAC, 50 Hz/60 Hz						
Main Circuit	Permitted Voltage			-15% to	o +10%					
	Input Current [Arr	0.8	1.6	2.4	5.0	8.7	16			
Power Supply				200 VA	C to 240 \	/AC, 50 H	z/60 Hz			
Control	Permitted Voltage	-15% to +10%								
Input Current [Arms		ns]*	0.2	0.2	0.2	0.2	0.2	0.25		
Control Powe	Control Power Supply			200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz						
Power Supply	Capacity [kVA]*		0.2	0.3	0.6	1.2	1.9	4.0		
	Main Circuit Powe	er Loss [W]	5.0	7.1	12.1	23.7	39.2	71.8		
	Control Circuit Po	wer Loss [W]	12	12	12	12	14	16		
Power Loss*	Built-in Regenerative Resistor Power Loss [W]		-	-	_	_	8	12		
	Total Power Loss	[W]	17.0	19.1	24.1	35.7	61.2	103.8		
	Built-In	Resistance $[\Omega]$	_	-	_	_	40	12		
Regenera- tive Resistor	Regenerative Resistor	Capacity [W]	_	-	-	-	40	60		
	Minimum Allowab Resistance [Ω]	40	40	40	40	40	12			
Overvoltage C	Overvoltage Category				I					

* This is the net value at the rated load.

2.1.1 Ratings

270 VDC

	Model SGD7S-	R70A	R90A	1R6A	2R8A	3R8A	5R5A	7R6A	120A
Maximum Applicable Motor Capacity [kW]			0.1	0.2	0.4	0.5	0.75	1.0	1.5
Continuous Output Current [Arms]			0.91	1.6	2.8	3.8	5.5	7.6	11.6
Instantaneous Maximum Output Current [Arms]			3.2	5.9	9.3	11.0	16.9	17.0	28.0
Power Supply				27	OVDC to	o 324 V	DC		
Main Circuit	Permitted Voltage Fluctuation		-15% to +10%						
	Input Current [Arms] ^{*1}	0.5	1.0	1.5	3.0	3.8	4.9	6.9	11
	Power Supply	270 VDC to 324 VDC							
Control	Permitted Voltage Fluctuation	-15% to +10%							
	Input Current [Arms] ^{*1}	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2*2
Power Supply (Capacity [kVA] ^{*1}	0.2	0.3	0.6	1	1.4	1.6	2.3	3.2
	Main Circuit Power Loss [W]	4.4	5.9	9.8	17.5	23.0	30.7	38.7	55.8
Power Loss ^{*1}	Control Circuit Power Loss [W]	12	12	12	12	14	14	14	15
	Total Power Loss [W]	16.4	17.9	21.8	29.5	37.0	44.7	52.7	70.8
Overvoltage Ca	itegory				I				

*1. This is the net value at the rated load.

*2. This is 0.25 Arms for the SGD7S-120AE0A008.

	Model SGD7S-	180A	200A	330A	470A	550A	590A	780A	
Maximum Applicable Motor Capacity [kW]			3.0	5.0	6.0	7.5	11.0	15.0	
Continuous Output Current [Arms]		18.5	19.6	32.9	46.9	54.7	58.6	78.0	
Instantaneous Maximum Output Current [Arms]		42.0	56.0	84.0	110	130	140	170	
	Power Supply	270 VDC to 324 VDC							
Main Circuit	Permitted Voltage Fluctuation	-15% to +10%							
	Input Current [Arms]*	14	20	34	36	48	68	92	
	Power Supply	270 VDC to 324 VDC							
Control	Permitted Voltage Fluctuation	-15% to +10%							
	Input Current [Arms]*	0.25	0.25	0.3	0.3	0.3	0.4	0.4	
Power Supply Capacity [kVA]*		4.0	5.9	7.5	10.7	14.6	21.7	29.6	
	Main Circuit Power Loss [W]	82.7	83.5	146.2	211.6	255.3	243.6	343.4	
Power Loss*	Control Circuit Power Loss [W]	16	16	19	21	21	28	28	
	Total Power Loss [W]	98.7	99.5	165.2	232.6	276.3	271.6	371.4	
Overvoltage Category		III							

* This is the net value at the rated load.

Single-Phase, 100 VAC

	Model SGD7S-	R70F	R90F	2R1F	2R8F		
Maximum App	blicable Motor Capacity [kW]	0.05	0.1	0.2	0.4		
Continuous Output Current [Arms]		0.66	0.91	2.1	2.8		
Instantaneous Maximum Output Current [Arms]		2.1	3.2	6.5	9.3		
	Power Supply	100 VAC to 120 VAC, 50 Hz/60 Hz					
Main Circuit	Permitted Voltage Fluctuation	-15% to +10%					
	Input Current [Arms]*	1.5	2.5	5	10		
	Power Supply	100 VAC to 120 VAC, 50 Hz/60 Hz					
Control	Permitted Voltage Fluctuation	-15% to +10%					
	Input Current [Arms]*	0.38	0.38	0.38	0.38		
Power Supply Capacity [kVA]*		0.2	0.3	0.6	1.4		
	Main Circuit Power Loss [W]	5.3	7.8	14.2	26.2		
Power Loss*	Control Circuit Power Loss [W]	12	12	12	12		
	Total Power Loss [W]	17.3	19.8	26.2	38.2		
Regenera- tive ResistorMinimum Allowable Resistance $[\Omega]$		40	40	40	40		
Overvoltage Category							

* This is the net value at the rated load.

2.1.2 Power Loss in the INDEXER Module

Power is supplied to the INDEXER Module from the control power supply of the SERVOPACK. The power loss is given in the following table.

Item	Specifications
Min. operating voltage	5.05 V
Max. operating voltage	5.25 V
Max. operating current	500 mA
Max. power loss	2.6 W

2.1.3 SERVOPACK Overload Protection Characteristics

2.1.3 SERVOPACK Overload Protection Characteristics

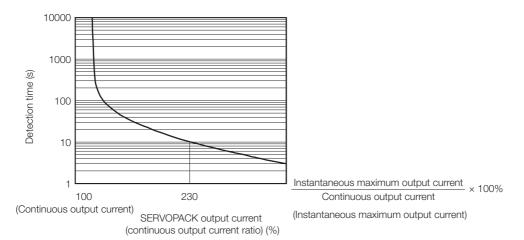
The overload detection level is set for hot start conditions with a SERVOPACK surrounding air temperature of 55°C.

An overload alarm (A.710 or A.720) will occur if overload operation that exceeds the overload protection characteristics shown in the following diagram (i.e., operation on the right side of the applicable line) is performed.

The actual overload detection level will be the detection level of the connected SERVOPACK or Servomotor that has the lower overload protection characteristics.

In most cases, that will be the overload protection characteristics of the Servomotor.

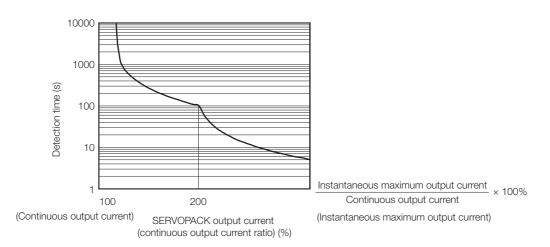
• SGD7S-R70A, -R90A, -1R6A, -2R8A, -R70F, -R90F, -2R1F, and -2R8F



Note: The above overload protection characteristics do not mean that you can perform continuous duty operation with an output of 100% or higher.

For a Yaskawa-specified combination of SERVOPACK and Servomotor, maintain the effective torque within the continuous duty zone of the torque-motor speed characteristic of the Servomotor.

 SGD7S-3R8A, -5R5A, -7R6A, -120A, -180A, -200A, -330A, -470A, -550A, -590A, and -780A



Note: The above overload protection characteristics do not mean that you can perform continuous duty operation with an output of 100% or higher.

For a Yaskawa-specified combination of SERVOPACK and Servomotor, maintain the effective torque within the continuous duty zone of the torque-motor speed characteristic of the Servomotor.

2.1.4 Specifications

2.1.4 Specifications

The specifications when the INDEXER Module is combined with a Command Option Attachable-type SERVOPACK are given in the following table.

Item		Specification			
Control Method		IGBT-based PWM control, sine wave current drive			
Feedback	With Rotary Servomotor	Serial encoder: 17 bits (absolute encoder) 20 bits or 24 bits (incremental encoder/absolute encoder) 22 bits (absolute encoder)			
	With Linear Servomotor	 Absolute linear encoder (The signal resolution depends on the absolute linear encoder.) Incremental linear encoder (The signal resolution depends on the incremental linear encoder or Serial Converter Unit.) 			
Environ- mental Conditions	Surrounding Air Temperature	0°C to 55°C			
	Storage Temperature	-20°C to 85°C			
	Surrounding Air Humidity	90% relative humidity max. (with no freezing or condensation)			
	Storage Humidity	90% relative humidity max. (with no freezing or condensation)			
	Vibration Resistance	4.9 m/s ²			
	Shock Resistance	19.6 m/s ²			
		Degree	SERVOPACK Model: SGD7S-		
	Degree of Protection	IP20 R70A, R90	DA, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A, 120A, F, 2R1F, 2R8F		
		IP10 120A00A0	08, 180A, 200A, 330A, 470A, 550A, 590A, 780A		
	Pollution Degree	 2 Must be no corrosive or flammable gases. Must be no exposure to water, oil, or chemicals. Must be no dust, salts, or iron dust. 			
	Altitude	1,000 m or less.			
	Others	Do not use the SERVOPACK in the following locations: Locations subject to static electricity, noise, strong electromagnetic/magnetic fields, or radioactivity			
Compliant Standards		Refer to the following section for details. Compliance with UL Standards, EU Directives, UK Regulations, and Other Safety Standards on page xxvi			
		Mounting	SERVOPACK Model: SGD7S-		
		Base-mounted	All Models		
Mounting		Rack-mounted	R70A, R90A, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A, 120A, 180A, 200A, 330A, R70F, R90F, 2R1F, 2R8F		
		Duct-ventilated	470A, 550A, 590A, 780A		
	Speed Control Range	1:5000 (At the rated torque, the lower limit of the speed control rangement of the speed contrangement of the speed contrang			
	Coefficient of Speed	$\pm 0.01\%$ of rated speed max. (for a load fluctuation of 0% to 100%)			
Perfor- mance		0% of rated speed max. (for a voltage fluctuation of ±10%)			
	Fluctuation ^{*1}	$\pm 0.1\%$ of rated speed max. (for a temperature fluctuation of 25°C ± 25 °C)			
	Torque Control Precision (Repeatability)	±1%			
	Soft Start Time Setting	0 s to 10 s (Can be set separately for acceleration and deceleration.)			
			Continued on next name		

2.1.4 Specifications

Continued from previous page.

Item				Specification			
	Encoder Divided Pulse Output			Phase A, phase B, phase C: Line-driver output Number of divided output pulses: Any setting is allowed.			
	Overheat Protection Input			Number of input points: 1 Input voltage range: 0 V to +5 V			
				Allowable voltage range: 24 VDC ±20% Number of input points: 6 (Input method: Sink inputs or source inputs)			
	Sequence Input Signals	SERVOPACK		Input signals: • /ALM-RST (Alarm Reset) signal • P-OT (Forward Drive Prohibit) signal • N-OT (Reverse Drive Prohibit) signal • /DEC (Homing Deceleration) switch • /RGRT (Registration Input) signal • /S-ON (Servo ON) signal Positive or negative logic can be changed in the parameters.			
				Allowable voltage range: 24 VDC ±10% Number of input points: 11 (Input method: Sink inputs or source inputs)			
				Input signal: MODE 0/1 (Mode Swit			
I/O Signals		INDEXER Module	Fixed Inputs	 Mode 0 /START-STOP (Program Table Operation Start-Stop Input) signal /PGMRES (Program Table Operation Reset Input) signal /SEL0 (Program Step Selection Input 0) signal /SEL1 (Program Step Selection Input 1) signal /SEL2 (Program Step Selection Input 2) signal /SEL3 (Program Step Selection Input 3) signal /SEL4 (Program Step Selection Input 4) signal /SEL5 (Program Step Selection Input 5) signal /SEL6 (Program Step Selection Input 6) signal /SEL7 (Program Step Selection Input 7) signal 	Mode 1 /HOME (Homing Input) signal /JOGP (Forward Jog Input) signal /JOGN (Reverse Jog Input) signal /JOG0 (Jog Speed Table Selection Input 0) signal /JOG1 (Jog Speed Table Selection Input 1) signal /JOG2 (Jog Speed Table Selection Input 2) signal /JOG3 (Jog Speed Table Selection Input 3) signal		

Continued on next page.

2.1.4 Specifications

Continued from previous page.

Item				Specification				
			Fixed Out- puts	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 1 (Output method: A photocoupler output (isolated) is used.) Output signal: ALM (Servo Alarm Output) signal				
I/O Signals		ACK	Output Signals for Which Allocations Can Be Changed	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 3 (A photocoupler output (isolated) is used.)				
	Sequence Output Signals	SERVOPACK		Output signals: • /WARN (Warning Output) signal • /BK (Brake Output) signal • /S-RDY (Servo Ready Output) signal • /ALO1, /ALO2, and /ALO3 (Alarm Code Output) signals Signal allocations and positive or negative logic can be changed in the parameters.				
			Fixed Out- puts	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 9 (Output method: A photocoupler output (isolated) is used.)				
		INDEXER Module		Output signals: /INPOSITION (Positioning Completion Output) signal /POUT0 (Programmable Output 0) signal /POUT1 (Programmable Output 1) signal /POUT2 (Programmable Output 2) signal /POUT3 (Programmable Output 3) signal /POUT4 (Programmable Output 4) signal /POUT5 (Programmable Output 5) signal /POUT6 (Programmable Output 6) signal /POUT7 (Programmable Output 7) signal				
	Digital	Interfaces 1:N Communi- cations Axis Address Setting		Digital Operator (JUSP-OP05A-1-E)				
	Opera- tor Com- municati			Up to N = 15 stations possible for RS-422A port				
Communi- cations	ons (CN3)			Set with parameters.				
	USB	Inter	face	Personal computer (with SigmaWin+)				
	Commu- nica- tions (CN7)	Communi- cations Standard		Conforms to USB2.0 standard (12 Mbps).				
Displays/	SERVOPA	CK		CHARGE and PWR indicators, and one-digit seven-segment display				
Indicators	INDEXER	Modu	lle	Refer to the following section for detailed information.				

Continued on next page.

2.1.4 Specifications

Continued from previous page.

	Item	Specification			
	Program Table Method	 Program table positioning in which steps are executed sequentially by commands given through contact input or serial communications Positioning in which station numbers are specified by commands given through contact input or serial communications 			
	Max. Number of Steps	256			
Operating Methods	Max. Number of Tables	256			
Methods	Max. Number of Stations	256			
	Serial Communications Method	Serial command by 1-channel ASCII code Communications specifications: RS-422/485 (50 m max.) Connection topology: Multi-drop connection (16 axes max.) Baud rate: 9600, 19200, 38400 bps			
	Other Functions	Registration (positioning by external signals), homing			
Analog Monitor (CN5)		Number of points: 2 Output voltage range: ±10 VDC (effective linearity range: ±8 V) Resolution: 16 bits Accuracy: ±20 mV (Typ) Maximum output current: ±10 mA Settling time (±1%): 1.2 ms (Typ)			
Dynamic Br	ake (DB)	Activated when a servo alarm or overtravel (OT) occurs, or when the power supply to the main circuit or servo is OFF.			
Regenerative Processing		 Built-in (An external resistor must be connected to the SGD7S-470A to -780A.) Refer to the following manual for details. Ω Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32) 			
Overtravel (OT) Prevention		Stopping with dynamic brake, deceleration to a stop, or coasting to a stop for the P-OT (Forward Drive Prohibit) or N-OT (Reverse Drive Prohibit) signal			
Protective F	unctions	Overcurrent, overvoltage, low voltage, overload, regeneration error, etc.			
Utility Functions		Gain adjustment, alarm history, jog operation, origin search, etc.			
	Inputs	/HWBB1 and /HWBB2: Base block signals for Power Modules			
Safety	Output	EDM1: Monitors the status of built-in safety circuit (fixed output).			
Functions	Compliant Standards ^{*2}	ISO13849-1 PLe (Category 3), IEC61508 SIL3			
Applicable (Option Modules	Fully-Closed Module Note: You cannot use a Safety Module if you are using an INDEXER Module.			

*1. The coefficient of speed fluctuation for load fluctuation is defined as follows:

Coefficient of speed fluctuation = <u>No-load motor speed - Total-load motor speed</u> × 100%

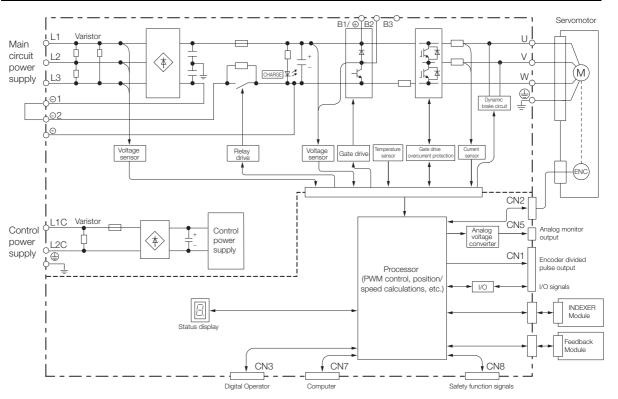
Rated motor speed

*2. Always perform risk assessment for the system and confirm that the safety requirements are met.

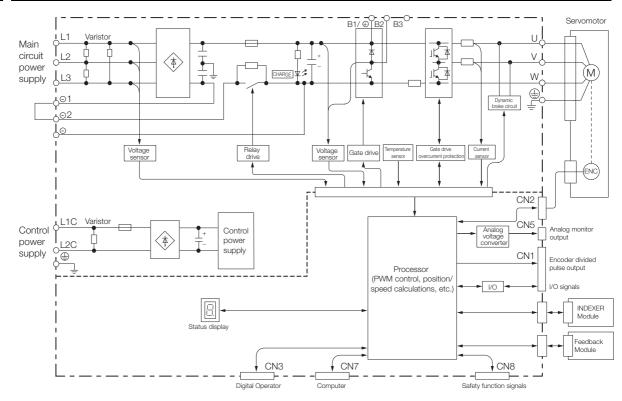
2.2.1 SGD7S-R70A, -R90A, and -1R6A

2.2 Block Diagrams

2.2.1 SGD7S-R70A, -R90A, and -1R6A

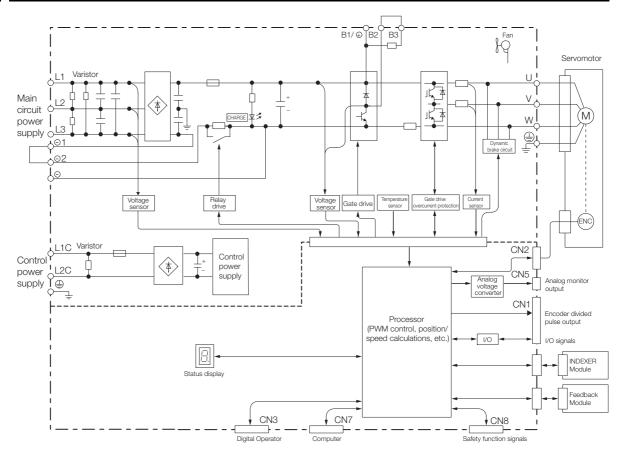


2.2.2 SGD7S-2R8A



2.2.3 SGD7S-3R8A, -5R5A, and -7R6A

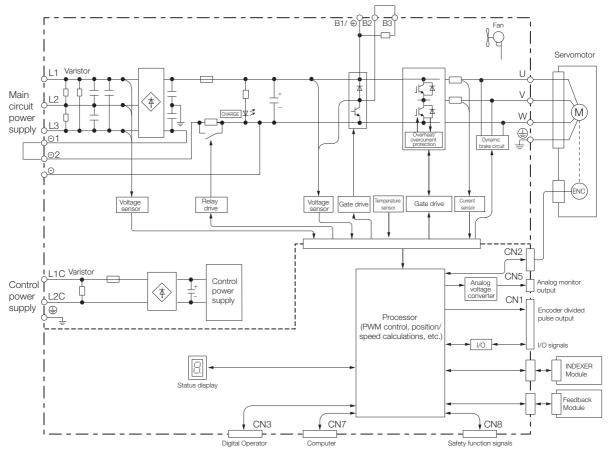
2.2.3 SGD7S-3R8A, -5R5A, and -7R6A



2.2.4 SGD7S-120A

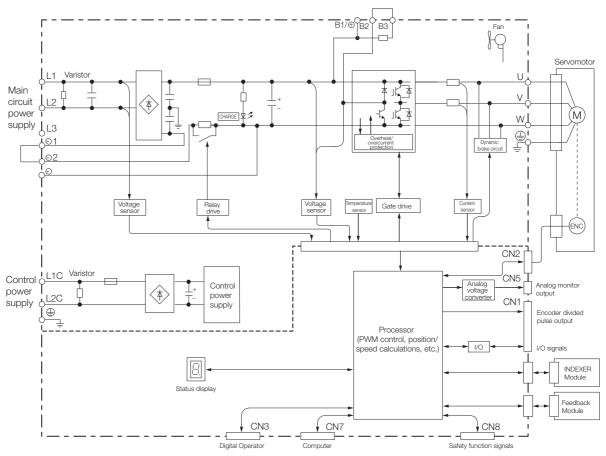
2.2.4 SGD7S-120A





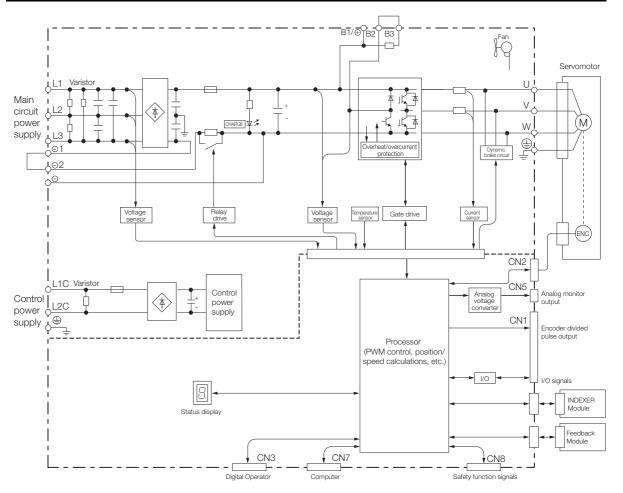
2.2.4 SGD7S-120A

Optional Specifications: Single-Phase, 200-VAC Power Supply Input (SERVOPACK Model: SGD7S-120AE0A008)



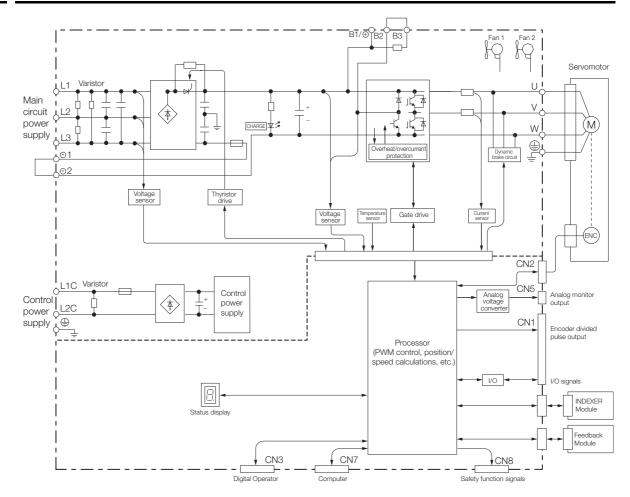
2.2.5 SGD7S-180A and -200A

2.2.5 SGD7S-180A and -200A



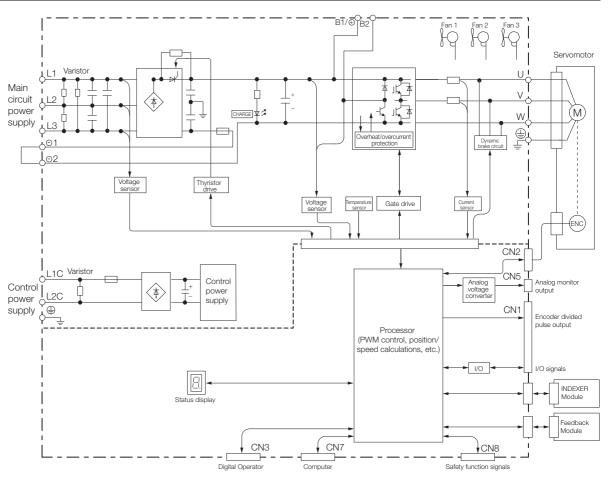
2.2.6 SGD7S-330A

2.2.6 SGD7S-330A



2.2.7 SGD7S-470A and -550A

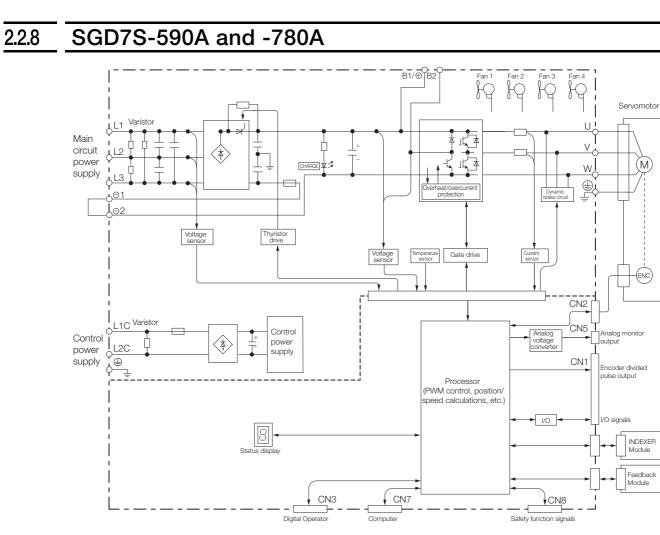




2

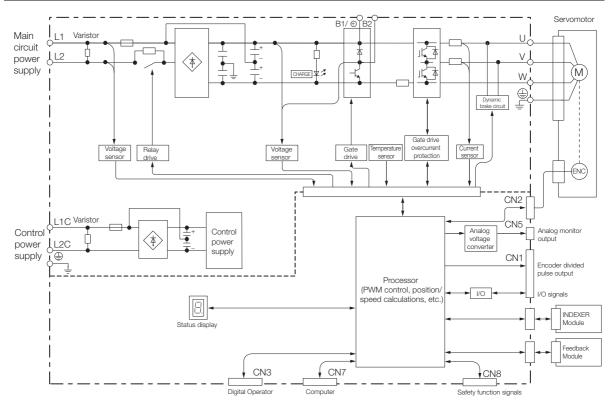
2-17

2.2.8 SGD7S-590A and -780A

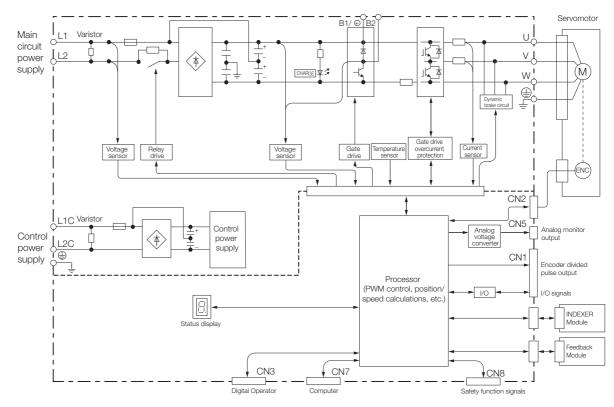


2.2.9 SGD7S-R70F, -R90F, and -2R1F





2.2.10 SGD7S-2R8F



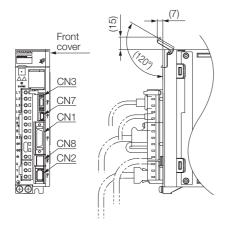
2.3.1 Front Cover Dimensions and Connector Specifications

2.3 External Dimensions

2.3.1 Front Cover Dimensions and Connector Specifications

The front cover dimensions and panel connector section are the same for all models. Refer to the following figures and table.

• Front Cover Dimensions



Connector Specifications

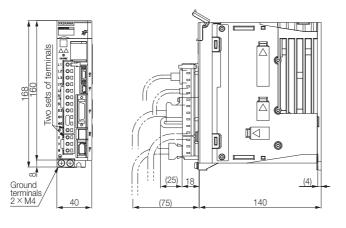
Connector No.	Model	Number of Pins	Manufacturer
CN1	10226-59A3MB	26	3M Japan Limited
CN2	3E106-0220KV	6	3M Japan Limited
CN3	HDR-EC14LFDTN- SLD-PLUS	14	Honda Tsushin Kogyo Co., Ltd.
CN7	2172034-1	5	Tyco Electronics Japan G.K.
CN8	1981080-1	8	Tyco Electronics Japan G.K.

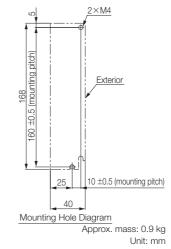
Note: The above connectors or their equivalents are used for the SERVOPACKs.

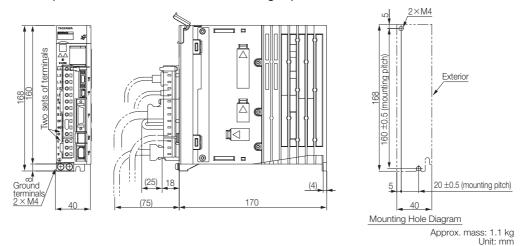
2.3.2 SERVOPACK External Dimensions

Base-mounted SERVOPACKs

• Three-phase, 200 VAC: SGD7S-R70A, -R90A, and -1R6A

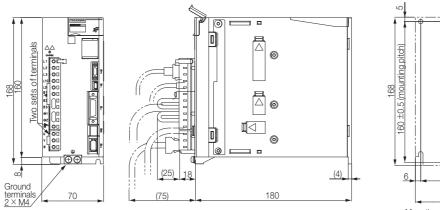






• Three-phase, 200 VAC: SGD7S-2R8A; Single-phase, 100 VAC: SGD7S-R70F, -R90F, and -2R1F

• Three-phase, 200 VAC: SGD7S-3R8A, -5R5A, and -7R6A; Single-phase, 100 VAC: SGD7S-2R8F



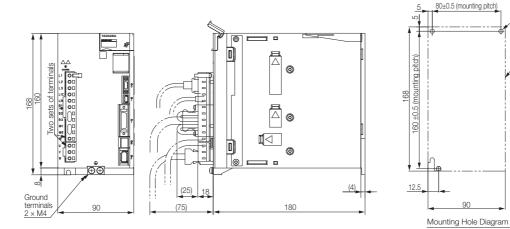
<u>3×M4</u>

Approx. mass: SGD7S-3R8A, -5R5A, -7R6A: 1.6 kg SGD7S-2R8F: 1.5 kg Unit: mm

3×M4

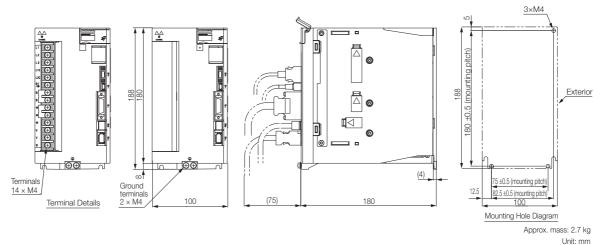
Exterior

Three-phase, 200 VAC: SGD7S-120A

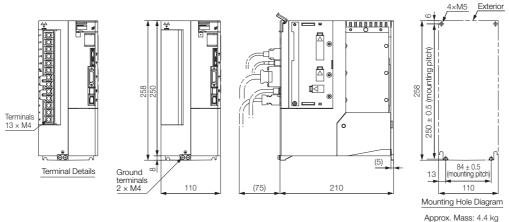


Approx. mass: 2.2 kg Unit: mm

Three-phase, 200 VAC: SGD7S-180A and -200A; Single-phase, 200 VAC: SGD7S-120AE0A008

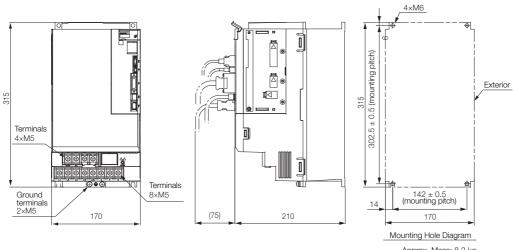


• Three-phase, 200 VAC: SGD7S-330A



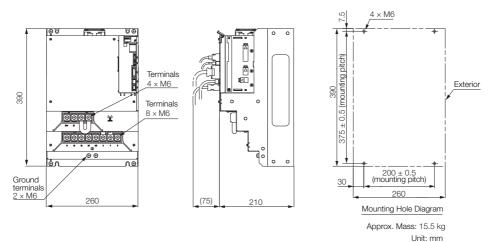
prox. Mass: 4.4 kg Unit: mm

• Three-phase, 200 VAC: SGD7S-470A and -550A



Approx. Mass: 8.2 kg Unit: mm

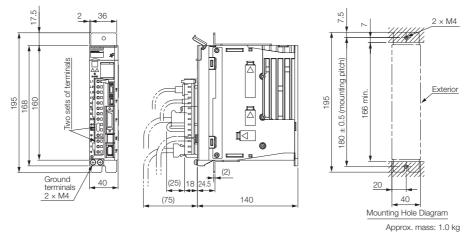
• Three-phase, 200 VAC: SGD7S-590A and -780A



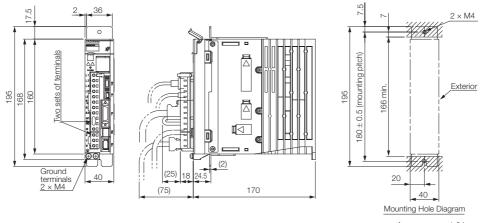
Rack-mounted SERVOPACKs

Hardware Option Code: 001

• Three-phase, 200 VAC: SGD7S-R70A, -R90A, and -1R6A



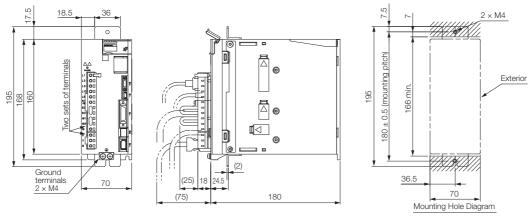
 Three-phase, 200 VAC: SGD7S-2R8A; Single-phase, 100 VAC: SGD7S-R70F, -R90F, and -2R1F



Approx. mass: 1.2 kg Unit: mm

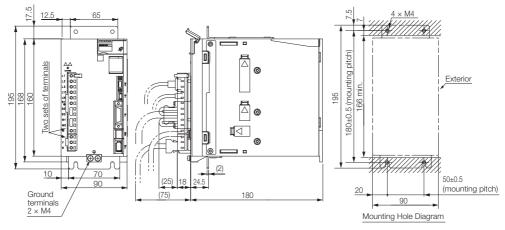
Unit: mm

 Three-phase, 200 VAC: SGD7S-3R8A, -5R5A, and -7R6A; Single-phase, 100 VAC: SGD7S-2R8F



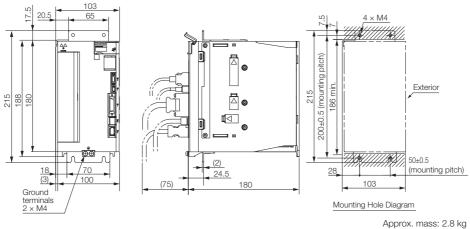
Approx. mass: SGD7S-3R8A, -5R5A, -7R6A: 1.7 kg SGD7S-2R8F: 1.6 kg Unit: mm

Three-phase, 200 VAC: SGD7S-120A



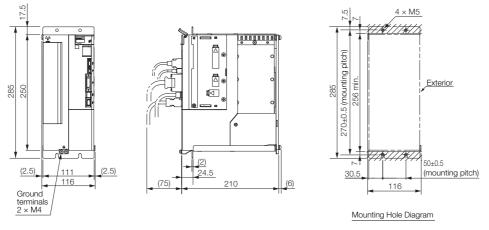
Approx. mass: 2.3 kg Unit: mm

• Three-phase, 200 VAC: SGD7S-180A and -200A



Unit: mm

• Three-phase, 200 VAC: SGD7S-330A

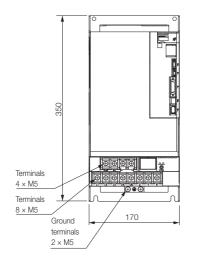


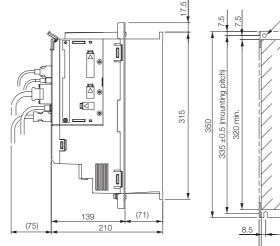
Approx. mass: 4.9 kg Unit: mm

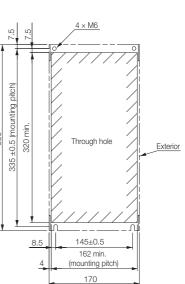
Duct-ventilated SERVOPACKs

Hardware Option Code: 001

• Three-phase, 200 VAC: SGD7S-470A and -550A





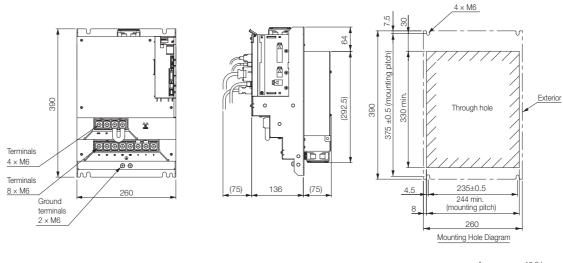


Approx. mass: 8.4 kg Unit: mm

Mounting Hole Diagram

2.3.3 INDEXER Module Dimensions and Connector Specifications

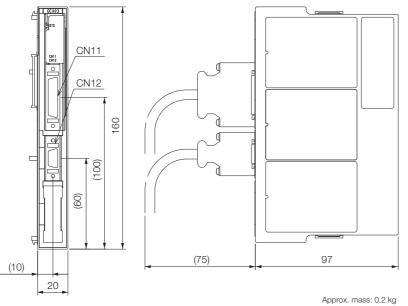
• Three-phase, 200 VAC: SGD7S-590A and -780A



Approx. mass: 13.8 kg Unit: mm

2.3.3 INDEXER Module Dimensions and Connector Specifications

External Dimensions



Unit: mm

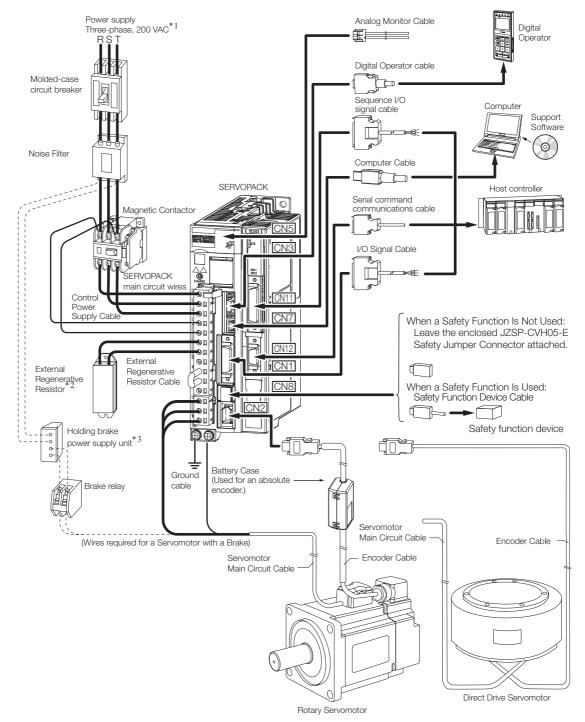
Connector Specifications

Connector No.	Model	Number of Pins	Manufacturer
CN11	10236-52A2PL	36	3M Japan Ltd.
CN12	10214-52A2PL	14	3M Japan Ltd.

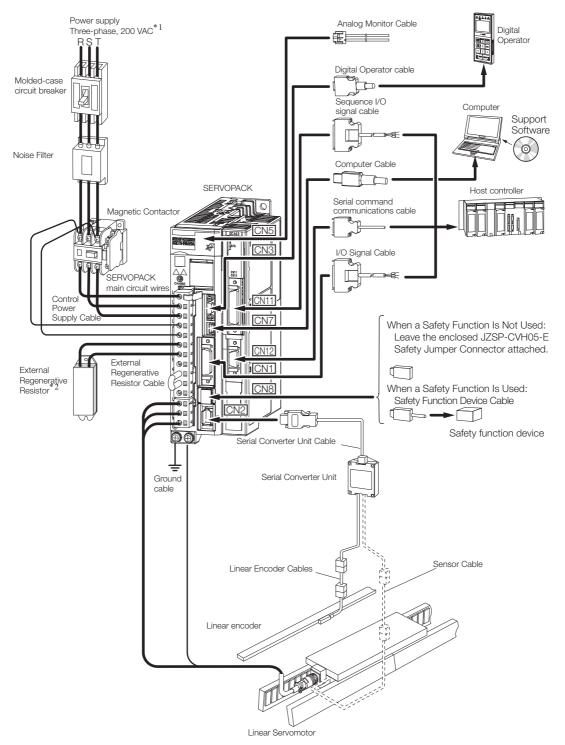
Note: The above connectors or their equivalents are used for the SERVOPACKs.

2.4 Examples of Standard Connections between SERVOPACKs and Peripheral Devices

Rotary Servomotors



- *1. This example is for a SERVOPACK with a three-phase, 200-VAC power supply input. The pin layout of the main circuit connector depends on the voltage.
- *2. External Regenerative Resistors are not provided by Yaskawa.
- *3. The power supply for the holding brake is not provided by Yaskawa. Select a power supply based on the holding brake specifications.
 - If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector.



· Linear Servomotors

- *1. This example is for a SERVOPACK with a three-phase, 200-VAC power supply input. The pin layout of the main circuit connector depends on the voltage.
- *2. External Regenerative Resistors are not provided by Yaskawa.

Installation



This chapter provides information on installing SERVO-PACKs and INDEXER Modules in the required locations.

3.1	Insta	Ilation Precautions
3.2	Attach	ing the INDEXER Module to the SERVOPACK 3-3
3.3	Mour	nting Types and Orientation
3.4	Mour	nting Hole Dimensions
3.5	N/	ting Interval 0.7
0.0	wour	nting Interval
0.0	3.5.1 3.5.2	Installing One SERVOPACK in a Control Panel 3-7 Installing More Than One SERVOPACK
0.0	3.5.1	Installing One SERVOPACK in a Control Panel 3-7
3.6	3.5.1 3.5.2	Installing One SERVOPACK in a Control Panel 3-7 Installing More Than One SERVOPACK

3.1 Installation Precautions

Refer to the following section for the ambient installation conditions. 2.1.4 Specifications on page 2-7

Installation Near Sources of Heat

Implement measures to prevent temperature increases caused by radiant or convection heat from heat sources so that the ambient temperature of the SERVOPACK meets the ambient conditions.

■ Installation Near Sources of Vibration

Install a vibration absorber on the mounting surface of the SERVOPACK so that the SERVO-PACK will not be subjected to vibration.

Other Precautions

Do not install the SERVOPACK in a location subject to high temperatures, high humidity, water drops, cutting oil, excessive dust, excessive dirt, excessive iron powder, corrosive gasses, or radioactivity.

3.2 Attaching the INDEXER Module to the SERVOPACK

Install the INDEXER Module correctly according to the installation procedures that are included with it.

 $\bigcap_{\text{(TOBP C720829 01)}} \Sigma$ -V-Series for Large-Capacity Models/ Σ -7-Series Installation Guide Command Option Module (TOBP C720829 01).

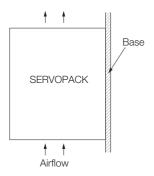
3.3 Mounting Types and Orientation

The SERVOPACKs come in the following mounting types: base-mounted, rack-mounted, and duct-ventilated types. Regardless of the mounting type, mount the SERVOPACK vertically, as shown in the following figures.

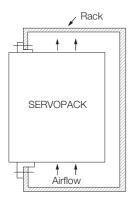
Also, mount the SERVOPACK so that the front panel is facing toward the operator.

Note: Prepare two to four mounting holes for the SERVOPACK and mount it securely in the mounting holes. (The number of mounting holes depends on the capacity of the SERVOPACK.)

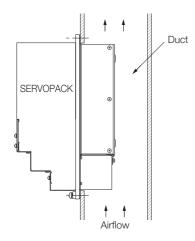
Base-mounted SERVOPACK



Rack-mounted SERVOPACK



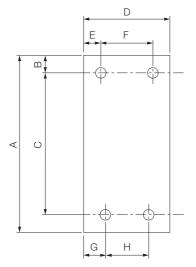
Duct-ventilated SERVOPACK



3.4 Mounting Hole Dimensions

Use mounting holes to securely mount the SERVOPACK to the mounting surface.

Note: To mount the SERVOPACK, you will need to prepare a screwdriver that is longer than the depth of the SER-VOPACK.



• Σ-7-series Mounting Hole Dimensions

SERVOPACK Model				D	imens	ions (ı	mm)			Screw Size	Number
		А	В	С	D	Е	F	G	н		of Screws
	R70A, R90A, 1R6A	168	5	160 ±0.5	40	35	-	25	-	M4	2
	2R8A, R70F, R90F, 2R1F	168	5	160 ±0.5	40	5	-	25	-	M4	2
	3R8A, 5R5A, 7R6A, 2R8F	168	5	160 ±0.5	70	6	58 ±0.5	64	-	M4	3
SGD7S-	120A	168	5	160 ±0.5	90	5	80 ±0.5	12.5	-	M4	3
	180A, 200A, 120AE0A008	188	5	180 ±0.5	100	95	-	12.5	75 ±0.5	M4	3
	330A	258	6	250 ±0.5	110	5	100 ±0.5	13	84 ±0.5	M5	4
	470A, 550A	315	6	302.5 ±0.5	170	14	142 ±0.5	14	142 ±0.5	M6	4
	590A, 780A	390	7.5	375 ±0.5	260	30	200 ±0.5	30	200 ±0.5	M6	4

• Σ -V-series-Compatible Mounting Hole Dimensions If you are replacing a Σ -V-Series SERVOPACK with a Σ -7-Series SERVOPACK, you can also use the mounting holes that were used for the Σ -V-Series SERVOPACK. Refer to the following table.

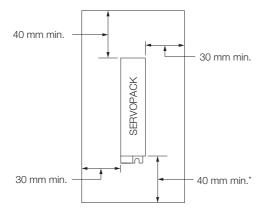
SERVOPACK Model			Dimensions (mm)								Number
		А	В	С	D	Е	F	G	н	Size	of Screws
	R70A, R90A, 1R6A	168	5	150 ±0.5	40	35	-	35	-	M4	2
	2R8A, R70F, R90F, 2R1F	168	5	150 ±0.5	40	5	-	35	-	M4	2
00070	3R8A, 5R5A, 7R6A, 2R8F	168	5	150 ±0.5	70	6	58 ±0.5	6	-	M4	3
SGD7S-	120A	168	5	150 ±0.5	90	5	80 ±0.5	5	-	M4	3
	180A, 200A, 120AE0A008	188	5	170 ±0.5	100	95	-	5	90 ±0.5	M4	3
	330A	250	6	238.5 ±0.5	110	5	100 ±0.5	5	100 ±0.5	M5	4
	470A, 550A, 590A, 780A			g compatibili a. Contact ye						nt is not	provided

3.5.1 Installing One SERVOPACK in a Control Panel

3.5 Mounting Interval

3.5.1 Installing One SERVOPACK in a Control Panel

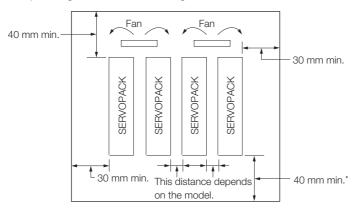
Provide the following spaces around the SERVOPACK.



* For this dimension, ignore items protruding from the main body of the SERVOPACK.

3.5.2 Installing More Than One SERVOPACK in a Control Panel

When multiple SERVOPACKs are installed close together in an enclosed space, natural convection may provide insufficient air circulation to distribute heat uniformly through the space, resulting in the air surrounding the SERVOPACKs to locally exceed the surrounding air temperature range. In this case, you must take measures to disperse the localized hot spots, such as by using fans. When using fans, install them as shown below.



* For this dimension, ignore items protruding from the main body of the SERVOPACK.

The space required on the right side of a SERVOPACK (when looking at the SERVOPACK from the front) depends on the SERVOPACK models. Refer to the following table.

	SERVOPACK Model	Space on Right Side	Cooling Fan Installation Conditions 10 mm above SERVOPACK's Top Surface
SGD7S-	R70A, R90A, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A, R70F, R90F, 2R1F, 2R8F	1 mm min.	Air speed: 0.5 m/s min.
	120A, 180A, 200A, 330A, 470A, 550A, 590A, 780A	10 mm min.	Air speed: 0.5 m/s min.

Note: When option modules are mounted on SERVOPACKs, the SERVOPACK installation conditions will depend on the option modules that are mounted. For details, refer to the manual for option module.

3.6 Monitoring the Installation Environment

You can use the SERVOPACK Installation Environment Monitor parameter to check the operating conditions of the SERVOPACK in the installation environment.

You can check the SERVOPACK installation environment monitor with either of the following methods.

- Using the SigmaWin+: Life Monitor Installation Environment Monitor SERVOPACK
- Digital Operator: Un025 (Installation Environment Monitor [%])

Implement one or more of the following actions if the monitor value exceeds 100%.

- Lower the surrounding temperature.
- Decrease the load.

Information The value of the SERVOPACK Installation Environment Monitor parameter will increase by about 10% for each 10°C increase in the ambient temperature.



Always observe the surrounding air temperature given in the SERVOPACK environment conditions. Even if the monitor value is 100% or lower, you cannot use a SERVOPACK in a location that exceeds the specified surrounding air temperature.

3.7 EMC Installation Conditions

This section gives the recommended installation conditions that were used for EMC certification testing.

The EMC installation conditions that are given here are the conditions that were used to pass testing criteria at Yaskawa. The EMC level may change under other conditions, such as the actual installation structure and wiring conditions. These Yaskawa products are designed to be built into equipment. Therefore, you must implement EMC measures and confirm compliance for the final equipment.

The compliant standards are EN 55011 Group 1, Class A, EN 61000-6-2, EN 61000-6-4, and EN 61800-3 (Category C2, Second environment).

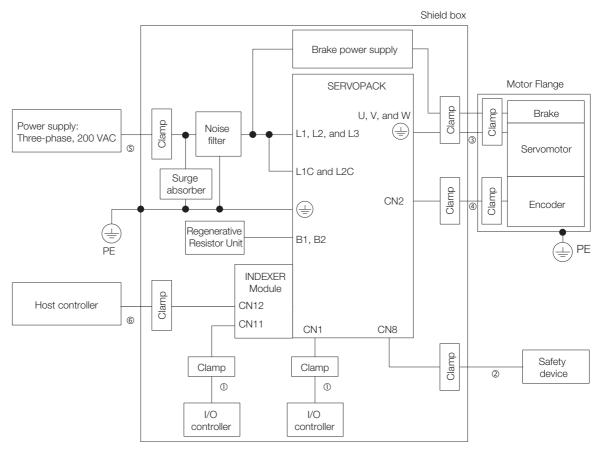


• In a domestic environment, this product may cause radio interference in which case supplementary mitigation measures may be required.



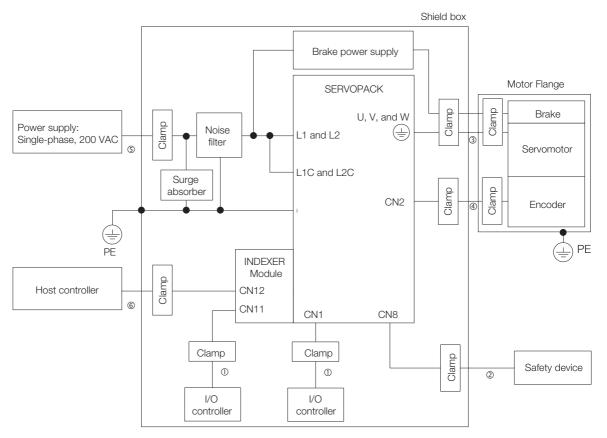
• This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

• Three-Phase, 200 VAC



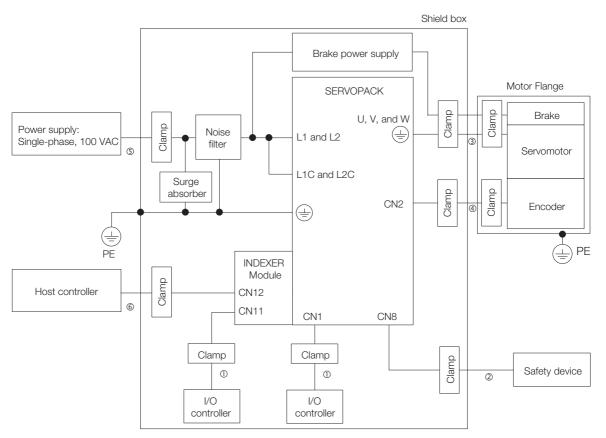
Symbol	Cable Name	Specification
0	I/O Signal Cable	Shielded cable
2	Safety Function Device Cable	Shielded cable
3	Servomotor Main Circuit Cable	Shielded cable
4	Encoder Cable	Shielded cable
5	Main Circuit Power Cable	Shielded cable
6	Cable for Serial Command Communications	Shielded cable

• Single-Phase, 200 VAC



Symbol	Cable Name	Specification
1	I/O Signal Cable	Shielded cable
2	Safety Function Device Cable	Shielded cable
3	Servomotor Main Circuit Cable	Shielded cable
4	Encoder Cable	Shielded cable
\$	Main Circuit Power Cable	Shielded cable
6	Cable for Serial Command Communications	Shielded cable

• Single-Phase, 100 VAC



Symbol	Cable Name	Specification
1	I/O Signal Cable	Shielded cable
2	Safety Function Device Cable	Shielded cable
3	Servomotor Main Circuit Cable	Shielded cable
4	Encoder Cable	Shielded cable
\$	Main Circuit Power Cable	Shielded cable
6	Cable for Serial Command Communications	Shielded cable

Wiring and Connecting

This chapter provides information on wiring and connecting SERVOPACKs and INDEXER Modules to power supplies and peripheral devices.

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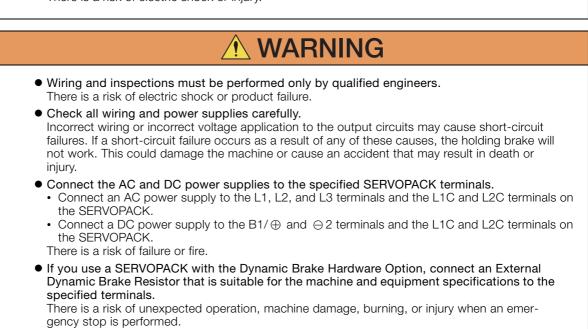
4.1.1 General Precautions

4.1 Wiring and Connecting SERVOPACKs

4.1.1 General Precautions

🚹 DANGER

• Do not change any wiring while power is being supplied. There is a risk of electric shock or injury.



4.1.1 General Precautions

• Wait for at least six minutes after turning OFF the power supply (with a SERVOPACK for a 100-VAC input, wait for at least nine minutes) and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the power supply terminals while the CHARGE lamp is lit after turning OFF the power supply because high voltage may still remain in the SERVOPACK. There is a risk of electric shock.
 Observe the precautions and instructions for wiring and trial operation precisely as described in this document. Failures caused by incorrect wiring or incorrect voltage application in the brake circuit may cause the SERVOPACK to fail, damage the equipment, or cause an accident resulting in death or injury.
 Check the wiring to be sure it has been performed correctly. Connectors and pin layouts are sometimes different for different models. Always confirm the pin layouts in technical documents for your model before operation. There is a risk of failure or malfunction.
 Connect wires to power supply terminals and motor connection terminals securely with the specified methods and tightening torque. Insufficient tightening may cause wires and terminal blocks to generate heat due to faulty con- tact, possibly resulting in fire.
 Use shielded twisted-pair cables or screened unshielded multi-twisted-pair cables for I/O Signal Cables and Encoder Cables.
 The maximum wiring length is 3 m for I/O Signal Cables, and 50 m for Encoder Cables or Servomotor Main Circuit Cables.
 Observe the following precautions when wiring the SERVOPACK's main circuit terminals. Turn ON the power supply to the SERVOPACK only after all wiring, including the main circuit terminals, has been completed. If a connector is used for the main circuit terminals, remove the main circuit connector from the SERVOPACK before you wire it. Insert only one wire per insertion hole in the main circuit terminals. When you insert a wire, make sure that the conductor wire (e.g., whiskers) does not come into contact with adjacent wires.
 Install molded-case circuit breakers and other safety measures to provide protection against short circuits in external wiring. There is a risk of fire or failure.
NOTICE
 Whenever possible, use the Cables specified by Yaskawa. If you use any other cables, confirm the rated current and application environment of your model and use the wiring materials specified by Yaskawa or equivalent materials. Securely tighten cable connector screws and lock mechanisms. Insufficient tightening may result in cable connectors falling off during operation. Do not bundle power lines (e.g., the Main Circuit Cable) and low-current lines (e.g., the I/O Signal Cables or Encoder Cables) together or run them through the same duct. If you do not

- Do not bundle power lines (e.g., the Main Circuit Cable) and low-current lines (e.g., the I/O Signal Cables or Encoder Cables) together or run them through the same duct. If you do not place power lines and low-current lines in separate ducts, separate them by at least 30 cm. If the cables are too close to each other, malfunctions may occur due to noise affecting the lowcurrent lines.
- Install a battery at either the host controller or on the Encoder Cable. If you install batteries both at the host controller and on the Encoder Cable at the same time, you will create a loop circuit between the batteries, resulting in a risk of damage or burning.
- When connecting a battery, connect the polarity correctly. There is a risk of battery rupture or encoder failure.

4.1.1 General Precautions



- Use a molded-case circuit breaker or fuse to protect the main circuit. The SERVOPACK connects directly to a commercial power supply; it is not isolated through a transformer or other device. Always use a molded-case circuit breaker or fuse to protect the servo system from accidents involving different power system voltages or other accidents.
- Install an earth leakage breaker. The SERVOPACK does not have a built-in ground fault protective circuit. To configure a safer system, install a ground fault detector against overloads and short-circuiting, or install a ground fault detector combined with a molded-case circuit breaker.
- Do not turn the power supply ON and OFF more than necessary.Do not use the SERVOPACK for applications that require the power supply to turn ON and
- OFF frequently. Such applications will cause elements in the SERVOPACK to deteriorate. • After you have started actual operation, allow at least one hour between turning the power
 - supply ON and OFF (as a guideline).

To ensure safe, stable application of the servo system, observe the following precautions when wiring.

• Use the cables specified by Yaskawa. Design and arrange the system so that each cable is as short as possible.

Refer to the following manual or catalog for information on the specified cables. \square AC Servo Drives Σ -7 Series (Catalog No.: KAEP S800001 23)

Ω Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)

• The signal cable conductors are as thin as 0.2 mm² or 0.3 mm². Do not subject them to excessive bending stress or tension.

4.1.2 Countermeasures against Noise

4.1.2 Countermeasures against Noise

The SERVOPACK is designed as an industrial device. It therefore provides no measures to prevent radio interference. The SERVOPACK uses high-speed switching elements in the main circuit. Therefore peripheral devices may be affected by switching noise. Important If the equipment is to be used near private houses or if radio interference is a problem, take

countermeasures against noise.

The SERVOPACK uses microprocessors. Therefore, it may be affected by switching noise from peripheral devices.

To prevent the noise from the SERVOPACK or the peripheral devices from causing malfunctions of any devices, take the following countermeasures against noise as required.

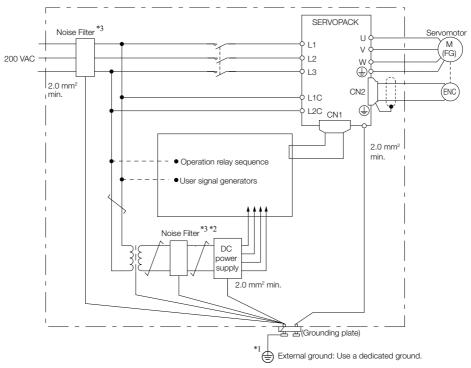
- Install the input reference device and Noise Filter as close to the SERVOPACK as possible.
- Always install a Surge Absorber for relays, solenoids, and Magnetic Contactor coils.
- Do not place the following cables in the same duct or bundle them together. Also, separate the cables from each other by at least 30 cm.
 - Main Circuit Cables and I/O Signal Cables
 - Main Circuit Cables and Encoder Cables
- Do not share the power supply with an electric welder or electrical discharge machine. If the SERVOPACK is placed near a high-frequency generator, install Noise Filters on the input side on the Main Circuit Power Supply Cable and Control Power Supply Cable even if the same power supply is not shared with the high-frequency generator. Refer to the following section for information on connecting Noise Filters.
 - Noise Filters on page 4-7
- Implement suitable grounding measures. Refer to the following section for information on grounding measures.

A.1.3 Grounding on page 4-9

4.1.2 Countermeasures against Noise

Noise Filters

You must attach Noise Filters in appropriate places to protect the SERVOPACK from the adverse effects of noise. The following is an example of wiring for countermeasures against noise.



*1. For the ground wire, use a wire with a thickness of at least 2.0 mm² (preferably, flat braided copper wire).

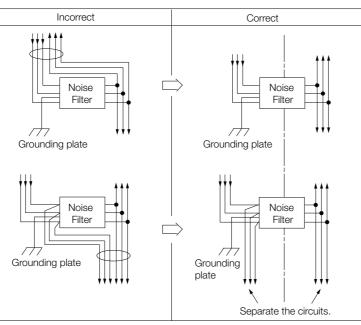
- *2. Whenever possible, use twisted-pair wires to wire all connections marked with $\underline{\frown}$.
- *3. Refer to the following section for precautions when using Noise Filters.

4.1.2 Countermeasures against Noise

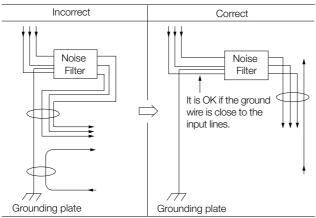
Noise Filter Wiring and Connection Precautions

Always observe the following precautions when wiring or connecting Noise Filters.

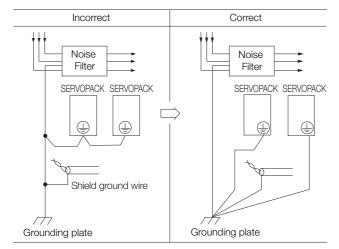
• Separate input lines from output lines. Do not place input lines and output lines in the same duct or bundle them together.



• Separate the Noise Filter ground wire from the output lines. Do not place the Noise Filter ground wire, output lines, and other signal lines in the same duct or bundle them together.

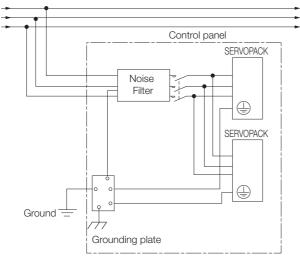


• Connect the Noise Filter ground wire directly to the grounding plate. Do not connect the Noise Filter ground wire to other ground wires.



4.1.3 Grounding

• If a Noise Filter is located inside a control panel, first connect the Noise Filter ground wire and the ground wires from other devices inside the control panel to the grounding plate for the control panel, then ground the plate.



4.1.3 Grounding

Implement grounding measures as described in this section. Implementing suitable grounding measures will also help prevent malfunctions, which can be caused by noise.

Observe the following precautions when wiring the ground cable.

- Ground the SERVOPACK to a resistance of 100 Ω or less.
- Be sure to ground at one point only.
- Ground the Servomotor directly if the Servomotor is insulated from the machine.

Motor Frame Ground or Motor Ground

If you ground the Servomotor through the machine, a current resulting from switching noise can flow from the main circuit of the SERVOPACK through the stray capacitance of the Servomotor. To prevent this, always connect the FG terminal of the Servomotor Main Circuit Cable connected to the Servomotor to the ground terminal) on the SERVOPACK. Also be sure to ground the ground terminal).

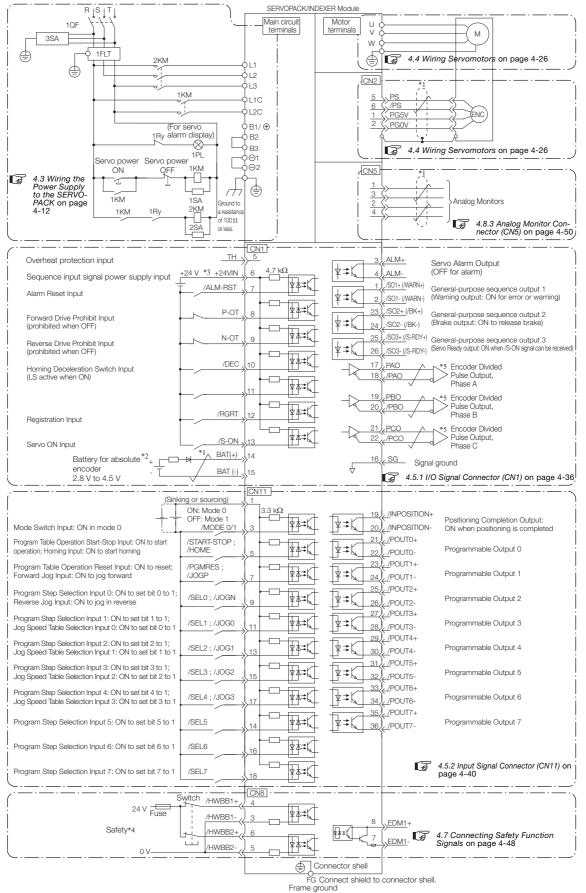
Always connect the shield wire of the Encoder Cable connected to the Servomotor to the connector case (shell).

Noise on I/O Signal Cables

If noise enters the I/O Signal Cable, connect the shield of the I/O Signal Cable to the connector shell to ground it. If the Servomotor Main Circuit Cable is placed in a metal conduit, ground the conduit and its junction box. For all grounding, ground at one point only.

4.2 Basic Wiring Diagrams

This section provide the basic wiring diagrams. Refer to the reference sections given in the diagrams for details.



- *1. represents twisted-pair wires.
 *2. Connect these when using an absolute encoder. If the Encoder Cable with a Battery Case is connected, do not connect a backup battery.
- *3. The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.
- *4. Refer to the following chapter if you use a safety function device.

Chapter 11 Safety Functions

If you do not use the safety function, insert the Safety Jumper Connector (provided as an accessory) into CN8 when you use the SERVOPACK.

*5. Always use line receivers to receive the output signals.

- Note: 1. If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector. If the power supply is shared, the I/O signals may malfunction.
 - 2. Default settings are given in parentheses.

4.3.1 Terminal Symbols and Terminal Names

4.3 Wiring the Power Supply to the SERVOPACK

Refer to the following manual or catalog for information on cables and peripheral devices. \square AC Servo Drives Σ -7 Series (Catalog No.: KAEP S800001 23)

~~~  $\Sigma$ -7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)

## 4.3.1 Terminal Symbols and Terminal Names

Use the main circuit connector on the SERVOPACK to wire the main circuit power supply and control circuit power supply to the SERVOPACK.

# 

• Wire all connections correctly according to the following table and specified reference information. There is a risk of SERVOPACK failure or fire if incorrect wiring is performed.

The SERVOPACKs have the following four types of main circuit power supply input specifications.

| • | Three-Phase, | 200-VAC | Power | Supply | Input |
|---|--------------|---------|-------|--------|-------|
|---|--------------|---------|-------|--------|-------|

| Terminal<br>Symbols | Terminal Name                                                             | Specifications and Reference                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                               |  |
|---------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| L1, L2, L3          | Main circuit power supply<br>input terminals for AC<br>power supply input | Three-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz                                                                                                                                                                                     |                                                                                                                                                                                                                                                                               |  |
| L1C, L2C            | Control power supply ter-                                                 | AC<br>power<br>supply                                                                                                                                                                                                                          | Single-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz                                                                                                                                                                                                                   |  |
| LTO, L20            | minals                                                                    | DC<br>power<br>supply                                                                                                                                                                                                                          | L1C: 270 VDC to 324 VDC, -15% to +10%, L2C: 0 VDC<br>or<br>L2C: 270 VDC to 324 VDC, -15% to +10%, L1C: 0 VDC                                                                                                                                                                  |  |
|                     |                                                                           |                                                                                                                                                                                                                                                | Wiring Regenerative Resistors on page 4-23                                                                                                                                                                                                                                    |  |
|                     |                                                                           | ■ For SGD7S-R70A, -R90A, -1R6A, and -2R8A<br>If the regenerative capacity is insufficient, connect an External<br>Regenerative Resistor between B1/⊕ and B2.<br>The External Regenerative Resistor is not included. Obtain it sepa-<br>rately. |                                                                                                                                                                                                                                                                               |  |
| B1/⊕, B2,<br>B3     | Regenerative Resistor ter-<br>minals                                      | 330A<br>If the int<br>short ba<br>tive Res                                                                                                                                                                                                     | 07S-3R8A,- 5R5A, -7R6A, -120A, -180A, -200A, and -<br>ernal regenerative resistor is insufficient, remove the lead or<br>ar between B2 and B3 and connect an External Regenera-<br>istor between B1/⊕ and B2.<br>ernal Regenerative Resistor is not included. Obtain it sepa- |  |
|                     |                                                                           | ■ For SGD7S-470A, -550A, -590A, and -780A                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                               |  |
|                     |                                                                           | Connect a Regenerative Resistor Unit between $B1/\oplus$ and $B2$ .<br>Obtain a Regenerative Resistor Unit separately. These models do<br>not have a B3 terminal.                                                                              |                                                                                                                                                                                                                                                                               |  |
|                     | DC Reactor terminals for                                                  | 3 4.3.6 Wiring Reactors for Harmonic Suppression on page 4-25                                                                                                                                                                                  |                                                                                                                                                                                                                                                                               |  |
| ⊖1, ⊖2              | power supply harmonic suppression                                         |                                                                                                                                                                                                                                                | minals are used to connect a DC Reactor for power supply suppression.                                                                                                                                                                                                         |  |
| $\ominus$           | -                                                                         | None. (Do not connect anything to this terminal.)                                                                                                                                                                                              |                                                                                                                                                                                                                                                                               |  |

4.3.1 Terminal Symbols and Terminal Names

| Terminal<br>Symbols | Terminal Name                                                                                                    | Specifications and Reference                                                                                 |                                                                                                                                                                                                                                                                 |
|---------------------|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| L1, L2              | Main circuit power supply<br>input terminals for AC power<br>supply input                                        | Single-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz                                                  |                                                                                                                                                                                                                                                                 |
|                     | L1C, L2C Control power supply terminals Control power supply terminals DC L1C: 270 VDC to 324 VDC, -15% power or | power                                                                                                        | Single-phase, 200 VAC to 240 VAC, -15% to +10%,<br>50 Hz/60 Hz                                                                                                                                                                                                  |
| LTO, L20            |                                                                                                                  | L1C: 270 VDC to 324 VDC, -15% to +10%, L2C: 0 VDC<br>or<br>L2C: 270 VDC to 324 VDC, -15% to +10%, L1C: 0 VDC |                                                                                                                                                                                                                                                                 |
|                     |                                                                                                                  | <b>4.3</b> .                                                                                                 | 5 Wiring Regenerative Resistors on page 4-23                                                                                                                                                                                                                    |
| B1/⊕, B2,           | Regenerative Resistor termi-                                                                                     | lf the r<br>Regen                                                                                            | COTS-R70A, -R90A, -1R6A, and -2R8A<br>egenerative capacity is insufficient, connect an External<br>erative Resistor between B1/⊕ and B2.<br>ternal Regenerative Resistor is not included. Obtain it<br>tely.                                                    |
| B3                  | nals                                                                                                             | If the ir<br>or sho<br>Regen                                                                                 | GD7S-5R5A and -120AE0A008<br>Internal regenerative resistor is insufficient, remove the lead<br>rt bar between B2 and B3 and connect an External<br>erative Resistor between B1/⊕ and B2.<br>Iternal Regenerative Resistor is not included. Obtain it<br>itely. |
|                     | DC Reactor terminals for                                                                                         | <b>F</b> 4.3.                                                                                                | 6 Wiring Reactors for Harmonic Suppression on page 4-25                                                                                                                                                                                                         |
| ⊖1, ⊖2              | power supply harmonic suppression                                                                                |                                                                                                              | erminals are used to connect a DC Reactor for power sup-<br>ionic suppression.                                                                                                                                                                                  |
| L3, ⊖               | _                                                                                                                | None. (Do not connect anything to these terminals.)                                                          |                                                                                                                                                                                                                                                                 |

#### • Single-Phase, 200-VAC Power Supply Input

You can use a single-phase, 200-V power supply input with the following models. • SGD7S-R70A, -R90A, -1R6A, -2R8A, -5R5A

If you use a single-phase, 200-VAC power supply input for the SERVOPACK's main circuit power supply, set parameter Pn00B to  $n.\Box 1 \Box \Box$  (Use a three-phase power supply input as a single-phase power supply input). Refer to the following section for details.

**Information** You do not need to change the setting of Pn00B to n.  $\Box 1 \Box \Box$  (Use a three-phase power supply input as a single-phase power supply input) for a SERVOPACK with a single-phase 200-VAC power supply input (model number: SGD7S-120AE0A008).

#### Terminal **Terminal Name** Specifications and Reference Symbols AC Single-phase, 200 VAC to 240 VAC, -15% to +10%, power 50 Hz/60 Hz supply Control power supply termi-L1C, L2C nals L1C: 270 VDC to 324 VDC, -15% to +10%, L2C: 0 VDC DC power or L2C: 270 VDC to 324 VDC, -15% to +10%, L1C: 0 VDC supply B1/⊕ Main circuit power supply 270 VDC to 324 VDC, -15% to +10% input terminals for DC 0 VDC Θ2 power supply input L1, L2, None. (Do not connect anything to these terminals.) L3, B2, Note: 1. SGD7S-470A to 780A do not have a B3 terminal. B3, ⊖1, 2. SGD7S-330A to 780A do not have a $\ominus$ terminal. Θ

#### • DC Power Supply Input

If you use a DC power supply input to the SERVOPACK, make sure to set parameter Pn00E to n.  $\Box\Box\Box$  1 (DC power supply input supported) before inputting the power supply. Refer to the following section for details.

5.2.1 AC Power Supply Input/DC Power Supply Input Setting on page 5-12

4.3.2 Wiring Procedure for Main Circuit Connector

| Terminal<br>Symbols | Terminal Name                                                             | Specifications and Reference                                                                                         |
|---------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| L1, L2              | Main circuit power supply<br>input terminals for AC<br>power supply input | Single-phase, 100 VAC to 120 VAC, -15% to +10%, 50 Hz/60 Hz                                                          |
| L1C, L2C            | Control power supply termi-<br>nals                                       | Single-phase, 100 VAC to 120 VAC, -15% to +10%, 50 Hz/60 Hz                                                          |
|                     |                                                                           | 4.3.5 Wiring Regenerative Resistors on page 4-23                                                                     |
| B1, B2              | Regenerative Resistor termi-                                              | If the regenerative capacity is insufficient, connect an External                                                    |
| 01, 02              | nals                                                                      | Regenerative Resistor between B1/⊕ and B2. The External Regenerative Resistor is not included. Obtain it separately. |

#### • Single-Phase, 100-VAC Power Supply Input

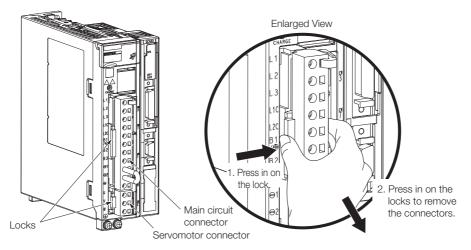
You can use a single-phase, 100-VAC power supply input with the following models. • SGD7S-R70F, -R90F, -2R1F, and -2R8F

## 4.3.2 Wiring Procedure for Main Circuit Connector

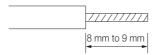
#### · Required Items

| Required Item                               | Remarks                                                                                                                                     |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Spring Opener or Flat-<br>blade Screwdriver | <ul> <li>Spring Opener</li> <li>SERVOPACK accessory</li> <li>(You can also use model 1981045-1 from Tyco Electronics Japan G.K.)</li> </ul> |
|                                             | <ul> <li>Flat-blade screwdriver<br/>Commercially available screwdriver with tip width of 3.0 mm to 3.5 mm</li> </ul>                        |

#### 1. Remove the main circuit connector and motor connector from the SERVOPACK.



2. Remove the sheath from the wire to connect.



4.3.3 Power ON Sequence

**3.** Open the wire insertion hole on the terminal connector with the tool. There are the following two ways to open the insertion hole. Use either method.

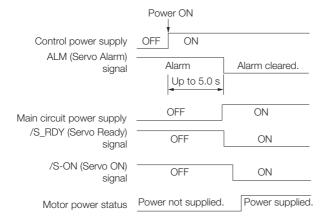
| Using a Spring Opener                                                  | ©Using a Flat-blade Screwdriver                                                                             |
|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Open the insertion hole with the Spring Opener as shown in the figure. | Firmly insert a flat-blade screwdriver into the screwdriver insertion hole to open the wire insertion hole. |
| Spring Opener<br>Wire                                                  |                                                                                                             |

- 4. Insert the conductor into the wire insertion hole. Then, remove the Spring Opener or flatblade screwdriver.
- 5. Make all other connections in the same way.
- 6. When you have completed wiring, attach the connectors to the SERVOPACK.

### 4.3.3 Power ON Sequence

Consider the following points when you design the power ON sequence.

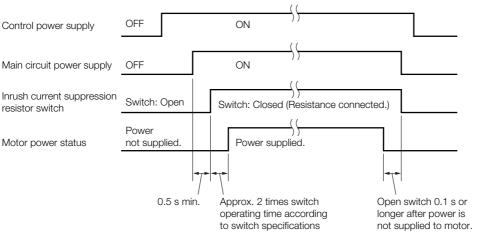
• The ALM (Servo Alarm) signal is output for up to five seconds when the control power supply is turned ON. Take this into consideration when you design the power ON sequence, and turn ON the main circuit power supply to the SERVOPACK when the ALM signal is OFF (alarm cleared).



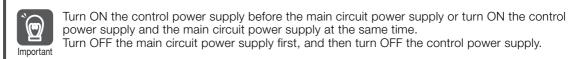
Information If the servo ON state cannot be achieved by turning ON the /S\_ON signal, the /S\_RDY signal is not ON. Check the status of the /S\_RDY signal. Refer to the following section for details.

#### 4.3.3 Power ON Sequence

• If you use a DC power supply input with any of the following SERVOPACKs, use the power ON sequence shown below: SGD7S-330A, -470A, -550A, -590A, or -780A.



- Design the power ON sequence so that main circuit power supply is turned OFF when an ALM (Servo Alarm) signal is output.
- Make sure that the power supply specifications of all parts are suitable for the input power supply.
- Allow at least 1 s after the power supply is turned OFF before you turn it ON again.



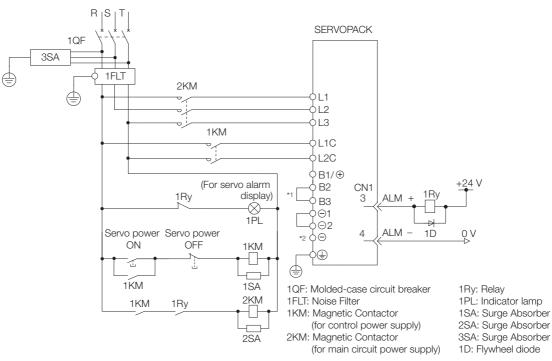
# 

• Even after you turn OFF the power supply, a high residual voltage may still remain in the SERVOPACK. To prevent electric shock, do not touch the power supply terminals after you turn OFF the power. When the voltage is discharged, the CHARGE indicator will turn OFF. Make sure the CHARGE indicator is OFF before you start wiring or inspection work.

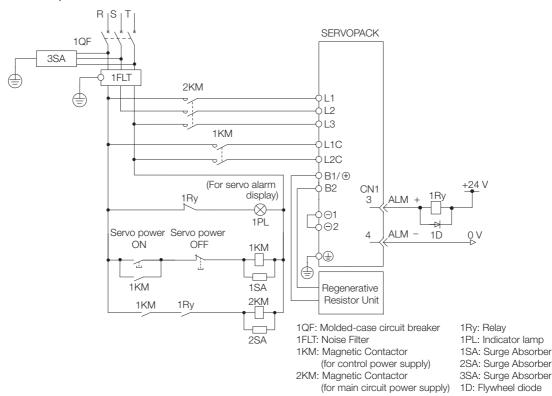
### 4.3.4 Power Supply Wiring Diagrams

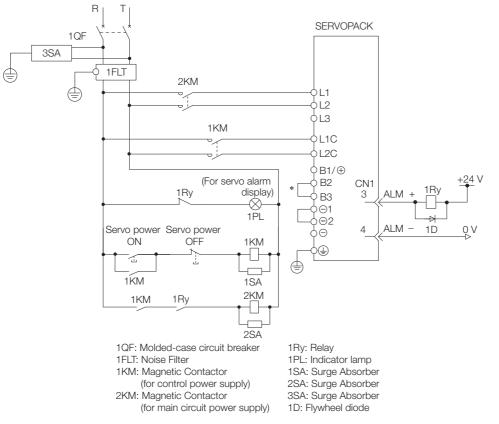
### Using Only One SERVOPACK

• Wiring Example for Three-Phase, 200-VAC Power Supply Input: SGD7S-R70A, -R90A, -1R6A, -2R8A, -3R8A, -5R5A, -7R6A, -120A, -180A, -200A, and -330A



- \*1. You do not have to connect B2 and B3 for the following models: SGD7S-R70A, SGD7S-R90A, SGD7S-1R6A, and SGD7S-2R8A. Do not connect them.
   \*2. A SGD7C 200A SCD VORACLE data and have a statement.
- \*2. A SGD7S-330A SERVOPACK does not have a terminal.
- Wiring Example for Three-Phase, 200-VAC Power Supply Input: SGD7S-470A, -550A, -590A, and -780A

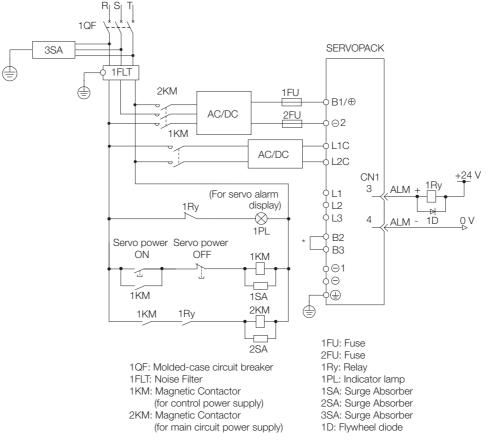




#### • Wiring Example for Single-Phase, 200-VAC Power Supply Input

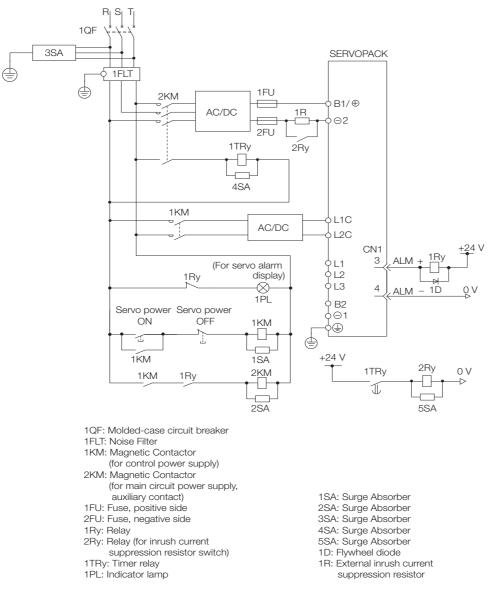
\* You do not have to connect B2 and B3 for the following models: SGD7S-R70A, SGD7S-R90A, SGD7S-1R6A, and SGD7S-2R8A. Do not connect them.

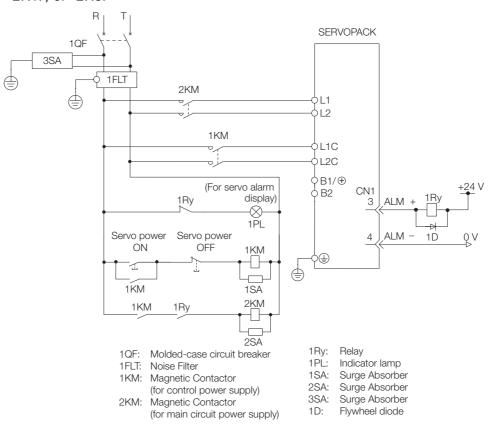
• Wiring Example for DC Power Supply Input: SGD7S-R70A, -R90A, -1R6A, -2R8A, -3R8A, -5R5A, -7R6A, -120A, -180A, and -200A



\* You do not have to connect B2 and B3 for the following models: SGD7S-R70A, SGD7S-R90A, SGD7S-1R6A, and SGD7S-2R8A. Do not connect them.

 Wiring Example for DC Power Supply Input: SGD7S-330A, -470A, -550A, -590A, and -780A





 Wiring Example for Single-Phase, 100-VAC Power Supply Input: SGD7S-R70F, -R90F, -2R1F, or -2R8F

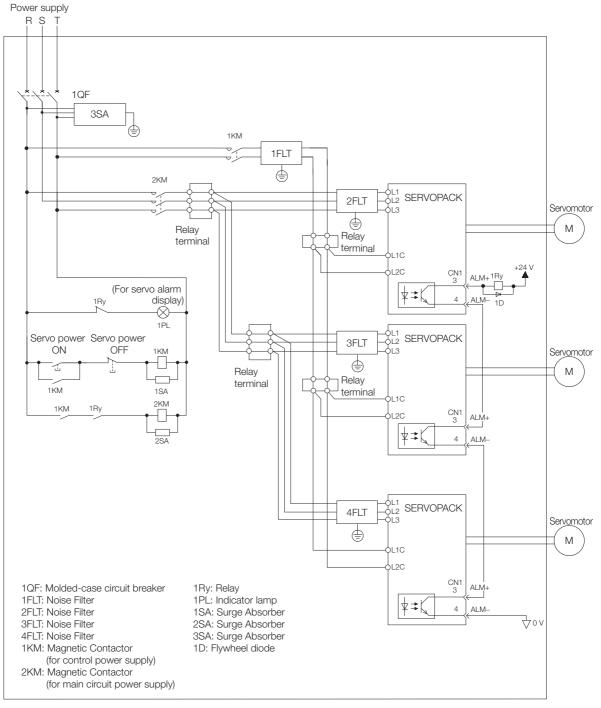
## Using More Than One SERVOPACK

Connect the ALM (Servo Alarm) output for these SERVOPACKs in series to operate the alarm detection relay (1RY).

When a SERVOPACK alarm is activated, the ALM output signal transistor turns OFF.

The following diagram shows the wiring to stop all of the Servomotors when there is an alarm for any one SERVOPACK.

More than one SERVOPACK can share a single Noise Filter. However, always select a Noise Filter that has a large enough capacity to handle the total power supply capacity of all the SERVOPACKs. Be sure to consider the load conditions.



To comply with UL/cUL standards, you must install a branch circuit protective device at the power supply input section to each SERVOPACK. Refer to the following manual for details.  $\square \Sigma$ -7-Series  $\Sigma$ -7S/ $\Sigma$ -7W/ $\Sigma$ -7C SERVOPACK Safety Precautions (Manual No.:TOMP C710828 00)

4.3.5 Wiring Regenerative Resistors

## 4.3.5 Wiring Regenerative Resistors

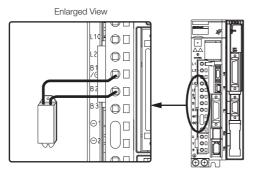
This section describes how to connect External Regenerative Resistors.

Refer to the following manual to select the capacity of a Regenerative Resistor.  $\square \Sigma$ -7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)



## **Connecting Regenerative Resistors**

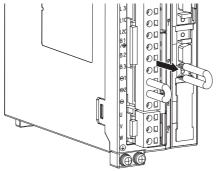
- SERVOPACK Models SGD7S-R70A, -R90A, -1R6A, -2R8A, -R70F, -R90F, -2R1F, and -2R8F
- 1. Connect the External Regenerative Resistor between the B1/⊕ and B2 terminals on the SERVOPACK.



2. Set Pn600 (Regenerative Resistor Capacity) and Pn603 (Regenerative Resistor Resistance).

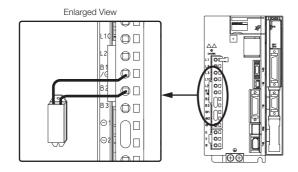
Refer to the following section for details on the settings. 5.17 Setting the Regenerative Resistor Capacity on page 5-54

- SERVOPACK Models SGD7S-3R8A, -5R5A, -7R6A, -120A, -180A, -200A, and -330A
- 1. Remove the lead from between the B2 and B3 terminals on the SERVOPACK.



4.3.5 Wiring Regenerative Resistors

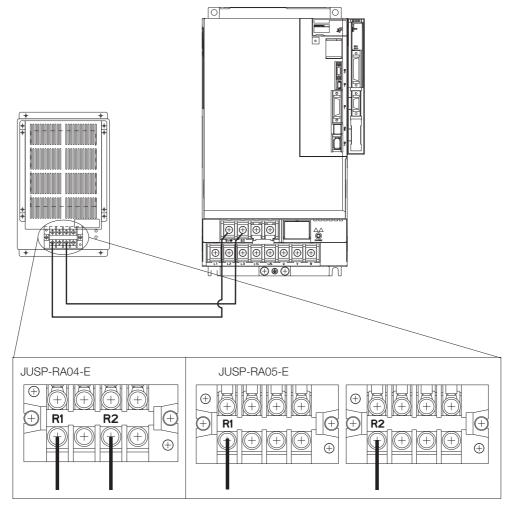
2. Connect the External Regenerative Resistor between the B1/ $\oplus$  and B2 terminals.



3. Set Pn600 (Regenerative Resistor Capacity) and Pn603 (Regenerative Resistor Resistance).

Refer to the following section for details on the settings. 5.17 Setting the Regenerative Resistor Capacity on page 5-54

- SERVOPACK Models SGD7S-470A, -550A, -590A, and -780A
- 1. Connect the R1 and R2 terminals on the Regenerative Resistor Unit to the B1/⊕ and B2 terminals on the SERVOPACK.



4.3.6 Wiring Reactors for Harmonic Suppression

# 2. Set Pn600 (Regenerative Resistor Capacity) and Pn603 (Regenerative Resistor Resistance) as required.

- When using the Yaskawa-recommended Regenerative Resistor Unit, use the default settings for Pn600 and Pn603.
- If you use any other external regenerative resistor, set Pn600 and Pn603 according to the specifications of the regenerative resistor.

Refer to the following section for details on the settings.

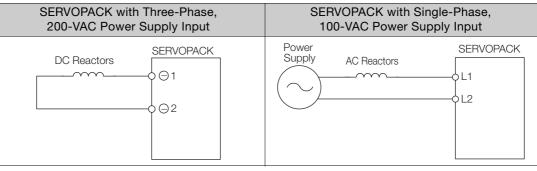
5.17 Setting the Regenerative Resistor Capacity on page 5-54

### 4.3.6 Wiring Reactors for Harmonic Suppression

You can connect a reactor for harmonic suppression to the SERVOPACK when power supply harmonic suppression is required. Refer to the following manual for details on reactors for harmonic suppression.

Ω Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)

#### Refer to the following figures to connect reactors.



Note: 1. Connection terminals  $\ominus$  1 and  $\ominus$  2 for a DC Reactor are connected when the SERVOPACK is shipped. Remove the lead wire and connect a DC Reactor.

2. Reactors are optional products. (Purchase them separately.)

3. You cannot connect a DC Reactor to a SERVOPACK with a single-phase, 100-VAC power supply input.

4.4.1 Terminal Symbols and Terminal Names

# 4.4 Wiring Servomotors

## 4.4.1 Terminal Symbols and Terminal Names

The SERVOPACK terminals or connectors that are required to connect the SERVOPACK to a Servomotor are given below.

| Terminal/Connector<br>Symbols | Terminal/Connector Name | Remarks                                                                                                                                                     |
|-------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| U, V, and W                   | Servomotor terminals    | <ul> <li>Refer to the following section for the wiring procedure.</li> <li><i>4.3.2 Wiring Procedure for Main Circuit Connector</i> on page 4-14</li> </ul> |
|                               | Ground terminal         | -                                                                                                                                                           |
| CN2                           | Encoder connector       | _                                                                                                                                                           |

# 4.4.2 Pin Arrangement of Encoder Connector (CN2)

| Pin No. | Signal   | Function                         |
|---------|----------|----------------------------------|
| 1       | PG5V     | Encoder power supply +5 V        |
| 2       | PG0V     | Encoder power supply 0 V         |
| 3       | BAT (+)* | Battery for absolute encoder (+) |
| 4       | BAT (-)* | Battery for absolute encoder (-) |
| 5       | PS       | Serial data (+)                  |
| 6       | /PS      | Serial data (-)                  |
| Shell   | Shield   | _                                |

\* No wiring is required for an incremental encoder or a batteryless absolute encoder.

#### · When Using a Direct Drive Servomotor

· When Using a Rotary Servomotor

| Pin No. | Signal | Function                  |
|---------|--------|---------------------------|
| 1       | PG5V   | Encoder power supply +5 V |
| 2       | PG0V   | Encoder power supply 0 V  |
| 3       | -      | – (Do not use.)           |
| 4       | -      | – (Do not use.)           |
| 5       | PS     | Serial data (+)           |
| 6       | /PS    | Serial data (-)           |
| Shell   | Shield | -                         |

#### · When Using a Linear Servomotor

| Pin No. | Signal | Function                         |
|---------|--------|----------------------------------|
| 1       | PG5V   | Linear encoder power supply +5 V |
| 2       | PG0V   | Linear encoder power supply 0 V  |
| 3       | -      | – (Do not use.)                  |
| 4       | -      | – (Do not use.)                  |
| 5       | PS     | Serial data (+)                  |
| 6       | /PS    | Serial data (-)                  |
| Shell   | Shield | -                                |

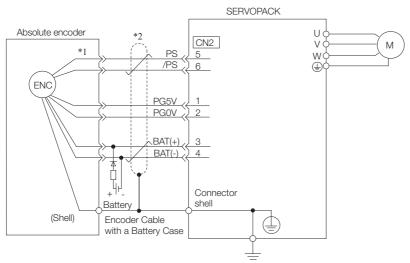
# 4.4.3 Wiring the SERVOPACK to the Encoder

### When Using an Absolute Encoder

If you use an absolute encoder, use an Encoder Cable with a JUSP-BA01-E Battery Case or install a battery on the host controller.

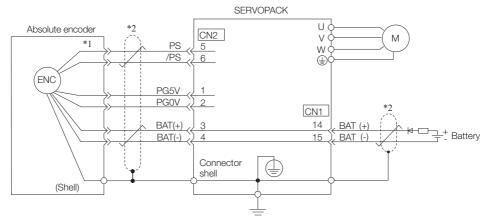
Refer to the following section for the battery replacement procedure. *15.1.3 Replacing the Battery* on page 15-3

• Wiring Example When Using an Encoder Cable with a Battery Case

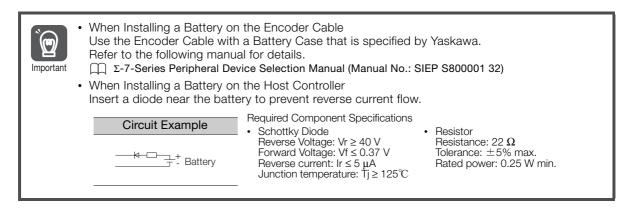


- \*1. The absolute encoder pin numbers for wiring the connector depend on the Servomotor that you use.
- \*2. represents a shielded twisted-pair cable.

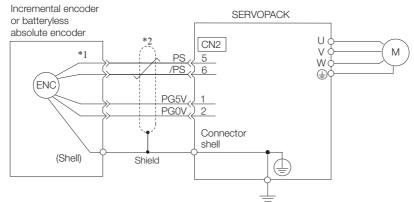
#### · Wiring Example When Installing a Battery on the Host Controller



- \*1. The absolute encoder pin numbers for wiring the connector depend on the Servomotor that you use.
- \*2. represents a shielded twisted-pair cable.



# When Using an Incremental Encoder or Batteryless Absolute Encoder



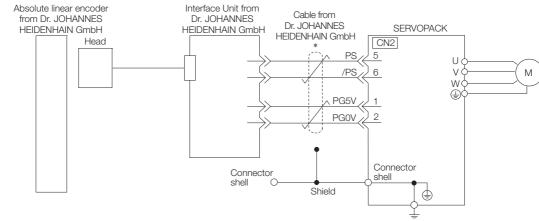
- \*1. The encoder pin numbers for wiring the connector depend on the Servomotor that you use.
- \*2. represents a shielded twisted-pair cable.

### When Using an Absolute Linear Encoder

The wiring depends on the manufacturer of the linear encoder.

#### Connections to Linear Encoder from Dr. JOHANNES HEIDENHAIN GmbH

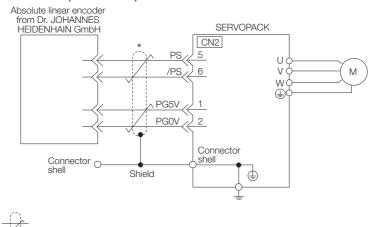
■ LIC4100 Series, LIC2100 Series, LC115, and LC415



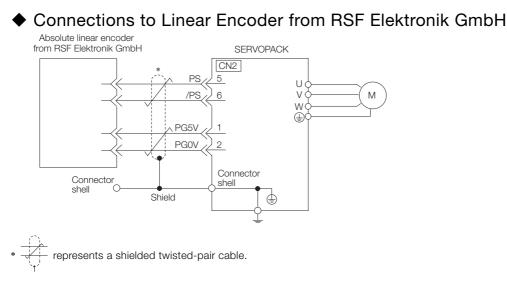
represents a shielded twisted-pair cable.

Information Sales of the interface unit EIB3391Y with the LIC4100 and LIC2100 series have ended due to the release of the LIC4190, LIC3190, and LIC2190 series.

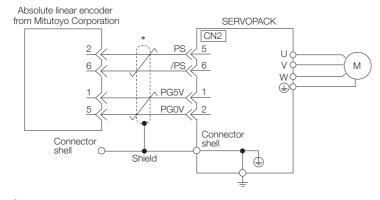
#### ■ LIC4190, LIC3190, and LIC2190 Series



\* represents a shielded twisted-pair cable.

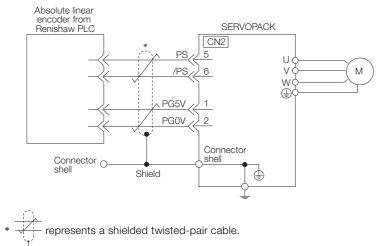


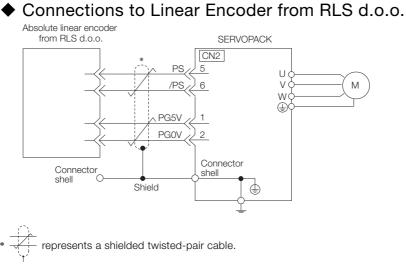
### Connections to Linear Encoder from Mitutoyo Corporation



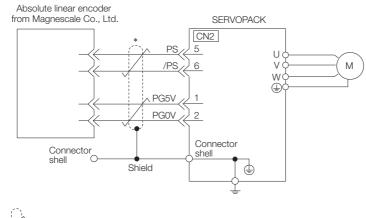
\*  $\overrightarrow{|}_{\tau'}$  represents a shielded twisted-pair cable.

#### Connections to Absolute Linear Encoder from Renishaw PLC



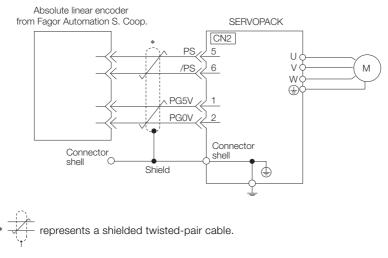


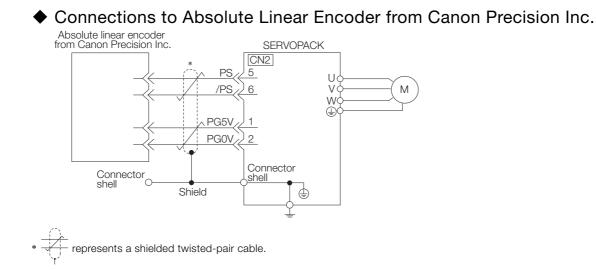
### Connections to Absolute Linear Encoder from Magnescale Co., Ltd.



represents a shielded twisted-pair cable.

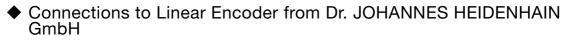
#### Connections to Absolute Linear Encoder from Fagor Automation S. Coop.

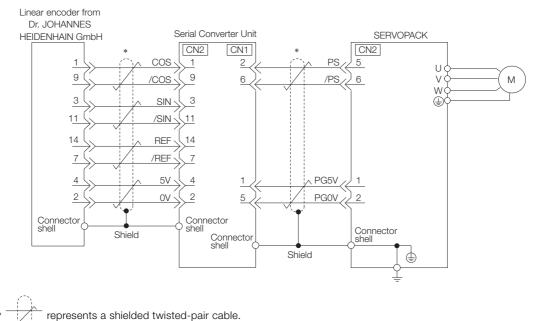




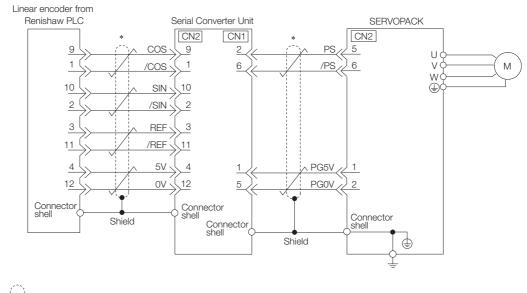
### When Using an Incremental Linear Encoder

The wiring depends on the manufacturer of the linear encoder.





### Connections to Linear Encoder from Renishaw PLC

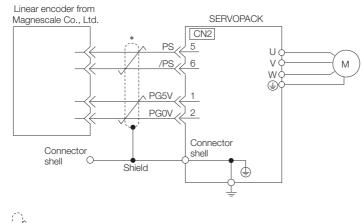


\* represents a shielded twisted-pair cable.

#### ◆ Connections to Linear Encoder from Magnescale Co., Ltd.

If you use a linear encoder from Magnescale Co., Ltd., the wiring will depend on the model of the linear encoder.

#### ■ SR75 and SR85

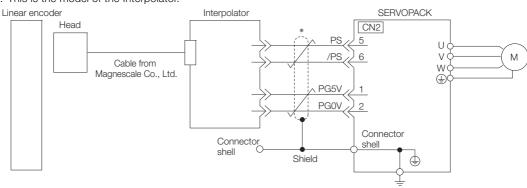


represents a shielded twisted-pair cable.

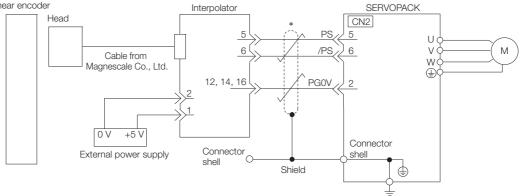
- SL700, SL710, SL720, SL730, and SQ10
- PL101-RY, MQ10-FLA, or MQ10-GLA Interpolator The following table gives the Linear Encoder and Interpolator combinations.

| Linear Encoder Model           | Interpolator Model |
|--------------------------------|--------------------|
| SL700, SL710, SL720, and SL730 | PL101-RY*1         |
| SQ10                           | MQ10-FLA*2         |
|                                | MQ10-GLA*2         |

- \*1. This is the model of the Head with Interpolator.
- \*2. This is the model of the Interpolator.

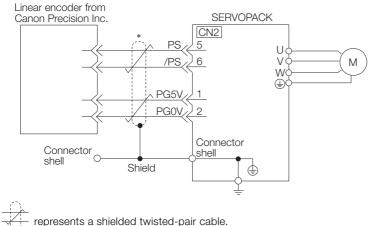


- \* represents a shielded twisted-pair cable.
- SL700, SL710, SL720, and SL730
   MJ620-T13 Interpolator
- Linear encoder



represents a shielded twisted-pair cable.

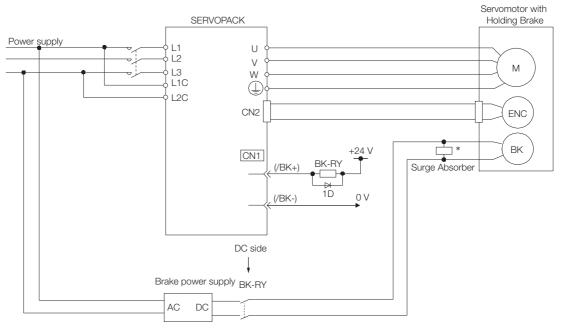
Connections to Linear Encoder from Canon Precision Inc.



4.4.4 Wiring the SERVOPACK to the Holding Brake

## 4.4.4 Wiring the SERVOPACK to the Holding Brake

If you use a Rotary Servomotor, select a Surge Absorber according to the brake current and brake power supply. Refer to the following manual for details.  $\square$   $\Sigma$ -7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32) Important After the Surge Absorber is connected, check the brake operation delay time in your application. The Surge Absorber may affect the brake operation delay time. Configure the relay circuit to activate the holding brake for an emergency stop. **Relay Circuit Example** SERVOPACK 5 VDC to 30 VDC Emergency stop -c Photocoupler ⋬⋧ 7 οv • If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector. If the power supply is shared, the I/O signals may malfunction.



BK-RY: Brake control relay 1D: Flywheel diode

\* Install the surge absorber near the brake terminals on the Servomotor.

# 4.5 I/O Signal Connections

# 4.5.1 I/O Signal Connector (CN1)

This section describes the I/O signals of the SERVOPACK.

### Names and Functions

The following table gives the pin numbers, names, and functions of the I/O signal pins.

#### Input Signals



You cannot change the pin allocations for the input signals on CN1.

| Signal   | Pin No. | Name                                        | Function                                                                                                                                            | Reference  |
|----------|---------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| /ALM-RST | 7       | Alarm Reset Input                           | -                                                                                                                                                   | page 15-48 |
| P-OT     | 8       | Forward Drive Prohibit<br>Input             | Stops Servomotor drive (to prevent over-<br>travel) when the moving part of the                                                                     | page 6-3   |
| N-OT     | 9       | Reverse Drive Prohibit<br>Input             | machine exceeds the range of movement.                                                                                                              |            |
| /DEC     | 10      | Homing Deceleration<br>Switch Input         | Connects the deceleration limit switch for homing.                                                                                                  | page 6-3   |
| Not used | 11      | -                                           | -                                                                                                                                                   | -          |
| /RGRT    | 12      | Registration Input                          | Inputs the latch signal that is used for reg-<br>istration (external positioning).                                                                  | page 6-4   |
| /S-ON    | 13      | Servo ON Input                              | Controls turning the Servomotor ON and OFF (supplying/not supplying power).                                                                         | page 6-3   |
| +24VIN   | 6       | Sequence Input Signal<br>Power Supply Input | Inputs the sequence input signal power<br>supply.<br>Allowable voltage range: 24 VDC ±20%<br>The 24-VDC power supply is not provided<br>by Yaskawa. | _          |
| BAT+     | 14      | Battery for Absolute<br>Encoder (+)         | These are the pins to connect the abso-<br>lute encoder backup battery.                                                                             |            |
| BAT-     | 15      | Battery for Absolute<br>Encoder (-)         | Do not connect these pins if you use the Encoder Cable with a Battery Case.                                                                         | _          |
| ТН       | 5       | Overheat Protection<br>Input                | Inputs the overheat protection signal from<br>a Linear Servomotor or from a sensor<br>attached to the machine.                                      | page 6-40  |

Note: If forward drive prohibition or reverse drive prohibition is used, the SERVOPACK is stopped by software controls. If the application does not satisfy the safety requirements, add external safety circuits as required.

#### Output Signals

Default settings are given in parentheses.

| Signal            | Pin No. | Name               | Function                                                                                                                         | Reference |
|-------------------|---------|--------------------|----------------------------------------------------------------------------------------------------------------------------------|-----------|
| ALM+              | 3       | Servo Alarm Output | Turns OFF (opens) when an error is detected.                                                                                     | page 6-7  |
| ALM-              | 4       | Servo Alarm Output | Turns Off (opens) when all error is detected.                                                                                    |           |
| /SO1+<br>(/WARN+) | 1       |                    | You can allocate the output signal to use with a parameter.                                                                      | page 6-8  |
| /SO1-<br>(/WARN-) | 2       | Warning Output     | (Error/Warning:<br>ON for 2 seconds when an error has occurred.<br>/WARN- ON continuously while a warning is<br>being detected.) |           |

Continued on next page.

Continued from previous page.

| Signal             | Pin No. | Name                  | Function                                                                                                 | Reference              |  |
|--------------------|---------|-----------------------|----------------------------------------------------------------------------------------------------------|------------------------|--|
| /SO2+<br>(/BK+)    | 23      | Brake Output          | You can allocate the output signal to use with a parameter.                                              |                        |  |
| /SO2-<br>(/BK-)    | 24      | Brake Output          | (Controls the brake. The brake is released when the signal turns ON (closes).)                           | page 6-8               |  |
| /SO3+<br>(/S-RDY+) | 25      |                       | You can allocate the output signal to use with a parameter.                                              |                        |  |
| /SO3-<br>(/S-RDY-) | 26      | Servo Ready Output    | (Turns ON (closes) when the SERVOPACK is ready to acknowledge the /S-ON (Servo ON) signal.)              | page 6-8               |  |
| PAO                | 17      | Encoder Divided Pulse |                                                                                                          |                        |  |
| /PAO               | 18      | Output, Phase A       | Output the encoder divided pulse output sig-                                                             | page 6-23<br>page 6-29 |  |
| PBO                | 19      | Encoder Divided Pulse | nals with a 90° phase differential.                                                                      |                        |  |
| /PBO               | 20      | Output, Phase B       |                                                                                                          |                        |  |
| PCO                | 21      | Encoder Divided Pulse | Outputs the origin signal once every encoder                                                             |                        |  |
| /PCO               | 22      | Output, Phase C       | rotation.                                                                                                |                        |  |
| SG                 | 16      | Signal ground         | This is the 0-V signal for the control circuits.                                                         | -                      |  |
| FG                 | Shell   | Frame ground          | Connected to the frame ground if the shield of the I/O Signal Cable is connected to the connector shell. | -                      |  |

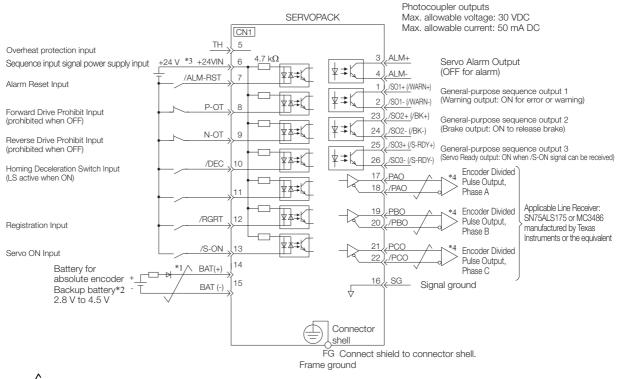
## **Pin Layout**

The following figure gives the pin arrangement of the of the I/O signal connector (CN1) for the default settings.

|                                                                                                                  | 2  | /SO1-                           | Warning                                     | 1              | /SO1+<br>(/WARN+)                       | Warning<br>Output            | 15    | BAT-               | Battery for<br>Absolute                           | 14 | BAT+               | Battery for<br>Absolute<br>Encoder (+) |
|------------------------------------------------------------------------------------------------------------------|----|---------------------------------|---------------------------------------------|----------------|-----------------------------------------|------------------------------|-------|--------------------|---------------------------------------------------|----|--------------------|----------------------------------------|
|                                                                                                                  |    | (/WARIN-)                       | (/WARN-) Output                             | 3              |                                         | Servo                        |       |                    | Encoder (-)                                       | 16 | 00                 | Signal                                 |
| Pin 1                                                                                                            |    | 4 ALM-                          | - Alarm<br>Output                           | 3              | ALM+                                    | Alarm<br>Output              | 17    | PAO                | Encoder<br>Divided<br>Pulse<br>Output,<br>Phase A | 16 | SG                 | Ground                                 |
| Pin 2                                                                                                            | 4  |                                 |                                             | 5 TH           | TH                                      | Overheat<br>Protection       |       |                    |                                                   | 18 | /PAO               | Encoder<br>Divided<br>Pulse            |
| Pin 12                                                                                                           |    |                                 | Sequence<br>Input Sig-                      | 7 /ALM-<br>RST | Input                                   |                              |       | Encoder<br>Divided |                                                   |    | Output,<br>Phase A |                                        |
| Pin 12<br>Pin 13<br>Pin 25<br>Pin 26                                                                             | 6  | +24VIN                          | nal Power<br>Supply<br>Input                |                | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | Alarm<br>Reset Input         | 19    | PBO                | Pulse<br>Output,<br>Phase B                       | 20 | /PBO               | Encoder<br>Divided<br>Pulse            |
| The above view is<br>from the direction<br>of the following<br>arrow without the<br>connector shell<br>attached. | 8  | P-OT                            | Forward<br>Drive<br>Prohibit<br>Input       |                |                                         | nooot input                  | 21    | PCO                | Encoder<br>Divided                                |    |                    | Output,<br>Phase B                     |
|                                                                                                                  |    |                                 |                                             | 9              | N-OT                                    | Reverse<br>Drive<br>Prohibit |       |                    | Pulse<br>Output,<br>Phase C                       | 22 | /PCO               | Encoder<br>Divided<br>Pulse            |
|                                                                                                                  | 10 | /DEC Decele<br>tion Sw<br>Input | Homing<br>Decelera-<br>tion Switch<br>Input |                |                                         | Input                        | 23    | /SO2+<br>(/BK+)    | Brake<br>Output                                   |    |                    | Output,<br>Phase C                     |
|                                                                                                                  |    |                                 |                                             | 11             | 11 Not<br>used                          | _                            |       |                    |                                                   | 24 | /SO2-<br>(/BK-)    | Brake<br>Output                        |
|                                                                                                                  | 12 |                                 | Registra-                                   | 0000           |                                         |                              | 25    | /SO3+<br>(/S-      | Servo<br>Ready<br>Output                          | 26 | /SO3-<br>(/S-      | Servo<br>Ready                         |
|                                                                                                                  | 12 |                                 | tion input                                  | 13             | 13 /S-ON                                | Servo ON<br>Input            | RDY+) |                    |                                                   |    |                    |                                        |
|                                                                                                                  |    |                                 |                                             |                |                                         |                              |       |                    |                                                   |    | RDY-)              | Output                                 |

### I/O Signal Wiring Examples

#### Using a Rotary Servomotor



\*1. - represents twisted-pair wires.

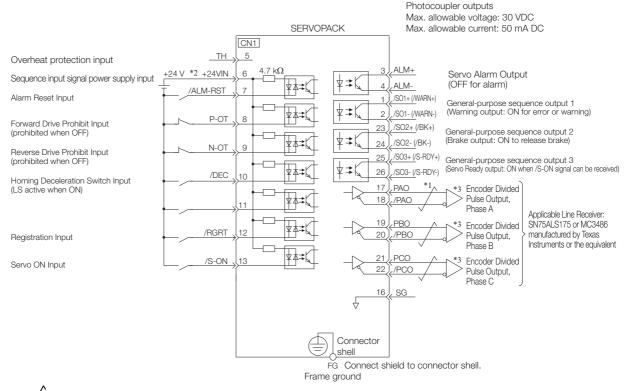
\*2. Connect these when using an absolute encoder. If the Encoder Cable with a Battery Case is connected, do not connect a backup battery.

\*3. The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.

\*4. Always use line receivers to receive the output signals.

Note: If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector. If the power supply is shared, the I/O signals may malfunction.

#### Using a Linear Servomotor



 represents twisted-pair wires. \*1

\*2. The 24-VDC power supply is not provided by Yaskawa. Use a 24-VDC power supply with double insulation or reinforced insulation.

\*3. Always use line receivers to receive the output signals.

Note: If you use a 24-V brake, install a separate power supply for the 24-VDC power supply from other power supplies, such as the one for the I/O signals of the CN1 connector. If the power supply is shared, the I/O signals may malfunction.

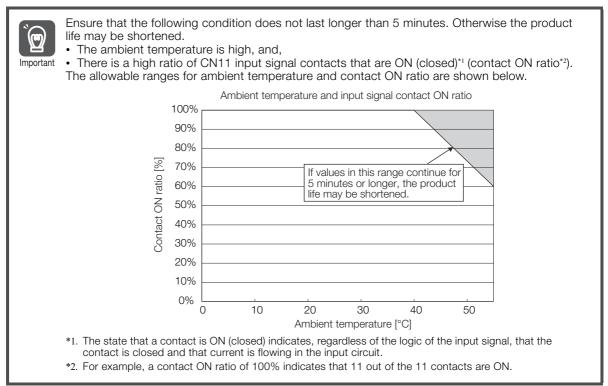
4.5.2 Input Signal Connector (CN11)

## 4.5.2 Input Signal Connector (CN11)

This section describes the I/O signals of the INDEXER Module.

### Names and Functions

#### Input Signals



| Signal Name           | Pin No. | Function                                                                                                                                                                                                                                                                                |  |  |  |  |  |
|-----------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| +24V/COM              | 1       | Power Supply for Sequence Signals. Voltage range: 24 VDC ±10%                                                                                                                                                                                                                           |  |  |  |  |  |
| /MODE 0/1             | 3       | This pin switches between Mode 0 and Mode 1.<br>ON: Mode 0 (program table operation)<br>OFF: Mode 1 (JOG speed table operation or homing)                                                                                                                                               |  |  |  |  |  |
| /START-STOP;<br>/HOME | 5       | <ul> <li>Mode 0: When ON, starts or restarts program table operation. Refers to signals /SEL0 through /SEL7 when starting operation.<br/>When OFF, interrupts program table operation.</li> <li>Mode 1: When ON, starts or restarts homing.<br/>When OFF, interrupts homing.</li> </ul> |  |  |  |  |  |
| /PGMRES; /JOGP        | 7       | <ul><li>Mode 0: When ON while program table operation is interrupted, resets program table operation.</li><li>Mode 1: When ON, causes forward JOG operation.</li><li>When OFF, stops forward JOG operation.</li></ul>                                                                   |  |  |  |  |  |
| /SEL0; /JOGN          | 9       | Mode 0: Program table 0<br>Mode 1: When ON, causes reverse JOG operation.<br>When OFF, stops reverse JOG operation.                                                                                                                                                                     |  |  |  |  |  |
| /SEL1; /JOG0          | 11      | Mode 0: Program table selection 1<br>Mode 1: JOG speed table selection 0                                                                                                                                                                                                                |  |  |  |  |  |
| /SEL2; /JOG1          | 13      | Mode 0: Program table selection 2<br>Mode 1: JOG speed table selection 1                                                                                                                                                                                                                |  |  |  |  |  |
| /SEL3; /JOG2          | 15      | Mode 0: Program table selection 3<br>Mode 1: JOG speed table selection 2                                                                                                                                                                                                                |  |  |  |  |  |

Continued on next page.

#### 4.5.2 Input Signal Connector (CN11)

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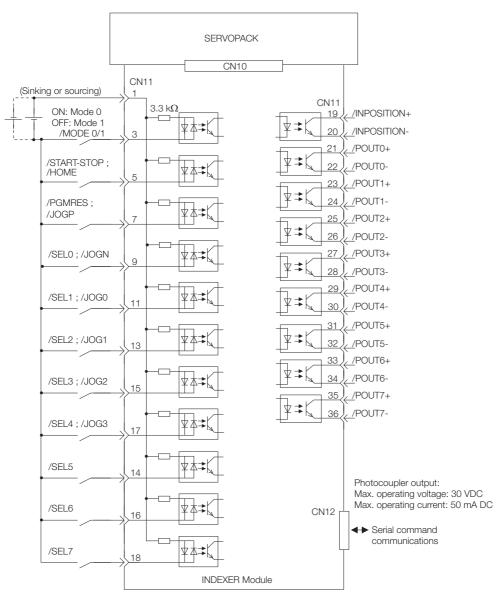
| Signal Name                                                                            | Pin No.                                               | Function                                       |
|----------------------------------------------------------------------------------------|-------------------------------------------------------|------------------------------------------------|
| /SEL4; /JOG317Mode 0: Program table selection 4<br>Mode 1: JOG speed table selection 3 |                                                       |                                                |
| /SEL5                                                                                  | 14                                                    | Mode 0: Program table selection 5<br>Mode 1: - |
| /SEL6                                                                                  | 16     Mode 0: Program table selection 6<br>Mode 1: – |                                                |
| /SEL7                                                                                  | 18                                                    | Mode 0: Program table selection 7<br>Mode 1: - |

#### ♦ Output Signals

| Signal Name   | Pin No. | Function               |
|---------------|---------|------------------------|
| /INPOSITION+  | 19      | Desitioning complete   |
| /INPOSITION - | 20      | Positioning complete   |
| /POUT0+       | 21      |                        |
| /POUT0-       | 22      |                        |
| /POUT1+       | 23      |                        |
| /POUT1-       | 24      |                        |
| /POUT2+       | 25      |                        |
| /POUT2-       | 26      |                        |
| /POUT3+       | 27      |                        |
| /POUT3-       | 28      | - Programmable outputs |
| /POUT4+       | 29      |                        |
| /POUT4-       | 30      |                        |
| /POUT5+       | 31      |                        |
| /POUT5-       | 32      |                        |
| /POUT6+       | 33      |                        |
| /POUT6-       | 34      |                        |
| /POUT7+       | 35      |                        |
| /POUT7-       | 36      | ]                      |

4.5.2 Input Signal Connector (CN11)

## **Connection Example**



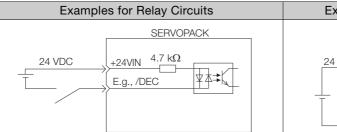
Note: /START-STOP, /PGMRES, /SEL0, /SEL1, /SEL2, /SEL3, /SEL4, /SEL5, /SEL6, and SEL7 signals are valid when Mode 0 is set. /HOME, /JOGP, /JOGN, /JOG0, /JOG1, /JOG2, and /JOG3 signals are valid when Mode 1 is set.

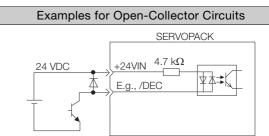
## 4.5.3 I/O Circuits

#### **Sequence Input Circuits**

#### Photocoupler Input Circuits

This section describes CN1 connector terminals 6 to 13.

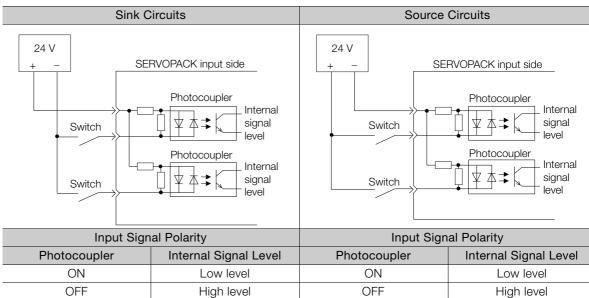




Note: The 24-VDC external power supply capacity must be 50 mA minimum.

The SERVOPACK input circuits use bidirectional photocouplers. Select either a sink circuit or source circuit according to the specifications required by the machine.

Note: The connection examples in I/O Signal Wiring Examples on page 4-38 are for sink circuit connections.



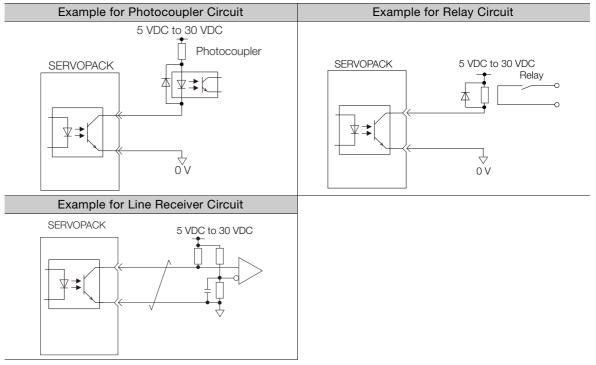
#### **Sequence Output Circuits**

Incorrect wiring or incorrect voltage application to the output circuits may cause short-circuit failures.

If a short-circuit failure occurs as a result of any of these causes, the holding brake will not work. Important This could damage the machine or cause an accident that may result in death or injury.

#### Photocoupler Output Circuits

Photocoupler output circuits are used for the ALM (Servo Alarm), /S-RDY (Servo Ready), and other sequence output signals. Connect an open-collector output circuit to a photocoupler, relay, or line-receiver circuit.



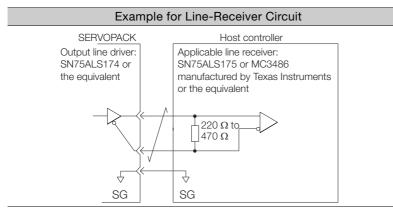
Note: The maximum allowable voltage and current range for photocoupler output circuits are as follows:

Maximum allowable voltage: 30 VDC
Current range: 5 mA to 50 mA DC

#### Line-Driver Output Circuits

This section describes CN1 connector terminals 17-18 (Phase-A Signal), 19-20 (Phase-B Signal), and 21-22 (Phase-C Signal).

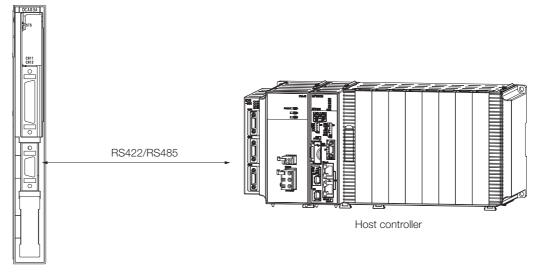
The serial data from the encoder is converted to two-phase (phases A and B) pulses. The resulting output signals (PAO, /PAO and PBO, /PBO), origin pulse signal (PCO and /PCO), and the absolute encoder position output signals (PSO and /PSO) are output with line-driver output circuits. Connect the line-driver output circuits to line-receiver circuits at the host controller.



4.6.1 Connector Mode

# 4.6 Serial Command Communications Connector (CN12)

The CN12 connector on the INDEXER Module is used for serial command communications.



## 4.6.1 Connector Mode

| INDEXER                 | Applicable Receptacles |                |               |  |
|-------------------------|------------------------|----------------|---------------|--|
| Module-end<br>Connector | Solder Type            | Case           | Manufacturer  |  |
| 10214-52A2PL<br>14 P    | 10114-3000PE           | 10314-52A0-008 | 3M Japan Ltd. |  |

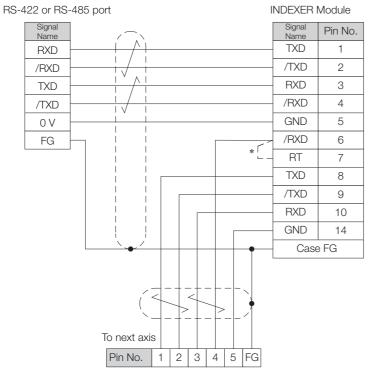
## 4.6.2 Connector Signal Names

| Pin No. | Signal Name | Signal Circuit Name                                                                                                     | Signal Direction                             |
|---------|-------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| 1       | TXD         | Transmit data (not inverted)                                                                                            | Host controller $\leftarrow$ INDEXER Module  |
| 2       | /TXD        | Transmit data (inverted)                                                                                                | Host controller ← INDEXER Module             |
| 3       | RXD         | Receive data (not inverted)                                                                                             | Host controller $\rightarrow$ INDEXER Module |
| 4       | /RXD        | Receive data (inverted)                                                                                                 | Host controller $\rightarrow$ INDEXER Module |
| 5       | GND         | Signal ground (0 V)                                                                                                     | -                                            |
| 6       | /RXD        | Receive data (inverted)                                                                                                 | -                                            |
| 7       | RT          | If RT and /RXD are connected (shorted), the built-in terminator (120 $\Omega$ ) will be connected between RXD and /RXD. |                                              |
| 8       | TXD         | Transmit data (not inverted) Next axis ← INDEXER Module                                                                 |                                              |
| 9       | /TXD        | Transmit data (inverted)                                                                                                | Next axis $\leftarrow$ INDEXER Module        |
| 10      | RXD         | Receive data (not inverted)                                                                                             | Next axis $\rightarrow$ INDEXER Module       |
| 11      | Reserved    | Reserved pin                                                                                                            | -                                            |
| 12      | Reserved    | Reserved pin –                                                                                                          |                                              |
| 13      | Reserved    | Reserved pin –                                                                                                          |                                              |
| 14      | GND         | Signal ground (0 V)                                                                                                     | -                                            |

4.6.3 Connection Examples

## 4.6.3 Connection Examples

## **Full-duplex Wiring**



\* Connect (short) the RT and /RXD pins in the last axis. Note: Cable length: 50 m max.

## Half-duplex Wiring

RS-485 port **INDEXER** Module Signal Name Signal Name Pin No. TXD RXD З /TXD /RXD 4 0 V GND 5 /RXD 6 FG \* RT 7 RXD 10 GND 14 Case FG To next axis Pin No. 3 4 5 FG

\* Connect (short) the RT and /RXD pins in the last axis.

## 4.6.4 Wiring Precautions

- The maximum total length for RS-422 or RS-485 cable is 50 m. Use the minimum length of cable that is needed.
- The INDEXER Module's communications circuits are not insulated. If communications errors occur because of noise, use noise suppression methods such as shielded cable or ferrite cores.
- When using full-duplex wiring, connect a terminator in the host controller's reception circuit and the reception circuit of the last INDEXER Module in the line. The INDEXER Module has a built-in terminator (120  $\Omega$ ) that is connected between the RXD and /RXD pins when the RT and /RXD pins are shorted.
- When using half-duplex wiring, connect a terminator at both ends of the communications cable. The INDEXER Module has a built-in terminator (120  $\Omega$ ) that is connected between the RXD and /RXD pins when the RT and /RXD pins are shorted.
- The INDEXER Module's transmission circuit is high-impedance when it is not transmitting. Pull up or pull down the host controller's reception circuit.

4

4-47

4.7.1 Pin Arrangement of Safety Function Signals (CN8)

# 4.7 Connecting Safety Function Signals

This section describes the wiring required to use a safety function. Refer to the following chapter for details on the safety function. *Chapter 11 Safety Functions* 

## 4.7.1 Pin Arrangement of Safety Function Signals (CN8)

| Pin No. | Signal  | Name                                    | Function                                                                     |  |
|---------|---------|-----------------------------------------|------------------------------------------------------------------------------|--|
| 1       | _       | - (Do not uso those pips because they a | are connected to internal circuits.)                                         |  |
| 2       | -       | - (Do not use these pins because they a |                                                                              |  |
| 3       | /HWBB1- | Hard Wire Base Block Input 1            |                                                                              |  |
| 4       | /HWBB1+ | That whe base block input i             | For a hard wire base block input. The base block (motor power turned OFF) is |  |
| 5       | /HWBB2- | Hard Wire Base Block Input 2            | in effect when the signal is OFF.                                            |  |
| 6       | /HWBB2+ | That whe base block input 2             |                                                                              |  |
| 7       | EDM1-   | External Device Monitor Output          | Turns ON when the /HWBB1 and the /HWBB2 signals are input and the SER-       |  |
| 8       | EDM1+   |                                         | VOPACK enters a base block state.                                            |  |

### 4.7.2 I/O Circuits

For safety function signal connections, the input signal is the 0-V common and the output signal is a source output. This is opposite to other signals described in this manual.

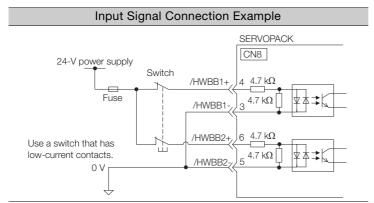
To avoid confusion, the ON and OFF status of signals for the safety function are defined as follows:

ON: The state in which the relay contacts are closed or the transistor is ON and current flows into the signal line.

OFF: The state in which the relay contacts are open or the transistor is OFF and no current flows into the signal line.

#### Safety Input Circuits

Use a 0-V common to connect the safety function signals. You must connect redundant input signals.



4.7.2 I/O Circuits

| Туре   | Signal | Connector<br>Pin No. | Status      | Meaning                                              |
|--------|--------|----------------------|-------------|------------------------------------------------------|
| ,      |        | CN8-4<br>CN8-3       | ON (closed) | Does not activate the HWBB (normal operation).       |
|        | /HWBB1 |                      | OFF (open)  | Activates the HWBB (motor current shut-OFF request). |
| Inputs | /HWBB2 | CN8-6<br>CN8-5       | ON (closed) | Does not activate the HWBB (normal operation).       |
|        |        |                      | OFF (open)  | Activates the HWBB (motor current shut-OFF request). |

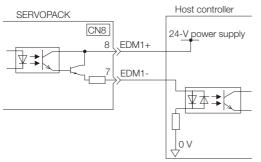
#### ◆ Input (HWBB) Signal Specifications

The input (HWBB) signals have the following electrical characteristics.

| Item                       | Characteristics | Remarks                                                                 |
|----------------------------|-----------------|-------------------------------------------------------------------------|
| Internal Imped-<br>ance    | 4.7 kΩ          | _                                                                       |
| Operating Voltage<br>Range | +24 V ±20%      | -                                                                       |
| Maximum Delay<br>Time      | 8 ms            | Time from /HWBB1 and /HWBB2 signals turning OFF until HWBB is activated |

## **Diagnostic Output Circuits**

The EDM1 output signal uses a source circuit. The following figure shows a connection example.



#### EDM1 Output Signal Specifications

| Туре   | Signal | Pin No. | Output<br>Status | Meaning                                                          |
|--------|--------|---------|------------------|------------------------------------------------------------------|
|        | EDM1   | CN8-8   | ON               | Both the /HWBB1 and /HWBB2 signals are operat-<br>ing normally.  |
| Output |        | CN8-7   | OFF              | The /HWBB1 signal, the /HWBB2 signal, or both are not operating. |

The electrical characteristics of the EDM1 signal are as follows:

| Item                           | Characteristics | Remarks                                                       |
|--------------------------------|-----------------|---------------------------------------------------------------|
| Maximum Allow-<br>able Voltage | 30 VDC          | _                                                             |
| Maximum Allow-<br>able Current | 50 mA DC        | _                                                             |
| Maximum ON<br>Voltage Drop     | 1.0 V           | Voltage between EDM1+ and EDM1- when current is 50 mA         |
| Maximum Delay<br>Time          | 8 ms            | Time from a change in /HWBB1 or /HWBB2 until a change in EDM1 |

4.8.1 Serial Communications Connector (CN3)

# 4.8 Connecting the Other Connectors

#### 4.8.1 Serial Communications Connector (CN3)

To use a Digital Operator, connect it to CN3 on the SERVOPACK.

Refer to the following manual for the operating procedures for the Digital Operator.  $\square \Sigma$ -7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

## 4.8.2 Computer Connector (CN7)

To use the SigmaWin+ Engineering Tool, connect the computer on which the SigmaWin+ is installed to CN7 on the SERVOPACK.

Refer to the following manual for the operating procedures for the SigmaWin+.

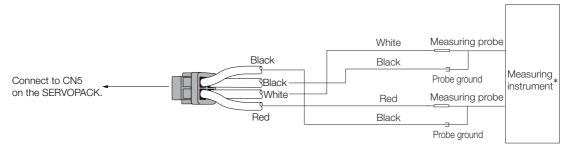


Use the Yaskawa-specified cables. Operation will not be dependable due to low noise resistance with any other cable.

## 4.8.3 Analog Monitor Connector (CN5)

To use an analog monitor, connect CN5 on the SERVOPACK.

• Wiring Example



\* The measuring instrument is not provided by Yaskawa.

Refer to the following section for information on the monitoring methods for an analog monitor. **9.3** Monitoring Machine Operation Status and Signal Waveforms on page 9-7

# Basic Functions That Require Setting before Operation

5

This chapter describes the basic functions that must be set before you start servo system operation. It also describes the setting methods.

| 5.1 | Manip                   | ulating Parameters (PnDDD)5-3                                                                                                                                   |
|-----|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
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5.1.1 Parameter Classification

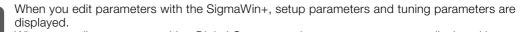
# 5.1 Manipulating Parameters (PnDDD)

This section describes the classifications, notation, and setting methods for the parameters given in this manual.

## 5.1.1 Parameter Classification

There are the following two types of SERVOPACK parameters.

| Classification    | Meaning                                                            |
|-------------------|--------------------------------------------------------------------|
| Setup Parameters  | Parameters for the basic settings that are required for operation. |
| Tuning Parameters | Parameters that are used to adjust servo performance.              |



When you edit parameters with a Digital Operator, only setup parameters are displayed by Important default. To edit tuning parameters, set Pn00B to n.  $\Box$   $\Box$   $\Box$   $\Box$  1 (Display all parameters).

| Parameter |                             | Meaning                        | When Enabled  | Classification |
|-----------|-----------------------------|--------------------------------|---------------|----------------|
| Pn00B     | n.□□□0<br>(default setting) | Display only setup parameters. | After restart | Setup          |
|           |                             | Display all parameters.        |               |                |

The setting method for each type of parameter is described below.

#### **Setup Parameters**

You can use the Digital Operator, or SigmaWin+ to set the setup parameters individually.

Information We recommend that you use the Setup Wizard of the SigmaWin+ to easily set the required setup parameters by setting the operating methods, machine specifications, and I/O signals according to on-screen Wizard instructions.

| Setup Wizard AXIS#00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                            | × |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| SGD7S-R90A00A (100W)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Setting tems                                                                                                                                                                                                                                                                                                               |   |
| Content of the selection for the selection is a selection in the selection is a selection in the selection of the selection o | G Servopack Selection / 400 Encoder Selection<br>Servopack and motor selection. Confirm your motor model and Servopack model. In Online mode<br>(when the Servopack is concerted), the model are automatically displayed. In Offline mode (when<br>the Servopack is disconnected), the model numbers must be set manually. |   |
| Control Mode Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Control Mode Selection<br>Control Mode Selection: Select a control mode such as Speed Control that uses analog votage<br>reference and Postion Control that uses pulse-train reference.                                                                                                                                    |   |
| Reference Input Setting<br>Reference Pulse Configuration : Sign + Pulse<br>Electronic gear ratio : 64 / 1<br>Positioning Completed Width : 7 [reference u                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Reference Input Setting<br>Set the reference input specifications and other items in accordance with the connected machine<br>and host controller.                                                                                                                                                                         |   |
| Motor Encoder Setting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Motor Encoder Setting<br>Configure the settings for the motor and encoder you use, such as encoder type, encoder output<br>from the Servopack (encoder dividing pulse).                                                                                                                                                    |   |
| Output puises : 2048 [P/Rev]<br>Absolute Encoder Usage : Uses absolute en<br>Rotation (movement) direction setting : Stanc<br>c Motor Stop Method Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Motor Stop Method Selection<br>Set the motor stop method and whether or not to use brake at occurrence of alarm when the servo<br>is off (motor power is off) or the when the overtravel limit is used (movable machine parts exceed<br>the alawabe range of motion and turn OH a limit switch).                           |   |
| Servo OFF, G1 alarm : Stop the motor by app<br>Overtravel : Apply the dynamic brake or coa<br>G2 alarm : Stops the motor by setting the spi<br>W VO Signal Setting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | V/O Signal Setting<br>The I/O signal allocations for specified terminal numbers of the CN-1 connector can be changed<br>from the standard allocation. I/O signal forced input and output are provided to check the wiring.                                                                                                 |   |
| Input signal setting : Customize the allocation<br>Output signal setting : Use the standard alloc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ■Save/Write<br>Check the allocated signals, and save the parameters in a file.                                                                                                                                                                                                                                             |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Close                                                                                                                                                                                                                                                                                                                      |   |

5.1.2 Notation for Parameters

#### **Tuning Parameters**

Normally the user does not need to set the tuning parameters individually.

Use the various SigmaWin+ tuning functions to set the related tuning parameters to increase the response even further for the conditions of your machine. Refer to the following sections for details.

3.6 Autotuning without Host Reference on page 8-23

3.7 Autotuning with a Host Reference on page 8-34

🕼 8.8 Custom Tuning on page 8-41

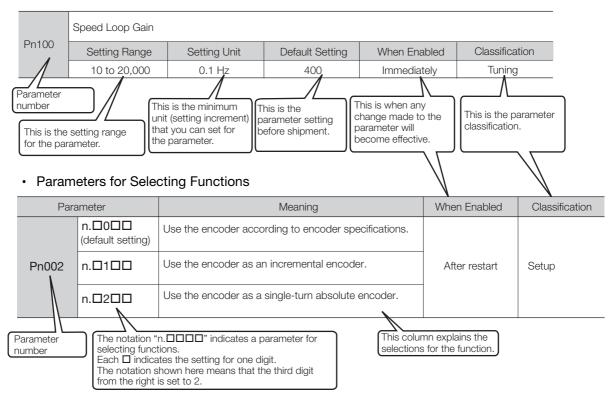
You can also set the tuning parameters individually to make adjustments. Refer to the following section for details.

3.13 Manual Tuning on page 8-73

#### 5.1.2 Notation for Parameters

There are two types of notation used for parameters that depend on whether the parameter requires a numeric setting (parameter for numeric setting) or requires the selection of a function (parameter for selecting a function).

#### · Parameters for Numeric Settings



## 5.1.3 Parameter Setting Methods

You can use the SigmaWin+ or a Digital Operator to set parameters. Use the following procedure to set the parameters.

#### Setting Parameters with the SigmaWin+

- 1. Click the 🥒 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Edit Parameters in the Menu Dialog Box. The Parameter Editing Dialog Box will be displayed.
- 3. Click the cell of the parameter to edit.

If the parameter to edit is not displayed in the Parameter Editing Dialog Box, click the A or S Button to display the parameter to edit.

| <b>☆</b>                                |                                                                                 |                        | YASKAWA SigmaWin+ Ver                              | .7     |                                |                    | -                            | e x   |
|-----------------------------------------|---------------------------------------------------------------------------------|------------------------|----------------------------------------------------|--------|--------------------------------|--------------------|------------------------------|-------|
| 💾 🥘 🕮                                   | Edit Parameters                                                                 | _                      |                                                    |        |                                |                    |                              | • a × |
|                                         | Category<br>All constant number                                                 | SERVOPACK              |                                                    |        |                                |                    |                              | ۵     |
| -R90A00A + R8 P-0T<br>R90A00A ESTP N-0T | Function Selection(Pn0xx-)<br>Gain(Pn1xx-)<br>Position(Pn2xx-)<br>Speed(Pn3xx-) | Edited<br>Parameters F | All Edited All<br>Parameters Parameters Parameters | Import | Export Save to Project Project | Initialize Compare | Remove<br>Servo from<br>List |       |
| POWER ESTP N-OT                         | Torque(Pn4xx-)                                                                  | Read from              | Servo Write to Servo                               | File   | Project                        | Function           | Display                      |       |
|                                         | Sequence(Pn5xx-)<br>I/O Sign                                                    | No.                    | Name                                               | Unit   | 001-SGD7S-R90     Axis A     ■ |                    |                              |       |
|                                         | Display Settings                                                                | Pn000.0                | Direction Selection                                | -      | 0 : Use CCW as t…              |                    |                              |       |
|                                         | Hierarchy:                                                                      | Pn000.1                | Control Method Selection                           | -      | 1 : Position contr             |                    |                              |       |
|                                         | Descriptions:                                                                   | Pn000.2                | Reserved parameter (Do not chang                   | -      | 0 : Reserved para…             |                    |                              |       |
|                                         |                                                                                 | Pn000.3                | Rotary/Linear Startup Selection Wh                 | -      | 0 : Start as a rota…           |                    |                              |       |
|                                         |                                                                                 | Pn001.0                | Servo OFF or Alarm Group 1 Stoppi                  | -      | 0 : Stop the moto…             |                    |                              |       |
|                                         |                                                                                 | Pn001.1                | Overtravel Stopping Method                         | -      | 0 : Apply the dyn…             |                    |                              |       |
|                                         |                                                                                 | Pn001.2                | Main Circuit Power Supply AC/DC In                 | -      | 0 : Input AC pow…              |                    |                              |       |
|                                         |                                                                                 | Pn001.3                | Warning Code Output Selection                      | -      | 0 : Output only al···          |                    |                              |       |
|                                         |                                                                                 | Pn002.0                | Speed/Position Control Option (T-R                 | -      | 0 : Do not use T-···           |                    |                              |       |
|                                         |                                                                                 | Pn002.1                | Torque Control Option (V-REF Input                 | -      | 0 : Do not use V-····          |                    |                              |       |
|                                         |                                                                                 | Pn002.2                | Absolute Encoder Usage                             | -      | 2 : Uses absolute…             |                    |                              |       |
|                                         |                                                                                 | Pn002.3                | External Encoder Usage                             | -      | 0 : Do not use an…             |                    |                              |       |
|                                         |                                                                                 | Pn006.0-1              | Analog Monitor 1 Signal Selection                  | -      | 02 : Torque refer…             |                    |                              |       |
|                                         |                                                                                 | Pn006.2                | Reserved parameter (Do not chang                   | -      | 0 : Reserved para…             |                    |                              |       |
|                                         |                                                                                 | Pn006.3                | Reserved parameter (Do not chang                   | -      | 0 : Reserved para…             |                    |                              |       |
|                                         |                                                                                 | Pn007.0-1              | Analog Monitor 2 Signal Selection                  | -      | 00 : Motor speed…              |                    |                              |       |
|                                         |                                                                                 | Pn007.2                | Reserved parameter (Do not chang                   | -      | 0 : Reserved para…             |                    |                              |       |
|                                         |                                                                                 | Pn007.3                | Reserved parameter (Do not chang                   | -      | 0 : Reserved para…             |                    |                              |       |
|                                         |                                                                                 | Pn008.0                | Low Battery Voltage Alarm/Warning                  | -      | 0 : Output alarm…              |                    |                              |       |
|                                         |                                                                                 | Pn008.1                | Function Selection for Undervoltage                | -      | 0 : Do not detect…             |                    |                              |       |
|                                         |                                                                                 | Pn008.2                | Warning Detection Selection                        | -      | 0 : Detect warnin…             |                    |                              |       |
|                                         | 1                                                                               | Pn008.3                | Reserved parameter (Do not chang                   | -      | 0 : Reserved para…             |                    |                              |       |
| o <sub>1</sub> - 🔀                      |                                                                                 | Pn009.0                | Reserved parameter (Do not chang                   | -      | 0 : Reserved para…             |                    |                              |       |

#### 4. Change the setting of the parameter.

Information

1. For a parameter for a numeric setting, input the numeric setting.

2. If the parameter requires selection of a function, select the function from the list of selections.

5. Press the Enter Key.

The background of the edited parameter cell will change to green.

| *                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                          |                      | YASKAWA SigmaWin+ Ver.              | 7     |                                                                              | - 6 × |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------|-------|------------------------------------------------------------------------------|-------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Edit Parameters                                                                                                          | _                    |                                     |       |                                                                              | ≁ û × |
| 001-56075         Image: Port of the second sec | Category                                                                                                                 | SERVOPACK            |                                     |       |                                                                              | ۵     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | All constant number<br>Function Selection(Pn0xx-)<br>Gain(Pn1xx-)<br>Position(Pn2xc-)<br>Speed(Pn3xx-)<br>Torque(Pn4xx-) | Edited<br>Parameters | Parameters Parameters               | mport | Export Save to Read from Project Initialize Compare Project Function Display |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Sequence(Pn5xx-)                                                                                                         |                      |                                     |       | 🛃 001-SGD7S-R90                                                              | *     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | I/O Sign                                                                                                                 | No.                  | Name                                | Unit  | Axis A                                                                       |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Display Settings                                                                                                         | Pn000.0              | Direction Selection                 | -     | 0 : Use CCW as t···                                                          |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Hierarchy:                                                                                                               | Pn000.1              | Control Method Selection            | -     | 1 : Position contr···                                                        |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Descriptions:                                                                                                            | Pn000.2              | Reserved parameter (Do not chang    | -     | 0 : Reserved para…                                                           |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn000.3              | Rotary/Linear Startup Selection Wh  | -     | 0 : Start as a rota···                                                       |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn001.0              | Servo OFF or Alarm Group 1 Stoppi   | -     | 0 : Stop the moto                                                            |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn001.1              | Overtravel Stopping Method          | -     | 0 : Apply the dyn…                                                           |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn001.2              | Main Circuit Power Supply AC/DC In  | -     | 0 : Input AC pow…                                                            |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn001.3              | Warning Code Output Selection       | -     | 0 : Output only al                                                           |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn002.0              | Speed/Position Control Option (T-R  | -     | 0 : Do not use T-···                                                         |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn002.1              | Torque Control Option (V-REF Input  | -     | 0 : Do not use V-···                                                         |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn002.2              | Absolute Encoder Usage              | -     | 2 : Uses absolute…                                                           |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn002.3              | External Encoder Usage              | -     | 0 : Do not use an…                                                           |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn006.0-1            | Analog Monitor 1 Signal Selection   | -     | 02 : Torque refer···                                                         |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn006.2              | Reserved parameter (Do not chang    | -     | 0 : Reserved para                                                            |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn006.3              | Reserved parameter (Do not chang    | -     | 0 : Reserved para…                                                           |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn007.0-1            | Analog Monitor 2 Signal Selection   | -     | 00 : Motor speed…                                                            |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn007.2              | Reserved parameter (Do not chang    | -     | 0 : Reserved para…                                                           |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn007.3              | Reserved parameter (Do not chang    | -     | 0 : Reserved para···                                                         |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn008.0              | Low Battery Voltage Alarm/Warning   | -     | 0 : Output alarm…                                                            |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn008.1              | Function Selection for Undervoltage | -     | 0 : Do not detect…                                                           |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          | Pn008.2              | Warning Detection Selection         | -     | 0 : Detect warnin…                                                           |       |
| ·                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -                                                                                                                        | Pn008.3              | Reserved parameter (Do not chang    | -     | 0 : Reserved para…                                                           |       |
| o <sub>1</sub> . 🔀                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                          | Pn009.0              | Reserved parameter (Do not chang    | -     | 0 : Reserved para···                                                         |       |

6. Select Edited Parameters in the Write to Servo Group.

The edited parameters are written to the SERVOPACK and the backgrounds of the cells change to white.

#### 7. Click the OK Button.

| YASKAWA SigmaWin+ Ver.7                                                                                      | ×  |
|--------------------------------------------------------------------------------------------------------------|----|
| To enable the settings that were written, turn OFF the circuit and control power supplies and then turn them |    |
| [[                                                                                                           | ОК |

**8.** To enable changes to the settings, turn the power supply to the SERVOPACK OFF and ON again.

This concludes the procedure to set the parameters.

#### Setting Parameters with a Digital Operator

Refer to the following manual for information on setting the parameters with a Digital Operator.  $\square \Sigma$ -7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

#### 5.1.4 Write Prohibition Setting for Parameters

You can prohibit writing parameters from the Digital Operator. Even if you do, you will still be able to change parameter settings from the SigmaWin+.

#### Preparations

No preparations are required.

#### **Applicable Tools**

The following table lists the tools that you can use to change the Write Prohibition Setting.

| Tool             | Fn No./Function Name              | Reference                                                                          |
|------------------|-----------------------------------|------------------------------------------------------------------------------------|
| Digital Operator | Fn010                             | Ω Σ-7-Series Digital Operator Operating<br>Manual (Manual No.: SIEP S800001<br>33) |
| SigmaWin+        | Others - Write Prohibited Setting | G Operating Procedure on page 5-7                                                  |

#### **Operating Procedure**

Use the following procedure to prohibit or permit writing parameter settings.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Write Prohibition Setting in the Menu Dialog Box. The Write Prohibition Setting Dialog Box will be displayed.
- **3.** Press the ▼ or ▲ for the rightmost digit and set one of the following. 0000: Writing is permitted (default setting). 0001: Writing is prohibited.

| G Write Prohibition Setting AXIS#00 | ×       |
|-------------------------------------|---------|
| Write Prohibition Setting is OFF.   |         |
|                                     | Setting |

4. Click the Setting Button.



5. Click the OK Button.

The setting will be written to the SERVOPACK.

| Write Pro | hibition Setting                                                                         |   |
|-----------|------------------------------------------------------------------------------------------|---|
| Â         | Write Prohibition Setting has changed.<br>The setting will be enabled the next power ON. |   |
|           | ОК                                                                                       | D |

6. To enable the new setting, turn the power supply to the SERVOPACK OFF and ON again.

This concludes the procedure to prohibit or permit writing parameter settings.

#### Restrictions

If you prohibit writing parameter settings, you will no longer be able to execute some functions. Refer to the following table.

|                                 | SigmaWin+                   |        | Digital Operator                                                       | M/h ar                           |               |  |
|---------------------------------|-----------------------------|--------|------------------------------------------------------------------------|----------------------------------|---------------|--|
| Button in<br>Menu<br>Dialog Box | SigmaWin+ Function<br>Name  | Fn No. | Utility Function Name                                                  | When<br>Writing Is<br>Prohibited | Reference     |  |
|                                 | Initialize <sup>*1</sup>    | FnB0B  | Initialize INDEXER Parameter<br>Settings                               | Cannot be executed.              | page 5-10     |  |
|                                 | Software Reset              | Fn030  | Software Reset                                                         | Can be executed.                 | page 6-30     |  |
| Basic<br>Functions              |                             | Fn011  | Display Servomotor Model                                               | Can be executed.                 | page 9-2      |  |
| Functions                       | Product Information         | Fn012  | Display Software Version                                               | Can be executed.                 |               |  |
|                                 |                             | Fn01E  | Display SERVOPACK and<br>Servomotor IDs                                | Can be executed.                 |               |  |
|                                 |                             | Fn01F  | Display Servomotor ID from<br>Feedback Option Module                   | Can be executed.                 |               |  |
|                                 | Absolute Encoder Reset      | Fn008  | Reset Absolute Encoder                                                 | Cannot be executed.              | page 5-48     |  |
| Encoder<br>Setting              | Multi-turn Limit Setup      | Fn013  | Multiturn Limit Setting after<br>Multiturn Limit Disagreement<br>Alarm | Cannot be executed.              | page 6-26     |  |
|                                 | Search Origin <sup>*2</sup> | Fn003  | Origin Search                                                          | Cannot be executed.              | page 7-19     |  |
|                                 | Zero Point Position Setting | Fn020  | Set Absolute Linear Encoder<br>Origin                                  | Cannot be executed.              | page 5-51     |  |
|                                 | Polarity Detection          | Fn080  | Polarity Detection Cannot be executed.                                 |                                  | page 5-26     |  |
|                                 | -                           | FnB09  | Set Absolute Encoder Origin                                            | Cannot be executed.              | page 12-6     |  |
|                                 | Edit Program Table          | FnB03  | Edit/Save Program Table                                                | Cannot be executed.              | page 13-14    |  |
|                                 |                             | FnB06  | Initialize Program Table                                               | Cannot be executed.              | page 13-14    |  |
| Table                           | Edit ZONE Table             | FnB04  | Edit/Save ZONE Table                                                   | Cannot be executed.              | nage 13-55    |  |
| Editing                         |                             | FnB07  | Initialize ZONE Table                                                  | Cannot be executed.              | - page 13-55  |  |
|                                 | Edit Jog Speed Table        | FnB05  | Edit/Save Jog Speed Table                                              | Cannot be executed.              | page 13-46    |  |
|                                 |                             | FnB08  | Initialize Jog Speed Table                                             | Cannot be executed.              | page 10 40    |  |
|                                 |                             | FnB0D  | Display INDEXER Alarm His-<br>tory                                     | Can be executed.                 | page 15-50    |  |
|                                 | Display Alarm               | FnB0C  | Reset INDEXER Alarm History                                            | Cannot be executed.              | page 15-51    |  |
| Trouble-<br>shooting            |                             |        | Reset INDEXER Alarm                                                    | Cannot be executed.              | page 15-48    |  |
|                                 |                             | Fn014  | Reset Option Module Config-<br>uration Error                           | Cannot be executed.              | page 15-52    |  |
|                                 | Reset Motor Type Alarm      | Fn021  | Reset Motor Type Alarm                                                 | Cannot be executed.              | page 15-54    |  |
| Operation                       | Jog                         | Fn002  | Jog                                                                    | Cannot be executed.              | page 7-6      |  |
| operation                       | Program JOG Operation       | Fn004  | Jog Program                                                            | Cannot be executed.              | page 7-13     |  |
|                                 |                             |        |                                                                        | Continued c                      | on next page. |  |

|                                 | SigmaWin+                                                       |        | Digital Operator                                           | When                     |             |  |
|---------------------------------|-----------------------------------------------------------------|--------|------------------------------------------------------------|--------------------------|-------------|--|
| Button in<br>Menu<br>Dialog Box | SigmaWin+ Function<br>Name                                      | Fn No. | Utility Function Name                                      | Writing Is<br>Prohibited | Reference   |  |
| Monitor                         | Monitor                                                         | FnB0A  | INDEXER Status Monitor                                     | Can be executed.         | page 9-3    |  |
|                                 | Tuning -<br>Autotuning without Host<br>Reference                | Fn201  | Advanced Autotuning with-<br>out Reference                 | Cannot be executed.      | page 8-23   |  |
|                                 | Tuning -<br>Autotuning with Host Ref-<br>erence                 | Fn202  | Advanced Autotuning with Reference                         | Cannot be executed.      | page 8-34   |  |
|                                 | Tuning -<br>Custom Tuning                                       | Fn203  | One-Parameter Tuning                                       | Cannot be executed.      | page 8-41   |  |
| Tuning                          | Tuning -<br>Custom Tuning -<br>Adjust Anti-resonance<br>Control | Fn204  | Adjust Anti-resonance Con-<br>trol                         | Cannot be executed.      | page 8-49   |  |
|                                 | Tuning -<br>Custom Tuning -<br>Vibration Suppression            | Fn205  | Vibration Suppression                                      | Cannot be executed.      | page 8-54   |  |
|                                 | Response Level Setting                                          | Fn200  | Tuning-less Level Setting                                  | Cannot be executed.      | page 8-11   |  |
| Diagnostic                      | Easy FFT                                                        | Fn206  | Easy FFT                                                   | Cannot be executed.      | page 8-89   |  |
|                                 | Adjust the Analog Monitor                                       | Fn00C  | Adjust Analog Monitor Output<br>Offset                     | Cannot be executed.      | - page 9-10 |  |
|                                 | Output                                                          | Fn00D  | Adjust Analog Monitor Output<br>Gain                       | Cannot be executed.      |             |  |
| Others                          | Adjust the Motor Current                                        | Fn00E  | Autotune Motor Current<br>Detection Signal Offset          | Cannot be executed.      | page 6-36   |  |
| Others                          | Detection Offsets                                               | Fn00F  | Manually Adjust Motor Cur-<br>rent Detection Signal Offset | Cannot be executed.      | page 0-00   |  |
|                                 | Initialize Vibration Detection<br>Level                         | Fn01B  | Initialize Vibration Detection<br>Level                    | Cannot be executed.      | page 6-32   |  |
|                                 | Write Prohibited Setting                                        | Fn010  | Write Prohibition Setting                                  | Can be executed.         | page 5-6    |  |

Continued from previous page.

\*1. An Initialize Button will be displayed in the Parameter Editing Dialog Box.

\*2. Cannot be used when connecting a Linear Servomotor.

5.1.5 Initializing Parameter Settings

#### **Initializing Parameter Settings** 5.1.5

You can return the parameters to their default settings. This function restores the factory settings and initializes the parameters of both the SERVOPACK and the INDEXER Module.

This function will not initialize the settings of the parameters that are adjusted for the Fn00C, Fn00D, Fn00E, and Fn00F utility functions.



• To bring the settings into effect, always turn the SERVOPACK power supply off and back on after this operation.



The parameters of the INDEXER Module are not initialized with Fn005. To initialize these parameters, execute FnB0B.

Preparations

Always check the following before you initialize the parameter settings.

- The parameters must not be write prohibited.
- The servo must be OFF.
- Initializing the parameter settings must not be in progress for any other tool.
- Execution of the RES command must not be in progress.

#### **Applicable Tools**

The following table lists the tools that you can use to initialize the parameter settings.

| Tool                               | Fn No./Function Name                            | Reference                                                                          |
|------------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------|
| Digital Operator                   | FnB0B                                           | Ω Σ-7-Series Digital Operator Operating<br>Manual (Manual No.: SIEP S800001<br>33) |
| SigmaWin+                          | Basic Functions - Edit Parameters               | Gerating Procedure on page 5-10                                                    |
| Serial command com-<br>munications | PRMINIT (Parameter Initialization) com-<br>mand | Parameter Editing Commands on page 14-30                                           |

## **Operating Procedure**

Use the following procedure to initialize the parameter settings.

- 1. Click the *P* Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Edit Parameters in the Menu Dialog Box. The Parameter Editing Dialog Box will be displayed.
- 3. Select any parameter of the axis to initialize.

5.1.5 Initializing Parameter Settings

|                                                |                                                                                                        |                                      | -                                  |      |                      |                          |        |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------|------------------------------------|------|----------------------|--------------------------|--------|
| *                                              |                                                                                                        |                                      | YASKAWA SigmaWin+ Ver.7            |      |                      |                          | - 5    |
|                                                | Edit Parameters                                                                                        | _                                    |                                    |      |                      |                          | •      |
|                                                | Category                                                                                               | SERVOPACK                            |                                    |      |                      |                          |        |
| 0001-SV2<br>-020L2 HB8 P-0T<br>POWER ESTP N-0T | All constant number<br>Function Selection(Pn0xx-)<br>Gain(Pn1xx-)<br>Position(Pn2xx-)<br>Speed(Pn3xx-) | Edited<br>Parameters Pa<br>Read from | nameders parameters parameters     |      | Project Pr           | d from<br>oject Eunction | Displa |
|                                                | Torque(Pn4xx-)<br>Seguence(Pn5xx-)                                                                     | Read from :                          | Servo Write to Servo               | rile | Project              | Function                 | 1      |
|                                                | I/O Sign                                                                                               | NO.                                  | Name                               | Unit |                      |                          |        |
|                                                | Mechatrolink(Pn8xx-)<br>Common Parameters(PnAxx-)                                                      | Pn000.0                              | Direction Selection                | -    | 0 : Use CCW as t…    |                          |        |
|                                                |                                                                                                        | Pn000.1                              | Reserved parameter (Do not chang   | -    | 0 : Reserved para…   |                          |        |
|                                                | Display Settings<br>Hierarchy: or                                                                      |                                      | Reserved parameter (Do not chang   |      | 0 : Reserved para…   |                          |        |
|                                                | Descriptions:                                                                                          | Pn000.3                              | Rotary/Linear Startup Selection Wh | -    | 0 : Start as a rota… |                          |        |
|                                                |                                                                                                        | Pn001.0                              | Servo OFF or Alarm Group 1 Stoppi  | -    | 0 : Stop the moto…   |                          |        |
|                                                |                                                                                                        | Pn001.1                              | Overtravel Stopping Method         | -    | 1 : Decelerate the…  |                          |        |
|                                                |                                                                                                        | Pn001.2                              | Main Circuit Power Supply AC/DC Ir | -    | 0 : Input AC pow…    |                          |        |
|                                                |                                                                                                        | Pn001.3                              | Reserved parameter (Do not chang   | -    | 0 : Reserved para…   |                          |        |
|                                                |                                                                                                        | Pn002.0                              | MECHATROLINK Command Position      | -    | 1 : Use TLIM as t…   |                          |        |
|                                                |                                                                                                        | Pn002.1                              | Torque Control Option              | -    | 1 : Use the speed…   |                          |        |
|                                                |                                                                                                        | Pn002.2                              | Absolute Encoder Usage             | -    | 1 : Use the absol…   |                          |        |
|                                                |                                                                                                        | Pn002.3                              | External Encoder Usage             | -    | 0 : Do not use an…   |                          |        |
|                                                |                                                                                                        | Pn006.0-1                            | Analog Monitor 1 Signal Selection  | -    | 02 : Torque refer…   |                          |        |
|                                                |                                                                                                        | Pn006.2                              | Reserved parameter (Do not chang   | -    | 0 : Reserved para…   |                          |        |
|                                                |                                                                                                        | Pn006.3                              | Reserved parameter (Do not chang   | -    | 0 : Reserved para…   |                          |        |
|                                                |                                                                                                        | Pn007.0-1                            | Analog Monitor 2 Signal Selection  | -    | 00 : Motor speed…    |                          |        |
| •                                              |                                                                                                        | Pn007.2                              | Reserved parameter (Do not chang   | -    | 0 : Reserved para…   |                          |        |
| o <sub>1</sub> - 🖸                             |                                                                                                        | Pn007.3                              | Reserved parameter (Do not chang   | -    | 0 : Reserved para…   |                          |        |

4. Click the Initialize Button in the Function Group.

5. Click the OK Button.

| YASKAWA SigmaWin+ Ver.7                                                                                  |
|----------------------------------------------------------------------------------------------------------|
| If you restore the default settings, the settings may no longer agree with the current machine settings. |
| The SERVOPACK parameters will be returned to the default settings.OK?                                    |
| OK Cancel                                                                                                |

Click the **Cancel** Button to cancel initialization. The Parameter Editing Dialog Box will return.

6. Click the OK Button.



7. Turn the power supply to the SERVOPACK OFF and ON again after the parameter settings have been initialized.

This concludes the procedure to initialize the parameter settings.

5.2.1 AC Power Supply Input/DC Power Supply Input Setting

## 5.2 Power Supply Type Settings for the Main Circuit and Control Circuit

A SERVOPACK with a 200-VAC power supply input can be operated on either an AC power supply input or DC power supply input to the main and control circuits. If you select an AC power supply input, you can operate the SERVOPACK on either a single-phase power supply input or a three-phase power supply input. This section describes the settings related to the power supplies.

You cannot input DC power to a SERVOPACK with a single-phase, 100-VAC power supply input.

#### 5.2.1 AC Power Supply Input/DC Power Supply Input Setting

Set  $Pn001 = n.\Box X \Box \Box$  (Main Circuit Power Supply AC/DC Input Selection) to specify whether to use an AC or DC power supply input for the main circuit power supply to the SERVOPACK.

If the setting of  $Pn001 = n.\Box X \Box \Box$  does not agree with the actual power supply input, an A.330 alarm (Main Circuit Power Supply Wiring Error) will occur.

Example

- Examples of When an A.330 Alarm (Main Circuit Power Supply Wiring Error) Occurs
- A DC power supply is connected between the B1/⊕ and ⊝2 terminals, but an AC power supply input is specified (Pn001 = n.□0□□).
- An AC power supply is input to the L1, L2, and L3 terminals, but a DC power supply is specified (Pn001 = n.□1□□).

| Parameter |                                  | Meaning                       | When Enabled  | Classification |
|-----------|----------------------------------|-------------------------------|---------------|----------------|
| Pn001     | n.□0□□<br>(default set-<br>ting) | Use an AC power supply input. | After restart | Setup          |
|           | n.0100                           | Use a DC power supply input.  |               |                |

| <ul> <li>Connect the AC or DC power supplies to the specified SERVOPACK terminals.</li> <li>Connect an AC power supply to the L1, L2, and L3 terminals and the L1C and L2C terminals on the SERVOPACK.</li> <li>Connect a DC power supply to the B1/⊕ and ⊝2 terminals and the L1C and L2C terminals on the SERVOPACK.</li> <li>There is a risk of failure or fire.</li> </ul>                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul> <li>Always specify a DC power supply input (Pn001 = n.□1□□) before you input DC power for the main circuit power supply.</li> <li>If you input DC power without specifying a DC power supply input (i.e., without setting Pn001 to n.□1□□), the SERVOPACK's internal elements may burn and may cause fire or damage to the equipment.</li> </ul>                                                                                |
| <ul> <li>With a DC power supply input, time is required to discharge electricity after the main power supply is turned OFF. A high residual voltage may remain in the SERVOPACK after the power supply is turned OFF. Be careful not to get an electric shock.</li> <li>Install fuses on the power supply line if you use DC power.</li> </ul>                                                                                       |
| <ul> <li>The Servomotor returns regenerative energy to the power supply. If you use a SERVOPACK with a DC power supply input, regenerative energy is not processed. Process the regenerative energy at the power supply.</li> </ul>                                                                                                                                                                                                  |
| <ul> <li>If you use a DC power supply input with any of the following SERVOPACKs, externally connect an inrush current limiting circuit and use the power ON and OFF sequences recommended by Yaskawa: SGD7S-330A, -470A, -550A, -590A, or -780A. There is a risk of equipment damage.</li> <li>Refer to the following section for the power ON and OFF sequences.</li> <li><i>Q</i> 4.3.3 Power ON Sequence on page 4-15</li> </ul> |

Refer to the following section for information on wiring the SERVOPACK. *4.3.4 Power Supply Wiring Diagrams* on page 4-17

# 5.2.2 Single-phase AC Power Supply Input/Three-phase AC Power Supply Input Setting

Some models of Three-phase 200-VAC SERVOPACKs can also operate on a single-phase 200-VAC power supply.

You can use a single-phase, 200-V power supply input with the following models.

• SGD7S-R70A, -R90A, -1R6A, -2R8A, and -5R5A

If you use a single-phase, 200-VAC power supply input for the SERVOPACK's main circuit power supply, set parameter Pn00B to  $n.\Box 1 \Box \Box$  (Use a three-phase power supply input as a single-phase power supply input).

**Information** You do not need to change the setting of Pn00B to n.  $\Box 1 \Box \Box$  (Use a three-phase power supply input as a single-phase power supply input) for a SERVOPACK with a single-phase 200-VAC power supply input (model numbers: SGD7S-120AE0A008) or for a SERVOPACK with a single-phase 100-VAC power supply input.

| Parameter                                                                                                                                                                                                                                                                                                                                                                                  |                             | Meaning                                                                        | When Enabled  | Classification |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------------------------------------------------------|---------------|----------------|
| Pn00B                                                                                                                                                                                                                                                                                                                                                                                      | n.□0□□<br>(default setting) | Use a three-phase power supply input.                                          | After restart | Setup          |
| THOOD                                                                                                                                                                                                                                                                                                                                                                                      | n.0100                      | Use a three-phase power supply input and as a single-phase power supply input. | Aller Testart | Setup          |
| <ul> <li>1. If you use a single-phase power supply input without specifying a single-phase AC power supply (Pn00B = n.□1□□), an A.F10 alarm (Power Supply Line Open Phase) will occur.</li> <li>2. Not all SERVOPACKs can be run on a single-phase AC power supply input. If you connect a single-phase AC power supply input to a SERVOPACK that does not support single-phase</li> </ul> |                             |                                                                                |               |                |

- power, an A.F10 alarm (Power Supply Line Open Phase) will occur.If you use a single-phase 200-VAC power supply input, the torque-motor speed characteristic of the Servomotor will not be the same as for a three-phase AC power supply input. Decide whether to use a single-phase or three-phase AC power supply input after checking the char
  - acteristics given in the Servomotor manual or catalog.

Refer to the following section for information on wiring a single-phase AC power supply input to the SERVOPACK.

• Wiring Example for Single-Phase, 200-VAC Power Supply Input on page 4-18

# 5.3 Automatic Detection of Connected Motor

You can use a SERVOPACK to operate either a Rotary Servomotor or a Linear Servomotor.

If you connect the Servomotor encoder to the CN2 connector on the SERVOPACK, the SER-VOPACK will automatically determine which type of Servomotor is connected. Therefore, you normally do not need to specify the Servomotor type.

**Information** If an encoder is not connected, e.g., for a test without a motor, you can specify a Rotary Servomotor or a Linear Servomotor in  $Pn000 = n.X \square \square \square$  (Rotary/Linear Startup Selection When Encoder Is Not Connected). If you specify either a Rotary or Linear Servomotor, only the parameters, monitors, alarms, and functions for the specified motor type will be enabled.

| Parameter |                             | Meaning                                                                          | When Enabled  | Classification |
|-----------|-----------------------------|----------------------------------------------------------------------------------|---------------|----------------|
| Pn000     | n.0□□□<br>(default setting) | When an encoder is not connected, start as SERVOPACK for Rotary Servo-<br>motor. | After restart | Setup          |
| FILLOU    | n.1000                      | When an encoder is not connected, start as SERVOPACK for Linear Servo-<br>motor. | Alter restart | Setup          |

# 5.4 Motor Direction Setting

You can reverse the direction of Servomotor rotation by changing the setting of  $Pn000 = n.\square\square\squareX$  (Rotation Direction Selection) without changing the polarity of the speed or position reference. This causes the rotation direction of the Servomotor to change, but the polarity of the signals, such as encoder output pulses, output from the SERVOPACK do not change. Set the appropriate direction for your system.

Refer to the following section for details on the encoder divided pulse output. 6.5 Encoder Divided Pulse Output on page 6-15

#### Rotary Servomotors

The default setting for forward rotation is counterclockwise (CCW) as viewed from the load end of the Servomotor.

| Parameter |                                                | Forward/Reverse<br>Reference | Motor Direction and Encoder Divided Pulse Outputs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Applicable<br>Overtravel Signal (OT)              |
|-----------|------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
|           | n.□□□0<br>Use CCW as                           | Forward<br>reference         | CCW Hotor speed Ho | P-OT (For-<br>ward Drive<br>Prohibit) sig-<br>nal |
| Pn000     | the forward<br>direction.<br>(default setting) | Reverse<br>reference         | Torque reference Encoder Divided Pulse Outputs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | N-OT<br>(Reverse<br>Drive Pro-<br>hibit) signal   |
| FII000    | n.□□□1<br>Use CW as the<br>forward direc-      | Forward<br>reference         | + Torque reference Encoder Divided Pulse Outputs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | P-OT (For-<br>ward Drive<br>Prohibit) sig-<br>nal |
|           | tion.<br>(Reverse Rota-<br>tion Mode)          | Reverse<br>reference         | Torque reference Encoder Divided Pulse Outputs<br>PAO PAO Phase-A lead<br>CCW Motor speed PBO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | N-OT<br>(Reverse<br>Drive Pro-<br>hibit) signal   |

Note: The trace waveforms of the SigmaWin+ are shown in the above table for the torque reference and motor speed diagrams. If you measure them on a measuring instrument, e.g., with an analog monitor, the polarity will be reversed.

#### Linear Servomotors

Before you set this parameter, make sure that Pn080 = n.  $\Box \Box X \Box$  (Motor Phase Sequence Selection) is set correctly.

| Parameter |                                                                          | Forward/Reverse<br>Reference | Motor Moving Direction and Encoder Divided Pulse<br>Outputs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Applicable<br>Overtravel Signal (OT)         |
|-----------|--------------------------------------------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
|           | n.□□□0<br>Use the direc-<br>tion in which<br>the linear                  | Forward<br>reference         | Moves in the count-up direction. Hore speed Paise Outputs Encoder Divided Pulse Outputs PAO _ | P-OT (For-<br>ward Drive<br>Prohibit)signal  |
|           | encoder counts<br>up as the for-<br>ward direction.<br>(default setting) | Reverse<br>reference         | Moves in the count-down direction. Hore speed Page PBO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | N-OT<br>(Reverse Drive<br>Prohibit) signal   |
| Pn000     | n.□□□1<br>Use the direc-<br>tion in which<br>the linear                  | Forward<br>reference         | +       Force reference       Encoder Divided Pulse Outputs         Moves in the count-down direction.       Motor speed       PAO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | P-OT (For-<br>ward Drive<br>Prohibit) signal |
|           | encoder counts<br>down as the<br>forward direc-<br>tion.                 | Reverse<br>reference         | +       Force reference       Encoder Divided Pulse Outputs         Moves in the count-up direction.       Motor speed       PAO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | N-OT<br>(Reverse Drive<br>Prohibit) signal   |

Note: The trace waveforms of the SigmaWin+ are shown in the above table for the force reference and motor speed diagrams. If you measure them on a measuring instrument, e.g., with an analog monitor, the polarity will be reversed.

Term

# 5.5 Setting the Linear Encoder Pitch

If you connect a linear encoder to the SERVOPACK through a Serial Converter Unit, you must set the scale pitch of the linear encoder in Pn282.

If a Serial Converter Unit is not connected, the setting of the Pn282 is disabled.

#### Serial Converter Unit

The Serial Converter Unit converts the signal from the linear encoder into a form that can be read by the SERVOPACK.

#### Scale Pitch

A linear encoder has a scale for measuring lengths (positions). The length of one division on this scale is the scale pitch.

|       | Linear Encoder Pitch |              |                 |               |                |
|-------|----------------------|--------------|-----------------|---------------|----------------|
| Pn282 | Setting Range        | Setting Unit | Default Setting | When Enabled  | Classification |
|       | 0 to 6,553,600       | 0.01 µm      | 0               | After restart | Setup          |

You will not be able to control the Linear Servomotor if Pn282 is not set correctly. Check the above table and always set the correct value before you operate the Linear Servomotor.

| Type of Linear<br>Encoder | Manufacturer                                    | Model                             | Serial Converter Unit Model | Linear Encoder<br>Pitch<br>[µm] |
|---------------------------|-------------------------------------------------|-----------------------------------|-----------------------------|---------------------------------|
|                           |                                                 |                                   | JZDP-H003-DDD-E             | 20                              |
|                           | Dr. JOHANNES<br>HEIDENHAIN GmbH<br>Renishaw PLC | LIDA48                            | JZDP-J003-DD-E              | 20                              |
|                           |                                                 | LIF480                            | JZDP-H003-DD-E              | 4                               |
| Incremental               |                                                 |                                   | JZDP-J003-DD-E              |                                 |
| Incremental               |                                                 | RGH22B                            | JZDP-H005-DDD-E             | 20                              |
|                           |                                                 |                                   | JZDP-J005-DDD-E             |                                 |
|                           |                                                 | TONIC series<br>(Ti0000A00V only) | JZDP-H005-DDD-E             | 20                              |
|                           |                                                 |                                   | JZDP-J005-DDD-E             |                                 |

The first time you supply power to the SERVOPACK, the panel display on the front of the Servomotor will display an A.080 alarm (Linear Encoder Pitch Setting Error). The A.080 alarm is displayed because the setting of Pn282 has not been changed. The A.080 alarm will be cleared when you change the setting of Pn282 and then turn the power supply OFF and ON again.

Information

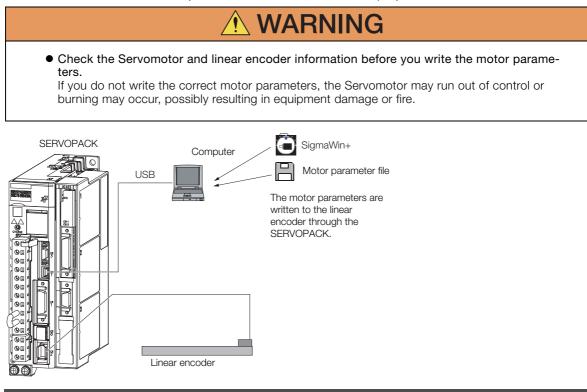
Linear Encoder Pitch

If you do not use a Serial Converter Unit, the linear encoder pitch is automatically set and the setting of the Pn282 is disabled. Refer to the following section for details.

# 5.6 Writing Linear Servomotor Parameters

If you connect a linear encoder to the SERVOPACK without going through a Serial Converter Unit, you must use the SigmaWin+ to write the motor parameters to the linear encoder. The motor parameters contain the information that is required by the SERVOPACK to operate the Linear Servomotor.

You can download the motor parameters from our web site (http://www.e-mechatronics.com/).





Serial number information is not included in the motor parameters. You cannot use the monitor functions of the SERVOPACK to monitor the serial number. If you attempt to monitor the serial number, \*\*\*\*\*\*\*\*\* will be displayed.

### Precautions

- If the encoder parameters are not written to the linear encoder, an A.CAO alarm (Encoder Parameter Error) will occur. Consult the manufacturer of the linear encoder.
- If the motor parameters are not written to the linear encoder, an A.CAO alarm (Encoder Parameter Error) will not occur, but the following alarms will occur.

A.040 (Parameter Setting Error), A.041 (Encoder Output Pulse Setting Error),

A.050 (Combination Error), A.051 (Unsupported Device Alarm),

A.550 (Maximum Speed Setting Error), A.710 (Instantaneous Overload),

A.720 (Continuous Overload), and A.C90 (Encoder Communications Error)

### Applicable Tools

The following table lists the tools that you can use to write the parameters to the Linear Servomotor.

| Tool             | Fn No./Function Name                                                     | Reference                          |
|------------------|--------------------------------------------------------------------------|------------------------------------|
| Digital Operator | You cannot write Linear Servomotor parameters from the Digital Operator. |                                    |
| SigmaWin+        | Encoder Setting – Motor Parameter<br>Scale Write                         | G Operating Procedure on page 5-18 |

#### **Operating Procedure**

Use the following procedure to write the motor parameters to the Linear Encoder.

- 1. Prepare the motor parameter file to write to the linear encoder.
- 2. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **3.** Select Motor Parameter Scale Write in the Menu Dialog Box. The Motor Parameter Scale Write Dialog Box will be displayed.
- 4. Click the OK Button.

| Motor parameter scale write                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                            |
| This function rewrites data in the scale.<br>If the data which does not suit the connected motor is rewritten, the motor<br>may not work normally, resulting in motor overrun, etc., and it is very<br>dangerous.<br>Be sure that the data written in the scale suits the connected motor. |
| OK Cacnel                                                                                                                                                                                                                                                                                  |

Click the **Cancel** Button to cancel writing the motor parameters to the linear encoder. The Main Window will return.

If the write is completed normally, the Motor Parameter Scale Write - File Select Dialog Box will be displayed.

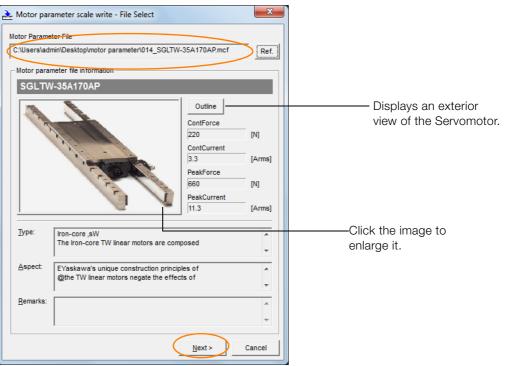
5. Click the Ref. Button.

| otor Parameter File              |      |
|----------------------------------|------|
|                                  | Ref. |
| Motor parameter file information |      |
| -1                               |      |

6. Select the motor parameter file that you prepared and click the Open Button.

| 🔾 🗢 🕌 🕨 motor parameter                     | Search motor parameter     |   |
|---------------------------------------------|----------------------------|---|
| Organize 🔻 New folder                       | iii 🕶 🛄                    |   |
| * Favorites                                 | Date modified Type         | 5 |
| Desktop 014_SGLTW-35A170AP.mcf              | 5/13/2015 7:39 PM MCF File |   |
| 1 Recent Places<br>E<br>Dibraries           |                            |   |
| Documents     Music     Pictures     Videos |                            |   |
| J Music                                     |                            |   |

7. Confirm that the motor parameter file information that is displayed is suitable for your Servomotor, and then click the **Next** Button.

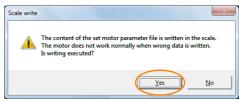


Click the **Cancel** Button to cancel writing the motor parameters to the linear encoder. The Main Window will return.

8. Click the Write Button.

| Motor parameter scale write - Scale write                                                                                                 |                                             |                   |                                                                                                                                                      |                                |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| The motor parameter is written in the scale.<br>Please confirm the motor which connects is corresponding to<br>the following information. |                                             |                   |                                                                                                                                                      |                                |
| - Motor para                                                                                                                              | meter file information —                    |                   |                                                                                                                                                      |                                |
| SGLTV                                                                                                                                     | V-35A170AP                                  |                   |                                                                                                                                                      |                                |
| Care of the second                                                                                                                        | And Street                                  |                   | Outline           ContForce           220           ContCurrent           3.3           PeakForce           660           PeakCurrent           11.3 | [N]<br>[Arms]<br>[N]<br>[Arms] |
|                                                                                                                                           | Iron-core ,sW<br>The Iron-core TW line      | ar motors are cor | nposed                                                                                                                                               | ^<br>•                         |
| <u>A</u> spect:                                                                                                                           | EYaskawa's unique c<br>@the TW linear motor |                   |                                                                                                                                                      | *<br>*                         |
| <u>R</u> emarks:                                                                                                                          |                                             |                   |                                                                                                                                                      | *<br>*                         |
|                                                                                                                                           |                                             | < <u>B</u> ack    | Complete                                                                                                                                             | Cancel                         |

9. Click the Yes Button.



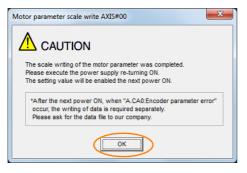
Click the No Button to cancel writing the motor parameters to the linear encoder.

If you click the Yes Button, writing the motor parameter scale will start.

#### 10. Click the Complete Button.

| Abotor parameter scale write - Scale write                                                                                                |                                                                                  |                                                                |               |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------|---------------|--|--|
| The motor parameter is written in the scale.<br>Please confirm the motor which connects is corresponding to<br>the following information. |                                                                                  |                                                                |               |  |  |
| - Motor para                                                                                                                              | meter file information                                                           |                                                                |               |  |  |
| SGLTV                                                                                                                                     | /-35A170AP                                                                       |                                                                |               |  |  |
| CRARK                                                                                                                                     |                                                                                  | Outline<br>ContForce<br>220<br>ContCurrent<br>3.3<br>PeakForce | [N]<br>[Arms] |  |  |
|                                                                                                                                           | Sec.                                                                             | 660<br>PeakCurrent<br>11.3                                     | [N]<br>[Arms] |  |  |
| <u>Т</u> уре:                                                                                                                             | Iron-core ,sW<br>The Iron-core TW linear motors are com                          | posed                                                          | ^<br>•        |  |  |
| Aspect:                                                                                                                                   | EYaskawa's unique construction princip<br>@the TW linear motors negate the effec |                                                                | ^<br>~        |  |  |
| Remarks:                                                                                                                                  |                                                                                  |                                                                |               |  |  |
|                                                                                                                                           |                                                                                  |                                                                |               |  |  |

#### 11. Click the OK Button.



12. Turn the power supply to the SERVOPACK OFF and ON again.

This concludes the procedure to write the motor parameters.

#### Confirming If the Motor Parameters Have Been Written

After you write the motor parameters, you can use a monitor function to confirm that the motor parameters are in the encoder.

If the motor parameters have not been written, no information on the Servomotor will be displayed.

9.1 Monitoring Product Information on page 9-2

# Selecting the Phase Sequence for a Linear Servomotor

You must select the phase sequence of the Linear Servomotor so that the forward direction of the Linear Servomotor is the same as the encoder's count-up direction.

Before you set the Linear Servomotor phase sequence (Pn080 =  $n.\Box\Box X\Box$ ), check the following items.

- · Confirm that the signal from the linear encoder is being received normally.
- Make sure that the forward direction of the Linear Servomotor and the count-up direction of the linear encoder are in the same direction.

If you do not confirm the above items before you attempt to operate the Servomotor, the Servomotor may not operate or it may run out of control. Always confirm these items before you operate the Servomotor. Important

#### **Related Parameters**

(0)

| Parameter |                             | Meaning                                                | When Enabled  | Classification |
|-----------|-----------------------------|--------------------------------------------------------|---------------|----------------|
| Pn080     | n.□□0□<br>(default setting) | Set a phase-A lead as a phase sequence of U, V, and W. | After restart | Setup          |
|           | n.□□1□                      | Set a phase-B lead as a phase sequence of U, V, and W. |               |                |

#### **Operating Procedure**

Use the following procedure to select the phase sequence for a Linear Servomotor.

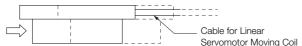
- **1.** Set Pn000 to  $n.\Box\Box\Box\Box$  (Set a phase-A lead as a phase sequence of U, V, and W). This setting is to make following confirmation work easier to understand.
- 2. Select Monitor in the Menu Dialog Box. The Operation Panel will be displayed so that you can check the feedback pulse counter.

To check the feedback pulse counter with the Digital Operator, use Un00D (Feedback Pulse Counter).

3. Manually move the Moving Coil from one end to the other of the stroke and confirm that only the correct number of feedback pulses is returned.

If the correct number and only the correct number of pulses is returned, the signal is being received correctly from the linear encoder.

In this example, assume that a linear encoder with a scale pitch of 20  $\mu m$  and a resolution of 256 is used. If you manually move the Moving Coil 1 cm in the count-up direction of the linear encoder, the number of feedback pulses would be as follows: 1 cm/(20 µm/256) = 128,000 pulses



If there are 128,000 pulses on the feedback pulse counter after you manually move the Moving Coil in the direction of the cable, you have completed the confirmation.

Note: The actual monitor display will be offset by the error in the travel distance. There is no problem as long as the above value is close to the calculated value.

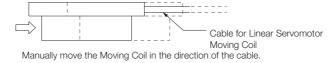
Example

Information If the correct value is not displayed for the feedback pulse counter, the following conditions may exist. Check the situation and correct any problems.

- The linear encoder pitch is not correct. If the scale pitch that is set in Pn282 does not agree with the actual scale pitch, the expected number of feedback pulses will not be returned. Check the specifications of the linear encoder.
- The linear encoder is not adjusted properly.
   If the linear encoder is not adjusted properly, the output signal level from the linear encoder will drop and the correct number of pulses will not be counted. Check the adjustment of the linear encoder. Contact the manufacturer of the linear encoder for details.
- There is a mistake in the wiring between the linear encoder and the Serial Converter Unit.

If the wiring is not correct, the correct number of pulses will not be counted. Correct the wiring.

**4.** Manually move the Moving Coil in the direction of the cable and check the value of the feedback pulse counter in the Operation Panel to confirm that it is counting up.



- 5. If the feedback pulse counter counts up, set a phase-A lead as a phase sequence of U, V, and W (Pn080 = n.□□0□).
  If the feedback pulse counter counts down, set a phase-B lead as a phase sequence of U, V, and W (Pn080 = n.□□1□).
- 6. Turn the power supply to the SERVOPACK OFF and ON again.
- 7. If necessary, return  $Pn000 = n.\Box\Box\BoxX$  (Direction Selection) to its original setting.

This concludes the procedure to set the phase sequence of the Linear Servomotor.

# 5.8 Polarity Sensor Setting

The polarity sensor detects the polarity of the Servomotor. You must set a parameter to specify whether the Linear Servomotor that is connected to the SERVOPACK has a polarity sensor. Specify whether there is a polarity sensor in Pn080 =  $n.\square\square\squareX$  (Polarity Sensor Selection).

If the Linear Servomotor has a polarity sensor, set Pn080 to n.  $\Box\Box\Box$  (Use polarity sensor) (default setting).

If the Linear Servomotor does not have a polarity sensor, set Pn080 to n.  $\Box\Box\Box$  (Do not use polarity sensor). Turn the power supply OFF and ON again to enable the new setting.

|       | Parameter Meaning           |                             | When Enabled  | Classification |  |
|-------|-----------------------------|-----------------------------|---------------|----------------|--|
| Pn080 | n.□□□0<br>(default setting) | Use polarity sensor.        | After restart | Setup          |  |
|       | n.0001                      | Do not use polarity sensor. |               |                |  |

Information If you set Pn080 to n. DDD (Use polarity sensor) and the Linear Servomotor that is connected to the SERVOPACK does not have a polarity sensor, an A.C21 alarm (Polarity Sensor Error) will occur when you turn the power supply OFF and ON again. 5.9.1 Restrictions

# 5.9 Polarity Detection

If you use a Linear Servomotor that does not have a polarity sensor, then you must detect the polarity.

Detecting the polarity means that the position of the electrical angle phase on the electrical angle coordinates of the Servomotor is detected. The SERVOPACK cannot control the Servomotor correctly unless it accurately knows the position of the electrical angle coordinate of the Servomotor.

The execution timing and execution method for polarity detection depend on the encoder specification as described in the following table.

| Encoder Specification | Polarity Detection Execution Timing                                                                                                                                                                                                                                        | Polarity Detection Execution Method                                                                                                                                                                                           |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Incremental encoder   | Each time the control power supply to<br>the SERVOPACK is turned ON<br>(Even after you execute polarity detec-<br>tion, the position of the polarity will be<br>lost the next time the control power<br>supply to the SERVOPACK is turned<br>OFF.)                         | <ul> <li>Use the /S-ON (Servo ON) signal.</li> <li>Use the polarity detection function of<br/>the SigmaWin+.</li> <li>Execute the Fn080 (Polarity Detection)<br/>utility function from the Digital Opera-<br/>tor.</li> </ul> |
| Absolute encoder      | Only for initial setup, or after the<br>SERVOPACK, linear encoder, or<br>Servomotor has been replaced<br>(The results of polarity detection is<br>stored in the absolute encoder, so the<br>polarity position is not lost when the<br>control power supply is turned OFF.) | <ul> <li>Use the polarity detection function of<br/>the SigmaWin+.</li> <li>Execute the Fn080 (Polarity Detection)<br/>utility function from the Digital Opera-<br/>tor.</li> </ul>                                           |

Information If you use a Linear Servomotor that does not have a polarity sensor, you will not be able to turn ON the servo until polarity detection has been completed.

### 5.9.1 Restrictions

#### **Assumed Conditions**

The Servomotor will move when you execute polarity detection. The following conditions must be met before you start.

- It must be OK to move the Moving Coil about 10 mm.
- (If polarity detection fails, the Moving Coil may move approximately 5 cm. The amount of movement depends on conditions.)
- The linear encoder pitch must be 100  $\mu m$  or less. (We recommend a pitch of 40  $\mu m$  or less for an incremental encoder.)
- As much as possible, the motor must not be subjected to an imbalanced external force. (We recommend 5% or less of the rated force.)
- The mass ratio must be 50x or less.
- The axis must be horizontal.
- There must be friction equivalent to a few percent of the rated force applied to the guides. (Air sliders cannot be used.)

#### Preparations

Always check the following before you execute polarity detection.

- Not using a polarity sensor must be specified (Pn080 =  $n.\Box\Box\Box$ 1).
- The servo must be OFF.
- The main circuit power supply must be ON.
- There must be no hard wire base block (HWBB).
- There must be no alarms except for an A.C22 alarm (Phase Information Disagreement).

- The parameters must not be write prohibited. (This item applies only when using the SigmaWin+ or Digital Operator.)
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- There must be no overtravel.
- If the motor parameters have been written or the origin of the absolute linear encoder has been set, the power supply to the SERVOPACK must be turned OFF and ON again after completion of the writing or setting operation.



1. Power is supplied to the Servomotor during polarity detection. Be careful not to get an electric shock. Also, the Moving Coil of the Linear Servomotor may greatly move during detection. Do not approach the moving parts of the Servomotor.

2. Polarity detection is affected by many factors.

For example, polarity detection may fail if the mass ratio or friction is too large or the cable tension is too strong.

#### Using the /S-ON (Servo ON) Signal to Perform Polarity 5.9.2 Detection

You can use the /S-ON (Servo ON) signal to perform polarity detection only with an incremental linear encoder.

Polarity detection will be performed when you turn the control power supply to the SERVO-PACK OFF and then ON again, and then input the /S-ON signal. As soon as polarity detection is completed, the /S-RDY (Servo Ready) signal will turn ON.

| Туре                                                                            | Signal                  | Connecto              | r Pin No. | Signal<br>Status | Meaning                                                                                                                                                         |
|---------------------------------------------------------------------------------|-------------------------|-----------------------|-----------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input                                                                           | /S-ON                   | CN1-13                |           | ON<br>(closed)   | The servo is turned ON (power is supplied to the motor), polarity detection is performed once, and then the servo is left ON. (The /S-RDY signal will turn ON.) |
|                                                                                 |                         |                       |           | OFF<br>(open)    | The servo is turned OFF (power is not supplied to the motor) and operation is disabled.                                                                         |
| /S-ON (Servo ON) signal OFF ON                                                  |                         |                       | C         | N                |                                                                                                                                                                 |
| /S-RDY (                                                                        | Servo Ready) s          | ignal ————            | C         | IFF              | ON                                                                                                                                                              |
| <del>∢</del><br>Polarity detection in progress<br>→ Status display: <b>P-dt</b> |                         |                       | ,         | 1 0              | <ul> <li>Completion of polarity detection</li> <li>→ Normal operation is enabled.</li> </ul>                                                                    |
| 1                                                                               | Power<br>Motor power st | not supplied.<br>atus | Pov       | ver supplied.    |                                                                                                                                                                 |

5.9.3 Using a Tool Function to Perform Polarity Detection

#### 5.9.3 Using a Tool Function to Perform Polarity Detection

#### Applicable Tools

The following table lists the tools that you can use to perform polarity detection.

| Tool             | Fn No./Function Name                 | Reference                                                                     |
|------------------|--------------------------------------|-------------------------------------------------------------------------------|
| Digital Operator | Fn080                                | Σ-7-Series Digital Operator Operating<br>Manual (Manual No.: SIEP S800001 33) |
| SigmaWin+        | Encoder Setting – Polarity Detection | Jean Operating Procedure on page 5-26                                         |

#### **Operating Procedure**

Use the following procedure to perform polarity detection.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Polarity Detection in the Menu Dialog Box. The Polarity Detection Dialog Box will be displayed.
- 3. Click the Continue Button.



Click the Cancel Button to cancel polarity detection. The Main Window will return.

#### 4. Click the Start Button.

Polarity detection will be executed.



This concludes the polarity detection procedure.

5.10.1 Overtravel Signals

# 5.10 Overtravel and Related Settings

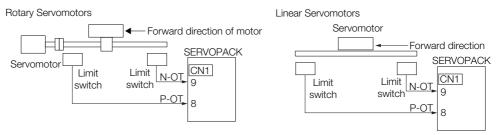
Overtravel is a function of the SERVOPACK that forces the Servomotor to stop in response to a signal input from a limit switch that is activated when a moving part of the machine exceeds the safe range of movement.

The overtravel signals include the P-OT (Forward Drive Prohibit) and the N-OT (Reverse Drive Prohibit) signals.

You use the P-OT and N-OT signals to stop the machine by installing limit switches at the positions where you want to stop the machine that is operated by the Servomotor.

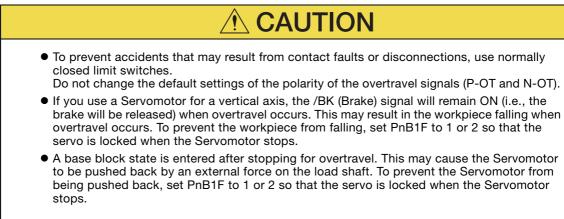
Even during overtravel, you can input a reference to drive the motor in the opposite direction.

A SERVOPACK wiring example is provided below.



Using the overtravel function is not necessary for rotating applications such as rotary tables and conveyors. No wiring for overtravel input signals is required.

This section describes the parameters settings related to overtravel.



### 5.10.1 Overtravel Signals

The overtravel signals include the P-OT (Forward Drive Prohibit) and the N-OT (Reverse Drive Prohibit) signals.

| Туре  | Signal | Connector Pin No. | Signal Status | Meaning                                           |
|-------|--------|-------------------|---------------|---------------------------------------------------|
| Input | P-OT   | CN1-8             | ON            | Forward drive is enabled (actual operation).      |
|       |        |                   | OFF           | Forward drive is prohibited (forward overtravel). |
|       | N-OT   | CN1-9             | ON            | Reverse drive is enabled (actual operation).      |
|       |        |                   | OFF           | Reverse drive is prohibited (reverse overtravel). |

Even during overtravel, you can input a reference to drive the motor in the opposite direction.

5.10.2 Overtravel Settings

### 5.10.2 Overtravel Settings

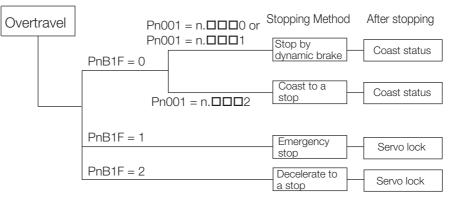
|       | 9                      |                                                                                   |               |
|-------|------------------------|-----------------------------------------------------------------------------------|---------------|
| F     | Parameter              | Meaning                                                                           | When Enabled  |
| PnB0F | 0<br>(default setting) | When input signal is OFF (open), forward run is prohibited (forward overtravel).  |               |
|       | 1                      | When input signal is ON (closed), forward run is prohibited (forward overtravel). |               |
|       | 2                      | Forward run is always prohibited (forward overtravel).                            |               |
|       | 3                      | Forward run is always enabled. (P-OT signal is not used.)                         | After restart |
| PnB10 | 0<br>(default setting) | When input signal is OFF (open), reverse run is prohibited (reverse overtravel).  | Aller Testart |
|       | 1                      | When input signal is ON (closed), reverse run is prohibited (reverse overtravel). |               |
|       | 2                      | Reverse run is always prohibited (reverse overtravel).                            |               |
|       | 3                      | Reverse run is always enabled. (N-OT signal is not used.)                         |               |

You can use the following parameters to set the input signals for overtravel.

Note: During the overtravel state or software limit state, the servomotor is not positioned to the target position specified by the controller. Check the current position to confirm that the axis is stopped at a safe position.

### 5.10.3 Motor Stopping Method When Overtravel is Used

Set the following parameter to specify the motor stopping method when overtravel is used.



| Parameter |                        | Meaning                                                                                                                    | When Enabled  |
|-----------|------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------|
|           | 0<br>(default setting) | Stops the motor with the same method as when the servo is turned OFF (according to setting of Pn001 = $n.\Box\Box\BoxX$ ). |               |
| PnB1F     | 1                      | Stops motor immediately, and then changes motor state to servo lock.                                                       | After restart |
|           | 2                      | Decelerates motor to a stop at deceleration rate set with PnB2B, and then changes motor state to servo lock.               |               |

5.10.4 Overtravel Warnings

Set the deceleration rate when decelerating to a stop in PnB2B.

|       | Deceleration   |                                      |                 |              |
|-------|----------------|--------------------------------------|-----------------|--------------|
|       | Setting Range  | Setting Unit                         | Default Setting | When Enabled |
| PnB2B | 1 to 99999999* | 1000<br>(Reference units/min)<br>/ms | 1000            | Immediately  |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be 1 to 199,999,999. Refer to the following section for details.

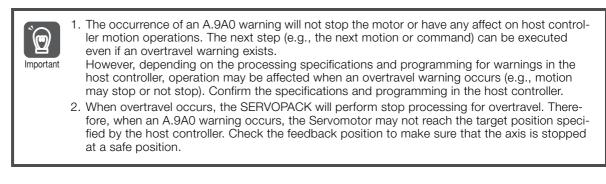
32.4 Speed/Position Expansion Function Setting on page 12-8



If the servo turns OFF due to overtravel, the servo will not turn ON even if the overtravel is released. To turn ON the servo, turn the /S-ON signal OFF and then ON or send the SVON serial command. If parameter PnB0E is set to 2 to keep the /S-ON signal always ON, turn the power supply OFF and then ON again.

### 5.10.4 Overtravel Warnings

You can set the system to detect an A.9A0 warning (Overtravel) if overtravel occurs while the servo is ON. This allows the SERVOPACK to notify the host controller with a warning even when the overtravel signal is input only momentarily. An alarm occurs only if overtravel occurs while the servo is ON. An overtravel warning will not be detected when the servo is OFF, even if overtravel occurs.



The following parameter is set for this function.

| Parameter                                              |                             | Meaning                            | When Enabled | Classification |  |
|--------------------------------------------------------|-----------------------------|------------------------------------|--------------|----------------|--|
| Pn00D                                                  | n.0□□□<br>(default setting) | Do not detect overtravel warnings. | Immediately  | Setup          |  |
|                                                        | n.1000                      | Detect overtravel warnings.        |              |                |  |
| A timing abort for warning detection is provided below |                             |                                    |              |                |  |

A timing chart for warning detection is provided below.

| Servo ON/OFF status                                               | OFF                    | ON                     |                                                        |
|-------------------------------------------------------------------|------------------------|------------------------|--------------------------------------------------------|
| Overtravel signal<br>(P-OT or N-OT signal)                        | Disabled Enabled Disab | ed Enabled Disabled    |                                                        |
| Overtravel warning (A.9A0) -<br>A warning is no<br>because the se |                        | Warning status for 1 s | Normal status<br>The warning is automatically cleared. |

#### 5.10.4 Overtravel Warnings

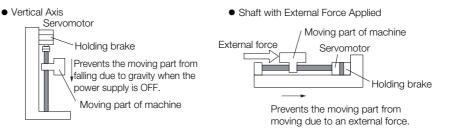
#### Information 1. Warnings are detected for overtravel in the same direction as the reference.

- 2. Warnings are not detected for overtravel in the opposite direction from the reference. Example: A warning will not be output for a forward reference even if the N-OT signal turns ON.
- 3. A warning can be detected in either the forward or reverse direction if there is no reference.
- 4. A warning will not be detected when the servo is turned ON even if overtravel status exists.
- 5. The warning status will be held for one second after the overtravel status no longer exists and it will then be cleared automatically.

# 5.11 Holding Brake

A holding brake is used to hold the position of the moving part of the machine when the SER-VOPACK is turned OFF so that moving part does not move due to gravity or an external force. You can use the brake that is built into a Servomotor with a Brake, or you can provide one on the machine.

The holding brake is used in the following cases.



• The brake built into a Servomotor with a Brake is a de-energization brake. It is used only to hold the Servomotor and cannot be used for braking. Use the holding brake only to hold a Servomotor that is already stopped.

• The /BK signal will remain ON during overtravel. The brake will not be applied.

# 5.11.1 Brake Operating Sequence

You must consider the brake release delay time and the brake operation delay time to determine the brake operation timing, as described below.

| Term |  |
|------|--|

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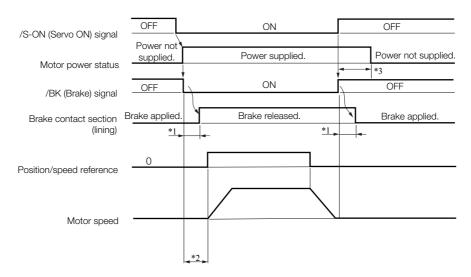
Important

#### Brake Release Delay Time

The time from when the /BK (Brake) signal is turned ON until the brake is actually released.

#### Brake Operation Delay Time

The time from when the /BK (Brake) signal is turned OFF until the brake actually operates.



\*1. Rotary Servomotors: The brake delay times for Servomotors with Holding Brakes are given in the following table. The operation delay times in the following table are examples for when the power supply is switched on the DC side. You must evaluate the actual brake delay times on the actual equipment before using the application.

#### 5.11 Holding Brake

5.11.2 Allocating the /BK (Brake) Signal

| Model            | Voltage | Brake Release<br>Delay Time [ms] | Brake Operation<br>Delay Time [ms] |
|------------------|---------|----------------------------------|------------------------------------|
| SGM7M-A1 to -A3  |         | 60                               |                                    |
| SGM7J-A5 to -04  |         | 00                               |                                    |
| SGM7J-06 and -08 |         | 80                               | 100                                |
| SGM7A-A5 to -04  |         | 60                               |                                    |
| SGM7A-06 to -10  |         | 80                               |                                    |
| SGM7A-15 to -25  |         | 170                              | 80                                 |
| SGM7A-30 to -50  | 24 VDC  | 100                              | 00                                 |
| SGM7P-01         | 24 VDC  | 20                               |                                    |
| SGM7P-02 and -04 |         | 40                               | 100                                |
| SGM7P-08 and -15 |         | 20                               |                                    |
| SGM7G-03 to -20  |         | 100                              | 80                                 |
| SGM7G-30 to -44  |         | 170                              | 100                                |
| SGM7G-55 to -1A  |         | 170                              | 80                                 |
| SGM7G-1E         |         | 250                              | 00                                 |

Linear Servomotors: The brake delay times depend on the brake that you use. Set the parameters related to /BK signal output timing according to the delay times for the brake that you will actually use.

\*2. Before you output a reference from the host controller to the SERVOPACK, wait for at least 50 ms plus the brake release delay time after you send the SV\_ON command.

\*3. Use the following parameters to set the timing of when the brake will operate and when the servo will be turned OFF.

Rotary Servomotors: Pn506 (Brake Reference-Servo OFF Delay Time), Pn507 (Brake Reference Output Speed Level), and Pn508 (Servo OFF-Brake Reference Waiting Time)

 Linear Servomotors: Pn506 (Brake Reference-Servo OFF Delay Time), Pn508 (Servo OFF-Brake Reference Waiting Time), and Pn583 (Brake Reference Output Speed Level)

### **Connection Examples**

Refer to the following section for information on brake wiring. *4.4.4 Wiring the SERVOPACK to the Holding Brake* on page 4-35

### 5.11.2 Allocating the /BK (Brake) Signal

The following settings are for the output signal that controls the brake.

The /BK signal is turned OFF (to operate the brake) when the servo is turned OFF or when an alarm is detected. You can adjust the timing of brake operation (i.e., the timing of turning OFF the /BK signal) with the servo OFF delay time (Pn506).

| Туре   | Signal | Connector Pin No. | Signal Status | Meaning              |
|--------|--------|-------------------|---------------|----------------------|
| Output | /BK    | CN1-23, CN1-24    | ON (closed)   | Releases the brake.  |
| Output |        | (default setting) | OFF (open)    | Activates the brake. |

Information The /BK signal will remain ON during overtravel. The brake will not be applied.

#### Allocating the /BK (Brake) Signal

The setting of the /BK signal can be changed with the parameters below.

| Parameter |                        | Meaning                                                              | When Enabled  |
|-----------|------------------------|----------------------------------------------------------------------|---------------|
| PnB1D     | 0<br>(default setting) | When the /BK signal is ON (closed), the brake is released.           | After restart |
|           | 1                      | When the /BK signal is OFF (open), the brake is released.            |               |
| DpD51     | 0<br>(default setting) | Does not output /ALO1 to /ALO3. (/WARN, /BK, and /S-RDY are output.) | After restart |
| PnB51     | 1                      | Outputs /ALO1 to /ALO3. (/WARN, /BK, and /S-RDY are not output.)     | Aller restart |

#### 5.11.3 Output Timing of /BK (Brake) Signal When the Servomotor Is Stopped



Inverting the polarity of the brake output signal (/BK), i.e. positive logic, will prevent the holding brake from working in case of its signal line disconnection. If this setting is absolutely necessary, check the operation and confirm that there are no safety

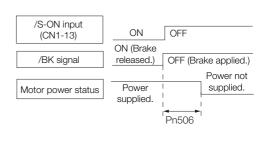
problems.

#### 5.11.3 Output Timing of /BK (Brake) Signal When the Servomotor Is Stopped

When the Servomotor is stopped, the /BK signal turns OFF at the same time as the /S-ON signal turns OFF. Use the servo OFF delay time (Pn506) to change the timing to turn OFF power supply to the motor after the /S-ON signal turns OFF.

| Brake Reference-Servo OFF Delay Time |                                                                        |       |   |             |       |  |
|--------------------------------------|------------------------------------------------------------------------|-------|---|-------------|-------|--|
| Pn506                                | Setting Range Setting Unit Default Setting When Enabled Classification |       |   |             |       |  |
|                                      | 0 to 50                                                                | 10 ms | 0 | Immediately | Setup |  |

- When the Servomotor is used to control a vertical axis, the machine moving part may move slightly due to gravity or an external force. You can eliminate this slight motion by setting the servo OFF delay time (Pn506) so that power supply to the motor is stopped after the brake is applied.
- This parameter sets the timing of stopping power supply to the Servomotor while the Servomotor is stopped.



Power supply to the Servomotor will be stopped immediately when an alarm occurs, regardless of the setting of this parameter. The machine moving part may move due to gravity or an external force before the brake is applied.

# 5.11.4 Output Timing of /BK (Brake) Signal When the Servomotor Is Operating

If an alarm occurs while the Servomotor is operating, the Servomotor will start stopping and the /BK signal will be turned OFF. You can adjust the timing of /BK signal output by setting the brake reference output speed level (Rotary Servomotors: Pn507, Linear Servomotors: Pn583) and the servo OFF-brake reference waiting time (Pn508).

Note: If zero-speed stopping is set as the stopping method for alarms, the setting of Pn506 (Brake Reference-Servo OFF Delay Time) is used after the motor stops.

Rotary Servomotors

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|       | Brake Reference Output Speed Level     |                     |                 |              |                |  |  |
|-------|----------------------------------------|---------------------|-----------------|--------------|----------------|--|--|
| Pn507 | Setting Range                          | Setting Unit        | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 10,000                            | 1 min <sup>-1</sup> | 100             | Immediately  | Setup          |  |  |
|       | Servo OFF-Brake Reference Waiting Time |                     |                 |              |                |  |  |
| Pn508 | Setting Range                          | Setting Unit        | Default Setting | When Enabled | Classification |  |  |
|       | 10 to 100                              | 10 ms               | 50              | Immediately  | Setup          |  |  |

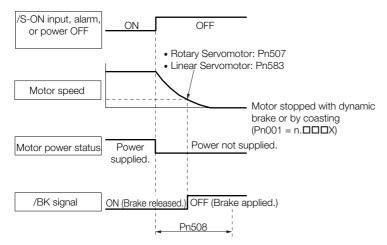
5.11.4 Output Timing of /BK (Brake) Signal When the Servomotor Is Operating

• Linear Servomotors

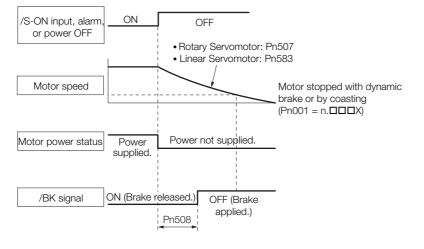
|       | Brake Reference Output Speed Level     |              |                 |              |                |  |  |
|-------|----------------------------------------|--------------|-----------------|--------------|----------------|--|--|
| Pn583 | Setting Range                          | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 10,000                            | 1 mm/s       | 10              | Immediately  | Setup          |  |  |
|       | Servo OFF-Brake Reference Waiting Time |              |                 |              |                |  |  |
| Pn508 | Setting Range                          | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 10 to 100                              | 10 ms        | 50              | Immediately  | Setup          |  |  |

The brake operates when either of the following conditions is satisfied:

• When the Motor Speed Goes below the Level Set in Pn507 for a Rotary Servomotor or in Pn583 for a Linear Servomotor after the Power Supply to the Motor Is Stopped



• When the Time Set In Pn508 Elapses after the Power Supply to the Motor Is Stopped



Important

The Servomotor will be limited to its maximum speed even if the brake reference output speed level (Rotary Servomotor: Pn507, Linear Servomotor: Pn583) is higher than the maximum speed.

# 5.12 Motor Stopping Methods for Servo OFF and Alarms

You can use the following methods to stop the Servomotor when the servo is turned OFF or an alarm occurs.

There are the following four stopping methods.

| Motor Stopping Method                     | Meaning                                                                        |
|-------------------------------------------|--------------------------------------------------------------------------------|
| Stopping by Applying the<br>Dynamic Brake | The electric circuits are internally connected to stop the Servomotor quickly. |
| Coasting to a Stop                        | The motor stops naturally due to friction during operation.                    |
| Zero-speed Stopping                       | The speed reference is set to 0 to stop the Servomotor quickly.                |
| Decelerating to a Stop                    | Emergency stop torque is used to decelerate the motor to a stop.               |

There are the following three conditions after stopping.

| Status after Stopping | Meaning                                                                                                                          |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Dynamic Brake Applied | The electric circuits are internally connected to hold the Servomotor.                                                           |
| Coasting              | The SERVOPACK does not control the Servomotor. (The machine will move in response to a force from the load.)                     |
| Zero Clamping         | A position loop is created and the Servomotor remains stopped at a position reference of 0. (The current stop position is held.) |

• The dynamic brake is used for emergency stops. The dynamic brake circuit will operate frequently if the power supply is turned ON and OFF or the servo is turned ON and OFF while a reference input is applied to start and stop the Servomotor. This may result in deterioration of the internal elements in the SERVOPACK. Use speed input references or position references to start and stop the Servomotor.

 If you turn OFF the main circuit power supply or control power supply during operation before you turn OFF the servo, the Servomotor stopping method depends on the SERVOPACK model as shown in the following table.

|                                                                         | Servomotor Stopping Method                                                                                 |                    |  |  |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------|--|--|
| Condition                                                               | SGD7S-R70A, -1R6A, -2R8A,<br>-3R8A, -5R5A, -7R6A, -120A,<br>-180A, -200A, -R70F, -R90F,<br>-2R1F, or -2R8F |                    |  |  |
| Main circuit power supply<br>turned OFF before turning<br>OFF the servo | Stopping with dynamic brake                                                                                |                    |  |  |
| Control power supply<br>turned OFF before turning<br>OFF the servo      | Stopping with dynamic brake                                                                                | Coasting to a stop |  |  |

• If the Servomotor must be stopped by coasting rather than with the dynamic brake when the main circuit power supply or the control power supply is turned OFF before the servo is turned OFF, use a SERVOPACK with the Dynamic Brake Hardware Option.

• To minimize the coasting distance of the Servomotor to come to a stop when an alarm occurs, zero-speed stopping is the default method for alarms to which it is applicable. However, depending on the application, stopping with the dynamic brake may be more suitable than zero-speed stopping.

For example, when coupling two shafts (twin-drive operation), machine damage may occur if a zero-speed stopping alarm occurs for one of the coupled shafts and the other shaft stops with a dynamic brake. In such cases, change the stopping method to the dynamic brake.

5.12.1 Stopping Method for Servo OFF

### 5.12.1 Stopping Method for Servo OFF

Set the stopping method for when the servo is turned OFF in Pn001 =  $n.\Box\Box\BoxX$  (Servo OFF or Alarm Group 1 Stopping Method).

| Parameter |                             | Servomotor<br>Stopping Method | Status after<br>Servomotor Stops | When Enabled  | Classification |
|-----------|-----------------------------|-------------------------------|----------------------------------|---------------|----------------|
| _         | n.□□□0<br>(default setting) | Dynamic brake*                | Dynamic brake*                   |               |                |
| Pn001     | n.0001                      |                               | Coasting                         | After restart | Setup          |
|           | n.🗆 🗆 🗆 2                   | Coasting                      | Coasting                         |               |                |

\* The Servomotor will coast to a stop when the SERVOPACK is not equipped with a built-in Dynamic Brake Resistor or an External Dynamic Brake Resistor is not connected.

Note: If Pn001 is set to n. DDD0 (Stop the motor by applying the dynamic brake) and the Servomotor is stopped or operates at a low speed, braking force may not be generated, just like it is not generated for coasting to a stop.

### 5.12.2 Servomotor Stopping Method for Alarms

There are two types of alarms, group 1 (Gr. 1) alarms and group 2 (Gr. 2) alarms. A different parameter is used to set the stopping method for alarms for each alarm type.

Refer to the following section to see which alarms are in group 1 and which are in group 2. *15.2.1 List of Alarms* on page 15-5

#### Motor Stopping Method for Group 1 Alarms

When a group 1 alarm occurs, the Servomotor will stop according to the setting of  $Pn001 = n.\Box\Box\BoxX$ . The default setting is to stop by applying the dynamic brake.

Refer to the following section for details.

5.12.1 Stopping Method for Servo OFF on page 5-36

#### Motor Stopping Method for Group 2 Alarms

When a group 2 alarm occurs, the Servomotor will stop according to the settings of the following three parameters. The default setting is for zero clamping.

- Pn001 = n. DDX (Servo OFF or Alarm Group 1 Stopping Method)
- Pn00A = n. DDDX (Motor Stopping Method for Group 2 Alarms)
- Pn00B = n. DIXI (Motor Stopping Method for Group 2 Alarms)

If you set Pn00B to n.  $\Box\Box1\Box$  (Apply dynamic brake or coast Servomotor to a stop), you can use the same stopping method as group 1. If you are coordinating a number of Servomotors, you can use this stopping method to prevent machine damage that may result because of differences in the stopping method.

The following table shows the combinations of the parameter settings and the resulting stopping methods.

#### 5.12.2 Servomotor Stopping Method for Alarms

|                      | Paramete                                 | er                                                              | Servomotor                                                                              | Status after        | When            |                |
|----------------------|------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------|-----------------|----------------|
| Pn00B                | Pn00A                                    | Pn001                                                           | Stopping Method                                                                         | Servomotor<br>Stops | Enabled         | Classification |
| n.□□0□<br>/defeult   |                                          | n.□□□0     Dynamic       (default setting)     Zero-speed stop- |                                                                                         |                     |                 |                |
| (default<br>setting) | _                                        | n.□□□1<br>n.□□□2                                                | ping                                                                                    | Coasting            |                 |                |
|                      |                                          | n.□□□0<br>(default setting)                                     | Dynamic brake                                                                           | Dynamic<br>brake    |                 |                |
| n.0010               | _                                        | n.0001<br>n.0002                                                | Coasting                                                                                | Coasting            |                 |                |
|                      | n.□□□0                                   | n.□□□0<br>(default setting)                                     | Dynamic brake                                                                           | Dynamic<br>brake    | -               | Setup          |
|                      |                                          | n.□□□1<br>n.□□□2                                                | Coasting                                                                                | Coasting            | - After restart |                |
|                      | n.□□□1<br>(default<br>setting)<br>n.□□□2 | n.□□□0<br>(default setting)                                     | Motor is deceler-<br>ated using the<br>torque set in<br>Pn406 as the<br>maximum torque. | Dynamic<br>brake    |                 |                |
|                      |                                          |                                                                 |                                                                                         | Coasting            |                 |                |
| n.0020               | n.0002                                   | n.□□□0<br>(default setting)                                     |                                                                                         | Coasting            |                 |                |
| 11.0020              | 11.0002                                  | n.0001<br>n.0002                                                |                                                                                         | Coasting            |                 |                |
|                      |                                          | n.□□□0<br>(default setting)                                     |                                                                                         | Dynamic<br>brake    |                 |                |
|                      | n.□□□3                                   | n.□□□1<br>n.□□□2                                                | Motor is deceler-                                                                       | Coasting            | -               |                |
|                      | n.0004                                   | n.□□□0<br>(default setting)<br>n.□□□1                           | ated according to setting of Pn30A.                                                     | Coasting            |                 |                |
|                      |                                          | n.0002                                                          |                                                                                         |                     |                 |                |

Note: 1. The setting of Pn00A is ignored if Pn00B is set to n. DDD or n. DD1D.

2. Refer to the following section for details on Pn406 (Emergency Stop Torque).

Stopping the Servomotor by Setting Emergency Stop Torque on page 5-37

3. Refer to the following section for details on Pn30A (Deceleration Time for Servo OFF and Forced Stops). Stopping the Servomotor by Setting the Deceleration Time on page 5-38

#### Stopping the Servomotor by Setting Emergency Stop Torque

To stop the Servomotor by setting emergency stop torque, set Pn406 (Emergency Stop Torque).

If  $Pn00A = n.\Box\Box\BoxX$  is set to 1 or 2, the Servomotor will be decelerated to a stop using the torque set in Pn406 as the maximum torque.

The default setting is 800%. This setting is large enough to allow you to operate the Servomotor at the maximum torque. However, the maximum emergency stop torque that you can actually use is the maximum torque of the Servomotor.

|       | Emergency Stop Torque                                                  |     |     |             |       |  |  |
|-------|------------------------------------------------------------------------|-----|-----|-------------|-------|--|--|
| Pn406 | Setting Range Setting Unit Default Setting When Enabled Classification |     |     |             |       |  |  |
|       | 0 to 800                                                               | 1%* | 800 | Immediately | Setup |  |  |

\* Set a percentage of the motor rated torque.

5.12.2 Servomotor Stopping Method for Alarms

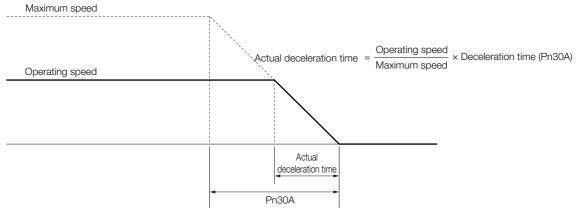
### Stopping the Servomotor by Setting the Deceleration Time

To specify the Servomotor deceleration time and use it to stop the Servomotor, set Pn30A (Deceleration Time for Servo OFF and Forced Stops).

|       | Deceleration Time for Servo OFF and Forced Stops              |      |   |             |       |  |
|-------|---------------------------------------------------------------|------|---|-------------|-------|--|
| Pn30A | In30A Setting Range Setting Unit Default Setting When Enabled |      |   |             |       |  |
|       | 0 to 10,000                                                   | 1 ms | 0 | Immediately | Setup |  |

If you set Pn30A to 0, the Servomotor will be stopped with a zero speed.

The deceleration time that you set in Pn30A is the time to decelerate the Servomotor from the maximum motor speed.



#### 5.13.1 Detection Timing for Overload Warnings (A.910)

# 5.13 Motor Overload Detection Level

The motor overload detection level is the threshold used to detect overload alarms and overload warnings when the Servomotor is subjected to a continuous load that exceeds the Servomotor ratings.

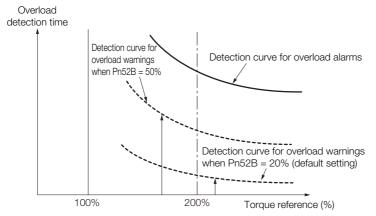
It is designed to prevent Servomotor overheating.

You can change the detection timing for A.910 warnings (Overload) and A.720 alarms (Continuous Overload). You cannot change the detection level for A.710 alarms (Instantaneous Overload).

## 5.13.1 Detection Timing for Overload Warnings (A.910)

With the default setting for overload warnings, an overload warning is detected in 20% of the time required to detect an overload alarm. You can change the time required to detect an overload warning by changing the setting of the overload warning level (Pn52B). You can increase safety by using overload warning detection as an overload protection function matched to the system.

The following graph shows an example of the detection of overload warnings when the overload warning level (Pn52B) is changed from 20% to 50%. An overload warning is detected in half of the time required to detect an overload alarm.



|       | Overload Warning Level |              |                 |              |                |  |  |
|-------|------------------------|--------------|-----------------|--------------|----------------|--|--|
| Pn52B | Setting Range          | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 1 to 100               | 1%           | 20              | Immediately  | Setup          |  |  |

5.13.2 Detection Timing for Overload Alarms (A.720)

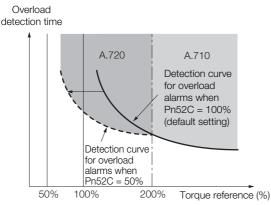
### 5.13.2 Detection Timing for Overload Alarms (A.720)

If Servomotor heat dissipation is insufficient (e.g., if the heat sink is too small), you can lower the overload alarm detection level to help prevent overheating.

To reduce the overload alarm detection level, change the setting of Pn52C (Base Current Derating at Motor Overload Detection).

|       | Base Current Derating at Motor Overload Detection |              |                 |               |                |  |
|-------|---------------------------------------------------|--------------|-----------------|---------------|----------------|--|
| Pn52C | Setting Range                                     | Setting Unit | Default Setting | When Enabled  | Classification |  |
|       | 10 to 100                                         | 1%           | 100             | After restart | Setup          |  |

An A.720 alarm (Continuous Overload) can be detected earlier to protect the Servomotor from overloading.



Note: The gray areas in the above graph show where A.710 and A.720 alarms occur.

Refer to the relevant manual given below for a diagram that shows the relationships between the Servomotor heat dissipation conditions (heat sink size, surrounding air temperature, and derating). You can protect the Servomotor from overloads more effectively by setting this derating value in Pn52C.

Ω Σ-7-Series Rotary Servomotor Product Manual (Manual No.: SIEP S800001 36)

Ω Σ-7-Series Linear Servomotor Product Manual (Manual No.: SIEP S800001 37)

Ω Σ-7-Series Direct Drive Servomotor Product Manual (Manual No.: SIEP S800001 38)

# 5.14 Electronic Gear Settings

The minimum unit of the position data that is used to move a load is called the reference unit. The reference unit is used to give travel amounts, not in pulses, but rather in distances or other physical units (such as  $\mu m$  or °) that are easier to understand.

The electronic gear is used to convert the travel distances that are specified in reference units to pulses, which are required for actual movements.

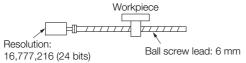
With the electronic gear, one reference unit is equal to the workpiece travel distance per reference pulse input to the SERVOPACK. In other words, if you use the SERVOPACK's electronic gear, pulses can be read as reference units.

Note: If you set an electronic gear in the host controller, normally set the electronic gear ratio in the SERVOPACK to 1:1.

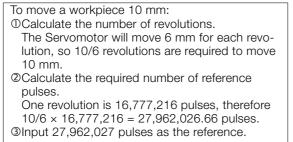
The difference between using and not using the electronic gear is shown below.

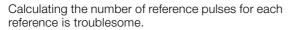
#### Rotary Servomotors

In this example, the following machine configuration is used to move the workpiece 10 mm.



When the Electronic Gear Is Not Used





When the Electronic Gear Is Used

If you use reference units to move the workpiece when one reference unit is set to 1  $\mu$ m, the travel distance is 1  $\mu$ m per pulse. To move the workpiece 10 mm (10,000  $\mu$ m), 10,000 ÷ 1 = 10,000 pulses, so 10,000 pulses would be input.

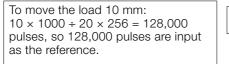
Calculating the number of reference pulses for each reference is not necessary.

#### · Linear Servomotors

In this example, the following machine configuration is used to move the load 10 mm. We'll assume that the scale pitch of the linear encoder is 20  $\mu$ m and that the resolution of the serial converter unit is 256.

Linear encoder

When the Electronic Gear Is Not Used



Calculating the number of reference pulses for each reference is trouble-some.

When the Electronic Gear Is Used

To use reference units to move the load 10 mm: If we set the reference unit to 1  $\mu$ m, the travel distance is 1  $\mu$ m per pulse. To move the load 10 mm (10,000  $\mu$ m), 10,000/1 = 10,000 pulses, so 10,000 pulses would be input as the reference.

Calculating the number of reference pulses for each reference is not necessary.

### 5.14.1 Electronic Gear Ratio Settings

Set the electronic gear ratio using Pn20E and Pn210.

| Important | $0.001 \le$ Electronic gear ratio (B/A) $\le$ 64,000<br>If the electronic gear ratio is outside of this range, an A.040 alarm (Parameter Setting Error) will                                                                                                                                                                                                                                               |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | <ul> <li>occur.</li> <li>Pn040 = n.□□1□ (Use a resolution of 20 bits when connected to an SGM7J, SGM7A, SGM7P, SGM7G, SGM7E, or SGM7F Servomotor.)</li> <li>Set the electronic gear ratio within the following range.</li> <li>0.001 ≤ Electronic gear ratio (B/A) ≤ 4,000</li> <li>If the electronic gear ratio is outside of this range, an A.040 alarm (Parameter Setting Error) will occur.</li> </ul> |

|       | Electronic Gear Ratio (Numerator)   |              |                 |               |                |  |  |
|-------|-------------------------------------|--------------|-----------------|---------------|----------------|--|--|
| Pn20E | Setting Range                       | Setting Unit | Default Setting | When Enabled  | Classification |  |  |
|       | 1 to 1,073,741,824                  | 1            | 64              | After restart | Setup          |  |  |
|       | Electronic Gear Ratio (Denominator) |              |                 |               |                |  |  |
| Pn210 | Setting Range                       | Setting Unit | Default Setting | When Enabled  | Classification |  |  |
|       | 1 to 1,073,741,824                  | 1            | 1               | After restart | Setup          |  |  |

### Calculating the Settings for the Electronic Gear Ratio

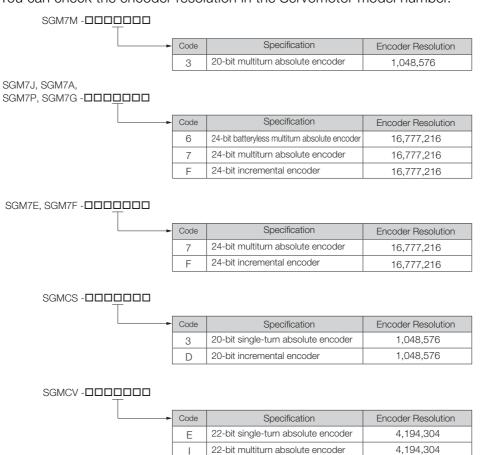
#### Rotary Servomotors

If the gear ratio between the Servomotor shaft and the load is given as n/m, where n is the number of load rotations for m Servomotor shaft rotations, the settings for the electronic gear ratio can be calculated as follows:

Electronic gear ratio  $\frac{B}{A} = \frac{Pn20E}{Pn210} = \frac{Encoder resolution}{Travel distance per load shaft revolution (reference units)} \times \frac{m}{n}$ 

#### Encoder Resolution

You can check the encoder resolution in the Servomotor model number.



#### Linear Servomotors

You can calculate the settings for the electronic gear ratio with the following equation: When Not Using a Serial Converter Unit

Use the following formula if the linear encoder and SERVOPACK are connected directly or if a linear encoder that does not require a Serial Converter Unit is used.

| Flastrania gaar ratio B _ Pn20E _                           | Travel distance per reference unit (reference units) × Linear encoder resolution |
|-------------------------------------------------------------|----------------------------------------------------------------------------------|
| Electronic gear ratio $\frac{B}{A} = \frac{Pn20E}{Pn210} =$ | Linear encoder pitch (the value from the following table)                        |
| When Using a Serial Co                                      | onverter Unit                                                                    |

|                       | В   | Pn20E     | Travel distance per reference unit (reference units) × Resolution of the Serial Converter Unit |
|-----------------------|-----|-----------|------------------------------------------------------------------------------------------------|
| Electronic gear ratio | A = | = Pn210 = | Linear encoder pitch (setting of Pn282)                                                        |

#### Feedback Resolution of Linear Encoder

The linear encoder pitches and resolutions are given in the following table.

Calculate the electronic gear ratio using the values in the following table.

| Type of<br>Linear<br>Encoder | Manufacturer               | Linear Encoder Model                              | Linear<br>Encoder<br>Pitch<br>[µm] <sup>*1</sup> | Relay Device Model<br>between SERVOPACK<br>and Linear Encoder | Resolution         | Resolution |
|------------------------------|----------------------------|---------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------|--------------------|------------|
|                              |                            | LIDA480                                           | 20                                               | JZDP-H003- <b>DDD</b> -E <sup>*2</sup>                        | 256                | 0.078 µm   |
|                              | Dr. JOHANNES<br>HEIDENHAIN |                                                   | 20                                               | JZDP-J003- <b>DDD</b> -E <sup>*2</sup>                        | 4,096              | 0.0049 µm  |
|                              | GmbH                       | LIF480                                            | 4                                                | JZDP-H003- <b>DDD</b> -E <sup>*2</sup>                        | 256                | 0.016 µm   |
|                              |                            |                                                   | 4                                                | JZDP-J003- <b>DDD</b> -E <sup>*2</sup>                        | 4,096              | 0.00098 µm |
|                              |                            | RGH22B                                            | 20                                               | JZDP-H005- <b>DDD</b> -E <sup>*2</sup>                        | 256                | 0.078 µm   |
|                              | Renishaw                   | TONIC series<br>(Ti0000A00V only)                 | 20                                               | JZDP-J005- <b>DDD</b> -E <sup>*2</sup>                        | 4,096              | 0.0049 μm  |
|                              | PLC                        |                                                   | 20                                               | JZDP-H005- <b>DDD</b> -E <sup>*2</sup>                        | 256                | 0.078 µm   |
|                              |                            |                                                   | 20                                               | JZDP-J005- <b>DDD</b> -E <sup>*2</sup>                        | 4,096              | 0.0049 μm  |
| Incre-                       |                            | SR75-0000LF*6                                     | 80                                               | -                                                             | 8,192              | 0.0098 µm  |
| mental                       |                            | SR75-DDDDDMF                                      | 80                                               | -                                                             | 1,024              | 0.078 µm   |
|                              |                            | $SR85-DDDDDLF^{*6}$                               | 80                                               | _                                                             | 8,192              | 0.0098 µm  |
|                              | Magnescale                 | SR85-DDDDDMF                                      | 80                                               | _                                                             | 1,024              | 0.078 µm   |
|                              | Co., Ltd.                  | SL700 <sup>*6</sup> , SL710 <sup>*6</sup> ,       | 800                                              | PL101-RY*3                                                    | - 8,192<br>- 8,192 | 0.0977 μm  |
|                              |                            | SL720 <sup>*6</sup> , SL730 <sup>*6</sup><br>SQ10 | 000                                              | MJ620-T13 <sup>*4</sup>                                       |                    |            |
|                              |                            |                                                   | 400                                              | MQ10-FLA <sup>*4</sup>                                        |                    | 0.0499.um  |
|                              |                            |                                                   | 400                                              | MQ10-GLA <sup>*4</sup>                                        |                    | 0.0488 µm  |
|                              | Canon                      | PH03-36110                                        | 128                                              | _                                                             | 2,048              | 0.0625 μm  |
|                              | Precision Inc.             | PH03-36120                                        | 128                                              | _                                                             | 2,048              | 0.0625 μm  |

Continued on next page.

Continued from previous page.

| Type of<br>Linear<br>Encoder | Manufacturer            | Linear Encoder Model                                | Linear<br>Encoder<br>Pitch<br>[µm] <sup>*1</sup> | Relay Device Model<br>between SERVOPACK<br>and Linear Encoder | Resolution | Resolution |
|------------------------------|-------------------------|-----------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------|------------|------------|
|                              |                         | LIC4100 Series <sup>*7</sup>                        | 20.48                                            | EIB3391Y*5                                                    | 4,096      | 0.005 μm   |
|                              |                         |                                                     | 204.8                                            | EIB3391Y*5                                                    | 4,096      | 0.05 µm    |
|                              |                         | LIC2100 Series <sup>*7</sup>                        | 409.6                                            | EIB3391Y*5                                                    | 4,096      | 0.1 µm     |
|                              |                         |                                                     | 40.96                                            | _                                                             | 4,096      | 0.01 µm    |
|                              | Dr.                     | LIC4190 Series                                      | 20.48                                            | _                                                             | 4,096      | 0.005 μm   |
|                              | JOHANNES<br>HEIDENHAIN  |                                                     | 4.096                                            | _                                                             | 4,096      | 0.001 µm   |
|                              | GmbH                    | LIC3190 Series                                      | 40.96                                            | _                                                             | 4,096      | 0.01 µm    |
|                              |                         | LIC2190 Series                                      | 409.6                                            | _                                                             | 4,096      | 0.1 μm     |
|                              |                         | LICZ 190 Series                                     | 204.8                                            | -                                                             | 4,096      | 0.05 µm    |
|                              |                         | LC115                                               | 40.96                                            | EIB3391Y*5                                                    | 4,096      | 0.01 µm    |
|                              |                         | LC415                                               | 40.96                                            | EIB3391Y*5                                                    | 4,096      | 0.01 µm    |
|                              | RSF Elektronik          |                                                     | 409.6                                            | _                                                             | 4,096      | 0.1 μm     |
|                              | GmbH                    | MC15Y Series                                        | 204.8                                            | _                                                             | 4,096      | 0.05 µm    |
|                              |                         | ST781A/ST781AL                                      | 256                                              | _                                                             | 512        | 0.5 µm     |
|                              |                         | ST782A/ST782AL                                      | 256                                              | _                                                             | 512        | 0.5 μm     |
|                              |                         | ST783/ST783AL                                       | 51.2                                             | _                                                             | 512        | 0.1 μm     |
|                              | Mitutoyo                | ST784/ST784AL                                       | 51.2                                             | -                                                             | 512        | 0.1 μm     |
|                              | Corporation             | ST788A/ST788AL                                      | 51.2                                             | _                                                             | 512        | 0.1 μm     |
|                              | olute                   | ST789A/ST789AL                                      | 25.6                                             | _                                                             | 512        | 0.05 µm    |
| Absolute                     |                         | ST1381                                              | 5.12                                             | _                                                             | 512        | 0.01 µm    |
|                              |                         | ST1382                                              | 0.512                                            | _                                                             | 512        | 0.001 μm   |
|                              |                         | EL36Y0050F000                                       | 12.8                                             | _                                                             | 256        | 0.05 µm    |
|                              | Deviele                 |                                                     | 25.6                                             | _                                                             | 256        | 0.1 µm     |
|                              | Renishaw<br>PLC         |                                                     | 128                                              | _                                                             | 256        | 0.5 µm     |
|                              |                         |                                                     | 12.8                                             | _                                                             | 256        | 0.05 µm    |
|                              |                         | RL36Y0001000                                        | 0.256                                            | _                                                             | 256        | 0.001 µm   |
|                              |                         |                                                     | 2,000                                            | _                                                             | 2,048      | 0.9765 µm  |
|                              | RLS d.o.o.              | LA11YA Series                                       | 2,000                                            | -                                                             | 4,096      | 0.4882 µm  |
|                              |                         |                                                     | 2,000                                            | _                                                             | 8,192      | 0.2441 µm  |
|                              |                         | $SR77-DDDDDLF^{*6}$                                 | 80                                               | _                                                             | 8,192      | 0.0098 µm  |
|                              |                         | SR77-DDDDDMF                                        | 80                                               | _                                                             | 1,024      | 0.078 μm   |
|                              |                         | $SR87-DDDDDLF^{*6}$                                 | 80                                               | _                                                             | 8,192      | 0.0098 µm  |
|                              |                         | SR87-DDDDDMF                                        | 80                                               | _                                                             | 1,024      | 0.078 μm   |
|                              | Magnescale<br>Co., Ltd. | SQ47/SQ57-<br>DDDDDSFDDD<br>SQ47/SQ57-<br>DDDDTFDDD | 20.48                                            | _                                                             | 4,096      | 0.005 μm   |
|                              |                         | SQ47/SQ57-<br>DDDDDAFDDD<br>SQ47/SQ57-<br>DDDDFFDDD | 40.96                                            | _                                                             | 4,096      | 0.01 µm    |

Continued on next page.

|                              |                         |                      |                                                  | 001111                                                        |            | evious page. |
|------------------------------|-------------------------|----------------------|--------------------------------------------------|---------------------------------------------------------------|------------|--------------|
| Type of<br>Linear<br>Encoder | Manufacturer            | Linear Encoder Model | Linear<br>Encoder<br>Pitch<br>[µm] <sup>*1</sup> | Relay Device Model<br>between SERVOPACK<br>and Linear Encoder | Resolution | Resolution   |
|                              |                         | L2AK208              | 20                                               | _                                                             | 256        | 0.078 μm     |
|                              |                         | L2AK211              | 20                                               | -                                                             | 2,048      | 0.0098 µm    |
|                              |                         | LAK209               | 40                                               | _                                                             | 512        | 0.078 μm     |
|                              | LAK212                  | 40                   | _                                                | 4,096                                                         | 0.0098 μm  |              |
|                              | Fagor<br>Automation     | S2AK208              | 20                                               | _                                                             | 256        | 0.078 μm     |
| Absolute                     | S. Coop.                | SV2AK208             | 20                                               | -                                                             | 256        | 0.078 µm     |
| 7.0501010                    |                         | G2AK208              | 20                                               | -                                                             | 256        | 0.078 µm     |
|                              |                         | S2AK211              | 20                                               | -                                                             | 2,048      | 0.0098 µm    |
|                              |                         | SV2AK211             | 20                                               | -                                                             | 2,048      | 0.0098 µm    |
|                              |                         | G2AK211              | 20                                               | -                                                             | 2,048      | 0.0098 µm    |
|                              | Canon<br>Precision Inc. | PH03-36E00           | 128                                              | -                                                             | 2,048      | 0.0625 μm    |

Continued from previous page

\*1. These are reference values for setting SERVOPACK parameters. Contact the manufacturer for actual linear encoder scale pitches.

\*2. This is the model of the Serial Converter Unit.

\*3. This is the model of the Head with Interpolator.

\*4. This is the model of the Interpolator.

\*5. This is the model of the Interface Unit.

\*6. If you use an encoder pulse output with this linear encoder, the setting range of the encoder output resolution (Pn281) is restricted. Refer to the following section for details on the encoder output resolution (Pn281). 6.5.2 Setting for the Encoder Divided Pulse Output on page 6-20

\*7. Sales of the interface unit EIB3391Y with the LIC4100 and LIC2100 series have ended due to the release of the LIC4190, LIC3190, and LIC2190 series.

#### Resolution Information

You can calculate the resolution that is used inside the SERVOPACK (i.e., the travel distance per feedback pulse) with the following formula.

Resolution (travel distance per feedback pulse) = Resolution of Serial Converter Unit or linear encoder The SERVOPACK uses feedback pulses as the unit to control a Servomotor.



Linear encoder pitch =Distance for one cycle of the analog voltage feedback signal from the linear encoder

Linear encoder pitch

5.14.2 Electronic Gear Ratio Setting Examples

# 5.14.2 Electronic Gear Ratio Setting Examples

Setting examples are provided in this section.

• Rotary Servomotors

|      |                                                                   |                                                                                                   | Machine Configuration                                                              |                                                                                                                       |
|------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|      |                                                                   | Ball Screw                                                                                        | Rotary Table                                                                       | Belt and Pulley                                                                                                       |
| Step | Description                                                       | Reference unit: 0.001 mm<br>Load shaft<br>Load shaft<br>Encoder: Ball screw lead:<br>24 bits 6 mm | Reference unit: 0.01°<br>Gear ratio:<br>1/100<br>Load shaft<br>Encoder: 24 bits    | Reference unit: 0.005 mm<br>Load shaft<br>Gear ratio: Pulley dia.:<br>1/50 Pulley dia.:<br>100 mm<br>Encoder: 24 bits |
| 1    | Machine<br>Specifications                                         | <ul><li>Ball screw lead: 6 mm</li><li>Gear ratio: 1/1</li></ul>                                   | <ul> <li>Rotation angle per revolution: 360°</li> <li>Gear ratio: 1/100</li> </ul> | <ul> <li>Pulley dia.: 100 mm<br/>(Pulley circumference:<br/>314 mm)</li> <li>Gear ratio: 1/50</li> </ul>              |
| 2    | Encoder Resolution                                                | 16,777,216 (24 bits)                                                                              | 16,777,216 (24 bits)                                                               | 16,777,216 (24 bits)                                                                                                  |
| 3    | Reference Unit                                                    | 0.001 mm (1 μm)                                                                                   | 0.01°                                                                              | 0.005 mm (5 μm)                                                                                                       |
| 4    | Travel Distance per<br>Load Shaft Revolution<br>(Reference Units) | 6 mm/0.001 mm =<br>6,000                                                                          | 360°/0.01° = 36,000                                                                | 314 mm/0.005 mm =<br>62,800                                                                                           |
| 5    | Electronic Gear Ratio                                             | $\frac{B}{A} = \frac{16,777,216}{6,000} \times \frac{1}{1}$                                       | $\frac{B}{A} = \frac{16,777,216}{36,000} \times \frac{100}{1}$                     | $\frac{B}{A} = \frac{16,777,216}{62,800} \times \frac{50}{1}$                                                         |
| 6    | Parameters                                                        | Pn20E: 16,777,216                                                                                 | Pn20E: 167,772,160                                                                 | Pn20E: 838,860,800                                                                                                    |
| 0    |                                                                   | Pn210: 6,000                                                                                      | Pn210: 3,600                                                                       | Pn210: 62,800                                                                                                         |

#### Linear Servomotors

A setting example for a Serial Converter Unit resolution of 256 is given below.

|      |                       | Machine Configuration                                   |
|------|-----------------------|---------------------------------------------------------|
| Step | Description           | Reference unit:<br>0.02 mm (20 μm)<br>Forward direction |
| 1    | Linear encoder pitch  | 0.02 mm (20 μm)                                         |
| 2    | Reference Unit        | 0.001 mm (1 μm)                                         |
| 3    | Electronic Gear Ratio | $\frac{B}{A} = \frac{1 (\mu m)}{20 (\mu m)} \times 256$ |
| 4    | Setting Parameters    | Pn20E: 256                                              |
|      | Setting Farameters    | Pn210: 20                                               |

Basic Functions That Require Setting before Operation

5.15.1 Precautions on Resetting

# 5.15 Resetting the Absolute Encoder

In a system that uses an absolute encoder, the multiturn data must be reset at startup. An alarm related to the absolute encoder (A.810 or A.820) will occur when the absolute encoder must be reset, such as when the power supply is turned ON.

When you reset the absolute encoder, the multiturn data is reset and any alarms related to the absolute encoder are cleared.

Reset the absolute encoder in the following cases.

- When an A.810 alarm (Encoder Backup Alarm) occurs
- When an A.820 alarm (Encoder Checksum Alarm) occurs
- · When starting the system for the first time
- · When you want to reset the multiturn data in the absolute encoder
- · When the Servomotor has been replaced

# 

• The multiturn data will be reset to a value between -2 and +2 rotations when the absolute encoder is reset. The reference position of the machine system will change. Adjust the reference position in the host controller to the position that results from resetting the absolute encoder.

If the machine is started without adjusting the position in the host controller, unexpected operation may cause personal injury or damage to the machine.

#### Information

- The multiturn data will always be zero in the following cases. It is never necessary to reset the absolute encoder in these cases. An alarm related to the absolute encoder (A.810 or A.820) will not occur.
  - When you use a single-turn absolute encoder
  - When the encoder is set to be used as a single-turn absolute encoder (Pn002 =  $n.\Box 2\Box \Box$ )
  - 2. If a batteryless absolute encoder is used, an A.810 alarm (Encoder Backup Alarm) will occur the first time the power is turned ON. After you reset the absolute encoder, the A.810 alarm will no longer occur.

### 5.15.1 Precautions on Resetting

- You cannot use the /ALM-RST (Alarm Reset) signal from the SERVOPACK to clear the A.810 alarm (Encoder Backup Alarm) or the A.820 alarm (Encoder Checksum Alarm). Always execute the operation to reset the absolute encoder to clear these alarms.
- If an A.8 alarm (Internal Encoder Monitoring Alarm) occurs, turn OFF the power supply to reset the alarm.
- · Confirm that setup (initialization) is not in progress from any other tool.

#### 5.15.2 Preparations

Always check the following before you reset an absolute encoder.

- The parameters must not be write prohibited.
- The servo must be OFF to reset the absolute encoder.

5.15.3 Applicable Tools

## 5.15.3 Applicable Tools

The following table lists the tools that you can use to reset the absolute encoder.

| Tool                               | Fn No./Function Name                        | Reference                                                                       |
|------------------------------------|---------------------------------------------|---------------------------------------------------------------------------------|
| Digital Operator                   | Fn008                                       | Ω Σ-7-Series Digital Operator Operating<br>Manual (Manual No.: SIEP S800001 33) |
| SigmaWin+                          | Encoder Setting – Reset Absolute<br>Encoder | 5.15.4 Operating Procedure on page 5-49                                         |
| Serial command com-<br>munications | ABSPGRES utility command                    | Monitor and Utility Function Commands on page 14-32                             |

### 5.15.4 Operating Procedure

Use the following procedure to reset the absolute encoder.

- 1. Confirm that the servo is OFF.
- 2. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **3.** Select Absolute Encoder Reset in the Menu Dialog Box. The Absolute Encoder Reset Dialog Box will be displayed.
- 4. Click the Continue Button.

| Absolute Encoder Warning                                                                                                                                                                                                |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
|                                                                                                                                                                                                                         |  |  |
| The Setup Absolute Encoder resets the multiturn amount of the<br>connected serial-type absolute encoder as well as encoder<br>alarms from the PC.                                                                       |  |  |
| Upon resetting the absolute encoder multiturn to "0", the<br>mechanical system will go to a position data system differing from<br>that used until now.                                                                 |  |  |
| Operating the machine in this state is extremely dangerous(In the<br>worst case, my lead to injury to person or damage to machine).<br>Be sure to reset the zero point of the machine after completing<br>this process. |  |  |
| Continue absolute encoder setup processing?                                                                                                                                                                             |  |  |
| Continue                                                                                                                                                                                                                |  |  |

Click the **Cancel** Button to cancel resetting the absolute encoder. The Main Window will return.

5. Click the Execute setting Button.



The current alarm code and name will be displayed in the Alarm name Box.

#### 5.15.4 Operating Procedure

6. Click the Continue Button.



Click the Cancel Button to cancel resetting the absolute encoder. The previous dialog box will return.

#### 7. Click the OK Button.

The absolute encoder will be reset.

#### When Resetting Fails

If you attempted to reset the absolute encoder when the servo was ON in the SERVOPACK, the following dialog box will be displayed and processing will be canceled.

| Absolute | encoder reset conditions error                                          |
|----------|-------------------------------------------------------------------------|
| <b></b>  | Servo ON now.<br>Tum the Servo OFF when resetting the absolute encoder. |
|          | ОК                                                                      |

Click the **OK** Button. The Main Window will return. Turn OFF the servo and repeat the procedure from step 1.

#### When Resetting Is Successful

The following dialog box will be displayed when the absolute encoder has been reset.

| Completion Warning Message                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                    |
| Absolute Encoder reset processing has been performed. The<br>Multiturn amount in the absolute encoder has been to "0".<br>Be sure to reset the mechanical system to "0" after restarting<br>power. |
| ОК                                                                                                                                                                                                 |

The Main Window will return.

8. To enable the change to the settings, turn the power supply to the SERVOPACK OFF and ON again.

This concludes the procedure to reset the absolute encoder.

5.16.1 Preparations

# 5.16 Setting the Origin of the Absolute Linear Encoder

You can set any position as the origin in the following Linear Encoders.

- Dr. JOHANNES HEIDENHAIN GmbH LIC4190, LIC3190, or LIC2190 Series
- RSF Elektronik GmbH
- MC15Y Series
- Mitutoyo Corporation ABS ST780A Series or ST1300 Series Models: ABS ST78□A/ST78□AL/ST13□□
- Renishaw PLC EVOLUTE Series Models: EL36Y
- Renishaw PLC RESOLUTE Series Models: RL36Y
- Canon Precision Inc. Model: PH03-36E00
  - 1. After you set the origin, the /S-RDY (Servo Ready) signal will become inactive because the system position data was changed. Always turn the SERVOPACK power supply OFF and ON again.
  - Important 2. After you set the origin, the Servomotor phase data in the SERVOPACK will be discarded. If you are using a Linear Servomotor without a Polarity Sensor, execute polarity detection again to save the Servomotor phase data in the SERVOPACK.

### 5.16.1 Preparations

Always check the following before you set the origin of an absolute encoder.

- The parameters must not be write prohibited.
- The servo must be OFF.

### 5.16.2 Applicable Tools

The following table lists the tools that you can use to set the origin of the absolute linear encoder.

| Tool             | Fn No./Function Name                          | Reference                                                                     |
|------------------|-----------------------------------------------|-------------------------------------------------------------------------------|
| Digital Operator | Fn020                                         | Σ-7-Series Digital Operator Operating<br>Manual (Manual No.: SIEP S800001 33) |
| SigmaWin+        | Encoder Setting – Zero Point Position Setting | G Operating Procedure on page 5-52                                            |

5.16.3 Operating Procedure

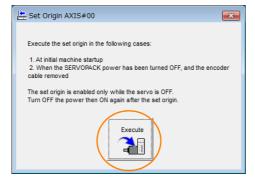
#### 5.16.3 Operating Procedure

Use the following procedure to set the origin of an absolute linear encoder.

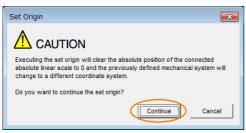
- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Zero Point Position Setting in the Menu Dialog Box. The Set Origin Dialog Box will be displayed.
- 3. Click the Continue Button.

| et Origin                                                                                                                                                                                                                                                                                                                                                                                                                   | × |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                             |   |
| The set origin sets the current position to the connected absolute linear scale<br>as the zero-point position.<br>Always refer to the user's manual before executing this function.<br>Note the following points:                                                                                                                                                                                                           |   |
| 1.Always make the settings for the mechanical system again after the set origin.                                                                                                                                                                                                                                                                                                                                            |   |
| The absolute position of the connected absolute linear scale is cleared to 0 and the previously<br>defined mechanical system will change to a different coordinate system.<br>Operating the machine in this state is extremely dangerous.<br>Failure to observe this warning may result in personal injury and/or damage to the machine.<br>Be sure to reset the zero point for the mechanical system after the set origin. |   |
| 2.Satisfy the following conditions before executing this function:                                                                                                                                                                                                                                                                                                                                                          |   |
| The following conditions must be satisfied to execute the set origin:<br>a. Servo OFF<br>b. The polarity detection has been completed.<br>Check the SERVOPACK status.                                                                                                                                                                                                                                                       |   |
| 3.Always turn the SERVOPACK power OFF then ON again after the set origin.                                                                                                                                                                                                                                                                                                                                                   |   |
| The set zero point position will be valid after turning OFF the power then ON again.<br>Always turn OFF the SERVOPACK power then ON again after the set origin.                                                                                                                                                                                                                                                             |   |
| Do you want to continue the set origin?                                                                                                                                                                                                                                                                                                                                                                                     |   |
| Cancel                                                                                                                                                                                                                                                                                                                                                                                                                      |   |

4. Click the Execute Button.



5. Click the Continue Button.



Click the **Cancel** Button to cancel setting the origin of the absolute linear encoder. The previous dialog box will return.

5.16.3 Operating Procedure

6. Click the OK Button.



- 7. Turn the power supply to the SERVOPACK OFF and ON again.
- 8. If you use a Linear Servomotor that does not have a polarity sensor, perform polarity detection.
   Refer to the following section for details on the polarity detection.
   3.9 Polarity Detection on page 5-24

This concludes the procedure to set the origin of the absolute linear encoder.

# 5.17 Setting the Regenerative Resistor Capacity

The regenerative resistor consumes regenerative energy that is generated by the Servomotor, e.g., when the Servomotor decelerates.

If an External Regenerative Resistor is connected, you must set Pn600 (Regenerative Resistor Capacity) and Pn603 (Regenerative Resistor Resistance).

Refer to the following manual to select the capacity of a Regenerative Resistor.  $\square \Sigma$ -7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)



- If you connect an External Regenerative Resistor, set Pn600 and Pn603 to suitable values. If a suitable value is not set, A.320 alarms (Regenerative Overload) will not be detected correctly, and the External Regenerative Resistor may be damaged or personal injury or fire may result.
- When you select an External Regenerative Resistor, make sure that it has a suitable capacity.
   There is a risk of personal injury or fire.

**Regenerative Resistor Capacity** Setting Unit **Default Setting** When Enabled Classification Setting Range Pn600 0 to SERVOPACK's maximum applica-10 W 0 Immediately Setup ble motor capacity **Regenerative Resistor Resistance** Pn603 Setting Range Setting Unit **Default Setting** When Enabled Classification 0 to 65.535 10 mΩ Immediatelv Ο Setup

Set the regenerative resistor capacity to a value that is consistent with the allowable capacity of the External Regenerative Resistor. The setting depends on the cooling conditions of the External Regenerative Resistor.

- For self-cooling (natural convection cooling): Set the parameter to a maximum 20% of the capacity (W) of the actually installed regenerative resistor.
- For forced-air cooling: Set the parameter to a maximum 50% of the capacity (W) of the actually installed regenerative resistor.

Example

For a self-cooling 100-W External Regenerative Resistor, set Pn600 to 2 (×10 W) (100 W × 20% = 20 W).

Note: 1. An A.320 alarm will be displayed if the setting is not suitable.

2. The default setting of 0 specifies that the SERVOPACK's built-in regenerative resistor or Yaskawa's Regenerative Resistor Unit is being used.



1. When an External Regenerative Resistor is used at the normal rated load ratio, the resistor temperature increases to between 200°C and 300°C. Always apply derating. Consult the manufacturer for the resistor's load characteristics.

2. For safety, use an External Regenerative Resistor with a thermoswitch.

# Application Functions

This chapter describes the application functions that you can set before you start servo system operation. It also describes the setting methods.

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6.1.1 Input Signals

# 6.1 I/O Signals

# 6.1.1 Input Signals

# /S-ON (Servo ON) Signal

This signal enables operation of the Servomotor.

| Туре  | Signal | Connector Pin No. | Signal Status | Function                                                             |
|-------|--------|-------------------|---------------|----------------------------------------------------------------------|
| Input | /S-ON  | CN1-13            | ON (closed)   | Power is supplied to the Servomo-<br>tor to enable operation.        |
|       |        |                   | OFF (open)    | Power supply to the Servomotor is stopped and operation is disabled. |



Input the /S-ON signal while the Servomotor is stopped. You cannot turn ON the servo while the Servomotor is operating.

You can change the setting for the /S-ON signal with PnB0E.

| Parameter |                        | Meaning                                                                               | When Enabled  | Classification |
|-----------|------------------------|---------------------------------------------------------------------------------------|---------------|----------------|
|           | 0<br>(default setting) | When input signal is ON (closed), servomotor power is ON. Servomotor can be operated. |               |                |
| PnB0E     | 1                      | When input signal is OFF (open), servomotor power is ON. Servomotor can be operated.  | After restart | Setup          |
|           | 2                      | Always servo ON                                                                       |               |                |
|           | 3                      | Always servo OFF                                                                      |               |                |



If a resettable alarm occurs and operation is disabled (power is not supplied to the motor), operation will be automatically enabled (power will be supplied to the motor) when the alarm is reset. If you set PnBOE to 2 (Servo always ON), the Servomotor or machine may perform unexpected operation when an alarm is reset.

# P-OT (Forward Drive Prohibit) Signal and N-OT (Reverse Drive Prohibit) Signal

Refer to the following section for details. 5.10.2 Overtravel Settings on page 5-28

# /ALM-RST (Alarm Reset) Signal

Refer to the following section for details. 15.2.4 Resetting INDEXER Alarms on page 15-48

# /DEC (Homing Deceleration Switch Input) Signal

Connects the deceleration limit switch for homing.

| Туре  | Signal | Pin No. | Signal Status | Meaning                                                                                                       |
|-------|--------|---------|---------------|---------------------------------------------------------------------------------------------------------------|
| Input | /DEC   | CN1-10  | ON (closed)   | The homing speed is changed to the approach speed or creep speed. The operation depends on the homing method. |
|       |        |         | OFF (open)    | The speed does not change.                                                                                    |

You can change the setting for the /DEC signal with PnB11.

#### 6.1 I/O Signals

#### 6.1.1 Input Signals

| Parameter    |                        | Meaning                                                                   | When Enabled   | Classification |
|--------------|------------------------|---------------------------------------------------------------------------|----------------|----------------|
|              | 0<br>(default setting) | Starts deceleration during homing when the /DEC signal turns ON (closes). | After un obert | Catura         |
| PnB11 2<br>3 | 1                      | Starts deceleration during homing when the /DEC signal turns OFF (opens). |                |                |
|              | 2                      | Sets the homing limit switch so that it is always ON.                     | After restart  | Setup          |
|              | 3                      | Sets the homing limit switch so that it is always OFF.                    |                |                |

### /RGRT (Registration Input) Signal

This is the latch signal that is used for registration (external positioning).

| Туре  | Signal     | Connector Pin No. | Signal Status | Meaning                                                                                    |
|-------|------------|-------------------|---------------|--------------------------------------------------------------------------------------------|
| Input | nput /RGRT | CN1-12            | ON (closed)   | The current position has reached the latch posi-<br>tion.                                  |
| Input |            | GNT-12            | OFF (open)    | The current position has not reached the latch position, or has passed the latch position. |

You can change the setting for the /RGRT signal with PnB12.

| F     | Parameter              | Meaning                                                                           | When Enabled  | Classification |
|-------|------------------------|-----------------------------------------------------------------------------------|---------------|----------------|
|       | 0<br>(default setting) | Starts registration by switching the /RGRT signal from OFF (open) to ON (closed). |               |                |
| PnB12 | 1                      | Starts registration by switching the /RGRT signal from ON (closed) to OFF (open). | After restart | Setup          |
|       | 2, 3                   | Does not start registration.                                                      |               |                |

### /MODE 0/1 (Mode Switch Input) Signal

You can use this signal to change between Mode 0 (program table operation) and Mode 1 (jog speed table operation or homing).

| Туре  | Signal           | Pin No.     | Signal Status                                | Meaning |
|-------|------------------|-------------|----------------------------------------------|---------|
| /MODE | CN11-3           | ON (closed) | Mode 0 (Program Table Operation)             |         |
| mput  | Input 0/1 CN11-3 | OFF (open)  | Mode 1 (jog speed table operation or homing) |         |

You can change the setting for the /MODE 0/1 signal with PnB03.

| Parameter |                        | Meaning                                                                   | When Enabled  | Classification |
|-----------|------------------------|---------------------------------------------------------------------------|---------------|----------------|
|           | 0<br>(default setting) | When input signal is ON (closed), mode is set to default setting) Mode 0. |               |                |
| PnB03     | 1                      | When input signal is OFF (open), mode is set to Mode 0.                   | After restart | Setup          |
|           | 2                      | Always Mode 0.                                                            |               |                |
|           | 3                      | Always Mode 1.                                                            |               |                |

# /START-STOP (Program Table Operation Start-Stop Input Signal)

This signal is used to start and stop operation for the program step that is specified by the /SEL0 to /SEL7 (Program Step Selection Inputs) signals.

| Туре  | Signal                 | Pin No.     | Signal Status                                                                                                                                | Meaning                                                                                       |
|-------|------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Input | /START-<br>STOP CN11-5 | ON (closed) | Turn ON this signal to start operation for the program step that is specified by the /SEL0 to /SEL7 (Program Step Selection Inputs) signals. |                                                                                               |
|       | 310F                   |             | OFF (open)                                                                                                                                   | Turn OFF this signal to stop program table oper-<br>ation and decelerate the motor to a stop. |

6.1.1 Input Signals

You can change the setting for the /START-STOP signal with PnB04. If you change the setting for the /START-STOP signal, set the /MODE 0/1 signal to ON (closed) (Mode 0).

| F     | Parameter              | Meaning                                                                                                                                                    | When Enabled  | Classification |
|-------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|
| PnB04 | 0<br>(default setting) | Starts program table operation when the /START-STOP signal turns ON (closes). Stops program table operation when the /START-STOP signal turns OFF (opens). |               | Setup          |
|       | 1                      | Starts program table operation when the /START-STOP signal turns OFF (opens). Stops program table operation when the /START-STOP signal turns ON (closes). | After restart |                |
|       | 2, 3                   | The /START-STOP signal is not used.                                                                                                                        |               |                |

### /HOME (Homing Input) Signal

This signal functions as the homing command.

| Туре  | Signal   | Pin No.   | Signal Status | Meaning            |
|-------|----------|-----------|---------------|--------------------|
| Input | It /HOME | ME CN11-5 | ON (closed)   | Homing is started. |
| input |          |           | OFF (open)    | Stops homing.      |

You can change the setting for the /HOME signal with PnB04. If you change the setting for the /HOME signal, set the /MODE 0/1 signal to OFF (open) (Mode 1).

| F     | Parameter              | Meaning                                                | When Enabled  | Classification |
|-------|------------------------|--------------------------------------------------------|---------------|----------------|
|       | 0<br>(default setting) | Starts homing when the /HOME signal turns ON (closes). |               |                |
| PnB04 | 1                      | Starts homing when the /HOME signal turns OFF (opens). | After restart | Setup          |
|       | 2, 3                   | The /HOME signal is not used.                          |               |                |

### /PGMRES (Program Table Operation Reset Input) Signal

If this signal turns ON while a program table operation is stopped, the program table operation will be reset and canceled.\*

| Туре          | Signal  | Pin No.     | Signal Status                         | Meaning |
|---------------|---------|-------------|---------------------------------------|---------|
| Input /PGMRES |         | ON (closed) | Program table operation is reset.     |         |
|               | CINTI-7 | OFF (open)  | Program table operation is not reset. |         |

\* "Canceled" is the state in which the mode is mode 0, execution is not in a stopped state, and no program step has been executed.

You can change the setting for the /PGMRES signal with PnB05. If you change the setting for the /PGMRES signal, set the /MODE 0/1 signal to ON (closed) (Mode 0).

|   | P                           | arameter | Meaning                                                                                                    | When Enabled  | Classification |  |
|---|-----------------------------|----------|------------------------------------------------------------------------------------------------------------|---------------|----------------|--|
|   | PnB05 0 (default setting) 1 |          | Resets and cancels program table operation by switching the /PGMRES signal from OFF (open) to ON (closed). |               |                |  |
| F |                             |          | Resets and cancels program table operation by switching the /PGMRES signal from ON (closed) to OFF (open). | After restart | Setup          |  |
|   |                             | 2, 3     | Program table operation is not reset.                                                                      |               |                |  |

6.1.1 Input Signals

## /JOGP (Forward Jog Input) Signal

This signal functions as the forward jog operation command.

| Туре        | Signal   | Pin No.     | Signal Status                                                                                    | Meaning                  |
|-------------|----------|-------------|--------------------------------------------------------------------------------------------------|--------------------------|
| Input /JOGP | P CN11-7 | ON (closed) | Forward jog operation is performed. Jog opera-<br>tion is performed as long as the signal is ON. |                          |
|             |          |             | OFF (open)                                                                                       | Stops the jog operation. |

You can change the setting for the /JOGP signal with PnB05. If you change the setting for the / JOGP signal, set the /MODE 0/1 signal to OFF (open) (Mode 1).

|                        | Parameter | Meaning                                                                                | When Enabled  | Classification |
|------------------------|-----------|----------------------------------------------------------------------------------------|---------------|----------------|
| 0<br>(default setting) |           | Executes JOG operation in the forward direction while the /JOGP signal is ON (closed). |               |                |
| PnB05                  | 1         | Executes JOG operation in the forward direction while the /JOGP signal is OFF (open).  | After restart | Setup          |
|                        | 2, 3      | Does not execute JOG operation.                                                        |               |                |

### /JOGN (Reverse Jog Input) Signal

This signal functions as the reverse jog operation command.

| Туре  | Signal | Pin No.  | Signal Status | Meaning                                                                                          |
|-------|--------|----------|---------------|--------------------------------------------------------------------------------------------------|
| Input | /JOGN  | I CN11-9 | ON (closed)   | Reverse jog operation is performed. Jog opera-<br>tion is performed as long as the signal is ON. |
|       |        |          | OFF (open)    | Stops the jog operation.                                                                         |

You can change the setting for the /JOGN signal with PnB06. If you change the setting for the /JOGN signal, set the /MODE 0/1 signal to OFF (open) (Mode 1).

| F     | Parameter              | Meaning                                                                                | When Enabled  | Classification |
|-------|------------------------|----------------------------------------------------------------------------------------|---------------|----------------|
|       | 0<br>(default setting) | Executes JOG operation in the reverse direction while the /JOGN signal is ON (closed). |               |                |
| PnB06 | 1                      | Executes JOG operation in the reverse direction while the /JOGN signal is OFF (open).  | After restart | Setup          |
|       | 2, 3                   | Does not execute JOG operation.                                                        |               |                |

### /JOG0 to /JOG3 (Jog Speed Table Selection Inputs) Signals

These signals specify the speed in the jog speed table.

| Туре  | Signal               | Pin No.                       | Signal Status | Meaning                                                                                                                             |
|-------|----------------------|-------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------|
|       | (10.00               |                               | ON (closed)   | These signals specify a jog speed that is regis-                                                                                    |
| Input | /JOG0<br>to<br>/JOG3 | CN11-11, -13,<br>-15, and -17 | OFF (open)    | tered in the jog speed table. Refer to the follow-<br>ing section for details.<br><i>13.4.3 Jog Speed Table and Speed Selection</i> |
|       |                      |                               |               | Signals on page 13-45                                                                                                               |

You can change the settings for the /JOG0 to /JOG3 signals with PnB07 to PnB0A. If you change the settings for the /JOG0 to /JOG3 signals, set the /MODE 0/1 signal to OFF (open) (Mode 1).

| F              | Parameter              | Meaning                                              | When Enabled  | Classification |
|----------------|------------------------|------------------------------------------------------|---------------|----------------|
| PnB07          | 0<br>(default setting) | The /JOG□ signal is active when ON (closed).         |               |                |
| PnB08          | 1                      | The /JOG $\square$ signal is active when OFF (open). | After restart | Setup          |
| PnB09<br>PnB0A | 2                      | The /JOG□ signal is always active.                   |               |                |
|                | 3                      | The /JOG□ signal is always inactive.                 |               |                |

6.1.2 Output Signals

### /SEL0 to /SEL7 (Program Step Selection Inputs) Signals

These signals specify the program step.

| Туре  | Signal              | Pin No.     | Signal Status                                                                                  | Meaning                                                                                                         |
|-------|---------------------|-------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| /SEL0 | CN11-911.           | ON (closed) | These signals specify the program step number at which to start program table operation. Refer |                                                                                                                 |
| Input | Input to -13 to -18 | , ,         | OFF (open)                                                                                     | to the following section for details. <i>Igruput Signals Related to Program Table Opera- tion</i> on page 13-11 |

You can change the settings for the /SEL0 to /SEL7 signals with PnB06 to PnB0D. If you change the settings for the /SEL0 to /SEL4 signals, set the /MODE 0/1 signal to ON (closed) (Mode 0). If you change the settings for the /SEL5 to /SEL7 signals, the setting of the /MODE 0/1 signal is irrelevant.

| Parameter               |                        | Meaning                                      | When Enabled  | Classification |
|-------------------------|------------------------|----------------------------------------------|---------------|----------------|
| PnB06<br>PnB07          | 0<br>(default setting) | The /SEL□ signal is active when ON (closed). |               |                |
| PnB08                   | 1                      | The /SEL signal is active when OFF (open).   |               |                |
| PnB09<br>PnB0A          | 2                      | The /SEL□ signal is always active.           | After restart | Setup          |
| PnB0B<br>PnB0C<br>PnB0D | 3                      | The /SEL□ signal is always inactive.         |               |                |

### 6.1.2 Output Signals

#### ALM (Servo Alarm) Signal

This signal is output when the SERVOPACK detects an error.

| Ì         |
|-----------|
| Important |

Configure an external circuit so that this alarm output turns OFF the main circuit power supply to the SERVOPACK whenever an error occurs.

| Туре   | Signal | Connector Pin No. | Signal Status | Meaning                 |
|--------|--------|-------------------|---------------|-------------------------|
| Output | ALM    | CN1-3 and CN1-4   | ON (closed)   | Normal SERVOPACK status |
|        |        |                   | OFF (open)    | SERVOPACK alarm         |

#### Alarm Code (/ALO1 to /ALO3) Signals

The ALO1 to ALO3 (Alarm Code) signals report alarms and warnings that occur in the SERVO-PACK. Use the alarm code output signals as required to display the contents of the alarm at the host controller (e.g., HMI).

Refer to the following sections for details on the alarm codes.  $\square$  15.2.1 List of Alarms on page 15-5

| Туре   | Signal Name | Pin No.     | Description       |
|--------|-------------|-------------|-------------------|
|        | /ALO1       | CN1-1, -2   | Alarm code output |
| Output | /ALO2       | CN1-23, -24 | Alarm code output |
|        | /ALO3       | CN1-25, -26 | Alarm code output |

#### 6.1 I/O Signals

#### 6.1.2 Output Signals

Select whether /ALO1 to /ALO3 are used or /WARN, /BK and /S-RDY are used with the parameter below.

| Parameter |                        | Meaning                                                              | When Enabled  |
|-----------|------------------------|----------------------------------------------------------------------|---------------|
| DoB51     | 0<br>(default setting) | Does not output /ALO1 to /ALO3. (/WARN, /BK, and /S-RDY are output.) | After restart |
| PnB51     | 1                      | Outputs /ALO1 to /ALO3. (/WARN, /BK, and /S-RDY are not output.)     | Aller lestalt |

### /WARN (Warning) Signal

This signal is for an error or warning issued before the occurrence of an alarm. A signal is output for only 2 seconds for errors. A signal is continuously output for warnings until the cause of the warning is removed. There is no need to stop operation.

The /WARN signal is allocated to CN1-1 and CN1-2 by default.

| Туре   | Signal | Connector Pin No.                 | Signal Status | Meaning       |
|--------|--------|-----------------------------------|---------------|---------------|
| Output | /WARN  | CN1-1 and CN1-2 (default setting) | ON (closed)   | Warning       |
|        |        |                                   | OFF (open)    | Normal status |

Note: You can use PnB51 to allocate the /ALO1 to /ALO3 signals instead of the /WARN, /BK, and /S-RDY signals. Refer to the following section for details.

Alarm Code (/ALO1 to /ALO3) Signals on page 6-7

You can change the setting for the /WARN signal with PnB1C.

| Parameter |                        | Meaning                                                                                  | When Enabled  |
|-----------|------------------------|------------------------------------------------------------------------------------------|---------------|
| PnB1C     | 0<br>(default setting) | When an error/warning occurs (error/warning status), the /WARN signal turns ON (closes). |               |
|           | 1                      | When an error/warning occurs (error/warning status), the /WARN signal turns OFF (opens). | After restart |

#### Setting the Warning Code Output

You can use the /ALO1 to /ALO3 (Alarm Code Output) signals to output warning codes. Use  $Pn001 = n.X \square \square \square$  (Warning Code Output Selection) to set the output.

Refer to the following sections for details on the warnings.

3 15.3.1 List of Warnings on page 15-56

| Parameter |        | Description                                                                                                                      | When Enabled  | Classification |
|-----------|--------|----------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|
| Pn001     | n.0000 | Output only alarm codes on the /ALO1 to /ALO3 terminals.                                                                         | After restart | Setup          |
|           | n.1000 | Output both warning codes and alarm codes on<br>the /ALO1 to /ALO3 terminals. If there is an<br>alarm, the alarm code is output. |               |                |

### /BK (Brake) Signal

Refer to the following section for details. 5.11.2 Allocating the /BK (Brake) Signal on page 5-32

### /S-RDY (Servo Ready) Signal

The /S-RDY (Servo Ready) signal turns ON when the SERVOPACK is ready to accept the /S-ON (Servo ON) input signal. The /S-RDY signal is turned ON under the following conditions.

- Main circuit power supply is ON.
- There is no hard wire base block state.
- There are no alarms.
- If a Servomotor without a polarity sensor is used, polarity detection has been completed.

#### 6.1.2 Output Signals

The /S-RDY signal is allocated to CN1-25 and CN1-26 by default.

| Туре   | Signal | Connector Pin No.                       | Signal Status | Meaning                                                |
|--------|--------|-----------------------------------------|---------------|--------------------------------------------------------|
| Output | /S-RDY | CN1-25 and CN1-<br>26 (default setting) | ON (closed)   | Ready to receive the /S-ON (Servo ON) signal.          |
|        |        |                                         |               | Not ready to receive the /S-ON (Servo ON) sig-<br>nal. |

Note: 1. You can use PnB51 to allocate the /ALO1 to /ALO3 signals instead of the /WARN, /BK, and /S-RDY signals. Refer to the following section for details.

Alarm Code (/ALO1 to /ALO3) Signals on page 6-7

2. Refer to the following section for information on the hard wire base block and the /S-RDY signal.

11.2.7 /S-RDY (Servo Ready Output) Signal on page 11-6
 Refer to the following section for information on the polarity detection.

5.9 Polarity Detection on page 5-24

You can change the setting for the /S-RDY signal with PnB1E.

| Parameter |                        | Meaning                                                           | When Enabled  |  |
|-----------|------------------------|-------------------------------------------------------------------|---------------|--|
| PnB1E     | 0<br>(default setting) | When the SERVOPACK is ready, the /S-RDY signal turns ON (closes). | After restart |  |
| FIDIC     | 1                      | When the SERVOPACK is ready, the /S-RDY signal turns OFF (opens). | After restart |  |

### /INPOSITION (Positioning Completion Output Signal)

This signal indicates that servomotor positioning has been completed.

The signal is output when the motor stops, even if the current position has not reached the target position.

If the difference between the reference from the INDEXER Module and the movement of the servomotor (the number of position error pulses) drops below the value set for this parameter, the positioning completed signal will be output.

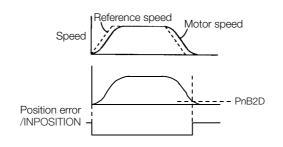
Use this signal to confirm whether positioning has been completed at the host controller.

| Туре   | Signal Name | Pin No.      | Output Status | Meaning                         |
|--------|-------------|--------------|---------------|---------------------------------|
| Output |             | CN111 10 20  | ON (closed)   | Positioning has been completed. |
| Output | /INPOSITION | CN11-19, -20 | OFF (open)    | Positioning is not completed.   |

| Parameter |                        | Meaning                                                                        | When Enabled  |
|-----------|------------------------|--------------------------------------------------------------------------------|---------------|
| PnB13     | 0<br>(default setting) | When positioning has been completed, the /INPOSITION signal turns ON (closes). | Aftor rootart |
|           | 1                      | When positioning has been completed, the /INPOSITION signal turns OFF (opens). | After restart |

|   |      | /INPOSITION width | POSITION width   |                 |              |  |  |  |  |
|---|------|-------------------|------------------|-----------------|--------------|--|--|--|--|
| Ρ | nB2D | Setting Range     | Setting Unit     | Default Setting | When Enabled |  |  |  |  |
|   |      | 0 to 99999        | 1 reference unit | 1               | Immediately  |  |  |  |  |

• The inposition width setting has no effect on final positioning accuracy.



6.1.2 Output Signals

#### Notes when the Positioning Completed State is Established while Canceling a Motion Command

When the SERVOPACK enters any of the following states during execution of a motion command, it may cancel the execution of the motion command and establish the positioning completed state.

- The servo OFF state has been established due to an alarm.
- The servo OFF state has been established because the main power supply was turned OFF.
- The motor has stopped due to overtravel or a software limit.

In this case, the motor has not reached the target position specified by the host controller. Check the current position to confirm that the axis is stopped at a safe position.



If the state of an OT signal varies over a short time (in a pulsing manner for example), the host controller may not be able to monitor the variation of the OT signal properly. Take due care about the selection of limit switches and their mounting and wiring to avoid chattering of OT signals and malfunctioning.

# /POUT0 to /POUT7 (Program Step Number) Signals

These signals output the specified status. The output status is specified with POUT in the program steps or with the POUT serial command.

| Туре   | Signal       | Pin No.        | Signal Status | Meaning                                                                               |
|--------|--------------|----------------|---------------|---------------------------------------------------------------------------------------|
| Output | /POUT0       | CN11-21 to -36 | ON (closed)   | The /POUT0 to /POUT7 signals output the sta-                                          |
|        | to<br>/POUT7 |                | OFF (open)    | tus that is specified with POUT in the program steps or with the POUT serial command. |

You can change the settings for the /POUT0 to /POUT7 signals with PnB14 to PnB1B.

| F                                                  | Parameter              | Meaning                                                                        | When Enabled  | Classification |
|----------------------------------------------------|------------------------|--------------------------------------------------------------------------------|---------------|----------------|
| PnB14<br>PnB15                                     | 0<br>(default setting) | The /POUT signal turns ON (opens) when pro-<br>grammable output is active.     |               |                |
| PnB16<br>PnB17<br>PnB18<br>PnB19<br>PnB1A<br>PnB1B | 1                      | The /POUT signal turns OFF (closes) when pro-<br>grammable output I is active. | After restart | Setup          |

# /Z0 to /Z4 (ZONE Output) Signals

These signals indicate when the current position is within a zone specified in the ZONE table.

Note: You can use the initial status of the programmable output signals (/POUT0 to /POUT7) as the ZONE signals. Refer to the following section for details.

3.5.2 Parameters Related to ZONE Signals on page 13-54

| Туре   | Signal        | Pin No.            | Signal Status | Meaning                                         |
|--------|---------------|--------------------|---------------|-------------------------------------------------|
| Output | /Z0 to<br>/Z4 | Must be allocated. | ON (closed)   | The /Z0 to /Z4 signals give a 5-bit binary num- |
|        |               |                    | OFF (open)    | ber. Z0 to Z3 specify a ZONE.                   |

# /PAO, /PBO, and /PCO (Encoder Output) Signals

Refer to the following section for information on the /PAO, /PBO, and /PCO (encoder output) signals.

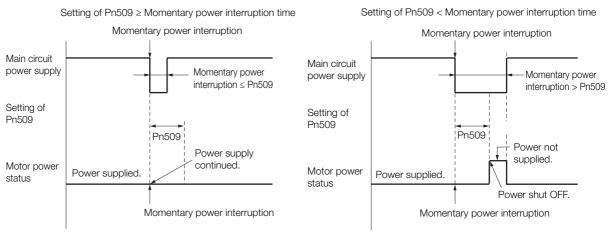
6.5 Encoder Divided Pulse Output on page 6-15

# 6.2 **Operation for Momentary Power Interruptions**

Even if the main power supply to the SERVOPACK is interrupted momentarily, power supply to the motor (servo ON status) will be maintained for the time set in Pn509 (Momentary Power Interruption Hold Time).

|       | Momentary Power Interruption Hold Time |              |                 |              |                |  |  |
|-------|----------------------------------------|--------------|-----------------|--------------|----------------|--|--|
| Pn509 | Setting Range                          | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 20 to 50,000                           | 1 ms         | 20              | Immediately  | Setup          |  |  |

If the momentary power interruption time is equal to or less than the setting of Pn509, power supply to the motor will be continued. If it is longer than the setting, power supply to the motor will be stopped. Power will be supplied to the motor again when the main circuit power supply recovers.



- Information 1. If the momentary power interruption time exceeds the setting of Pn509, the /S-RDY (Servo Ready) signal will turn OFF.
  - 2. If uninterruptible power supplies are used for the control power supply and main circuit power supply, the SERVOPACK can withstand a power interruption that lasts longer than 50,000 ms.
  - 3. The holding time of the SERVOPACK control power supply is approximately 100 ms. If control operations become impossible during a momentary power interruption of the control power supply, the setting of Pn509 will be ignored and the same operation will be performed as for when the power supply is turned OFF normally.



The holding time of the main circuit power supply depends on the output from the SERVOPACK. If the load on the Servomotor is large and an A.410 alarm (Undervoltage) occurs, the setting of Pn509 will be ignored.

# 6.3 SEMI F47 Function

The SEMI F47 function detects an A.971 warning (Undervoltage) and limits the output current if the DC main circuit power supply voltage to the SERVOPACK drops to a specified value or lower because the power was momentarily interrupted or the main circuit power supply voltage was temporarily reduced.

This function complies with the SEMI F47 standards for semiconductor manufacturing equipment.

You can combine this function with the momentary power interruption hold time (Pn509) to allow the Servomotor to continue operating without stopping for an alarm or without recovery work even if the power supply voltage drops.

### **Execution Sequence**

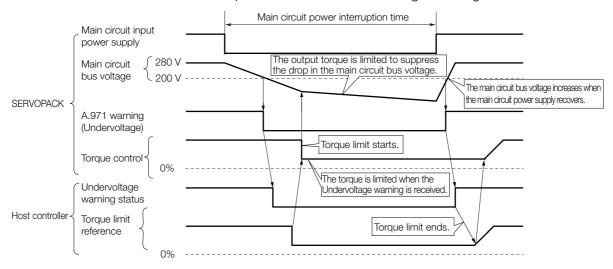
This function can be executed either with the host controller or with the SERVOPACK. Use  $Pn008 = n.\square\squareX\square$  (Function Selection for Undervoltage) to specify whether the function is executed by the host controller or by the SERVOPACK.

The default setting (Pn008 =  $n.\Box\Box0\Box$ ) disables detection of an A.971 warning (Undervoltage).

| Parameter |                                                                                                      | Description                 | When Enabled  | Classification |  |
|-----------|------------------------------------------------------------------------------------------------------|-----------------------------|---------------|----------------|--|
|           | n.□□0□<br>(default set-<br>ting)                                                                     | Do not detect undervoltage. |               |                |  |
| Pn008     | n. Detect undervoltage warning and limit torque at host controller.                                  |                             | After restart | Setup          |  |
|           | n.□□2□ Detect undervoltage warning and limit torque with Pn424 and Pn425 (i.e., only in SERVO-PACK). |                             |               |                |  |

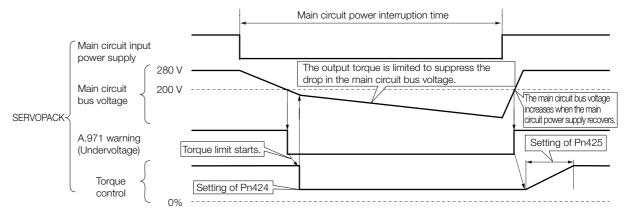
### • Execution with the Host Controller (Pn008 = $n.\Box\Box1\Box$ )

The host controller limits the torque in response to an A.971 warning (Undervoltage). The host controller removes the torque limit after the Undervoltage warning is cleared.



### • Execution with the SERVOPACK (Pn008 = $n.\Box\Box2\Box$ )

The torque is limited in the SERVOPACK in response to an Undervoltage warning. The SERVOPACK controls the torque limit for the set time after the Undervoltage warning is cleared.



### **Related Parameters**

The following parameters are related to the SEMI F47 function.

|       | Torque Limit at Main Circuit Voltage Drop                  |              |                 |              |                |  |  |
|-------|------------------------------------------------------------|--------------|-----------------|--------------|----------------|--|--|
| Pn424 | Setting Range                                              | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 100                                                   | 1%*          | 50              | Immediately  | Setup          |  |  |
|       | Release Time for Torque Limit at Main Circuit Voltage Drop |              |                 |              |                |  |  |
| Pn425 | Setting Range                                              | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 1,000                                                 | 1 ms         | 100             | Immediately  | Setup          |  |  |
|       | Momentary Power Interruption Hold Time                     |              |                 |              |                |  |  |
| Pn509 | Setting Range                                              | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 20 to 50,000                                               | 1 ms         | 20              | Immediately  | Setup          |  |  |

\* Set a percentage of the motor rated torque.

Note: If you will use the SEMI F47 function, set the time to 1,000 ms.

This function handles momentary power interruptions for the voltage and time ranges stipulated in SEMI F47. An uninterruptible power supply (UPS) is required as a backup for momentary power interruptions that exceed these voltage and time ranges.
Set the host controller or SERVOPACK torque limit so that a torque reference that exceeds the specified acceleration torque will not be output when the power supply for the main circuit is restored.
For a vertical axis, do not limit the torque to a value that is lower than the holding torque.
This function limits torque within the range of the SERVOPACK's capability for power interruptions. It is not intended for use under all load and operating conditions. Set the parameters while monitoring operation on the actual machine.
You can set the momentary power interruption hold time to increase the amount of time from

when the power supply is turned OFF until power supply to the motor is stopped. To stop the power supply to the motor immediately, turn OFF the /S-ON (Servo ON) signal.

# 6.4 Setting the Motor Maximum Speed

You can set the maximum speed of the Servomotor with the following parameter.

Rotary Servomotors

|       | Maximum Motor Speed |              |                 |               |                |  |  |  |  |
|-------|---------------------|--------------|-----------------|---------------|----------------|--|--|--|--|
| Pn316 | Setting Range       | Setting Unit | Default Setting | When Enabled  | Classification |  |  |  |  |
|       | 0 to 65,535         | 1 min⁻¹      | 10,000          | After restart | Setup          |  |  |  |  |
|       |                     |              |                 |               |                |  |  |  |  |

Linear Servomotors

|       | Maximum Motor Speed |              |                 |               |                |  |
|-------|---------------------|--------------|-----------------|---------------|----------------|--|
| Pn385 | Setting Range       | Setting Unit | Default Setting | When Enabled  | Classification |  |
|       | 1 to 100            | 100 mm/s     | 50              | After restart | Setup          |  |

You can achieve the following by lowering the maximum speed of the Servomotor.

• If the Servomotor speed exceeds the setting, an A.510 alarm (Overspeed) will occur.

With a Linear Servomotor, you can increase the upper limit for the setting of Pn281 (Encoder Output Resolution). Refer to the following section for details.
 6.5 Encoder Divided Pulse Output on page 6-15

Changing the setting of the parameter is effective in the following cases.

- To protect the machine by stopping machine operation with an alarm when the set speed is reached or exceeded
- To limit the speed so that the load is driven beyond the allowable moment of inertia Refer to relevant manual from the following list for the relationship between the speed and the allowable moment of inertia.

Ω Σ-7-Series Rotary Servomotor Product Manual (Manual No.: SIEP S800001 36)

Ω Σ-7-Series Direct Drive Servomotor Product Manual (Manual No.: SIEP S800001 38)

 $\bigcap ~\Sigma$ -7-Series Linear Servomotor Product Manual (Manual No.: SIEP S800001 37)

• To increase the encoder output resolution and increase the position resolution managed by the host controller (for a Linear Servomotor)

# 6.5 Encoder Divided Pulse Output

The encoder divided pulse output is a signal that is output from the encoder and processed inside the SERVOPACK. It is then output externally in the form of two phase pulse signals (phases A and B) with a 90° phase differential. At the host controller, it can be used as the position feedback.

The encoder signals can be used to monitor the servomotor's speed and position. However, the INDEXER Module manages the servomotor's speed and position so it is not necessary to use the encoder signals to monitor the speed and position from the host controller.

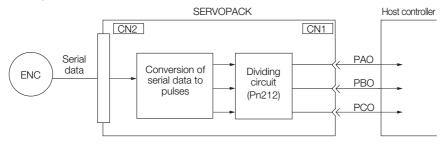
The following table describes the signals and output phase forms.

# 6.5.1 Encoder Divided Pulse Output Signals

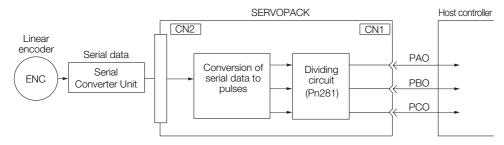
| Туре   | Signal | Connector Pin No. | Name                                     | Remarks                                                                                                                                                                                                                                                                                |  |  |
|--------|--------|-------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| Output | PAO    | CN1-17            | Encoder Divided Pulse Output,            | <ul> <li>Rotary Servomotors</li> <li>These encoder divided pulse<br/>output pins output the number</li> </ul>                                                                                                                                                                          |  |  |
|        | /PAO   | CN1-18            | Phase A                                  | of pulses per Servomotor reso-<br>lution that is set in Pn212<br>(Number of Encoder Output                                                                                                                                                                                             |  |  |
|        | PBO    | CN1-19            |                                          | Pulses). The phase difference<br>between phase A and phase B<br>is an electric angle of 90°.<br>• Linear Servomotors                                                                                                                                                                   |  |  |
|        | /PBO   | CN1-20            | Encoder Divided Pulse Output,<br>Phase B | <ul> <li>Elinear Servornotors</li> <li>These encoder divided pulse<br/>output pins output pulses at the<br/>resolution that is set in Pn281<br/>(Encoder Output Resolution).</li> <li>The phase difference between<br/>phase A and phase B is an<br/>electric angle of 90°.</li> </ul> |  |  |
|        | PCO    | CN1-21            | Encoder Divided Pulse Output,            | These pins output one pulse                                                                                                                                                                                                                                                            |  |  |
|        | /PCO   | CN1-22            | Phase C*                                 | every Servomotor rotation.                                                                                                                                                                                                                                                             |  |  |

\* Refer to the following section for information on the origin within one encoder rotation.

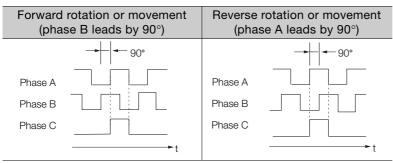
• Rotary Servomotor



Linear Servomotors



### **Output Phase Forms**



Note: The pulse width of the origin within one encoder rotation depends on the setting of number of encoder output pulses (Pn212) or the encoder output resolution (Pn281). It is the same as the width of phase A. Even for reverse operation (Pn000 =  $n.\square\square\square1$ ), the output phase form is the same as shown above.



If you use the SERVOPACK's phase-C pulse output for homing, rotate the Servomotor two or more rotations before you start homing. If the Servomotor cannot be rotated two or more times, perform homing at a motor speed of 600 min<sup>-1</sup> or lower. If the motor speed is higher than 600 min<sup>-1</sup>, the phase-C pulse may not be output correctly.

# **Linear Encoder Application Precautions**

The following precautions apply to the encoder output pulses when an external linear encoder is used.

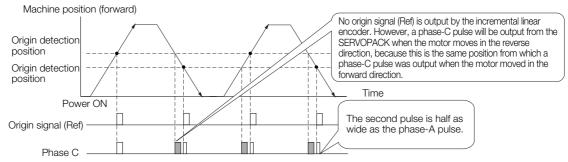
 Relation between Renishaw PLC Incremental Linear Encoders and Encoder Output Pulse Signal from the SERVOPACK When Using an RGS20 Scale and RGH22B Sensor Head, or a TONIC Series Encoder

The output position of the origin signal (Ref) will depend on the direction of movement for some models of incremental linear encoders from Renishaw PLC.

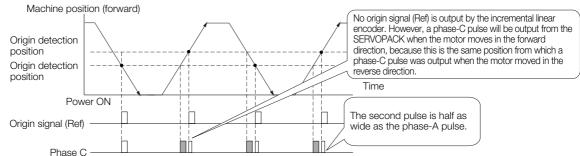
In that case, the phase-C pulse of the SERVOPACK is output at two positions.

For detailed specifications on the origin signal, refer to the manual for the Renishaw PLC incremental linear encoder.

When Passing the First Origin Signal (Ref) in the Forward Direction and Returning after Turning ON the Power Supply



When Passing the First Origin Signal (Ref) in the Reverse Direction and Returning after Turning ON the Power Supply

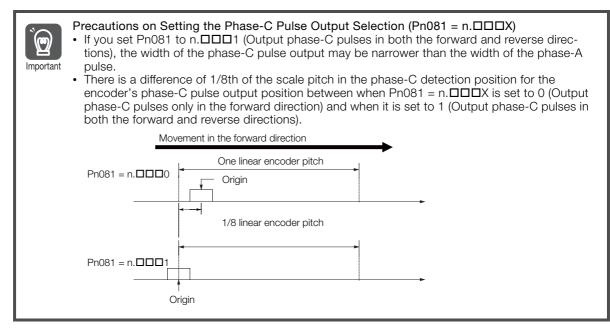


#### Precautions When Using a Linear Incremental Encoder from Magnescale Co., Ltd.

#### ■ Encoder Divided Phase-C Pulse Output Selection

You can also output the encoder's phase-C pulse for reverse movement. To do so, set Pn081 to n. DDD1.

| F            | Parameter                   | Meaning                                                           | When Enabled  | Classification |
|--------------|-----------------------------|-------------------------------------------------------------------|---------------|----------------|
| <b>Pn081</b> | n.□□□0<br>(default setting) | Output phase-C pulses only in the forward direction.              | After restart | Setup          |
| Pn081        | n.0001                      | Output phase-C pulses in both the forward and reverse directions. |               | Getup          |



Observe the following precaution if you set Pn081 to n. DDD (Output phase-C pulses only in the forward direction).

When a linear incremental encoder from Magnescale Co., Ltd. is used, the count direction of the encoder determines how the phase-C pulse (CN1-21 and CN1-22) is output.

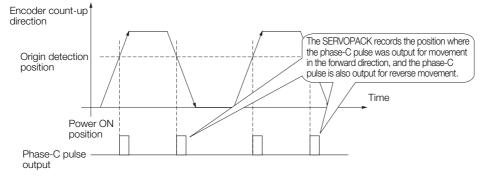
| Note: The count direction (up or down) of the linear encoder determines whether a phase-C pulse is output. The |
|----------------------------------------------------------------------------------------------------------------|
| output of the pulse does not depend on the setting of the movement direction (Pn000 = $n.\Box\Box\Box\Box$ ).  |

| Encoder Model Interpolator |                       | Linear Encoder Pitch [µm] |  |
|----------------------------|-----------------------|---------------------------|--|
| SL710                      |                       | 800                       |  |
| SL720                      | PL101-RY<br>MJ620-T13 | 800                       |  |
| SL730                      |                       | 800                       |  |
| SR75                       |                       | 80                        |  |
|                            | SR85                  | 80                        |  |
| SQ10                       | MQ10-FLA              | 400                       |  |
| 5010                       | MQ10-GLA              | 400                       |  |

#### When First Passing the Origin Signal in the Forward Direction and Returning after Turning ON the Power Supply

The encoder's phase-C pulse (CN1-21 and CN1-22) is output when the origin detection position is passed for the first time in the forward direction after the power supply is turned ON.

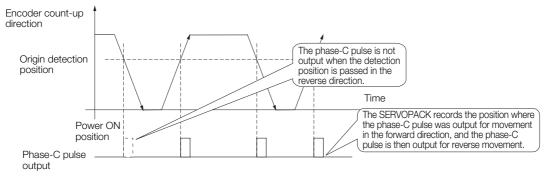
After that, the phase-C pulse is output whenever the origin detection position is passed in the forward or reverse direction.



#### When First Passing the Origin Signal in the Reverse Direction and Returning after Turning ON the Power Supply

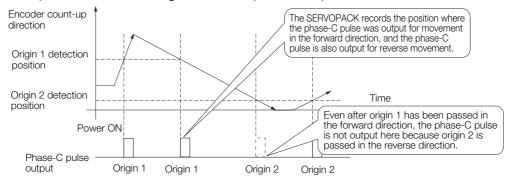
The encoder's phase-C pulse (CN1-19 and CN1-20) is not output when the origin detection position is passed for the first time in the reverse direction after the power supply is turned ON.

However, after the origin detection position is passed in the forward direction and the encoder's phase-C pulse is output, it will then also be output when the origin detection point is passed in the reverse direction.



When Using a Linear Encoder with Multiple Origins and First Passing the Origin Position in the Forward Direction and Returning after Turning ON the Power Supply

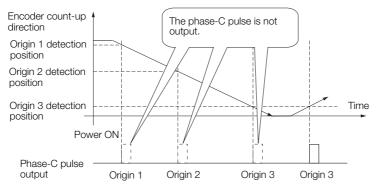
The encoder's phase-C pulse is output when the origin detection position is passed for the first time in the forward direction after the power supply is turned ON. After that, the phase-C pulse is output whenever the origin detection position is passed in the forward or reverse direction.



# When Using a Linear Encoder with Multiple Origins and First Passing the Origin Position in the Reverse Direction after Turning ON the Power Supply

The encoder's phase-C pulse is not output when the origin detection position is passed for the first time in the reverse direction after the power supply is turned ON.

However, after the origin detection position is passed in the forward direction and the encoder's phase-C pulse it output, it will then also be output when the origin detection point is passed in the reverse direction.



6.5.2 Setting for the Encoder Divided Pulse Output

### 6.5.2 Setting for the Encoder Divided Pulse Output

This section describes the setting for the encoder divided pulse output for a Rotary Servomotor or Linear Servomotor.

# Encoder Divided Pulse Output When Using a Rotary Servomotor

If you will use a Rotary Servomotor, set the number of encoder output pulses (Pn212).

|       | Number of Encoder Output Pulses |              |                 |               |                |  |
|-------|---------------------------------|--------------|-----------------|---------------|----------------|--|
| Pn212 | Setting Range                   | Setting Unit | Default Setting | When Enabled  | Classification |  |
|       | 16 to 1,073,741,824             | 1 P/Rev      | 2,048           | After restart | Setup          |  |

The number of pulses from the encoder per rotation are processed inside the SERVOPACK, divided by the setting of Pn212, and then output.

Set the number of encoder divided output pulses according to the system specifications of the machine or host controller.

The setting of the number of encoder output pulses is limited by the resolution of the encoder.

| Setting of the Number               |                      | Encoder Resolution               |                                  |                                   | Upper Limit of Servo-                                                          |  |
|-------------------------------------|----------------------|----------------------------------|----------------------------------|-----------------------------------|--------------------------------------------------------------------------------|--|
| of Encoder Output<br>Pulses [P/Rev] | Setting<br>Increment | 20 bits<br>(1,048,576<br>pulses) | 22 bits<br>(4,194,304<br>pulses) | 24 bits<br>(16,777,216<br>pulses) | motor Speed for Set<br>Number of Encoder<br>Output Pulses [min <sup>-1</sup> ] |  |
| 16 to 16,384                        | 1                    | 0                                | 0                                | 0                                 | 6,000                                                                          |  |
| 16,386 to 32,768                    | 2                    | 0                                | 0                                | 0                                 | 3,000                                                                          |  |
| 32,772 to 65,536                    | 4                    | 0                                | 0                                | 0                                 | 1,500                                                                          |  |
| 65,544 to 131,072                   | 8                    | 0                                | 0                                | 0                                 | 750                                                                            |  |
| 131,088 to 262,144                  | 16                   | 0                                | 0                                | 0                                 | 375                                                                            |  |
| 262,176 to 524,288                  | 32                   | -                                | 0                                | 0                                 | 187                                                                            |  |
| 524,352 to 1,048,576                | 64                   | -                                | 0                                | 0                                 | 93                                                                             |  |
| 1,048,704 to 2,097,152              | 128                  | -                                | _                                | 0*                                | 46                                                                             |  |
| 2,097,408 to 4,194,304              | 256                  | _                                | _                                | 0*                                | 23                                                                             |  |

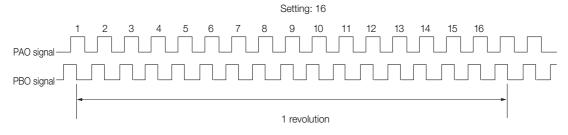
\* Available only for incremental encoder

Note: 1. The setting range of the number of encoder output pulses (Pn212) depends on the resolution of the Servomotor encoder. An A.041 alarm (Encoder Output Pulse Setting Error) will occur if the above setting conditions are not met.

Correct setting example: Pn212 can be set to 25,000 [P/Rev]. Incorrect setting example: Pn212 cannot be set to 25,001 (P/Rev) because the setting increment in the above table is not used.

 The upper limit of the pulse frequency is approximately 1.6 Mpps. The Servomotor speed will be limited if the setting of the number of encoder output pulses is too high. An A.511 alarm (Encoder Output Pulse Overspeed) will occur if the upper limit of the motor speed is exceeded.

Output example: An output example is given below for the PAO (Encoder Pulse Output Phase A) signal and the PBO (Encoder Pulse Output Phase B) signal when Pn212 is set to 16 (16 pulses output per revolution).



6.5.2 Setting for the Encoder Divided Pulse Output

# Encoder Divided Pulse Output When Using a Linear Servomotor

If you will use a Linear Servomotor, set the encoder output resolution (Pn281).

| Encoder Output Resolution |               |              |                 |               |                |
|---------------------------|---------------|--------------|-----------------|---------------|----------------|
| Pn281                     | Setting Range | Setting Unit | Default Setting | When Enabled  | Classification |
|                           | 1 to 4,096    | 1 edge/pitch | 20              | After restart | Setup          |

Note: 1. The maximum setting for the encoder output resolution is 4,096.

If the resolution of the external encoder exceeds 4,096, pulse output will no longer be possible at the resolution given in *Feedback Resolution of Linear Encoder* on page 5-44.

2. If the setting of Pn281 exceeds the resolution of the external encoder, the A.041 alarm (Encoder Output Pulse Setting Error) will be output.

Set the encoder output resolution for the encoder pulse output signals (PAO, /PAO, PBO, and /PBO) from the SERVOPACK to the host controller.

The number of feedback pulses per linear encoder pitch is divided by the setting of Pn281 (after multiplication by 4) inside the SERVOPACK and then the resulting number of pulses is output. Set the parameter according to the system specifications of the machine or host controller.

The setting range depends on the Servomotor's maximum speed (Pn385) and the linear scale pitch (Pn282).\* You can calculate the upper limit of the setting of Pn281 with the following formula.

Upper limit of Pn281 =  $\frac{\text{Linear Encoder Pitch*/100}}{\text{Pn385}} \times 72$ 

\* The value depends on whether a Serial Converter Unit is used.

| ·                                                                                                                                                                                          |                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Using a Seria                                                                                                                                                                              | al Converter Unit                                                                                                                                        | Setting of Pn282                                                                                                                                                                                                                                                                                                                                                               |
| Not Using a Serial Converter Unit (when the lin-<br>ear encoder and SERVOPACK are connected<br>directly or when a linear encoder that does not<br>require a Serial Converter Unit is used) |                                                                                                                                                          | The linear encoder pitch is automatically detected by the SERVO-<br>PACK, so the setting of Pn282 is disabled.                                                                                                                                                                                                                                                                 |
| Information                                                                                                                                                                                | because of the maximum resp<br>If the setting is out of range or<br>(Encoder Output Pulse Setting<br>limit for the set encoder output<br>will be output. | is 4 $\mu$ m, the maximum motor speed is limited to 1 m/s<br>conse frequency of the Serial Converter Unit.<br>does not satisfy the setting conditions, an A.041 alarm<br>g Error) will be output. If the motor speed exceeds the upper<br>t resolution, an A.511 alarm (Encoder Output Pulse Overspeed)<br>r output resolution is restricted by the dividing specifications of |
| Example                                                                                                                                                                                    | (Pn385 = 50): Pn281 = 28 (edg                                                                                                                            | coder pitch of 20 μm and a maximum motor speed of 5 m/s<br>ges/pitch)<br>(edges/pitch) (An A.041 alarm would be output.)                                                                                                                                                                                                                                                       |
| Example                                                                                                                                                                                    | Pulse Output Example<br>When Pn281 = 20 (20-edge o<br>Phase A<br>Phase B                                                                                 | utput (5-pulse output) per linear encoder pitch)                                                                                                                                                                                                                                                                                                                               |
|                                                                                                                                                                                            | Linear en                                                                                                                                                | coder pitch                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                                            |                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                |

# 6.6 Internal Torque Limits

You can limit the torque that is output by the Servomotor.

If you use internal torque limits, the maximum output torque will always be limited to the specified forward torque limit (Pn402) and reverse torque limit (Pn403).

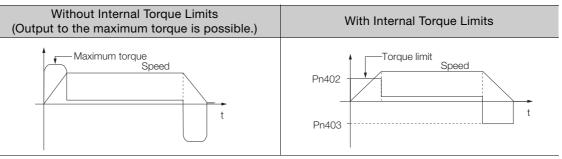
Note: If you set a value that exceeds the maximum torque of the Servomotor, the torque will be limited to the maximum torque of the Servomotor.

Rotary Servomotors

|       | Forward Torque Limit |              |                 |              |                |  |
|-------|----------------------|--------------|-----------------|--------------|----------------|--|
| Pn402 | Setting Range        | Setting Unit | Default Setting | When Enabled | Classification |  |
|       | 0 to 800             | 1%*          | 800             | Immediately  | Setup          |  |
|       | Reverse Torque Limit |              |                 |              |                |  |
| Pn403 | Setting Range        | Setting Unit | Default Setting | When Enabled | Classification |  |
|       | 0 to 800             | 1%*          | 800             | Immediately  | Setup          |  |

\* Set a percentage of the rated motor torque.

Note: If the setting of Pn402 or Pn403 is too low, the torque may be insufficient for acceleration or deceleration of the Servomotor.

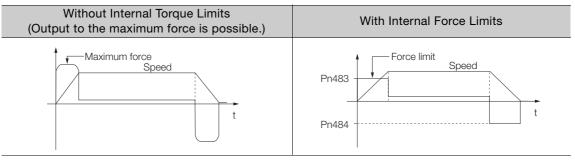


Linear Servomotors

|       | Forward Force Limit |              |                 |              |                |  |
|-------|---------------------|--------------|-----------------|--------------|----------------|--|
| Pn483 | Setting Range       | Setting Unit | Default Setting | When Enabled | Classification |  |
|       | 0 to 800            | 1%*          | 30              | Immediately  | Setup          |  |
|       | Reverse Force Limit |              |                 |              |                |  |
| Pn484 | Setting Range       | Setting Unit | Default Setting | When Enabled | Classification |  |
|       | 0 to 800            | 1%*          | 30              | Immediately  | Setup          |  |

\* Set a percentage of the rated motor force.

Note: If the setting of Pn483 or Pn484 is too low, the force may be insufficient for acceleration or deceleration of the Servomotor.



# 6.7 Absolute Encoders

The absolute encoder records the current position of the stop position even when the power supply is OFF.

With a system that uses an absolute encoder, the host controller can monitor the current position. Therefore, it is not necessary to perform homing when the power supply to the system is turned ON.

There are four types of encoders for Rotary Servomotors. The usage of the encoder is specified in  $Pn002 = n.\Box X \Box \Box$ .

SERVOPACKs with software version 0023 or higher support batteryless absolute encoders.

Refer to the following section for encoder models.

■ Encoder Resolution on page 5-43

#### Parameter Settings When Using an Incremental Encoder

| F | Parameter                   | Meaning                                                                          | When Enabled  | Classification |
|---|-----------------------------|----------------------------------------------------------------------------------|---------------|----------------|
|   | n.□0□□<br>(default setting) | Use the encoder as an incremental encoder.<br>A battery is not required.         |               |                |
|   | n.0100                      | Use the encoder as an incremental encoder.<br>A battery is not required.         | After restart | Setup          |
|   | n.0200                      | Use the encoder as a single-turn absolute encoder.<br>A battery is not required. |               |                |

#### · Parameter Settings When Using a Single-Turn Absolute Encoder

| Parameter |                             | Meaning                                                                          | When Enabled  | Classification |
|-----------|-----------------------------|----------------------------------------------------------------------------------|---------------|----------------|
|           | n.□0□□<br>(default setting) | Use the encoder as a single-turn absolute encoder.<br>A battery is not required. | After restart | Setup          |
| Pn002     | 002 n.0100                  | Use the encoder as an incremental encoder.<br>A battery is not required.         |               |                |
|           | n.0200                      | Use the encoder as a single-turn absolute encoder.<br>A battery is not required. |               |                |

#### Parameter Settings When Using a Multiturn Absolute Encoder

| F     | Parameter                   | Meaning                                                                          | When Enabled  | Classification |
|-------|-----------------------------|----------------------------------------------------------------------------------|---------------|----------------|
|       | n.□0□□<br>(default setting) | Use the encoder as a multiturn absolute encoder.<br>A battery is required.       |               | Setup          |
| Pn002 | n.u1uu                      | Use the encoder as an incremental encoder.<br>A battery is not required.         | After restart |                |
|       |                             | Use the encoder as a single-turn absolute encoder.<br>A battery is not required. |               |                |

#### Parameter Settings When Using a Batteryless Multiturn Absolute Encoder

| Parameter |                             | Meaning                                                                                       | When Enabled  | Classification |
|-----------|-----------------------------|-----------------------------------------------------------------------------------------------|---------------|----------------|
|           | n.□0□□<br>(default setting) | Use the encoder as a batteryless multiturn absolute<br>encoder.<br>A battery is not required. |               | Setup          |
| Pn002     |                             | Use the encoder as an incremental encoder.<br>A battery is not required.                      | After restart |                |
|           |                             | Use the encoder as a single-turn absolute encoder.<br>A battery is not required.              |               |                |

# NOTICE

• Install a battery at either the host controller or on the Encoder Cable. If you install batteries both at the host controller and on the Encoder Cable at the same time, you will create a loop circuit between the batteries, resulting in a risk of damage or burning. 6.7.1 Connecting an Absolute Encoder

# 6.7.1 Connecting an Absolute Encoder

If you use an absolute encoder, the encoder divided pulse output signals (PAO, PBO, and PCO) are output only once when the power supply turns ON. Normally, do not use these signals. You can get the position data from the absolute encoder with MECHATROLINK communications. Therefore, it is not necessary to wire the PAO, PBO, and PCO (Encoder Divided Pulse Output) signals.

If they need to be wired, refer to the following section.

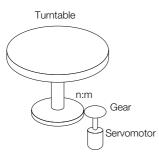
[ ₹ 4.4.3 Wiring the SERVOPACK to the Encoder on page 4-27

JO Signal Wiring Examples on page 4-38

6.7.2 Multiturn Limit Setting

#### 6.7.2 **Multiturn Limit Setting**

The multiturn limit is used in position control for a turntable or other rotating body. For example, consider a machine that moves the turntable shown in the following diagram in only one direction.



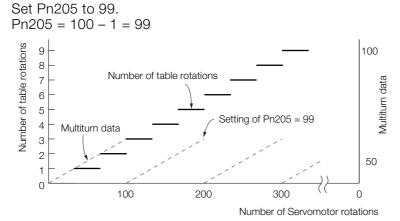
Because the turntable moves in only one direction, the upper limit to the number of rotations that can be counted by an absolute encoder will eventually be exceeded.

The multiturn limit is used in cases like this to prevent fractions from being produced by the integer ratio of the number of Servomotor rotations and the number of turntable rotations.

For a machine with a ratio of n:m between the number of Servomotor rotations and the number of turntable rotations, as shown above, the value of m minus 1 will be the setting for the multiturn limit setting (Pn205).

Multiturn limit (Pn205) = m - 1

If m = 100 and n = 3 (i.e., the turntable rotates three times for each 100 Servomotor rotations), the relationship between the number of Servomotor rotations and the number of turntable rotations would be as shown below.



|       | Multiturn Limit |              |                 |               |                |  |  |  |
|-------|-----------------|--------------|-----------------|---------------|----------------|--|--|--|
| Pn205 | Setting Range   | Setting Unit | Default Setting | When Enabled  | Classification |  |  |  |
|       | 0 to 65,535     | 1 Rev        | 65,535          | After restart | Setup          |  |  |  |

Note: This parameter is enabled when you use an absolute encoder.

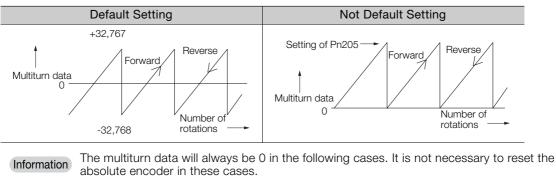
The data will change as shown below when this parameter is set to anything other than the default setting.

- If the Servomotor operates in the reverse direction when the multiturn data is 0, the multiturn data will change to the value set in Pn205.
- If the motor operates in the forward direction when the multiturn data is at the value set in Pn205, the multiturn data will change to 0.

Set Pn205 to one less than the desired multiturn data.

If you change the multiturn limit in Pn205, an A.CCO alarm (Multiturn Limit Disagreement) will be displayed because the setting disagrees with the value in the encoder. Refer to the following section for the procedure to change the multiturn limit settings in the encoder.

#### 6.7.3 Multiturn Limit Disagreement Alarm (A.CC0)



- When you use a single-turn absolute encoder
- When the encoder is set to be used as a single-turn absolute encoder (Pn002 =  $n.\Box 2\Box \Box$ ) Absolute encoder-related alarms (A.810 and A.820) will not occur.

### 6.7.3 Multiturn Limit Disagreement Alarm (A.CC0)

If you change the multiturn limit in Pn205 (Multiturn Limit), an A.CCO alarm (Multiturn Limit Disagreement) will be displayed because the setting disagrees with the value in the encoder.

| Display | Name                 | Alarm Code Output |            | tput     | Meaning                                   |
|---------|----------------------|-------------------|------------|----------|-------------------------------------------|
| A.CC0   | Multiturn Limit Dis- |                   | /ALO2      | /ALO3    | Different multiturn limits are set in the |
| A.CCU   | agreement            | ON (low)          | OFF (high) | ON (low) | encoder and SERVOPACK.                    |

If this alarm is displayed, use the following procedure to change the multiturn limit in the encoder to the same value as the setting of Pn205.

### **Applicable Tools**

The following table lists the tools that you can use to set the multiturn limit.

| Tool                                    | Fn No./Function Name                          | Operating Procedure Reference                                                   |
|-----------------------------------------|-----------------------------------------------|---------------------------------------------------------------------------------|
| Digital Operator                        | Fn013                                         | Ω Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+                               | Encoder Setting – Multi-turn<br>Limit Setting | Gerating Procedure on page 6-26                                                 |
| Serial com-<br>mand commu-<br>nications | MLTLIMSET utility command                     | Monitor and Utility Function Commands on page 14-32                             |

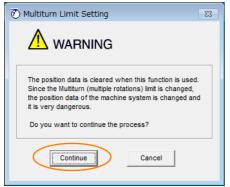
### **Operating Procedure**

Use the following procedure to adjust the multiturn limit setting.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Multi-turn Limit Setting in the Menu Dialog Box. The Multiturn Limit Setting Dialog Box will be displayed.

6.7.3 Multiturn Limit Disagreement Alarm (A.CC0)

3. Click the Continue Button.

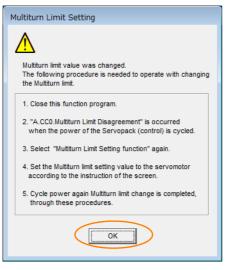


Click the **Cancel** Button to cancel setting the multiturn limit. The Main Window will return.

4. Change the setting.

| 🐻 Multiturn L     | imit Setting AXIS#00           | <b>—X</b> — |  |  |  |  |  |  |
|-------------------|--------------------------------|-------------|--|--|--|--|--|--|
| Multiturn Limit S | Multiturn Limit Setting Change |             |  |  |  |  |  |  |
| Pn205:Multiturn   | Limit                          |             |  |  |  |  |  |  |
| 65535             | [Rev] 🕨 65535                  | [ Rev ]     |  |  |  |  |  |  |
|                   | (0-65535)                      |             |  |  |  |  |  |  |
|                   | Writing into<br>the Servopack  |             |  |  |  |  |  |  |

- 5. Click the Writing into the Servopack Button.
- 6. Click the OK Button.



- 7. Turn the power supply to the SERVOPACK OFF and ON again. An A.CC0 alarm (Multiturn Limit Disagreement) will occur because setting the multiturn limit in the Servomotor is not yet completed even though the setting has been changed in the SERVOPACK.
- 8. Display the Multiturn Limit Setting in the Menu Dialog Box.

6.7.3 Multiturn Limit Disagreement Alarm (A.CC0)

9. Click the Continue Button.

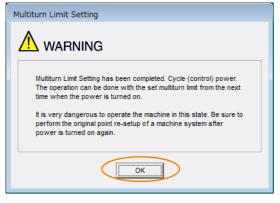


10. Click the Writing into the Motor Button.

| 🕐 Multiturn Limit Setting                        |  |  |  |  |  |  |  |
|--------------------------------------------------|--|--|--|--|--|--|--|
| Set the multiturn limit value to the servomotor. |  |  |  |  |  |  |  |
| Pn205:Multiturn Limit                            |  |  |  |  |  |  |  |
| 1555 [Rev] Re-Change                             |  |  |  |  |  |  |  |
| Writing into<br>the servomotor                   |  |  |  |  |  |  |  |

Click the **Re-change** Button to change the setting.

11. Click the OK Button.



This concludes the procedure to set the multiturn limit.

#### 6.8.1 Connecting an Absolute Linear Encoder

# 6.8 Absolute Linear Encoders

The absolute linear encoder records the current position of the stop position even when the power supply is OFF.

With a system that uses an absolute linear encoder, the host controller can monitor the current position. Therefore, it is not necessary to perform homing when the power supply to the system is turned ON.

There are three types of linear encoders for Linear Servomotors. The usage of the linear encoder is specified in  $Pn002 = n.\Box X \Box \Box$ .

Refer to the following section for linear encoder models.

■ Feedback Resolution of Linear Encoder on page 5-44

#### · Parameter Settings When Using an Incremental Linear Encoder

| Parameter |       | arameter                    | Meaning                                           | When Enabled  | Classification |
|-----------|-------|-----------------------------|---------------------------------------------------|---------------|----------------|
|           | Pn002 | n.□0□□<br>(default setting) | Use the encoder as an incremental linear encoder. | After restart | Setup          |
|           |       | n.0100                      | Use the encoder as an incremental linear encoder. |               |                |

#### Parameter Settings When Using an Absolute Linear Encoder

|   | Parameter |                             | Meaning                                           | When Enabled  | Classification |
|---|-----------|-----------------------------|---------------------------------------------------|---------------|----------------|
| F |           | n.□0□□<br>(default setting) | Use the encoder as an absolute linear encoder.    | After restart | Setup          |
|   |           | n.0100                      | Use the encoder as an incremental linear encoder. |               |                |

### 6.8.1 Connecting an Absolute Linear Encoder

If you use an absolute linear encoder, the encoder divided pulse output signals (PAO, PBO, and PCO) are output only once when the power supply turns ON. Normally, do not use these signals. You can get the position data from the absolute linear encoder with MECHATROLINK communications. Therefore, it is not necessary to wire the PAO, PBO, and PCO (Encoder Divided Pulse Output) signals.

If they need to be wired, refer to the following section.

 $\fbox{3}$  4.4.3 Wiring the SERVOPACK to the Encoder on page 4-27

I/O Signal Wiring Examples on page 4-38

6.9.1 Preparations

# 6.9 Software Reset

You can reset the SERVOPACK internally with the software. A software reset is used when resetting alarms and changing the settings of parameters that normally require turning the power supply to the SERVOPACK OFF and ON again. This can be used to change those parameters without turning the power supply to the SERVOPACK OFF and ON again.

Information 1. Always confirm that the servo is OFF and that the Servomotor is stopped before you start a software reset.

- 2. This function resets the SERVOPACK independently of the host controller. The SERVO-PACK carries out the same processing as when the power supply is turned ON and outputs the ALM (Servo Alarm) signal. The status of other output signals may be forcibly changed.
- 3. When you execute a software reset, the SERVOPACK will not respond for approximately five seconds.

Before you execute a software reset, check the status of the SERVOPACK and Servomotor and make sure that no problems will occur.

### 6.9.1 Preparations

Always check the following before you perform a software reset.

- The servo must be OFF.
- The motor must be stopped.

### 6.9.2 Applicable Tools

The following table lists the tools that you can use to perform a software reset.

| Tool                          | Fn No./Function Name                  | Operating Procedure Reference                                                   |
|-------------------------------|---------------------------------------|---------------------------------------------------------------------------------|
| Digital Operator              | Fn030                                 | Ω Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+                     | Basic Functions – Soft-<br>ware Reset | 6.9.3 Operating Procedure on page 6-30                                          |
| Serial command communications | RES basic operation com-<br>mand      | 14.8.1 Basic Operation Commands on page 14-11                                   |

# 6.9.3 Operating Procedure

Use the following procedure to perform a software reset.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Software Reset in the Menu Dialog Box. The Software Reset Dialog Box will be displayed.

6.9.3 Operating Procedure

3. Click the Execute Button.



Click the Cancel Button to cancel the software reset. The Main Window will return.

4. Click the Execute Button.

| ① Software Reset Common for the Unit                                                                                                         | × |
|----------------------------------------------------------------------------------------------------------------------------------------------|---|
| The software reset function will be executed.<br>The Servopack will stop responding for approximately 5<br>seconds after the fuction begins. |   |
| Execute                                                                                                                                      |   |
| 0%                                                                                                                                           |   |
|                                                                                                                                              |   |

5. Click the OK Button to end the software reset operation.

All settings including parameters will have been re-calculated. When you finish this operation, disconnect the SigmaWin+ from the SERVOPACK, and then connect it again.



This concludes the procedure to reset the software.

#### 6.10.1 Preparations

# 6.10 Initializing the Vibration Detection Level

You can detect machine vibration during operation to automatically adjust the settings of Pn312 or Pn384 (Vibration Detection Level) to detect A.520 alarms (Vibration Alarm) and A.911 warnings (Vibration Warning) more precisely.

This function detects specific vibration components in the Servomotor speed.

| Parameter |       | Parameter                   | Meaning                                            | When<br>Enabled | Classification |
|-----------|-------|-----------------------------|----------------------------------------------------|-----------------|----------------|
|           |       | n.□□□0<br>(default setting) | Do not detect vibration.                           |                 | Ostur          |
|           | Pn310 | n.0001                      | Output a warning (A.911) if vibration is detected. | Immediately     | Setup          |
|           |       | n.□□□2                      | Output an alarm (A.520) if vibration is detected.  |                 |                |

If the vibration exceeds the detection level calculated with the following formula, an alarm or warning occurs according to Pn310 (Vibration Detection Selection).

Rotary Servomotors

Detection level = Vibration detection level (Pn312 [min-1]) × Vibration detection sensitivity (Pn311 [%])

100

• Linear Servomotors

Detection level = <u>
Vibration detection level (Pn384 [mm/s]) × Vibration detection sensitivity (Pn311 [%])</u> 100

Use this function only if A.520 or A.911 alarms are not output at the correct times when vibration is detected with the default vibration detection level (Pn312 or Pn384).

There will be discrepancies in the detection sensitivity for vibration alarms and warnings depending on the condition of your machine. If there is a discrepancy, use the above formula to adjust Pn311 (Vibration Detection Sensitivity).

|       | Vibration Detection Sensitivity |              |                 |              |                |
|-------|---------------------------------|--------------|-----------------|--------------|----------------|
| Pn311 | Setting Range                   | Setting Unit | Default Setting | When Enabled | Classification |
|       | 50 to 500                       | 1%           | 100             | Immediately  | Tuning         |

Information 1. Vibration may not be detected because of unsuitable servo gains. Also, not all kinds of vibrations can be detected.

2. Set a suitable moment of inertia ratio (Pn103). An unsuitable setting may result in falsely detecting or not detecting vibration alarms or vibration warnings.

- 3. To use this function, you must input the actual references that will be used to operate your system.
- 4. Execute this function under the operating conditions for which you want to set the vibration detection level.
- 5. Execute this function while the Servomotor is operating at 10% of its maximum speed or faster.

### 6.10.1 Preparations

Always check the following before you initialize the vibration detection level.

- The parameters must not be write prohibited.
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).

# 6.10.2 Applicable Tools

The following table lists the tools that you can use to initialize the vibration detection level.

| Tool             | Fn No./Function Name                             | Operating Procedure Reference                                                   |
|------------------|--------------------------------------------------|---------------------------------------------------------------------------------|
| Digital Operator | Fn01B                                            | Ω Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Others – Initialize Vibration<br>Detection Level | 6.10.3 Operating Procedure on page 6-33                                         |

# 6.10.3 Operating Procedure

Use the following procedure to initialize the vibration detection level.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Initialize Vibration Detection Level in the Menu Dialog Box. The Initialize Vibration Detection Level Dialog Box will be displayed.
- Select Pn311: Vibration Detection Sensitivity and Pn310: Vibration Detection Selections and then click the Detection Start Button. A setting execution standby mode will be entered.

| Initialize Vibration Detection Level AXIS#00                                    |  |  |  |  |  |
|---------------------------------------------------------------------------------|--|--|--|--|--|
| Setting Condition                                                               |  |  |  |  |  |
| Pn311 : Vibration Detection Sensitivity (50 - 500)                              |  |  |  |  |  |
| 100 . [%]                                                                       |  |  |  |  |  |
| Pn310 : Vibration Detection Selections<br>digit 0 Vibration Detection Selection |  |  |  |  |  |
| 2 : Output an alarm (A.520) if vibration is detected.                           |  |  |  |  |  |
| Detection Start                                                                 |  |  |  |  |  |
| Setting Result                                                                  |  |  |  |  |  |
| Pn312 : Vibration Detection Level                                               |  |  |  |  |  |
| 50 [min-1]                                                                      |  |  |  |  |  |
|                                                                                 |  |  |  |  |  |

6.10.3 Operating Procedure

4. Click the Execute Button.

| ♥ Initialize Vibration Detection Level AXIS#00                                  |  |  |  |  |  |
|---------------------------------------------------------------------------------|--|--|--|--|--|
| Setting Condition                                                               |  |  |  |  |  |
| Pn311 : Vibration Detection Sensitivity (50 - 500)                              |  |  |  |  |  |
| Pn310 : Vibration Detection Selections<br>digit 0 Vibration Detection Selection |  |  |  |  |  |
| 2 : Output an alarm (A.520) if vibration is detected.                           |  |  |  |  |  |
| Execute                                                                         |  |  |  |  |  |
| Setting Result                                                                  |  |  |  |  |  |
| Pn312 : Vibration Detection Level                                               |  |  |  |  |  |
| 50 [min-1]                                                                      |  |  |  |  |  |
|                                                                                 |  |  |  |  |  |

The newly set vibration detection level will be displayed and the value will be saved in the SERVO-PACK.

| Initialize Vibration Detection Level AXIS#00                                                                                                                                                                                                                                                                                 |  |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|
| Setting Condition                                                                                                                                                                                                                                                                                                            |  |  |  |  |  |  |
| Pn311 : Vibration Detection Sensitivity (50 - 500)                                                                                                                                                                                                                                                                           |  |  |  |  |  |  |
| 100 • [%]                                                                                                                                                                                                                                                                                                                    |  |  |  |  |  |  |
| Pn310 : Vibration Detection Selections<br>digit 0 Vibration Detection Selection                                                                                                                                                                                                                                              |  |  |  |  |  |  |
| 2 : Output an alarm (A.520) if vibration is detected.                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |
| Detection Start                                                                                                                                                                                                                                                                                                              |  |  |  |  |  |  |
| Setting Result                                                                                                                                                                                                                                                                                                               |  |  |  |  |  |  |
| Pn312 : Vibration Detection Level                                                                                                                                                                                                                                                                                            |  |  |  |  |  |  |
| 50 [min-1] <b>b</b> 50 [min-1]                                                                                                                                                                                                                                                                                               |  |  |  |  |  |  |
| When vibration exceeds a detection level 50 [min-1],<br>Alarm(A.520) is detected.                                                                                                                                                                                                                                            |  |  |  |  |  |  |
| digit 0 Vibration Detection Selection          2 : Output an alarm (A.520) if vibration is detected.         Detection Start         Detection Start         Setting Result         Pn312 : Vibration Detection Level         50       [min-1]         Solution         When vibration exceeds a detection level 50 [min-1], |  |  |  |  |  |  |

This concludes the procedure to initialize the vibration detection level.

6.10.4 Related Parameters

# 6.10.4 Related Parameters

The following three items are given in the following table.

- Parameters Related to this Function
  - These are the parameters that are used or referenced when this function is executed.
- Changes during Function Execution Not allowed: The parameter cannot be changed using the SigmaWin+ or other tool while this function is being executed.

Allowed: The parameter can be changed using the SigmaWin+ or other tool while this function is being executed.

• Automatic Changes after Function Execution Yes: The parameter is automatically set or adjusted after execution of this function. No: The parameter is not automatically set or adjusted after execution of this function.

| Parameter | Name                            | Setting Changes | Automatic<br>Changes |
|-----------|---------------------------------|-----------------|----------------------|
| Pn311     | Vibration Detection Sensitivity | Allowed         | No                   |
| Pn312     | Vibration Detection Level       | Not allowed     | Yes                  |
| Pn384     | Vibration Detection Level       | Not allowed     | Yes                  |

6.11.1 Automatic Adjustment

# 6.11 Adjusting the Motor Current Detection Signal Offset

The motor current detection signal offset is used to reduce ripple in the torque. You can adjust the motor current detection signal offset either automatically or manually.

# 6.11.1 Automatic Adjustment

Perform this adjustment only if highly accurate adjustment is required to reduce torque ripple. It is normally not necessary to adjust this offset.



Execute the automatic offset adjustment if the torque ripple is too large when compared with other SERVOPACKs.

Information The offset does not use a parameter, so it will not change even if the parameter settings are initialized.

### Preparations

Always check the following before you automatically adjust the motor current detection signal offset.

- The parameters must not be write prohibited.
- The servo must be in ready status.
- The servo must be OFF.

### **Applicable Tools**

The following table lists the tools that you can use to automatically adjust the offset.

| Tool                          | Fn No./Function Name                                  | Operating Procedure Reference                                                    |
|-------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------|
| Digital Operator              | Fn00E                                                 | Ω Σ-7-Series Digital Operator Operating Manual<br>(document No. SIEP S800001 33) |
| SigmaWin+                     | Others – Adjust the Motor Current<br>Detection Offset | Gerating Procedure on page 6-36                                                  |
| Serial command communications | CURZERO utility command                               | Monitor and Utility Function Commands on page 14-32                              |

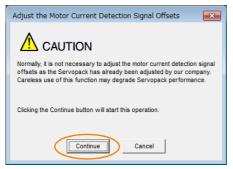
# **Operating Procedure**

Use the following procedure to automatically adjust the motor current detection signal offset.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Adjust the Motor Current Detection Offset in the Menu Dialog Box. The Adjust the Motor Current Detection Signal Offsets Dialog Box will be displayed.

6.11.1 Automatic Adjustment

3. Click the Continue Button.



4. Click the Automatic Adjustment Tab in the Adjust the Motor Current Detection Signal Offsets Dialog Box.

| Search Adjust the Motor Current Detection Signal O |  |  |  |  |  |
|----------------------------------------------------|--|--|--|--|--|
|                                                    |  |  |  |  |  |
|                                                    |  |  |  |  |  |
| Automatic Adjustment Manual Adjustment             |  |  |  |  |  |
|                                                    |  |  |  |  |  |
| New                                                |  |  |  |  |  |
| U-phase Offset                                     |  |  |  |  |  |
| V-phase Offset -63                                 |  |  |  |  |  |
| Adjust                                             |  |  |  |  |  |
|                                                    |  |  |  |  |  |

5. Click the Adjust Button.

The values that result from automatic adjustment will be displayed in the New Boxes.

| 🗣 Adjust the Motor Current Detection Signal O 🎫         |  |  |  |  |  |  |
|---------------------------------------------------------|--|--|--|--|--|--|
|                                                         |  |  |  |  |  |  |
| Automatic Adjustment Manual Adjustment                  |  |  |  |  |  |  |
| U-phase Offset<br>-73<br>V-phase Offset<br>-63<br>► -63 |  |  |  |  |  |  |
| Adjust                                                  |  |  |  |  |  |  |

This concludes the procedure to automatically adjust the motor current detection signal offset.

6.11.2 Manual Adjustment

# 6.11.2 Manual Adjustment

You can use this function if you automatically adjust the motor current detection signal offset and the torque ripple is still too large.

If the offset is incorrectly adjusted with this function, the Servomotor characteristics may be adversely affected.

- Observe the following precautions when you manually adjust the offset.
- Important Operate the Servomotor at a speed of approximately 100 min<sup>-1</sup>.
  - Adjust the offset while monitoring the torque reference with the analog monitor until the ripple is minimized.
  - Adjust the offsets for the phase-U current and phase-V current of the Servomotor so that they
    are balanced. Alternately adjust both offsets several times.

Information

on The offset does not use a parameter, so it will not change even if the parameter settings are initialized.

# Preparations

Always check the following before you manually adjust the motor current detection signal offset.

• The parameters must not be write prohibited.

# Applicable Tools

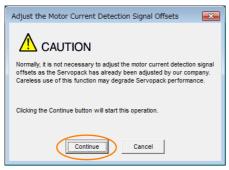
The following table lists the tools that you can use to manually adjust the offset.

| Tool             | Fn No./Function Name                                  | Operating Procedure Reference                                                   |
|------------------|-------------------------------------------------------|---------------------------------------------------------------------------------|
| Digital Operator | Fn00F                                                 | C Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Others – Adjust the Motor Current<br>Detection Offset | Operating Procedure on page 6-38                                                |

### **Operating Procedure**

Use the following procedure to manually adjust the motor current detection signal offset.

- 1. Operate the Servomotor at approximately 100 min<sup>-1</sup>.
- 2. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **3.** Select Adjust the Motor Current Detection Offset in the Menu Dialog Box. The Adjust the Motor Current Detection Signal Offsets Dialog Box will be displayed.
- 4. Click the Continue Button.



6.11.2 Manual Adjustment

5. Click the Manual Adjustment Tab in the Adjust the Motor Current Detection Signal Offsets Dialog Box.

| Adjust the Motor Current Detection Signal O |  |  |  |  |
|---------------------------------------------|--|--|--|--|
|                                             |  |  |  |  |
| Automatic Adjustment Manual Adjustment      |  |  |  |  |
| - Motor Current Detection Offset            |  |  |  |  |
| Channel U-phase 💌                           |  |  |  |  |
| 0ffset<br>-74 -1 Q↓                         |  |  |  |  |
| l                                           |  |  |  |  |

- 6. Set the Channel Box in the Motor Current Detection Offset Area to U-phase.
- **7.** Use the +1 and -1 Buttons to adjust the offset for phase U. Change the offset by about 10 in the direction that reduces the torque ripple. Adjustment range: -512 to +511
- 8. Set the Channel Box in the Motor Current Detection Offset Area to V-phase.
- 9. Use the +1 and -1 Buttons to adjust the offset for phase V. Change the offset by about 10 in the direction that reduces the torque ripple.
- **10.** Repeat steps 6 to 9 until the torque ripple cannot be decreased any further regardless of whether you increase or decrease the offsets.
- 11. Reduce the amount by which you change the offsets each time and repeat steps 6 to 9.

This concludes the procedure to manually adjust the motor current detection signal offset.

6.12.1 Connecting the Overheat Protection Input (TH) Signal

# 6.12 Overheat Protection

Overheat protection detects an A.93B warning (Overheat Warning) and an A.862 alarm (Overheat Alarm) by monitoring the overheat protection input signal from a Yaskawa SGLFW2 Linear Servomotor or from a sensor attached to the machine.

SERVOPACKs with software version 0023 or higher support overheat protection.

When you use overheat protection, you must wire the overheat protection input (TH) signal and select overheat protection (Pn61A =  $n.\Box\Box\BoxX$ ).

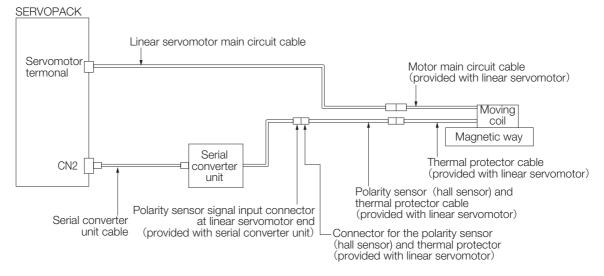
### 6.12.1 Connecting the Overheat Protection Input (TH) Signal

To use overheat protection, you must connect an overheat protection input (TH) signal to the SERVOPACK. This section describes the connection methods for the overheat protection input (TH) signal.

### Using Overheat Protection in the Linear Servomotor

#### When Using a Serial Converter Unit

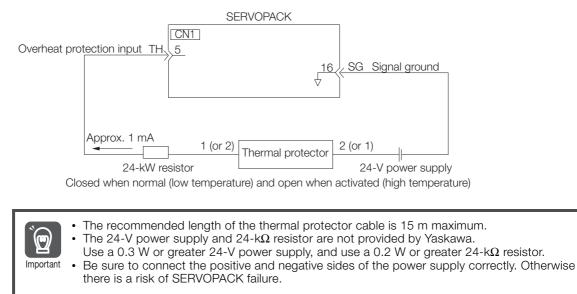
Connect the connector for the polarity sensor (hall sensor) and thermal protector of the linear servomotor to the serial converter unit.



6.12.1 Connecting the Overheat Protection Input (TH) Signal

# Using Overheat Protection for the Machine

To use overheat protection for the machine, connect the overheat protection input (an analog voltage input) from the sensor mounted to the machine to the CN1-5 on the SERVOPACK.



6.12.2 Overheat Protection Selection

# 6.12.2 Overheat Protection Selection

The overheat protection function is selected with  $Pn61A = n.\Box\Box\BoxX$  (Overheat Protection Selections).

| Parameter |                             | Meaning                                                                                              | When Enabled  | Classification |
|-----------|-----------------------------|------------------------------------------------------------------------------------------------------|---------------|----------------|
| Pn61A     | n.□□□0<br>(default setting) | Disable overheat protection.                                                                         |               | Setup          |
|           | n.0001                      | Use overheat protection in the Yaskawa Linear Servomotor.*                                           | After restart |                |
|           | n.0002                      | Monitor a negative voltage input from a sensor attached to the machine and use overheat pro-tection. |               |                |
|           | n.□□□3                      | Monitor a positive voltage input from a sensor attached to the machine and use overheat protection.  |               |                |

\* The SGLFW2 is the only Yaskawa Linear Servomotor that supports this function.

# Using Overheat Protection in the Yaskawa Linear Servomotor

To use the overheat protection in the Yaskawa Linear Servomotor (SGLFW2), set Pn61A to n.DDD1.

An A.93B warning (Overheat Warning) will be detected if the overheat protection input (TH) signal from the Yaskawa SGLFW2 Linear Servomotor exceeds the warning temperature.

An A.862 alarm (Overheat Alarm) will be detected if the overheat protection input (TH) signal from the Yaskawa SGLFW2 Linear Servomotor exceeds the alarm temperature.

- If the overheat protection input signal line is disconnected or short-circuited, an A.862 alarm will occur.
- If you set Pn61A to n. DDD1 (Use overheat protection in the Yaskawa Linear Servomotor), the parameters in the Servomotor are enabled and the following parameters are disabled.
  - Overheat Alarm Level (Pn61B)
  - Overheat Warning Level (Pn61C)
  - Overheat Alarm Filter Time (Pn61D)

# Monitoring the Machine's Temperature and Using Overheat Protection

Set Pn61A =  $n.\Box\Box\BoxX$  to 2 or 3 to use overheat protection for the machine.

Set the following parameters as required.

|       | Overheat Alarm Level       |              |                 |              |                |  |  |
|-------|----------------------------|--------------|-----------------|--------------|----------------|--|--|
| Pn61B | Setting Range              | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 500                   | 0.01 V       | 250             | Immediately  | Setup          |  |  |
|       | Overheat Warning Level     |              |                 |              |                |  |  |
| Pn61C | Setting Range              | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 100                   | 1%           | 100             | Immediately  | Setup          |  |  |
|       | Overheat Alarm Filter Time |              |                 |              |                |  |  |
| Pn61D | Setting Range              | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 65,535                | 1 s          | 0               | Immediately  | Setup          |  |  |
| -     |                            |              |                 |              |                |  |  |



 When Pn61A is set to n. DDD2, an A.862 alarm will occur if the overheat protection input signal line is disconnected or short-circuited.

• When Pn61A is set to n. DDD3, an A862 alarm will not occur if the overheat protection input signal line is disconnected or short-circuited. To ensure safety, we recommend that you connect the external circuits so that you can use a negative voltage input for the overheat protection input (an analog voltage input).

# **Trial Operation**

This chapter provides information on the flow and procedures for trial operation and convenient functions to use during trial operation.

| 7.1 | Flow                    | of Trial Operation7-2                                                                                    |
|-----|-------------------------|----------------------------------------------------------------------------------------------------------|
|     | 7.1.1<br>7.1.2          | Flow of Trial Operation for Rotary Servomotors 7-2<br>Flow of Trial Operation for Linear Servomotors 7-3 |
| 7.2 | Inspec                  | tions and Confirmations before Trial Operation 7-5                                                       |
| 7.3 | Trial O                 | peration for the Servomotor without a Load 7-6                                                           |
|     | 7.3.1<br>7.3.2<br>7.3.3 | Preparations                                                                                             |
| 7.4 | Trial Op                | peration with Digital I/O and Serial Communications7-9                                                   |
| 7.5 | Trial Op                | eration with the Servomotor Connected to the Machine7-11                                                 |
|     | 7.5.1<br>7.5.2<br>7.5.3 | Precautions                                                                                              |
| 7.6 | Conve                   | nient Function to Use during Trial Operation7-13                                                         |
|     | 7.6.1<br>7.6.2<br>7.6.3 | Program Jog Operation7-13Origin Search7-19Test without a Motor7-21                                       |

7.1.1 Flow of Trial Operation for Rotary Servomotors

# 7.1 Flow of Trial Operation

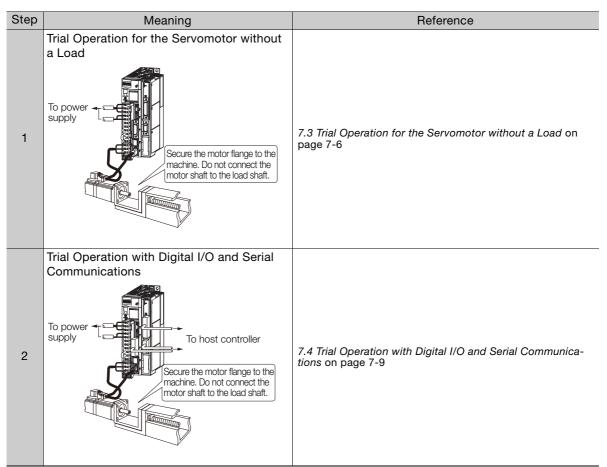
# 7.1.1 Flow of Trial Operation for Rotary Servomotors

The procedure for trial operation is given below.

#### Preparations for Trial Operation

| Step | Meaning                                                                                                                                                                                         | Reference                                                            |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| 1    | Installation<br>Install the Servomotor and SERVOPACK<br>according to the installation conditions. First,<br>operation is checked with no load. Do not<br>connect the Servomotor to the machine. | Chapter 3 Installation                                               |
| 2    | Wiring and Connections<br>Wire and connect the SERVOPACK. First,<br>Servomotor operation is checked without a<br>load. Do not connect the CN1 connector on<br>the SERVOPACK.                    | Chapter 4 Wiring and Connecting                                      |
| 3    | Confirmations before Trial Operation                                                                                                                                                            | 7.2 Inspections and Confirmations before Trial Operation on page 7-5 |
| 4    | Power ON                                                                                                                                                                                        | -                                                                    |
| 5    | Resetting the Absolute Encoder<br>This step is necessary only for a Servomotor<br>with an Absolute Encoder.                                                                                     | 5.15 Resetting the Absolute Encoder on page 5-48                     |

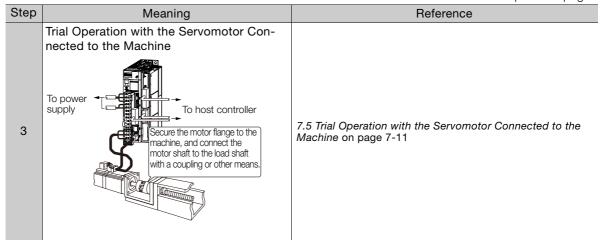
#### Trial Operation



Continued on next page.

#### 7.1.2 Flow of Trial Operation for Linear Servomotors

Continued from previous page.



## 7.1.2 Flow of Trial Operation for Linear Servomotors

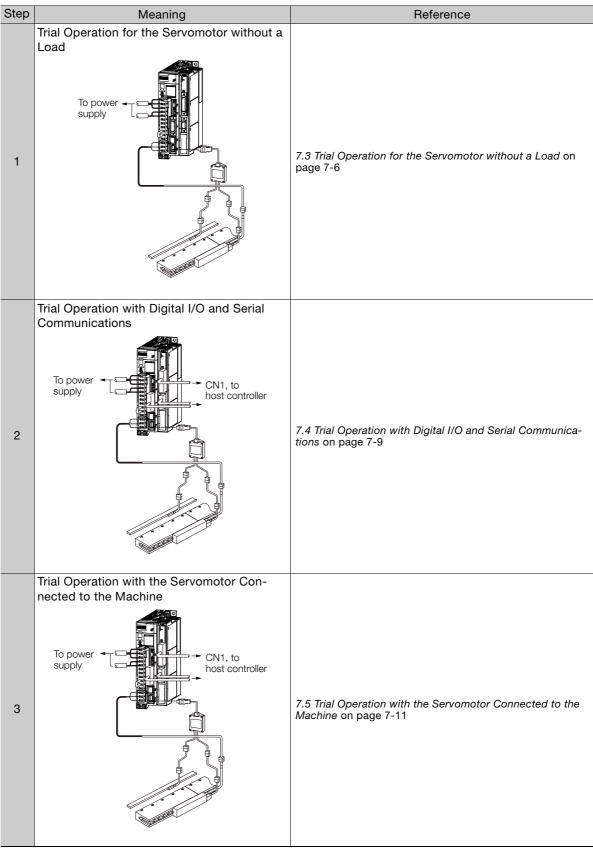
The procedure for trial operation is given below.

#### • Preparations for Trial Operation

| Step |                                                                                                                                                                                                 | Meaning                                             |                                      |                                 | Reference                                                                   |                |  |  |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------|---------------------------------|-----------------------------------------------------------------------------|----------------|--|--|
| 1    | Installation<br>Install the Servomotor and SERVOPACK<br>according to the installation conditions. First,<br>operation is checked with no load. Do not<br>connect the Servomotor to the machine. |                                                     |                                      | Chap                            | hapter 3 Installation                                                       |                |  |  |
| 2    | Wiring and Connections<br>Wire and connect the SERVOPACK. First,<br>Servomotor operation is checked without a<br>load. Do not connect the CN1 connector on<br>the SERVOPACK.                    |                                                     | Chap                                 | Chapter 4 Wiring and Connecting |                                                                             |                |  |  |
| 3    | Confir                                                                                                                                                                                          | mations before Trial Operation                      |                                      |                                 | spections and Confirmations before T<br>age 7-5                             | rial Operation |  |  |
| 4    | Power                                                                                                                                                                                           | ON                                                  |                                      | -                               |                                                                             |                |  |  |
|      | Setting                                                                                                                                                                                         | y Parameters in the S<br>No. of Parameter<br>to Set | Description                          |                                 | Remarks                                                                     | Reference      |  |  |
|      | 5-1                                                                                                                                                                                             | Pn282                                               | Linear Encoder Pitch                 |                                 | Set this parameter only if you are using a Serial Converter Unit.           | page 5-16      |  |  |
|      | 5-2                                                                                                                                                                                             | -                                                   | Writing Parameters the Linear Servom |                                 | Set this parameter only if you are not using a Serial Converter Unit.       | page 5-17      |  |  |
| 5    | 5-3                                                                                                                                                                                             | Pn080 = n.□□X□                                      | Motor Phase Sequ<br>Selection        | ence                            | -                                                                           | page 5-21      |  |  |
|      | 5-4                                                                                                                                                                                             | Pn080 = n.□□□X                                      | Polarity Sensor Se tion              | lec-                            | -                                                                           | page 5-23      |  |  |
|      | 5-5                                                                                                                                                                                             | -                                                   | Polarity Detection                   |                                 | This step is necessary only for a Linear Servomotor with a Polarity Sensor. | page 5-24      |  |  |
|      | 5-6                                                                                                                                                                                             | PnB0F and PnB10                                     | Overtravel Signal Allocations        |                                 | -                                                                           | page 5-27      |  |  |
|      | 5-7                                                                                                                                                                                             | Pn483, Pn484                                        | Force Control                        |                                 | -                                                                           | page 6-22      |  |  |
| 6    | 6       Setting the Origin of the Absolute Linear Encoder of page 5-51                                                                                                                          |                                                     |                                      |                                 |                                                                             |                |  |  |

#### 7.1.2 Flow of Trial Operation for Linear Servomotors

#### Trial Operation



Continued on next page.

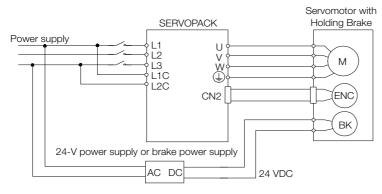
# 7.2 Inspections and Confirmations before Trial Operation

To ensure safe and correct trial operation, check the following items before you start trial operation.

- Make sure that the SERVOPACK and Servomotor are installed, wired, and connected correctly.
- Make sure that the correct power supply voltage is supplied to the SERVOPACK.
- Make sure that there are no loose parts in the Servomotor mounting.
- If you are using a Servomotor with an Oil Seal, make sure that the oil seal is not damaged. Also make sure that oil has been applied.
- If you are performing trial operation on a Servomotor that has been stored for a long period of time, make sure that all Servomotor inspection and maintenance procedures have been completed.

Refer to the manual for your Servomotor for Servomotor maintenance and inspection information.

• If you are using a Servomotor with a Holding Brake, make sure that the brake is released in advance. To release the brake, you must apply the specified voltage of 24 VDC to the brake. A circuit example for trial operation is provided below.



7.3.1 Preparations



# Trial Operation for the Servomotor without a Load

You use jog operation for trial operation of the Servomotor without a load.

Jog operation is used to check the operation of the Servomotor without connecting the SERVO-PACK to the host controller. The Servomotor is moved at the preset jog operation speed.



• During jog operation, the overtravel function is disabled. Consider the range of motion of your machine when you jog the Servomotor.



The tuning-less function is enabled as the default setting. When the tuning-less function is enabled, gain will increase and vibration may occur if the Servomotor is operated with no load. If vibration occurs, disable the tuning-less function ( $Pn170 = n.\square\square\square$ ).

### 7.3.1 Preparations

Always check the following before you execute jog operation.

- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- There must be no alarms.
- There must be no hard wire base block (HWBB).
- The servo must be OFF.
- The jog operation speed must be set considering the operating range of the machine. The jog operation speed is set with the following parameters.
  - Rotary Servomotors

|       | Jog Operation Speed          |                     |                 |              |                |  |  |  |  |
|-------|------------------------------|---------------------|-----------------|--------------|----------------|--|--|--|--|
| Pn304 | Setting Range                | Setting Unit        | Default Setting | When Enabled | Classification |  |  |  |  |
|       | 0 to 10,000                  | 1 min <sup>-1</sup> | 500             | Immediately  | Setup          |  |  |  |  |
|       | Soft Start Acceler           | ation Time          |                 |              |                |  |  |  |  |
| Pn305 | Setting Range                | Setting Unit        | Default Setting | When Enabled | Classification |  |  |  |  |
|       | 0 to 10,000                  | 1 ms                | 0               | Immediately  | Setup          |  |  |  |  |
|       | Soft Start Deceleration Time |                     |                 |              |                |  |  |  |  |
| Pn306 | Setting Range Setting Unit   |                     | Default Setting | When Enabled | Classification |  |  |  |  |
|       | 0 to 10,000                  | 1 ms                | 0               | Immediately  | Setup          |  |  |  |  |

#### Direct Drive Servomotors

|       | Jog Operation Speed          |                       |                 |              |                |  |  |  |  |
|-------|------------------------------|-----------------------|-----------------|--------------|----------------|--|--|--|--|
| Pn304 | Setting Range                | Setting Unit          | Default Setting | When Enabled | Classification |  |  |  |  |
|       | 0 to 10,000                  | 0.1 min <sup>-1</sup> | 500             | Immediately  | Setup          |  |  |  |  |
|       | Soft Start Acceler           | ation Time            |                 |              |                |  |  |  |  |
| Pn305 | Setting Range                | Setting Unit          | Default Setting | When Enabled | Classification |  |  |  |  |
|       | 0 to 10,000                  | 1 ms                  | 0               | Immediately  | Setup          |  |  |  |  |
|       | Soft Start Deceleration Time |                       |                 |              |                |  |  |  |  |
| Pn306 | Setting Range Setting Unit   |                       | Default Setting | When Enabled | Classification |  |  |  |  |
|       | 0 to 10,000                  | 1 ms                  | 0               | Immediately  | Setup          |  |  |  |  |

7.3.2 Applicable Tools

Linear Servomotors

|       | Jog Operation Sp             | eed                        |                 |              |                |  |  |
|-------|------------------------------|----------------------------|-----------------|--------------|----------------|--|--|
| Pn383 | Setting Range                | Setting Unit               | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 10,000                  | 1 mm/s                     | 50              | Immediately  | Setup          |  |  |
|       | Soft Start Acceler           | ation Time                 |                 |              |                |  |  |
| Pn305 | Setting Range                | Setting Unit               | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 10,000                  | 1 ms                       | 0               | Immediately  | Setup          |  |  |
|       | Soft Start Deceleration Time |                            |                 |              |                |  |  |
| Pn306 | Setting Range                | Setting Range Setting Unit |                 | When Enabled | Classification |  |  |
|       | 0 to 10,000                  | 1 ms                       | 0               | Immediately  | Setup          |  |  |

### 7.3.2 Applicable Tools

The following table lists the tools that you can use to perform jog operation.

| Tool             | Fn No./Function Name | Operating Procedure Reference                                              |
|------------------|----------------------|----------------------------------------------------------------------------|
| Digital Operator | Fn002                | Ω-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33) |
| SigmaWin+        | Operation – Jog      | Gerating Procedure on page 7-7                                             |

### 7.3.3 Operating Procedure

Use the following procedure for a jog operation.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select JOG Operation in the Menu Dialog Box. The Jog Operation Dialog Box will be displayed.
- 3. Read the warnings and then click the OK Button.



#### 7.3.3 Operating Procedure

4. Check the jog operation speed and then click the Servo ON Button.

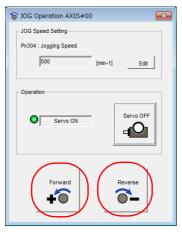




Information To change the speed, click the Edit Button and enter the new speed.

5. Click the Forward Button or the Reverse Button.

Jog operation will be performed only while you hold down the mouse button.



**6.** After you finish jog operation, turn the power supply to the SERVOPACK OFF and ON again.

This concludes the jog operation procedure.

# 7.4 Trial Operation with Digital I/O and Serial Communications

This section provides an example of trial operation with digital I/O and serial command communications. Refer to the following sections for information on operation with digital I/O and operation with serial command communications.

G Chapter 13 Operation with Digital I/O

Car Chapter 14 Operation with Serial Command Communications

**1.** Confirm that the wiring is correct, and then connect the I/O signal connectors (CN1 and CN11 connectors).

Refer to the following chapter for details on wiring. Chapter 4 Wiring and Connecting

#### 2. Turn ON the power supplies to the SERVOPACK.

If power is being supplied correctly, the CHARGE indicator on the SERVOPACK and the green indicator on the INDEXER Module will light.

If the green indicator on the INDEXER Module does not light and the red indicator lights, an alarm has occurred.

Refer to the following section to reset the alarm. *15.2 Alarm Displays* on page 15-5

**3.** Set the following items, which are necessary for trial operation. Program Table Operation

| Setting         | Reference                                         |
|-----------------|---------------------------------------------------|
| Electronic Gear | 5.14 Electronic Gear Settings on page 5-41        |
| Motor Direction | 5.4 Motor Direction Setting on page 5-15          |
| Overtravel      | 5.10 Overtravel and Related Settings on page 5-27 |

Serial Command Communications

| Setting                                 | Reference                                                       |
|-----------------------------------------|-----------------------------------------------------------------|
| Electronic Gear                         | 🗊 5.14 Electronic Gear Settings on page 5-41                    |
| Motor Direction                         | S.4 Motor Direction Setting on page 5-15                        |
| Overtravel                              | S.10 Overtravel and Related Settings on page 5-27               |
| Parameters for Serial<br>Communications | 14.3.3 Parameters Related to Serial Communications on page 14-6 |

#### 4. If you will use serial command communications, confirm that communications are performed normally.

Send the ALM command and confirm that the following acknowledgment is returned. If it is, then communications are normal.

| Serial Command | Acknowledgment            |
|----------------|---------------------------|
| ALM            | ALM[SP]BB[SP][SP][CR][LF] |

#### 5. Input the /S-ON (Servo ON) signal or send the SVON command.

The servo will turn ON. OK will be returned if you send the SVON command. Send the ALM command and confirm that the following acknowledgment is returned. If it is, then the servo is ON.

| Serial Command | Acknowledgment       |
|----------------|----------------------|
| ALM            | ALM[SP]INPOS[CR][LF] |

#### 6. Operate the Servomotor at low speed.

Program Table Operation

| PGM-<br>STEP | POS     | SPD  | RDST | RSPD | ACC | DEC | POUT | EVENT | LOOP | NEXT |
|--------------|---------|------|------|------|-----|-----|------|-------|------|------|
| 0            | l+10000 | 1000 | -    | 1000 | ••• | :   |      | IT0   | 1    | END  |

Serial Command Communications

SPD1000: Positioning speed specification of 1,000 [1,000 reference units/min]

STI+10000: Target position specification and starting positioning, Target position of +10,000 [reference units]

#### 7. While operation is in progress for step 6, confirm the following items.

| Confirmation Item                                                                                                                                                                             | Reference                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Confirm that the rotational direction of the<br>Servomotor agrees with the forward or<br>reverse reference. If they do not agree, cor-<br>rect the rotation direction of the Servomo-<br>tor. |                                                                                            |
| Confirm that no abnormal vibration, noise,<br>or temperature rise occurs. If any abnor-<br>malities are found, implement corrections.                                                         | 15.4 Troubleshooting Based on the Operation and Conditions of the Servomotor on page 15-72 |

Note: If the load machine is not sufficiently broken in before trial operation, the Servomotor may become overloaded.

7.5.1 Precautions

# 7.5 Trial Operation with the Servomotor Connected to the Machine

This section provides the procedure for trial operation with both the machine and Servomotor.

### 7.5.1 Precautions

# **WARNING**

• Operating mistakes that occur after the Servomotor is connected to the machine may not only damage the machine, but they may also cause accidents resulting in personal injury.



If you disabled the overtravel function for trial operation of the Servomotor without a load, enable the overtravel function (P-OT and N-OT signal) before you preform trial operation with the Servomotor connected to the machine in order to provide protection.

If you will use a holding brake, observe the following precautions during trial operation.

- Before you check the operation of the brake, implement measures to prevent the machine from falling due to gravity and to prevent vibration from being caused by an external force.
- First check the Servomotor operation and brake operation with the Servomotor uncoupled from the machine. If no problems are found, connect the Servomotor to the machine and perform trial operation again.

Control the operation of the brake with the /BK (Brake) signal output from the SERVOPACK. Refer to the following sections for information on wiring and the related parameter settings.

5.11 Holding Brake on page 5-31



Failures caused by incorrect wiring or incorrect voltage application in the brake circuit may cause the SERVOPACK to fail, damage the SERVOPACK, damage the equipment, or cause an accident resulting in death or injury.

Observe the precautions and instructions for wiring and trial operation precisely as described in this manual.

### 7.5.2 Preparations

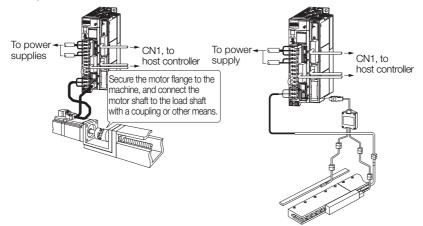
Always confirm the following before you perform the trial operation procedure for both the machine and Servomotor.

- Make sure that the procedure described in *7.4 Trial Operation with Digital I/O and Serial Communications* on page 7-9 has been completed.
- Make sure that the SERVOPACK is connected correctly to both the host controller and the peripheral devices.
  - Safety Function Wiring
    - If you are not using the safety function, leave the Safety Jumper Connector (provided as an accessory with the SERVOPACK) connected to CN8.
    - If you are using the safety function, remove the Safety Jumper Connector from CN8 and connect the safety function device.
  - Overtravel wiring
  - Brake wiring
  - Allocation of the /BK (Brake) signal to a pin on the I/O signal connector (CN1)
  - Emergency stop circuit wiring
  - Host controller wiring

7.5.3 Operating Procedure

### 7.5.3 Operating Procedure

- 1. Enable the overtravel signals.
- 2. Make the settings for the protective functions, such as the safety function, overtravel, and the brake.
  - 4.7 Connecting Safety Function Signals on page 4-48
  - 5.10 Overtravel and Related Settings on page 5-27
  - 3.11 Holding Brake on page 5-31
- **3.** Turn OFF the power supplies to the SERVOPACK. The control power supply and main circuit power supply will turn OFF.
- 4. Couple the Servomotor to the machine.



- 5. Turn ON the power supplies to the machine and host controller and turn ON the control power supply and main circuit power supply to the SERVOPACK.
- 6. Check the protective functions, such as overtravel and the brake, to confirm that they operate correctly.

Note: Enable activating an emergency stop so that the Servomotor can be stopped safely should an error occur during the remainder of the procedure.

- **7.** Perform trial operation according to 7.4 *Trial Operation with Digital I/O and Serial Communications* on page 7-9 and confirm that the same results are obtained as when trial operation was performed on the Servomotor without a load.
- 8. If necessary, adjust the servo gain to improve the Servomotor response characteristics. The Servomotor and machine may not be broken in completely for the trial operation. Therefore, let the system run for a sufficient amount of time to ensure that it is properly broken in.
- 9. For future maintenance, save the parameter settings with one of the following methods.
  Use the SigmaWin+ to save the parameters as a file.
  - Use the Parameter Copy Mode of the Digital Operator.
  - Record the settings manually.

This concludes the procedure for trial operation with both the machine and Servomotor.

# 7.6 Convenient Function to Use during Trial Operation

This section describes some convenient operations that you can use during trial operation. Use them as required.

### 7.6.1 Program Jog Operation

You can use program jog operation to perform continuous operation with a preset operation pattern, travel distance, movement speed, acceleration/deceleration time, waiting time, and number of movements.

You can use this operation when you set up the system in the same way as for normal jog operation to move the Servomotor without connecting it to the host controller in order to check Servomotor operation and execute simple positioning.

#### Preparations

Always check the following before you execute program jog operation.

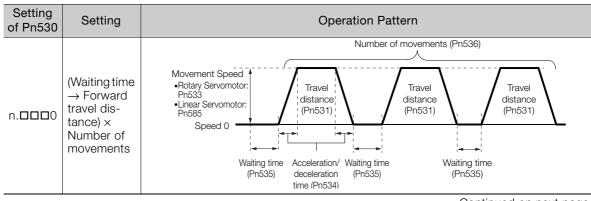
- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- There must be no alarms.
- There must be no hard wire base block (HWBB).
- The servo must be OFF.
- The range of machine motion and the safe movement speed of your machine must be considered when you set the travel distance and movement speed.
- There must be no overtravel.

#### **Additional Information**

- You can use the functions that are applicable position control. However, parameters related to Command Option Modules in PnB00 and higher are disabled.
- The overtravel function is enabled.

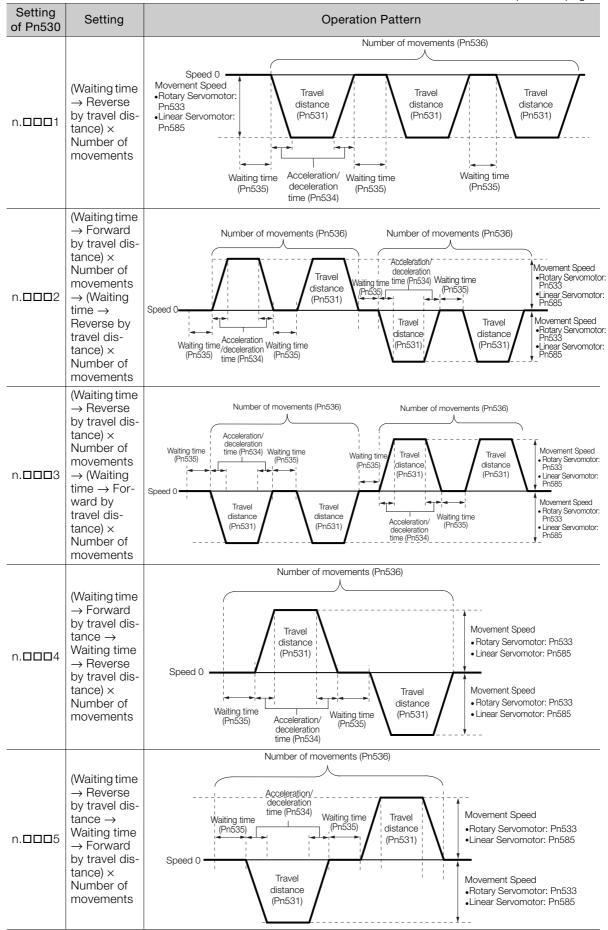
#### Program Jog Operation Pattern

An example of a program jog operation pattern is given below. In this example, the Servomotor direction is set to  $Pn000 = n.\Box\Box\Box\Box$  (Use CCW as the forward direction).



Continued on next page.

Continued from previous page.



Information If Pn530 is set to n.  $\Box$   $\Box$   $\Box$  0, n.  $\Box$   $\Box$   $\Box$  1, n.  $\Box$   $\Box$   $\Box$  4, or n.  $\Box$   $\Box$   $\Box$  5, you can set Pn536 (Program Jog Operation Number of Movements) to 0 to perform infinite time operation. You cannot use infinite time operation if Pn530 is set to n.  $\Box$   $\Box$   $\Box$  2 or n.  $\Box$   $\Box$   $\Box$  3. If you perform infinite time operation from the Digital Operator, press the **JOG/SVON** Key to turn OFF the servo to end infinite time operation.

### **Related Parameters**

Use the following parameters to set the program jog operation pattern. Do not change the settings while the program jog operation is being executed.

Rotary Servomotors

|       | Program Jog Opera                                    | tion-Related Selec                   | tions           |              |                |  |  |  |
|-------|------------------------------------------------------|--------------------------------------|-----------------|--------------|----------------|--|--|--|
| Pn530 | Setting Range                                        | Setting Unit                         | Default Setting | When Enabled | Classification |  |  |  |
|       | 0000 to 0005                                         | _                                    | 0000            | Immediately  | Setup          |  |  |  |
|       | Program Jog Opera                                    | tion Travel Distanc                  | e               |              |                |  |  |  |
| Pn531 | Setting Range                                        | Setting Unit                         | Default Setting | When Enabled | Classification |  |  |  |
|       | 1 to 1,073,741,824                                   | 1 reference unit                     | 32,768          | Immediately  | Setup          |  |  |  |
|       | Program Jog Opera                                    | Program Jog Operation Movement Speed |                 |              |                |  |  |  |
| Pn533 | Setting Range Setting Unit                           |                                      | Default Setting | When Enabled | Classification |  |  |  |
|       | 1 to 10,000                                          | 1 min <sup>-1</sup>                  | 500             | Immediately  | Setup          |  |  |  |
|       | Program Jog Operation Acceleration/Deceleration Time |                                      |                 |              |                |  |  |  |
| Pn534 | Setting Range                                        | Setting Unit                         | Default Setting | When Enabled | Classification |  |  |  |
|       | 2 to 10,000                                          | 1 ms                                 | 100             | Immediately  | Setup          |  |  |  |
|       | Program Jog Operation Waiting Time                   |                                      |                 |              |                |  |  |  |
| Pn535 | Setting Range                                        | Setting Unit                         | Default Setting | When Enabled | Classification |  |  |  |
|       | 0 to 10,000                                          | 1 ms                                 | 100             | Immediately  | Setup          |  |  |  |
|       | Program Jog Opera                                    | tion Number of Mo                    | ovements        |              |                |  |  |  |
| Pn536 | Setting Range                                        | Setting Unit                         | Default Setting | When Enabled | Classification |  |  |  |
|       | 0 to 1,000                                           | 1                                    | 1               | Immediately  | Setup          |  |  |  |

#### • Direct Drive Servomotors

| Program Jog Operation-Related Selections |                                                      |                                      |                 |              |                |  |
|------------------------------------------|------------------------------------------------------|--------------------------------------|-----------------|--------------|----------------|--|
| Pn530                                    | Setting Range                                        | Setting Unit                         | Default Setting | When Enabled | Classification |  |
|                                          | 0000 to 0005                                         | -                                    | 0000            | Immediately  | Setup          |  |
|                                          | Program Jog Opera                                    | tion Travel Distance                 | Э               |              |                |  |
| Pn531                                    | Setting Range                                        | Setting Unit                         | Default Setting | When Enabled | Classification |  |
|                                          | 1 to 1,073,741,824                                   | 1 reference unit                     | 32,768          | Immediately  | Setup          |  |
|                                          | Program Jog Opera                                    | Program Jog Operation Movement Speed |                 |              |                |  |
| Pn533                                    | Setting Range                                        | Setting Unit                         | Default Setting | When Enabled | Classification |  |
|                                          | 1 to 10,000                                          | 0.1 min <sup>-1</sup>                | 500             | Immediately  | Setup          |  |
|                                          | Program Jog Operation Acceleration/Deceleration Time |                                      |                 |              |                |  |
| Pn534                                    | Setting Range                                        | Setting Unit                         | Default Setting | When Enabled | Classification |  |
|                                          | 2 to 10,000                                          | 1 ms                                 | 100             | Immediately  | Setup          |  |
|                                          | Program Jog Opera                                    | tion Waiting Time                    |                 |              |                |  |
| Pn535                                    | Setting Range                                        | Setting Unit                         | Default Setting | When Enabled | Classification |  |
|                                          | 0 to 10,000                                          | 1 ms                                 | 100             | Immediately  | Setup          |  |
|                                          | Program Jog Operation Number of Movements            |                                      |                 |              |                |  |
| Pn536                                    | Setting Range                                        | Setting Unit                         | Default Setting | When Enabled | Classification |  |
|                                          | 0 to 1,000                                           | 1                                    | 1               | Immediately  | Setup          |  |

• Linear Servomotors

|       | Program Jog Operation-Related Selections             |                     |                 |              |                |
|-------|------------------------------------------------------|---------------------|-----------------|--------------|----------------|
| Pn530 | Setting Range                                        | Setting Unit        | Default Setting | When Enabled | Classification |
|       | 0000 to 0005                                         | _                   | 0000            | Immediately  | Setup          |
|       | Program Jog Opera                                    | tion Travel Distanc | е               |              |                |
| Pn531 | Setting Range                                        | Setting Unit        | Default Setting | When Enabled | Classification |
|       | 1 to 1,073,741,824                                   | 1 reference unit    | 32,768          | Immediately  | Setup          |
|       | Program Jog Operation Movement Speed                 |                     |                 |              |                |
| Pn585 | Setting Range                                        | Setting Unit        | Default Setting | When Enabled | Classification |
|       | 1 to 10,000                                          | 1 mm/s              | 50              | Immediately  | Setup          |
|       | Program Jog Operation Acceleration/Deceleration Time |                     |                 |              |                |
| Pn534 | Setting Range                                        | Setting Unit        | Default Setting | When Enabled | Classification |
|       | 2 to 10,000                                          | 1 ms                | 100             | Immediately  | Setup          |
|       | Program Jog Opera                                    | tion Waiting Time   |                 |              |                |
| Pn535 | Setting Range                                        | Setting Unit        | Default Setting | When Enabled | Classification |
|       | 0 to 10,000                                          | 1 ms                | 100             | Immediately  | Setup          |
|       | Program Jog Operation Number of Movements            |                     |                 |              |                |
| Pn536 | Setting Range                                        | Setting Unit        | Default Setting | When Enabled | Classification |
|       | 0 to 1,000                                           | 1                   | 1               | Immediately  | Setup          |

#### **Applicable Tools**

The following table lists the tools that you can use to perform program jog operation.

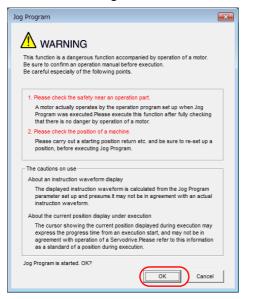
| Tool             | Fn No./Function Name                            | Reference                                                                       |  |
|------------------|-------------------------------------------------|---------------------------------------------------------------------------------|--|
| Digital Operator | Fn004                                           | Ω Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |  |
| SigmaWin+        | <b>Operation</b> – <b>Program JOG Operation</b> | Gerating Procedure on page 7-16                                                 |  |

### **Operating Procedure**

Use the following procedure for a program jog operation.

- 1. Click the 🥒 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select JOG Program in the Menu Dialog Box. The Jog Program Dialog Box will be displayed.

3. Read the warnings and then click the OK Button.

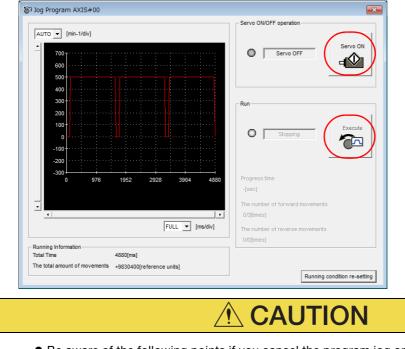


**4.** Set the operating conditions, click the **Apply** Button, and then click the **Run** Button. A graph of the operation pattern will be displayed.

|                      |                                               | Running Condition                                 |
|----------------------|-----------------------------------------------|---------------------------------------------------|
| AUTO                 | ▼ [min-1/div]                                 | Pn531:Program Jogging Travel Distance             |
| -                    | 700                                           | 3276800 [reference units] (1-1073741824)          |
|                      | 700                                           | Pn533:Program Jogging Movement Speed              |
|                      | 600                                           | 500 [min-1] (1-10000)                             |
|                      | 500                                           | Pn534:Program Jogging Acceleration/Deceleration   |
|                      | 400                                           | 26 [ms] (2-10000)                                 |
|                      | 300                                           |                                                   |
|                      | 200                                           | Pn535:Program Jogging Waiting Time                |
|                      | 100                                           | 100 [ms] (0-10000)                                |
|                      | <b>o</b>                                      | Pn536:Program Jogging Number of Movements         |
|                      | -100                                          | 3 [times] (0-1000) (0: Infinite)                  |
|                      |                                               | Pn530.0:Program Jogging Operation Pattern         |
|                      | -200                                          | 0 : (Waiting time in Pn535 -> Forward by travel d |
|                      | -300                                          |                                                   |
|                      | 0 510 1552 2520 5504                          | 4000                                              |
|                      |                                               |                                                   |
| -                    |                                               |                                                   |
| •                    |                                               | Apply                                             |
|                      | FULL 💌                                        | [ms/div]                                          |
|                      |                                               |                                                   |
| Running<br>Total Tir | e 4880[ms]                                    |                                                   |
|                      | amount of movements +9830400[reference units] | Run                                               |

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5. Click the Servo ON Button and then the Execute Button. The program jog operation will be executed.



- Be aware of the following points if you cancel the program jog operation while the Servomotor is operating.
  - If you cancel operation with the **Servo OFF** Button, the Servomotor will stop according to setting of the Servo OFF stopping method (Pn001 = n.□□□X).
  - If you cancel operation with the **Cancel** Button, the Servomotor will decelerate to a stop and then enter a zero-clamped state.

This concludes the program jog operation procedure.

7.6.2 Origin Search

### 7.6.2 Origin Search

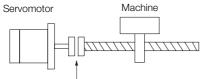
The origin search operation positions the motor to the origin within one rotation and then clamps it there.

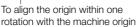


• Make sure that the load is not coupled when you execute an origin search. The Forward Drive Prohibit (P-OT) signal and Reverse Drive Prohibit (N-OT) signal are disabled during an origin search.

Use an origin search when it is necessary to align the origin within one rotation with the machine origin. The following speeds are used for origin searches.

- Rotary Servomotors: 60 min<sup>-1</sup>
- Direct Drive Servomotors: 6 min<sup>-1</sup>
- Linear Servomotors: 15 mm/s





#### Preparations

Always check the following before you execute an origin search.

- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- There must be no alarms.
- There must be no hard wire base block (HWBB).
- The servo must be OFF.

#### **Applicable Tools**

The following table lists the tools that you can use to perform an origin search.

| Tool             | Fn No./Function Name            | Reference                                                                          |  |
|------------------|---------------------------------|------------------------------------------------------------------------------------|--|
| Digital Operator | Fn003                           | Channel Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33) |  |
| SigmaWin+*       | Encoder Setting – Search Origin | G Operating Procedure on page 7-20                                                 |  |

\* Cannot be used when connecting a Linear Servomotor.

7.6.2 Origin Search

### **Operating Procedure**

Use the following procedure to perform an origin search.

- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Search Origin in the Menu Dialog Box. The Origin Search Dialog Box will be displayed.
- 3. Read the warnings and then click the OK Button.

| Origin Search                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                            |
| It is dangerous to operate this function, because the servomotor will rotate.<br>Always be sure to check the user's manual before operating.                                                                                                                               |
| Pay particular attention to the following points:                                                                                                                                                                                                                          |
| 1. Perform safety checks around moving parts.                                                                                                                                                                                                                              |
| The servomotor will actually turn at approximately 60min-1 (6min-1 with DD<br>motor) while clicking the FORWARD/REVERSE button. Perform this after<br>thoroughly checking that there is no danger from servomotor operation.                                               |
| 2. [Forward Run Prohibit (P-OT)]/[Reverse Run Prohibit (N-OT)] is disabled.                                                                                                                                                                                                |
| The Forward Run Prohibit (P-OT)/Reverse Run Prohibit (N-OT) signals are<br>disabled during origin search (the servomotor will not stop even if the<br>P-OTR-OT signals are passed). When operating, carefully verify the action<br>and position of the servomotor/machine. |
| Clicking the OK button to start the Origin Search.                                                                                                                                                                                                                         |

4. Click the Servo ON Button.

| 🎳 Origin Search AXIS#00              |
|--------------------------------------|
| Status<br>Origin Search Not Executed |
| Operation<br>Servo OFF               |
| Forward Reverse                      |

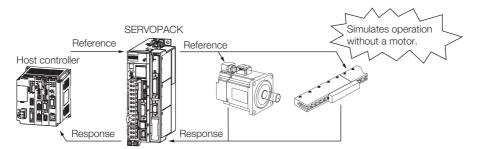
5. Click the Forward Button or the Reverse Button.

An origin search will be performed only while you hold down the mouse button. The motor will stop when the origin search has been completed.

| 🎳 Origin Search AXIS#00              |
|--------------------------------------|
| Status<br>Origin Search Not Executed |
| Operation<br>Servo ON<br>Servo OFF   |
| Forward                              |

This concludes the origin search procedure.

A test without a motor is used to check the operation of the host controller and peripheral devices by simulating the operation of the Servomotor in the SERVOPACK, i.e., without actually operating a Servomotor. This test allows you to check wiring, debug the system, and verify parameters to shorten the time required for setup work and to prevent damage to the machine that may result from possible malfunctions. The operation of the Servomotor can be checked with this test regardless of whether the Servomotor is actually connected or not.



Use  $Pn00C = n.\Box\Box\BoxX$  to enable or disable the test without a motor.

| Parameter |                             | Meaning                        | When Enabled  | Classification |
|-----------|-----------------------------|--------------------------------|---------------|----------------|
| Pn00C     | n.□□□0<br>(default setting) | Disable tests without a motor. | After restart | Setup          |
|           | n.□□□1                      | Enable tests without a motor.  |               |                |

Information An asterisk is displayed on the status display of the Digital Operator while a test without a motor is being executed.

### Motor Information and Encoder Information

The motor and encoder information is used during tests without a motor. The source of the information depends on the device connection status.

Rotary Servomotor

| Motor Connection<br>Status | Information That Is Used                                                             | Source of Information                                                                                                                                                                                                                                                                                                                                                                 |  |
|----------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Connected                  | Motor information <ul> <li>Rated motor speed</li> <li>Maximum motor speed</li> </ul> | Information in the Servemeter that is connected                                                                                                                                                                                                                                                                                                                                       |  |
| Connected                  | Encoder information <ul> <li>Encoder resolution</li> <li>Encoder type</li> </ul>     | Information in the Servomotor that is connected                                                                                                                                                                                                                                                                                                                                       |  |
| Not connected              | Motor information<br>• Rated motor speed<br>• Maximum motor speed                    | <ul> <li>Setting of Pn000 = n.X□□□ (Rotary/Linear Startup Selection When Encoder Is Not Connected)</li> <li>Rated motor speed and maximum motor speed The values previously saved in the SERVOPACK will be used for the rated motor speed and maximum motor speed. Use the motor displays (Un020: Rated Motor Speed and Un021: Maximum Motor Speed: ) to check the values.</li> </ul> |  |
|                            | Encoder information <ul> <li>Encoder resolution</li> <li>Encoder type</li> </ul>     | <ul> <li>Encoder resolution: Setting of Pn00C = n.□□X□<br/>(Encoder Resolution for Tests without a Motor)</li> <li>Encoder type: Setting of Pn00C = n.□X□□ (Encoder<br/>Type Selection for Tests without a Motor)</li> </ul>                                                                                                                                                          |  |

If you use fully-closed loop control, the external encoder information is also used.

| External Encoder Connection<br>Status | Information That Is<br>Used                       | Source of Information                                                       |
|---------------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------|
| Connected                             | External encoder infor-<br>mation                 | Information in the external encoder that is con-<br>nected                  |
| Not connected                         | <ul><li>Resolution</li><li>Encoder type</li></ul> | <ul><li>Resolution: 256</li><li>Encoder type: Incremental encoder</li></ul> |

#### Linear Servomotors

| Motor Connection<br>Status | Information That Is Used                                                             | Source of Information                                                                                                                                                                                     |
|----------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            | Motor information                                                                    | Information in the motor that is connected                                                                                                                                                                |
| Connected                  | Linear encoder informa-<br>tion<br>• Resolution<br>• Encoder pitch<br>• Encoder type | Information in the linear encoder that is connected                                                                                                                                                       |
|                            | Motor information                                                                    | Setting of Pn000 = n.XDDD (Rotary/Linear Startup Selection When Encoder Is Not Connected)                                                                                                                 |
| Not connected              | Linear encoder informa-<br>tion<br>• Resolution<br>• Encoder pitch<br>• Encoder type | <ul> <li>Resolution: 256</li> <li>Encoder pitch: Setting of Pn282 (Linear Encoder Pitch)</li> <li>Encoder type: Setting of Pn00C = n. IXIII (Encoder Type Selection for Tests without a Motor)</li> </ul> |

#### Related Parameters

| Parameter |                             | Meaning                                                                     | When Enabled  | Classification |
|-----------|-----------------------------|-----------------------------------------------------------------------------|---------------|----------------|
| Pn000     | n.0□□□<br>(default setting) | When an encoder is not connected, start as SERVOPACK for Rotary Servomotor. | After restart | Setup          |
| Pn000     | n.1000                      | When an encoder is not connected, start as SERVOPACK for Linear Servomotor. | Alter restart | Getup          |

|           | Linear Encoder P            | itch                                               |                       |     |                 |  |                |  |
|-----------|-----------------------------|----------------------------------------------------|-----------------------|-----|-----------------|--|----------------|--|
| Pn282     | Setting Range               | Setting Unit                                       | Default Setting       | Whe | hen Enabled     |  | Classification |  |
|           | 0 to 6,553,600              | 0.01 µm                                            | 0                     | Af  | ter restart     |  | Setup          |  |
| Parameter |                             | Meaning                                            |                       |     | When Enabled    |  | Classification |  |
|           | n.□□0□<br>(default setting) | Use 13 bits as enco<br>without a motor.            | der resolution for te | sts | - After restart |  |                |  |
|           | n.0010                      | Use 20 bits as enco<br>without a motor.            | der resolution for te | sts |                 |  |                |  |
| Pn00C     | n.0020                      | Use 22 bits as enco<br>without a motor.            | der resolution for te | sts |                 |  | Setup          |  |
| FILLOC    | n.□□3□                      | Use 24 bits as enco<br>without a motor.            | Aller Testar          | L   | Setup           |  |                |  |
|           | n.□0□□<br>(default setting) | Use an incremental e a motor.                      | thout                 |     |                 |  |                |  |
|           | n.0100                      | Use an absolute encoder for tests without a motor. |                       |     |                 |  |                |  |

#### Motor Position and Speed Responses

For a test without a motor, the following responses are simulated for references from the host controller according to the gain settings for position or speed control.

- Servomotor position
- Motor speed
- External encoder position

The load model will be for a rigid system with the moment of inertia ratio that is set in Pn103.

### Restrictions

The following functions cannot be used during the test without a motor.

- Regeneration and dynamic brake operation
- Brake output signal
- Items marked with " $\!\times\!\!$ " in the following utility function table

| SigmaWin+                       |                                | Digital Operator |                                                                        | Execu                  | Executable?        |            |  |
|---------------------------------|--------------------------------|------------------|------------------------------------------------------------------------|------------------------|--------------------|------------|--|
| Button in<br>Menu<br>Dialog Box | SigmaWin+<br>Function Name     | Fn No.           | Utility Function Name                                                  | Motor Not<br>Connected | Motor<br>Connected | Reference  |  |
|                                 | Initialize <sup>*1</sup>       | FnB0B            | Initialize INDEXER<br>Parameter Settings                               | 0                      | 0                  | page 5-10  |  |
|                                 | Software Reset                 | Fn030            | Software Reset                                                         | 0                      | 0                  | page 6-30  |  |
| Basic<br>Functions              |                                | Fn011            | Display Servomotor<br>Model                                            | 0                      | 0                  |            |  |
|                                 |                                | Fn012            | Display Software Ver-<br>sion                                          | 0                      | 0                  |            |  |
|                                 | Product Information            | Fn01E            | Display SERVOPACK<br>and Servomotor IDs                                | 0                      | 0                  | page 9-2   |  |
|                                 |                                | Fn01F            | Display Servomotor ID<br>from Feedback Option<br>Module                | 0                      | 0                  |            |  |
|                                 | Absolute Encoder<br>Reset      | Fn008            | Reset Absolute<br>Encoder                                              | ×                      | 0                  | page 5-48  |  |
|                                 | Multi-turn Limit Setup         | Fn013            | Multiturn Limit Setting<br>after Multiturn Limit<br>Disagreement Alarm | ×                      | 0                  | page 6-26  |  |
| Encoder<br>Setting              | Search Origin <sup>*2</sup>    | Fn003            | Origin Search                                                          | 0                      | 0                  | page 7-19  |  |
| Setting                         | Zero Point Position<br>Setting | Fn020            | Set Absolute Linear<br>Encoder Origin                                  | ×                      | 0                  | page 5-51  |  |
|                                 | Polarity Detection             | Fn080            | Polarity Detection                                                     | ×                      | ×                  | page 5-26  |  |
|                                 | _                              | FnB09            | Set Absolute Encoder<br>Origin                                         | 0                      | 0                  | page 12-6  |  |
|                                 | Edit Program Table             | FnB03            | Edit/Save Program<br>Table                                             | 0                      | 0                  | page 13-14 |  |
|                                 |                                | FnB06            | Initialize Program Table                                               | 0                      | 0                  |            |  |
| Table                           | Edit ZONE Table                | FnB04            | Edit/Save ZONE Table                                                   | 0                      | 0                  | page 13-55 |  |
| Editing                         |                                | FnB07            | Initialize ZONE Table                                                  | 0                      | 0                  | page to co |  |
|                                 | Edit Jog Speed Table           | FnB05            | Edit/Save Jog Speed<br>Table                                           | 0                      | 0                  | page 13-46 |  |
|                                 |                                | FnB08            | Initialize Jog Speed<br>Table                                          | 0                      | 0                  |            |  |
|                                 |                                | FnB0D            | Display INDEXER<br>Alarm History                                       | 0                      | 0                  | page 15-50 |  |
| Trouble-                        | Display Alarm                  | FnB0C            | Reset INDEXER Alarm<br>History                                         | 0                      | 0                  | page 15-51 |  |
| shooting                        |                                |                  | Reset INDEXER Alarm                                                    | 0                      | 0                  | page 15-48 |  |
|                                 |                                | Fn014            | Reset Option Module<br>Configuration Error                             | 0                      | 0                  | page 15-52 |  |
|                                 | Reset Motor Type<br>Alarm      | Fn021            | Reset Motor Type<br>Alarm                                              | 0                      | 0                  | page 15-54 |  |
|                                 | Jog                            | Fn002            | Jog                                                                    | 0                      | 0                  | page 7-6   |  |
| Operation                       | Program JOG Opera-<br>tion     | Fn004            | Jog Program                                                            | 0                      | 0                  | page 7-13  |  |
| Monitor                         | Monitor                        | FnB0A            | INDEXER Status Moni-<br>tor                                            | 0                      | 0                  | page 9-3   |  |

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| , c                             | SigmaWin+                                                         | Digital Operator |                                                               | Execu | table?             | nous page. |
|---------------------------------|-------------------------------------------------------------------|------------------|---------------------------------------------------------------|-------|--------------------|------------|
| Button in<br>Menu<br>Dialog Box | Menu SigmaWin+                                                    |                  | Fn No. Utility Function Name                                  |       | Motor<br>Connected | Reference  |
|                                 | Tuning -<br>Autotuning without<br>Host Reference                  | Fn201            | Advanced Autotuning without Reference                         | ×     | ×                  | page 8-23  |
|                                 | Tuning -<br>Autotuning with Host<br>Reference                     | Fn202            | Advanced Autotuning with Reference                            | ×     | ×                  | page 8-34  |
|                                 | Tuning -<br>Custom Tuning                                         | Fn203            | One-Parameter Tuning                                          | ×     | ×                  | page 8-41  |
| Tuning                          | Tuning -<br>Custom Tuning -<br>Adjust Anti-reso-<br>nance Control | Fn204            | Adjust Anti-resonance<br>Control                              | ×     | ×                  | page 8-49  |
|                                 | Tuning -<br>Custom Tuning -<br>Vibration Suppres-<br>sion         | Fn205            | Vibration Suppression                                         | ×     | ×                  | page 8-54  |
|                                 | Response Level Set-<br>ting                                       | Fn200            | Tuning-less Level Set-<br>ting                                | ×     | ×                  | page 8-11  |
| Diagnostic                      | Easy FFT                                                          | Fn206            | Easy FFT                                                      | ×     | ×                  | page 8-89  |
|                                 | Adjust the Analog                                                 | Fn00C            | Adjust Analog Monitor<br>Output Offset                        | 0     | 0                  | page 9-10  |
|                                 | Monitor Output                                                    | Fn00D            | Adjust Analog Monitor<br>Output Gain                          | 0     | 0                  | page 9-10  |
| Othere                          | Adjust the Motor<br>Current Detection                             | Fn00E            | Autotune Motor Cur-<br>rent Detection Signal<br>Offset        | ×     | 0                  | page 6-36  |
| Others                          | Offsets                                                           | Fn00F            | Manually Adjust Motor<br>Current Detection Sig-<br>nal Offset | ×     | 0                  | paye 0-00  |
|                                 | Initialize Vibration<br>Detection Level                           | Fn01B            | Initialize Vibration<br>Detection Level                       | ×     | ×                  | page 6-32  |
|                                 | Write Prohibited Set-<br>ting                                     | Fn010            | Write Prohibition Set-<br>ting                                | 0     | 0                  | page 5-6   |

Continued from previous page.

\*1. An Initialize Button will be displayed in the Parameter Editing Dialog Box.\*2. Cannot be used when connecting a Linear Servomotor.

# Tuning

This chapter provides information on the flow of tuning, details on tuning functions, and related operating procedures.

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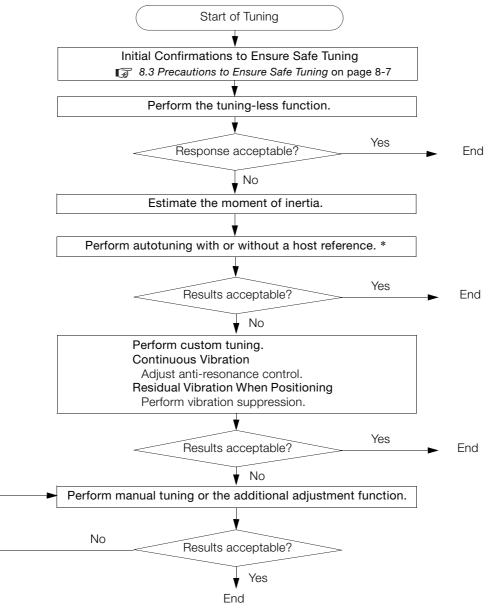
# 8.1 Overview and Flow of Tuning

Tuning is performed to optimize response by adjusting the servo gains in the SERVOPACK.

The servo gains are set using a combination of parameters, such as parameters for the speed loop gain, position loop gain, filters, friction compensation, and moment of inertia ratio. These parameters influence each other, so you must consider the balance between them.

The servo gains are set to stable settings by default. Use the various tuning functions to increase the response even further for the conditions of your machine.

The basic tuning procedure is shown in the following flowchart. Make suitable adjustments considering the conditions and operating requirements of your machine.



\* If possible, perform autotuning with a host reference.

If a host controller is not available, set an operation pattern that is as close as possible to the host reference and perform autotuning without a host reference. If an operation pattern that is close to the host reference is not possible, perform autotuning with a host reference

If an operation pattern that is close to the host reference is not possible, perform autotuning with a host reference while performing program jogging.

### 8.1.1 Tuning Functions

| Tuning Function                      | Outline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Reference |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Tuning-less Function                 | This automatic adjustment function is designed to enable stable opera-<br>tion without servo tuning. This function can be used to obtain a stable<br>response regardless of the type of machine or changes in the load. You<br>can use it with the default settings.                                                                                                                                                                                                                            | page 8-11 |
| Moment of Inertia<br>Estimation      | The moment of inertia ratio is calculated by operating the Servomotor a few times.<br>The moment of inertia ratio that is calculated here is used in other tuning functions.                                                                                                                                                                                                                                                                                                                    | page 8-15 |
| Autotuning without<br>Host Reference | <ul> <li>The following parameters are automatically adjusted in the internal references in the SERVOPACK during automatic operation.</li> <li>Gains (e.g., position loop gain and speed loop gain)</li> <li>Filters (torque reference filter and notch filters)</li> <li>Friction compensation</li> <li>Anti-resonance control</li> <li>Vibration suppression</li> </ul>                                                                                                                        | page 8-23 |
| Autotuning with Host<br>Reference    | <ul> <li>The following parameters are automatically adjusted with the position reference input from the host controller while the machine is in operation. You can use this function for fine-tuning after you perform autotuning without a host reference.</li> <li>Gains (e.g., position loop gain and speed loop gain)</li> <li>Filters (torque reference filter and notch filters)</li> <li>Friction compensation</li> <li>Anti-resonance control</li> <li>Vibration suppression</li> </ul> | page 8-34 |
| Custom Tuning                        | <ul> <li>The following parameters are adjusted with the position reference or speed reference input from the host controller while the machine is in operation.</li> <li>Gains (e.g., position loop gain and speed loop gain)</li> <li>Filters (torque reference filter and notch filters)</li> <li>Friction compensation</li> <li>Anti-resonance control</li> </ul>                                                                                                                            | page 8-41 |
| Anti-resonance<br>Control Adjustment | This function effectively suppresses continuous vibration.                                                                                                                                                                                                                                                                                                                                                                                                                                      | page 8-49 |
| Vibration<br>Suppression             | This function effectively suppresses residual vibration if it occurs when positioning.                                                                                                                                                                                                                                                                                                                                                                                                          | page 8-54 |
| Speed Ripple Com-<br>pensation       | This function reduces the ripple in the motor speed.                                                                                                                                                                                                                                                                                                                                                                                                                                            | page 8-58 |
| Additional<br>Adjustment Function    | This function combines autotuning with custom tuning. You can use it to improve adjustment results.                                                                                                                                                                                                                                                                                                                                                                                             | page 8-64 |
| Manual Tuning                        | You can manually adjust the servo gains to adjust the response.                                                                                                                                                                                                                                                                                                                                                                                                                                 | page 8-73 |

The following table provides an overview of the tuning functions.

### 8.1.2 Diagnostic Tool

You can use the following tools to measure the frequency characteristics of the machine and set notch filters.

| Diagnostic Tool Outline |                                                                                                                                               | Reference |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Mechanical Analysis     | The machine is subjected to vibration to detect resonance frequencies.<br>The measurement results are displayed as waveforms or numeric data. | page 8-88 |
| Easy FFT                | The machine is subjected to vibration to detect resonance frequencies.<br>The measurement results are displayed only as numeric data.         | page 8-89 |

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# 8.2 Monitoring Methods

You can use the data tracing function of the SigmaWin+ or the analog monitor signals of the SERVOPACK for monitoring. If you perform custom tuning or manual tuning, always use the above functions to monitor the machine operating status and SERVOPACK signal waveform while you adjust the servo gains.

Check the adjustment results with the following response waveforms.

| Item                     | Unit                   |                   |  |  |
|--------------------------|------------------------|-------------------|--|--|
| nem                      | Rotary Servomotor      | Linear Servomotor |  |  |
| Torque reference         | %                      |                   |  |  |
| Feedback speed           | min <sup>-1</sup>      | mm/s              |  |  |
| Position reference speed | min <sup>-1</sup> mm/s |                   |  |  |
| Position deviation       | Reference units        |                   |  |  |

8.3.1 Overtravel Settings

# 8.3 Precautions to Ensure Safe Tuning

## 

- Observe the following precautions when you perform tuning.
  - Do not touch the rotating parts of the motor when the servo is ON.
- Before starting the Servomotor, make sure that an emergency stop can be performed at any time.
- Make sure that trial operation has been successfully performed without any problems.
- Provide an appropriate stopping device on the machine to ensure safety.

Perform the following settings in a way that is suitable for tuning.

### 8.3.1 Overtravel Settings

Overtravel settings are made to force the Servomotor to stop for a signal input from a limit switch when a moving part of the machine exceeds the safe movement range.

Refer to the following section for details.

5.10 Overtravel and Related Settings on page 5-27

### 8.3.2 Torque Limit Settings

You can limit the torque that is output by the Servomotor based on calculations of the torque required for machine operation. You can use torque limits to reduce the amount of shock applied to the machine when problems occur, such as collisions or interference. If the torque limit is lower than the torque that is required for operation, overshooting or vibration may occur.

Refer to the following section for details. 6.6 Internal Torque Limits on page 6-22

### 8.3.3 Setting the Position Deviation Overflow Alarm Level

The position deviation overflow alarm is a protective function that is enabled when the SERVO-PACK is used in position control.

If the alarm level is set to a suitable value, the SERVOPACK will detect excessive position deviation and will stop the Servomotor if the Servomotor operation does not agree with the reference.

The position deviation is the difference between the position reference value and the actual position.

You can calculate the position deviation from the position loop gain (Pn102) and the motor speed with the following formula.

#### Rotary Servomotors

Position deviation [reference units] =  $\frac{\text{Motor speed [min^{-1}]}}{60} \times \frac{\text{Encoder resolution}^{*1}}{\text{Pn102 [0.1/s]/10}^{*2,*3}} \times \frac{\text{Pn210}}{\text{Pn20E}}$ 

#### Linear Servomotors

|                                      | Motor speed [mm/s]                   | Resolution                               | Pn210 |
|--------------------------------------|--------------------------------------|------------------------------------------|-------|
| Position deviation [reference units] | = Pn102 [0.1/s]/10 <sup>*2, *3</sup> | $\times$ Linear encoder pitch [µm]/1,000 | Pn20E |

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#### 8.3.3 Setting the Position Deviation Overflow Alarm Level

Position Deviation Overflow Alarm Level (Pn520) [setting unit: reference units]

#### Rotary Servomotors

 $Pn520 > \frac{Maximum motor speed [min<sup>-1</sup>]}{60} \times \frac{Encoder resolution<sup>*1</sup>}{Pn102 [0.1/s]/10^{*2, *3}} \times \frac{Pn210}{Pn20E} \times (\underline{1.2 \text{ to } 2)^{*4}}$ • Linear Servomotors

 $\mathsf{Pn520} > \frac{\mathsf{Maximum motor speed [mm/s]}}{\mathsf{Pn102 [0.1/s]/10}^{*2,*3}} \times \frac{\mathsf{Resolution}}{\mathsf{Linear encoder pitch [µm]/1,000}} \times \frac{\mathsf{Pn210}}{\mathsf{Pn20E}} \times \frac{(1.2 \text{ to } 2)^{*4}}{\mathsf{Pn20E}}$ 

\*1. Refer to the following section for details.

5.14 Electronic Gear Settings on page 5-41

- \*2. When model following control (Pn140 = n.□□□1) is enabled, use the setting of Pn141 (Model Following Control Gain) instead of the setting of Pn102 (Position Loop Gain).
- \*3. To check the setting of Pn102 on the Digital Operator, change the parameter display setting to display all parameters (Pn00B = n.□□□1).
- \*4. The underlined coefficient "× (1.2 to 2)" adds a margin to prevent an A.d00 alarm (Position Deviation Overflow) from occurring too frequently.

If you set a value that satisfies the formula, an A.d00 alarm (Position Deviation Overflow) should not occur during normal operation.

If the Servomotor operation does not agree with the reference, position deviation will occur, an error will be detected, and the Servomotor will stop.

The following calculation example uses a Rotary Servomotor with a maximum motor speed of

6,000 and an encoder resolution of 16,777,216 (24 bits). Pn102 is set to 400.  $\frac{Pn210}{Pn20E} = \frac{1}{1}$ 

 $Pn520 = \frac{6,000}{60} \times \frac{16,777,216}{400/10} \times \frac{1}{16} \times 2$  $= 2,621,440 \times 2$ 

= 5,242,880 (default setting of Pn520)

If the acceleration/deceleration rate required for the position reference exceeds the tracking capacity of the Servomotor, the tracking delay will increase and the position deviation will no longer satisfy the above formulas. If this occurs, lower the acceleration/deceleration rate so that the Servomotor can follow the position reference or increase the position deviation overflow alarm level.

#### **Related Parameters**

|       | Position Deviation Overflow Alarm Level   |                  |                 |              |                |  |  |  |  |
|-------|-------------------------------------------|------------------|-----------------|--------------|----------------|--|--|--|--|
| Pn520 | Setting Range                             | Setting Unit     | Default Setting | When Enabled | Classification |  |  |  |  |
|       | 1 to 1,073,741,823                        | 1 reference unit | 5,242,880       | Immediately  | Setup          |  |  |  |  |
|       | Position Deviation Overflow Warning Level |                  |                 |              |                |  |  |  |  |
| Pn51E | Setting Range                             | Setting Unit     | Default Setting | When Enabled | Classification |  |  |  |  |
|       | 10 to 100                                 | 1%               | 100             | Immediately  | Setup          |  |  |  |  |

#### **Related Alarm**

| Alarm Number | Alarm Name                     | Alarm Meaning                                                                                                       |
|--------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------|
| A.d00        | Position Deviation<br>Overflow | This alarm occurs if the position deviation exceeds the setting of Pn520 (Position Deviation Overflow Alarm Level). |

### **Related Warning**

| Warning Number | Warning Name                   | Warning Meaning                                                                                            |
|----------------|--------------------------------|------------------------------------------------------------------------------------------------------------|
| A.900          | Position Deviation<br>Overflow | This warning occurs if the position deviation exceeds the specified percentage (Pn520 $\times$ Pn51E/100). |

8.3.4 Vibration Detection Level Setting

### 8.3.4 Vibration Detection Level Setting

You can set the vibration detection level (Pn312) to more accurately detect A.520 alarms (Vibration Alarm) and A.911 warnings (Vibration Warning) when vibration is detected during machine operation.

Set the initial vibration detection level to an appropriate value. Refer to the following section for details.

6.10 Initializing the Vibration Detection Level on page 6-32

# 8.3.5 Setting the Position Deviation Overflow Alarm Level at Servo ON

If the servo is turned ON when there is a large position deviation, the Servomotor will attempt to return to the original position to bring the position deviation to 0, which may create a hazardous situation. To prevent this, you can set a position deviation overflow alarm level at servo ON to restrict operation.

The related parameters and alarms are given in the following tables.

#### **Related Parameters**

|       | Position Deviation Overflow Alarm Level at Servo ON   |                  |                 |                |                |  |  |  |
|-------|-------------------------------------------------------|------------------|-----------------|----------------|----------------|--|--|--|
| Pn526 | Setting Range Setting Unit Default Setting            |                  | When Enabled    | Classification |                |  |  |  |
|       | 1 to 1,073,741,823                                    | 1 reference unit | 5,242,880       | Immediately    | Setup          |  |  |  |
|       | Position Deviation Overflow Warning Level at Servo ON |                  |                 |                |                |  |  |  |
| Pn528 | Setting Range                                         | Setting Unit     | Default Setting | When Enabled   | Classification |  |  |  |
|       | 10 to 100                                             | 1%               | 100             | Immediately    | Setup          |  |  |  |

Rotary Servomotors

|       | Speed Limit Level at Servo ON |                     |                 |              |                |  |  |
|-------|-------------------------------|---------------------|-----------------|--------------|----------------|--|--|
| Pn529 | Setting Range                 | Setting Unit        | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 10,000                   | 1 min <sup>-1</sup> | 10,000          | Immediately  | Setup          |  |  |

· Linear Servomotors

|       | Speed Limit Level at Servo ON |              |                 |              |                |  |  |
|-------|-------------------------------|--------------|-----------------|--------------|----------------|--|--|
| Pn584 | Setting Range                 | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 10,000                   | 1 mm/s       | 10,000          | Immediately  | Setup          |  |  |

#### **Related Alarms**

| Alarm Number | Alarm Name                                                             | Alarm Meaning                                                                                                                                                                                                                                                                                                             |
|--------------|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A.d01        | Position Deviation<br>Overflow Alarm at<br>Servo ON                    | This alarm occurs if the servo is turned ON after the position devia-<br>tion exceeded the setting of Pn526 (Excessive Position Deviation<br>Alarm Level at Servo ON) while the servo was OFF.                                                                                                                            |
| A.d02        | Position Deviation<br>Overflow Alarm for<br>Speed Limit at Servo<br>ON | If position deviation remains in the deviation counter, the setting of<br>Pn529 or Pn584 (Speed Limit Level at Servo ON) will limit the speed<br>when the servo is turned ON. This alarm occurs if a position refer-<br>ence is input and the setting of Pn520 (Excessive Position Deviation<br>Alarm Level) is exceeded. |

Refer to the following section for information on troubleshooting alarms. *15.2.4 Resetting INDEXER Alarms* on page 15-48 8.3.5 Setting the Position Deviation Overflow Alarm Level at Servo ON

### **Related Warning**

| Warning Number | Warning Name                                          | Warning Meaning                                                                                                                  |
|----------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| A.901          | Position Deviation<br>Overflow Warning<br>at Servo ON | This warning occurs if the servo is turned ON while the position deviation exceeds the specified percentage (Pn526 × Pn528/100). |

8.4.1 Application Restrictions

# 8.4 **Tuning-less Function**

The tuning-less function performs autotuning to obtain a stable response regardless of the type of machine or changes in the load. Autotuning is started when the servo is turned ON.



- The Servomotor may momentarily emit a sound or vibrate the first time the servo is turned ON after the Servomotor is connected to the machine.
   This sound is caused by setting the automatic notch filter. It does not indicate a problem.
   However, if this sound or vibration continues, manually set a function to suppress vibration
- (e.g., a notch filter).
  The Servomotor may vibrate if it exceeds the allowable load moment of inertia. If that occurs, set the tuning-less load level to 2 (Pn170 = n.2□□□) or reduce the Tuning-less Rigidity Level (Pn170 = n.□X□□).
- To ensure safety, make sure that you can perform an emergency stop at any time when you execute the tuning-less function.

### 8.4.1 Application Restrictions

The following application restrictions apply to the tuning-less function.

| 0 11                                        | 113         | 0                                                                                                                                              |
|---------------------------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Function                                    | Executable? | Remarks                                                                                                                                        |
| Vibration Detection Level<br>Initialization | 0           | -                                                                                                                                              |
| Moment of Inertia Estimation                | ×           | Disable the tuning-less function (Pn170 = $n.\Box\Box\Box$ 0) before you execute moment of inertia estimation.                                 |
| Autotuning without Host<br>Reference        | ×           | Disable the tuning-less function (Pn170 = $n.\Box\Box\Box$ 0)<br>before you execute autotuning without a host reference.                       |
| Autotuning with Host Reference              | ×           | -                                                                                                                                              |
| Custom Tuning                               | ×           | -                                                                                                                                              |
| Anti-Resonance Control<br>Adjustment        | ×           | _                                                                                                                                              |
| Vibration Suppression                       | ×           | -                                                                                                                                              |
| Easy FFT                                    | 0           | The tuning-less function is disabled while you execute<br>Easy FFT and then it is enabled when Easy FFT has been<br>completed.                 |
| Friction Compensation                       | ×           | -                                                                                                                                              |
| Gain Selection                              | ×           | -                                                                                                                                              |
| Mechanical Analysis                         | 0           | The tuning-less function is disabled while you execute mechanical analysis and then it is enabled when mechanical analysis has been completed. |

\* O: Yes ×: No

8.4.2 Operating Procedure

### 8.4.2 Operating Procedure

The tuning-less function is enabled in the default settings. No specific procedure is required. You can use the following parameter to enable or disable the tuning-less function.

| Parameter |                             | Meaning                                                                | When Enabled  | Classification |
|-----------|-----------------------------|------------------------------------------------------------------------|---------------|----------------|
|           | n.🗆 🗆 🗆 0                   | Disable tuning-less function.                                          |               |                |
| Pn170     | n.□□□1<br>(default setting) | Enable tuning-less function.                                           | After restart | Setup          |
|           | n.□□0□<br>(default setting) | Use for speed control.                                                 |               |                |
|           | n.0010                      | Use for speed control and use host controller<br>for position control. |               |                |

When you enable the tuning-less function, you can select the tuning-less type. Normally, set Pn14F to n.  $\Box \Box \Box \Box$  (Use tuning-less type 3) (default setting). If compatibility with previous models is required, set Pn14F to n.  $\Box \Box \Box \Box$  (Use tuning-less type 1) or n.  $\Box \Box \Box \Box$  (Use tuning-less type 2).

| Parameter |                             | Meaning                                                                                  | When Enabled | Classification |
|-----------|-----------------------------|------------------------------------------------------------------------------------------|--------------|----------------|
|           | n.□□0□                      | Use tuning-less type 1.                                                                  |              |                |
| Pn14F     | n.0010                      | Use tuning-less type 2. (The noise level is improved more than with tuning-less type 1.) |              | Tuning         |
|           | n.□□2□<br>(default setting) | Use tuning-less type 3.                                                                  |              |                |

### **Tuning-less Level Settings**

If vibration or other problems occur, change the tuning-less levels. To change the tuning-less levels, use the SigmaWin+.

#### Preparations

Always check the following before you set the tuning-less levels.

- The tuning-less function must be enabled (Pn170 =  $n.\Box\Box\Box$ 1).
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).

#### ♦ Procedure

Use the following procedure to set the tuning-less levels.

In addition to the following procedure, you can also set the parameters directly. Refer to *Related Parameters*, below, for the parameters to set.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Response Level Setting in the Menu Dialog Box. The Tuning-less Level Setting-Adj Dialog Box will be displayed.

8.4.3 Troubleshooting Alarms

Click the ▲ or ▼ Button to adjust the tuning-less level setting. Increase the tuning-less level setting to increase the response. Decrease the tuning-less level setting to suppress vibration.

The default response level setting is 4.

| Tuning-less Level   | Description          | Remarks                                                                                                                         |
|---------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 7                   | Response level: High |                                                                                                                                 |
| 6                   |                      | You cannot select these levels if tuning-less type 1 or 2 ( $Pn14F = n.\Box\Box\Box\Box$ or $n.\Box\Box\Box\Box\Box$ ) is used. |
| 5                   |                      |                                                                                                                                 |
| 4 (default setting) |                      |                                                                                                                                 |
| 3                   |                      |                                                                                                                                 |
| 2                   |                      | -                                                                                                                               |
| 1                   | 25                   |                                                                                                                                 |
| 0                   | Response level: Low  |                                                                                                                                 |

#### 4. Click the Completed Button.

The adjustment results will be saved in the SERVOPACK.

#### Related Parameters

#### Tuning-less Rigidity Level

If you use tuning-less type 1 or 2 (Pn14F =  $n.\square\square\square\square$  or  $n.\square\square\square\square$ ), set the tuning-less level to between 0 and 4 (Pn170 =  $n.\square\square\square\square$  to  $n.\square4\square\square$ ). Do not set the tuning-less level to between 5 and 7 (Pn170 =  $n.\square5\square\square$  to  $n.\square7\square\square$ ).

| F     | Parameter                   | Description                                 |    | Vhen Enabled | Classification |
|-------|-----------------------------|---------------------------------------------|----|--------------|----------------|
|       | n.0000                      | Tuning-less rigidity level 0 (low rigidity) | )  |              |                |
|       | n.0100                      | Tuning-less rigidity level 1                |    |              |                |
| Pn170 | n.🗆2🗆 🗆                     | Tuning-less rigidity level 2                |    |              |                |
|       | n.🗆 3 🗆 🗆                   | Tuning-less rigidity level 3                |    |              |                |
|       | n.□4□□<br>(default setting) | Tuning-less rigidity level 4                |    | Immediately  | Setup          |
|       | n.¤5¤¤                      | Tuning-less rigidity level 5                |    |              |                |
|       | n.□6□□                      | Tuning-less rigidity level 6                |    |              |                |
|       | n.0700                      | Tuning-less rigidity level 7 (high rigidity | /) |              |                |

#### Tuning-less Load Level

| Parameter |                             | Description              | When Enabled | Classification |
|-----------|-----------------------------|--------------------------|--------------|----------------|
| Pn170     | n.0000                      | Tuning-less load level 0 |              |                |
|           | n.1000<br>(default setting) | Tuning-less load level 1 | Immediately  | Setup          |
|           | n.2000                      | Tuning-less load level 2 |              |                |

### 8.4.3 Troubleshooting Alarms

An A.521 alarm (Autotuning Alarm) will occur if a resonant sound occurs or if excessive vibration occurs during position control. If an alarm occurs, implement the following measures.

- Resonant Sound
- Decrease the setting of Pn170 =  $n.X\Box\Box\Box$  or the setting of Pn170 =  $n.\Box X\Box\Box$ .
- Excessive Vibration during Position Control Increase the setting of Pn170 = n.□X□□ or decrease the setting of Pn170 = n.□X□□.

8.4.4 Parameters Disabled by Tuning-less Function

### 8.4.4 Parameters Disabled by Tuning-less Function

When the tuning-less function is enabled (Pn170 =  $n.\Box\Box\Box1$ ) (default setting), the parameters in the following table are disabled.

| Item                              | Parameter Name                                                                | Parameter Number |
|-----------------------------------|-------------------------------------------------------------------------------|------------------|
|                                   | Speed Loop Gain<br>Second Speed Loop Gain                                     | Pn100<br>Pn104   |
| Gain-Related Parameters           | Speed Loop Integral Time Constant<br>Second Speed Loop Integral Time Constant | Pn101<br>Pn105   |
|                                   | Position Loop Gain<br>Second Position Loop Gain                               | Pn102<br>Pn106   |
|                                   | Moment of Inertia Ratio                                                       | Pn103            |
| Advanced Control-Related          | Friction Compensation Function Selection                                      | Pn408 = n.X□□□   |
| Parameters                        | Anti-Resonance Control Selection                                              | Pn160 = n.□□□X   |
| Gain Selection-Related Parameters | Gain Switching Selection                                                      | Pn139 = n.□□□X   |

The tuning-less function is disabled during Easy FFT and mechanical analysis for a vertical axis. The gain-related parameters in the above table are enabled for Easy FFT and mechanical analysis for a vertical axis.

### 8.4.5 Automatically Adjusted Function Setting

You can also automatically adjust notch filters.

Normally, set Pn460 to n. D1DD (Adjust automatically) (default setting). Vibration is automatically detected and a notch filter is set.

Set Pn460 to n.  $\Box 0 \Box \Box$  (Do not adjust automatically) only if you do not change the setting of the notch filter before you execute the tuning-less function.

| Parameter |                             | Meaning                                                                                                                                                                                                                         | When Enabled  | Classification |
|-----------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|
| Pn460     | n.□0□□                      | Do not adjust the second stage notch filter<br>automatically when the tuning-less function is<br>enabled or during execution of autotuning<br>without a host reference, autotuning with a<br>host reference, and custom tuning. | - Immediately | Tuning         |
|           | n.□1□□<br>(default setting) | Adjust the second stage notch filter automati-<br>cally when the tuning-less function is enabled<br>or during execution of autotuning without a<br>host reference, autotuning with a host refer-<br>ence, and custom tuning.    |               |                |

#### 8.4.6 Related Parameters

The following parameters are automatically adjusted when you execute the tuning-less function.

Do not manually change the settings of these parameters after you have enabled the tuningless function.

| Parameter | Name                                                    |
|-----------|---------------------------------------------------------|
| Pn401     | First Stage First Torque Reference Filter Time Constant |
| Pn40A     | First Stage Notch Filter Q Value                        |
| Pn40C     | Second Stage Notch Filter Frequency                     |
| Pn40D     | Second Stage Notch Filter Q Value                       |

8.5.1 Outline

# 8.5 Estimating the Moment of Inertia

This section describes how the moment of inertia is calculated.

The moment of inertia ratio that is calculated here is used in other tuning functions. You can also estimate the moment of inertia during autotuning without a host reference. Refer to the following section for the procedure.

8.6.4 Operating Procedure on page 8-25

# 8.5.1 Outline

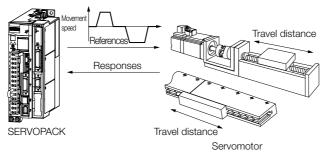
The moment of inertia during operation is automatically calculated by the SERVOPACK for round-trip (forward and reverse) operation. A reference from the host controller is not used.

The moment of inertia ratio (i.e., the ratio of the load moment of inertia to the motor moment of inertia) is a basic parameter for adjusting gains. It must be set as accurately as possible.

Although the load moment of inertia can be calculated from the weight and structure of the mechanisms, doing so is very troublesome and calculating it accurately can be very difficult with the complex mechanical structures that are used these days. With an estimate of the moment of inertia, you can obtain an accurate load moment of inertia simply by running the Servomotor in the actual system in a forward and reverse direction a few times.

The Servomotor is operated with the following specifications.

- Maximum speed: ±1,000 min<sup>-1</sup> (can be changed)
- Acceleration rate: ±20,000 min<sup>-1</sup>/s (can be changed)
- Travel distance: ±2.5 rotations max. (can be changed)



Note: Execute moment of inertia estimation after jog operation to a position that ensures a suitable range 8.5.2 Restrictions

# 8.5.2 Restrictions

The following restrictions apply to estimating the moment of inertia.

## Systems for which Execution Cannot Be Performed

- When the machine system can move only in one direction
- When the range of motion is 0.5 rotations or less

# Systems for Which Adjustments Cannot Be Made Accurately

- When a suitable range of motion is not possible
- · When the moment of inertia changes within the set operating range
- When the machine has high dynamic friction
- When the rigidity of the machine is low and vibration occurs when positioning is performed
- When the position integration function is used
- When mode switching is used

# Preparations

Always check the following before you execute moment of inertia estimation.

- The main circuit power supply must be ON.
- There must be no overtravel.
- The servo must be OFF.
- The gain switching selection must be set to disable automatic gain switching (Pn139 = n.□□□0).
- The first gains must be selected.
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- There must be no alarms or warnings.
- There must be no hard wire base block (HWBB).
- The parameters must not be write prohibited.
- The tuning-less function must be disabled (Pn170 =  $n.\Box\Box\Box$ 0).

## 8.5.3 Applicable Tools

The following table lists the tools that you can use to estimate the moment of inertia.

| Tool             | Fn No./Function Name                                                 | Operating Procedure Reference |  |
|------------------|----------------------------------------------------------------------|-------------------------------|--|
| Digital Operator | You cannot estimate the moment of inertia from the Digital Operator. |                               |  |
| SigmaWin+        | Vin+Tuning - TuningImage: 8.5.4 Operating Procedure on page 8-17     |                               |  |

Note: If you specify moment of inertia estimation, mode switching will be disabled and PI control will be used while the moment of inertia is being calculated. Mode switching will be enabled after moment of inertia estimation has been completed.

# 8.5.4 Operating Procedure

Use the following procedure to estimate the moment of inertia ratio.

# \land WARNING

• Estimating the moment of inertia requires operating the Servomotor and therefore presents hazards. Observe the following precautions.

Confirm safety around moving parts.

This function involves automatic operation with vibration. Make sure that you can perform an emergency stop (to turn OFF the power supply) at any time. There will be movement in both directions within the set range of movement. Check the range of movement and the directions and implement protective controls for safety, such as the overtravel functions.

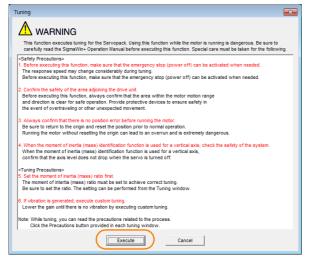
# **A CAUTION**

- Be aware of the following points if you cancel the moment of inertia estimation while the Servomotor is operating.
  - If you cancel operation with the Servo OFF Button, the Servomotor will stop according to setting of the Servo OFF stopping method (Pn001 = n.□□□X).
  - If you cancel operation with the **Cancel** Button, the Servomotor will decelerate to a stop and then enter a zero-clamped state.
- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.

### **2.** Select Tuning in the Menu Dialog Box. The Tuning Dialog Box will be displayed.

Click the **Cancel** Button to cancel tuning.

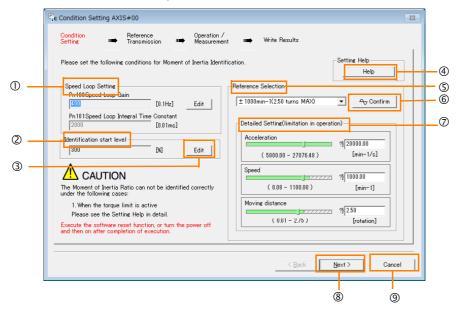
3. Click the Execute Button.



### 4. Click the Execute Button.

| Tuning AXIS#00                                                                 | × |
|--------------------------------------------------------------------------------|---|
| Set the moment of inertia (mass) ratio before Precaution executing autotuning. | s |
| Moment of inertia (mass) ratio identification                                  |   |
| Pn103 - Moment of Inertia Ratio                                                |   |
| Execute.                                                                       |   |
| 100 % Edit                                                                     |   |
| Ţ                                                                              |   |
| Autotuning                                                                     |   |
| Reference input from host controller                                           |   |
| Position Reference Input                                                       |   |
| C No Reference Input                                                           |   |
|                                                                                |   |
|                                                                                |   |
|                                                                                |   |
| Advanced adjustment Finish                                                     |   |

5. Set the conditions as required.



#### ① Speed Loop Setting Area

Make the speed loop settings in this area.

If the speed loop response is too bad, it will not be possible to measure the moment of inertia ratio accurately.

The values for the speed loop response that are required for moment of inertia estimation are set for the default settings. It is normally not necessary to change these settings.

If the default speed loop gain is too high for the machine (i.e., if vibration occurs), lower the setting. It is not necessary to increase the setting any farther.

### 2 Identification Start Level Group

This is the setting of the moment of inertia calculation starting level.

If the load is large or the machine has low rigidity, the torque limit may be applied, causing moment of inertia estimation to fail.

If that occurs, estimation may be possible if you double the setting of the start level. ③ Edit Buttons

# Click the button to display a dialog box to change the settings related to the speed loop or estimation start level.

④ Help Button

Click this button to display guidelines for setting the reference conditions. Make the following settings as required.

- Operate the Servomotor to measure the load moment of inertia of the machine in comparison with the rotor moment of inertia.
- Set the operation mode, reference pattern (maximum acceleration rate, maximum speed, and maximum travel distance), and speed loop-related parameters.
- Correct measurement of the moment of inertia ratio may not be possible depending on the settings. Set suitable settings using the measurement results as reference.

#### S Reference Selection Area

Either select the reference pattern for estimation processing from the box, or set the values in the **Detailed Setting** Group. Generally speaking, the larger the maximum acceleration rate is, the more accurate the moment of inertia estimation will be.

Set the maximum acceleration range within the possible range of movement considering the gear ratio, e.g., the pulley diameters or ball screw pitch.

### 6 Confirm Button

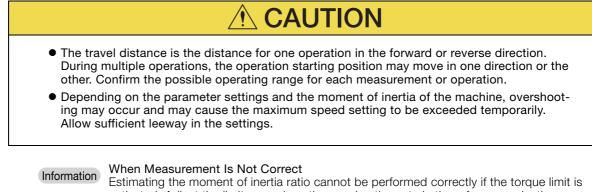
Click this button to display the Reference Confirmation Dialog Box.

| Reference confirmation |            |         |  |
|------------------------|------------|---------|--|
| Moving distance 2.50   | (rotation) |         |  |
| Driving pattern        |            |         |  |
|                        |            | _       |  |
| V:Speed                | 1000.00    | [min-1] |  |
| T1:Acceleration Time   | 50         | [ms]    |  |
| T2:Constant-speed time | 100        | [ms]    |  |
| Total operation time   | 400        | [ms]    |  |
| ОК                     |            |         |  |

#### ⑦ Detailed Setting Area

You can change the settings by moving the bars or directly inputting the settings to create the required reference pattern.

- In the second second
- Inck this button to display the Reference transmission
   Cancel Button
- Cancel Button
  - Click this button to return to the Tuning Dialog Box.



activated. Adjust the limits or reduce the acceleration rate in the reference selection so

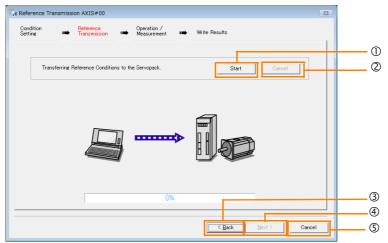
that the torque limit is not activated.

#### 6. Click the Next Button.

The Reference Transmission Dialog Box will be displayed.

Tuning

7. Click the Start Button.



#### ① Start Button

The reference conditions will be transferred to the SERVOPACK. A progress bar will show the progress of the transfer.

2 Cancel Button

The **Cancel** Button is enabled only while data is being transferred to the SERVOPACK. You cannot use it after the transfer has been completed.

3 Back Button

This button returns you to the Condition Setting Dialog Box. It is disabled while data is being transferred.

④ Next Button

This button is enabled only when the data has been transferred correctly. You cannot use it if an error occurs or if you cancel the transfer before it is completed.

Click the **Next** Button to display the Operation/Measurement Dialog Box.

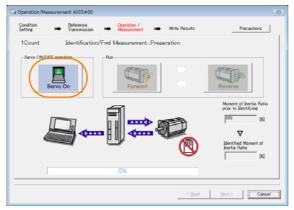
### S Cancel Button

This button cancels processing and returns you to the Tuning Dialog Box.

#### 8. Click the Next Button.

The Operation/Measurement Dialog Box will be displayed.

### 9. Click the Servo On Button.



#### 10. Click the Forward Button.

The Servomotor shaft will rotate in the forward direction and the measurement will start. After the measurement and data transfer have been completed, the **Reverse** Button will be displayed in color.

11. Click the Reverse Button.



The Servomotor shaft will rotate in the reverse direction and the measurement will start. After the measurement and data transfer have been completed, the **Forward** Button will be displayed in color.

| 🔓 Operation/Measu    | rement AXIS#00            |                                           | 23                                                          |
|----------------------|---------------------------|-------------------------------------------|-------------------------------------------------------------|
| Condition<br>Setting | Reference<br>Transmission | Operation / Important Important Write Res | ults Precautions                                            |
| 2Count               | Identification/           | Fwd MeasurementPrep. Complete             |                                                             |
| Servo ON/OFF         | operation                 | Pan<br>Forward                            | Reverse                                                     |
| Ĺ                    |                           | 120                                       | Moment of Inertia Ratio<br>prior to Identifying<br>[800 [X] |
|                      |                           |                                           | Mertia Advised Moment of<br>Inertia Ratio                   |
|                      |                           | 100%                                      |                                                             |
|                      |                           |                                           | Back Next > Cancel                                          |

12. Repeat steps 9 to 11 until the Next Button is enabled.

Measurements are performed from 2 to 7 times and then verified. The number of measurements is displayed in upper left corner of the dialog box. A progress bar at the bottom of the dialog box will show the progress of the transfer each time.

**13.** When the measurements have been completed, click the **Servo On** Button to turn OFF the servo.

#### 14. Click the Next Button.

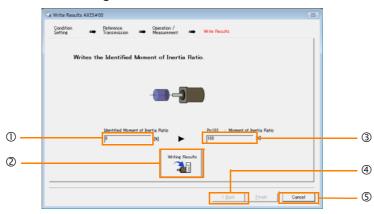
The Write Results Dialog Box will be displayed.

Information If you click the **Next** Button before you turn OFF the servo, the following Dialog Box will be displayed. Click the **OK** Button to turn OFF the servo.

| Moment of Inertia Iden | tification 📧 |
|------------------------|--------------|
| 1 turns the S          | Servo OFF.   |
| ОК                     | キャンセル        |

8

15. Click the Writing Results Button.



#### ① Identified Moment of Inertia Ratio Box

The moment of inertia ratio that was found with operation and measurements is displayed here.

<sup>(2)</sup> Writing Results Button

If you click this button, Pn103 (Moment of Inertia Ratio) in the SERVOPACK is set to the value that is displayed for the identified moment of inertia ratio.

### 3 Pn103: Moment of Inertia Ratio Box

The value that is set for the parameter is displayed here.

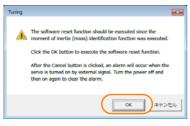
After you click the **Writing Results** Button, the value that was found with operation and measurements will be displayed as the new setting.

Back Button

This button is disabled. (5) Cancel Button

- This button will return you to the Tuning Dialog Box.
- 16. Confirm that the Identified Moment of Inertia Ratio Box and the Pn103: Moment of Inertia Ratio Box show the same value and then click the Finish Button.

### 17. Click the OK Button.



18. Click the Execute Button.

| ① Software Reset Common for the Unit                                                                                                         | × |
|----------------------------------------------------------------------------------------------------------------------------------------------|---|
| The software reset function will be executed.<br>The Servopack will stop responding for approximately 5<br>seconds after the fuction begins. |   |
| Execute                                                                                                                                      |   |
| 0%                                                                                                                                           |   |
|                                                                                                                                              |   |

If the setting of the moment of inertia ratio (Pn103) was changed, the new value will be saved and the Tuning Dialog Box will be displayed again.

This concludes the procedure to estimate the moment of inertia ratio.

8.6.1 Outline

# 8.6 Autotuning without Host Reference

This section describes autotuning without a host reference.

Autotuning without a host reference performs adjustments based on the setting of the speed loop gain (Pn100). Therefore, precise adjustments cannot be made if there is vibration when ( )adjustments are started. Make adjustments after lowering the speed loop gain (Pn100) until Important vibration is eliminated. You cannot execute autotuning without a host reference if the tuning-less function is enabled  $(Pn170 = n.\Box\Box\Box1 (default setting))$ . Disable the tuning-less function  $(Pn170 = n.\Box\Box\Box0)$ before you execute autotuning without a host reference. • If you change the machine load conditions or drive system after you execute autotuning without a host reference and then you execute autotuning without a host reference with moment of inertia estimation specified, use the following parameter settings. If you execute autotuning without a host reference for any other conditions, the machine may vibrate and may be damaged.  $Pn140 = n.\Box\Box\Box$  (Do not use model following control.)  $Pn160 = n.\Box\Box\Box$  (Do not use anti-resonance control.)  $Pn408 = n.00 \square 0$  (Disable friction compensation, first stage notch filter, and second stage notch filter.) Note: If you are using the Digital Operator and the above parameters are not displayed, change the parameter display setting to display all parameters (Pn00B =  $n.\Box\Box\Box$ 1) and then turn the power supply OFF and ON again.

# 8.6.1 Outline

For autotuning without a host reference, operation is automatically performed by the SERVO-PACK for round-trip (forward and reverse) operation to adjust for machine characteristics during operation. A reference from the host controller is not used.

The following items are adjusted automatically.

- Moment of inertia ratio
- Gains (e.g., speed loop gain and position loop gain)
- Filters (torque reference filter and notch filters)
- Friction compensation
- Anti-resonance control
- Vibration suppression (only for mode 2 or 3)

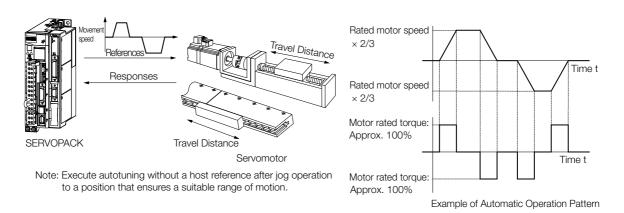
Refer to the following section for details on the parameters that are adjusted.  $\bigcirc$  8.6.7 Related Parameters on page 8-33

The Servomotor is operated with the following specifications.

| Maximum speed          | Rated motor speed × $\frac{2}{3}$                                                                                                                                                                    |                                                                                                                         |  |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--|
| Acceleration<br>Torque | Rated motor torque: Approx. 100%<br>Note: The acceleration torque depends on the setting of the moment of inertia ratio (Pn103), and<br>the influences of machine friction and external disturbance. |                                                                                                                         |  |
| Travel Distance        | Rotary Servomotors                                                                                                                                                                                   | You can set the desired travel distance. The default setting is for a value equivalent to 3 Servomotor shaft rotations. |  |
|                        | Direct Drive Servomotors                                                                                                                                                                             | You can set the desired travel distance. The default setting is for a value equivalent to 0.3 rotations.                |  |
|                        | Linear Servomotors                                                                                                                                                                                   | You can set the desired travel distance in increments of 1,000 reference units. (The default setting is for 90 mm.)     |  |

**Funing** 

#### 8.6.2 Restrictions



# \land WARNING

- Autotuning without a host reference requires operating the Servomotor and therefore presents hazards. Observe the following precaution.
  - Confirm safety around moving parts.

This function involves automatic operation with vibration. Make sure that you can perform an emergency stop (to turn OFF the power supply) at any time. There will be movement in both directions within the set range of movement. Check the range of movement and the directions and implement protective controls for safety, such as the overtravel functions.

# 8.6.2 Restrictions

The following restrictions apply to autotuning without a host reference.

If you cannot use autotuning without a host reference because of these restrictions, use autotuning with a host reference or custom tuning. Refer to the following sections for details.  $\mathbb{R}$  8.7 Autotuning with a Host Reference on page 8-34

₹ 8.8 Custom Tuning on page 8-41

### Systems for Which Execution Cannot Be Performed

- When the machine system can move only in one direction
- · When the range of motion is 0.5 rotations or less

# Systems for Which Adjustments Cannot Be Made Accurately

- When a suitable range of motion is not possible
- · When the moment of inertia changes within the set operating range
- When the machine has high friction
- When the rigidity of the machine is low and vibration occurs when positioning is performed
- When the position integration function is used
- When mode switching is used
  - Note: If you specify moment of inertia estimation, mode switching will be disabled and PI control will be used while the moment of inertia is being calculated. Mode switching will be enabled after moment of inertia estimation has been completed.
- When the positioning completed width (Pn522) is too narrow

8.6.3 Applicable Tools

## Preparations

Always check the following before you execute autotuning without a host reference.

- The main circuit power supply must be ON.
- There must be no overtravel.
- The servo must be OFF.
- The gain switching selection must be set to disable automatic gain switching (Pn139 = n.□□□0).
- The first gains must be selected.
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- There must be no alarms or warnings.
- There must be no hard wire base block (HWBB).
- The parameters must not be write prohibited.
- The tuning-less function must be disabled (Pn170 = n.□□□□0), or the tuning-less function must be enabled (Pn170 = n.□□□1) (default setting) and moment of inertia estimation must be specified.
- If you execute autotuning without a host reference during speed control, set the mode to 1.

# 8.6.3 Applicable Tools

The following table lists the tools that you can use to perform autotuning without a host reference.

| Tool             | Fn No./Function Name | Operating Procedure Reference                                                 |
|------------------|----------------------|-------------------------------------------------------------------------------|
| Digital Operator | Fn201                | Σ-7-Series Digital Operator Operating<br>Manual (Manual No.: SIEP S800001 33) |
| SigmaWin+        | Tuning - Tuning      | 3.6.4 Operating Procedure on page 8-25                                        |

# 8.6.4 Operating Procedure

Use the following procedure to perform autotuning without a host reference.

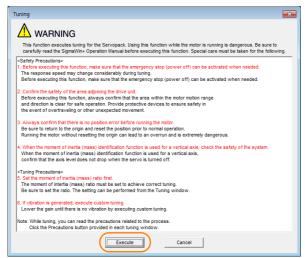


- If you specify not estimating the moment of inertia, set the moment of inertia ratio (Pn103) correctly. If the setting greatly differs from the actual moment of inertia ratio, normal control of the machine may not be possible, and vibration may result.
- 1. Confirm that the moment of inertia ratio (Pn103) is set correctly.
- 2. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **3.** Select Tuning in the Menu Dialog Box. The Tuning Dialog Box will be displayed. Click the **Cancel** Button to cancel tuning.

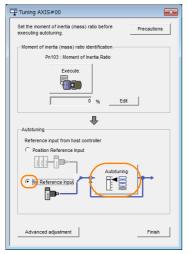
8

Information • If you start autotuning without a host reference while the SERVOPACK is in speed control for mode 2 or 3, the SERVOPACK will change to position control automatically to perform autotuning without a host reference. The SERVOPACK will return to speed control after autotuning has been completed.

4. Click the Execute Button.



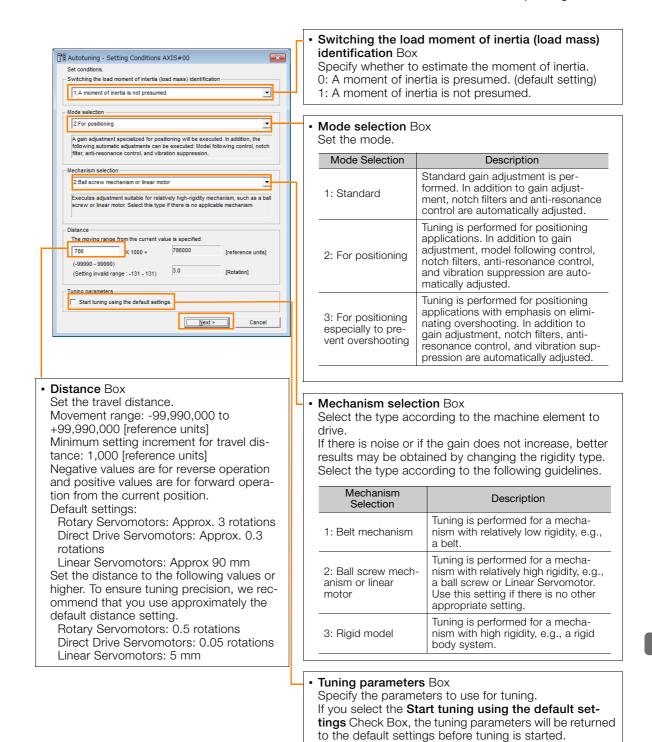
5. Select the No Reference Input Option in the Autotuning Area and then click the Autotuning Button.



Information When the following dialog box is displayed, click the **OK** Button and then confirm that the correct moment of inertia ratio is set in Pn103 (Moment of Inertia Ratio).

| Tuning                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                            |
| The moment of inertia (mass) ratio has never been changed from the default<br>setting.<br>Set a correct moment of inertia (mass) ratio in the Moment of Inertia (Mass) Setting<br>window before starting tuning.<br>If an incorrect moment of inertia (mass) ratio is set, vibration may be generated<br>during tuning.<br>Do you want to continue tuning? |
| Cancel                                                                                                                                                                                                                                                                                                                                                     |

6. Set the conditions in the Switching the load moment of inertia (load mass) identification Box, the Mode selection Box, the Mechanism selection Box, and the Distance Box, and then click the Next Button.



### 8-27

7. Click the Servo ON Button.

| Autotuning - Automatic s            | etting AXIS#00                     | <b>×</b>                 |
|-------------------------------------|------------------------------------|--------------------------|
| Waiting for execution               | Servo ON/OFF ope                   | vo OFF                   |
| Gain search<br>behaviour evaluation | Mode selection<br>2:For positionin | Start tuning             |
|                                     | Mechanism sele                     |                          |
|                                     | 2:Ball screw m<br>Distance         | echanism or linear motor |
| Notch filter                        | 786000                             | [reference units]        |
| Anti-res Adj<br>Vib Suppress        | 3.0                                | [Rotation]               |
| Precautions                         | < <u>B</u> ack                     | Finish                   |

8. Click the Start tuning Button.

| Sautotuning - Automatic                      | setting AXIS#00                                                                                                                                        |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Waiting for execution                        | Servo ON/OFF operation Servo OFF Servo ON Servo OFF                                                                                                    |
| Gain search<br>behaviour evaluation          | Tuning                                                                                                                                                 |
| Notch filter<br>Anti-res Adj<br>Vib Suppress | 2:For positioning       Mechanism selection       2:Ball screw mechanism or linear motor       Distance       786000       [reference units]       3.0 |
| Precautions                                  | < Back Finish Cancel                                                                                                                                   |

9. Confirm safety around moving parts and click the Yes Button.



The Servomotor will start operating and tuning will be executed. Vibration that occurs during tuning will be detected automatically and suitable settings will be made for that vibration. When the settings have been completed, the indicators for the functions that were used will light at the lower left of the dialog box.

### 8.6.5 Troubleshooting Problems in Autotuning without a Host Reference

| Autotuning - Automatic              | setting AXIS#00                           | 83  |
|-------------------------------------|-------------------------------------------|-----|
| Es Autotaning - Automatic           |                                           | ~~~ |
| Waiting for execution               | Servo ON/OFF operation Servo OFF Servo ON |     |
|                                     |                                           |     |
| Oscillation level<br>measurement    |                                           |     |
|                                     | Tuning                                    |     |
| Gain search<br>behaviour evaluation | Cancel                                    |     |
|                                     |                                           |     |
| Tuning completed                    | Mode selection                            |     |
|                                     | 2:For positioning                         |     |
|                                     | Mechanism selection                       |     |
|                                     | 2:Ball screw mechanism or linear motor    |     |
|                                     | Distance                                  |     |
| Notch filter                        | 786000 [reference units]                  |     |
| OAnti-res Adj<br>Vib Suppress       | 3.0 [Rotation]                            |     |
| Precautions                         | < Back Finish Cancel                      |     |

#### **10.** When tuning has been completed, click the **Finish** Button.

The results of tuning will be set in the parameters and you will return to the Tuning Dialog Box.

This concludes the procedure to perform autotuning without a host reference.

# 8.6.5 Troubleshooting Problems in Autotuning without a Host Reference

The following tables give the causes of and corrections for problems that may occur in autotuning without a host reference.

### Autotuning without a Host Reference Was Not Performed

| Possible Cause                                             | Corrective Action                                                                                                                                                          |
|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main circuit power supply is OFF.                          | Turn ON the main circuit power supply.                                                                                                                                     |
| An alarm or warning occurred.                              | Remove the cause of the alarm or warning.                                                                                                                                  |
| Overtraveling occurred.                                    | Remove the cause of overtraveling.                                                                                                                                         |
| The second gains were selected with the gain selection.    | Disable automatic gain switching.                                                                                                                                          |
| The HWBB was activated.                                    | Release the HWBB.                                                                                                                                                          |
| The setting of the travel distance is too small.           | Set the travel distance again in step 6 of the proce-<br>dure.                                                                                                             |
| The settings for the tuning-less function are not correct. | <ul> <li>Disable the tuning-less function (Pn170 = n.□□□0).</li> <li>Enable the tuning-less function (Pn170 = n.□□□1) and specify moment of inertia estimation.</li> </ul> |

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8.6.5 Troubleshooting Problems in Autotuning without a Host Reference

### When an Error Occurs during Execution of Autotuning without a Host Reference

| Error                                                                                                                     | Possible Cause                                                                                                 | Corrective Action                                                                                                                                                                                                                                                          |  |
|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| The gain adjustments<br>were not successfully<br>completed.                                                               | Machine vibration occurs or the posi-<br>tioning completion signal is not stable<br>when the Servomotor stops. | <ul> <li>Increase the setting of the positioning completed width (Pn522).</li> <li>Change the mode from 2 to 3.</li> <li>If machine vibration occurs, suppress the vibration with the anti-resonance control adjustment and the vibration suppression function.</li> </ul> |  |
| An error occurred during calculation of the moment of inertia.                                                            | Refer to the following section for troubleshooting information.                                                |                                                                                                                                                                                                                                                                            |  |
| Positioning was not<br>completed within<br>approximately 10 sec-<br>onds after position<br>adjustment was com-<br>pleted. | The positioning completed width is too narrow.                                                                 | Increase the setting of the positioning completed width (Pn522).                                                                                                                                                                                                           |  |

### When an Error Occurs during Calculation of Moment of Inertia

| Possible Cause                                                                                 | Corrective Action                                                                                                                                                      |
|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The SERVOPACK started calculating the moment of inertia but the calculation was not completed. | <ul><li>Increase the setting of the speed loop gain (Pn100).</li><li>Increase the stroke (travel distance).</li></ul>                                                  |
| The moment of inertia fluctuated greatly and did not converge within 10 tries.                 | Set Pn103 (Moment of Inertia Ratio) from the machine specifications and specify not estimating the moment of inertia.                                                  |
| Low-frequency vibration was detected.                                                          | Double the setting of moment of inertia calculation starting level (Pn324).                                                                                            |
| The torque limit was reached.                                                                  | <ul> <li>If you are using the torque limit, increase the torque limit.</li> <li>Double the setting of moment of inertia calculation starting level (Pn324).</li> </ul> |

### ◆ Adjustment Results Are Not Satisfactory for Position Control

You may be able to improve the adjustment results by changing the settings of the positioning completed width (Pn522) and the electronic gear (Pn20E/Pn210).

If satisfactory results are still not possible, adjust the overshoot detection level (Pn561). That may improve the adjustment results.

- Pn561 = 100% (default setting)
- This will allow tuning with overshooting that is equivalent to the positioning completed width. • Pn561 = 0%

This will allow tuning to be performed without overshooting within the positioning completed width, but the positioning completed width may be extended.

|       | Overshoot Detection Level |              |                 |              |                |
|-------|---------------------------|--------------|-----------------|--------------|----------------|
| Pn561 | Setting Range             | Setting Unit | Default Setting | When Enabled | Classification |
|       | 0 to 100                  | 1%           | 100             | Immediately  | Setup          |

8.6.6 Automatically Adjusted Function Settings

# 8.6.6 Automatically Adjusted Function Settings

You can specify whether to automatically adjust the following functions during autotuning.

### Automatic Notch Filters

Normally, set Pn460 to n. D1DD (Adjust automatically) (default setting).

Vibration will be detected during autotuning without a host reference and a notch filter will be adjusted.

Set Pn460 to n.  $\Box 0 \Box \Box$  (Do not adjust automatically) only if you do not change the setting of the notch filter before you execute this function.

| Parameter |                             | Function                                                                                                                                                                                                                        | When Enabled | Classification |
|-----------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------|
|           | n.□□□0                      | Do not adjust the first stage notch filter auto-<br>matically during execution of autotuning with-<br>out a host reference, autotuning with a host<br>reference, and custom tuning.                                             |              |                |
|           | n.□□□1<br>(default setting) | Adjust the first stage notch filter automatically<br>during execution of autotuning without a host<br>reference, autotuning with a host reference,<br>and custom tuning.                                                        |              |                |
| Pn460     | n.0000                      | Do not adjust the second stage notch filter<br>automatically when the tuning-less function is<br>enabled or during execution of autotuning<br>without a host reference, autotuning with a<br>host reference, and custom tuning. | Immediately  | Tuning         |
|           | n.□1□□<br>(default setting) | Adjust the second stage notch filter automati-<br>cally when the tuning-less function is enabled<br>or during execution of autotuning without a<br>host reference, autotuning with a host refer-<br>ence, and custom tuning.    |              |                |

### Anti-Resonance Control Adjustment

This function reduces low vibration frequencies, for which the notch filters cannot be used.

Normally, set Pn160 to n. DD1D (Adjust automatically) (default setting). Vibration will be detected during autotuning without a host reference and anti-resonance control will be automatically adjusted.

|       | Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Function | When Enabled | Classification |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------|----------------|
| Dp160 | Pn160       n.□□0□       Do not adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.         n.□□1□       Adjust anti-resonance control automatically during execution of autotuning with a host reference, and custom tuning.         (default setting)       Adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning. |          | Immediately  | Tuning         |
| FIITO |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          | Ininediately | Turning        |

8.6.6 Automatically Adjusted Function Settings

### Vibration Suppression

You can use vibration suppression to suppress transitional vibration at a low frequency from 1 Hz to 100 Hz, which is generated mainly when the machine vibrates during positioning.

Normally, set Pn140 to n. D1DD (Adjust automatically) (default setting).

Vibration will be detected during autotuning without a host reference and vibration suppression control will be automatically set.

Set  $Pn140 = n.\Box 0 \Box \Box$  (Do not adjust automatically) only if you do not change the settings for vibration suppression before you execute autotuning without a host reference.

Note: Autotuning without a host reference uses model following control. Therefore, it can be executed only if the mode is set to 2 or 3.

| Parameter |                                                                                                                                                                                     | Function                                                                                                                                                          | When Enabled | Classification |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------|
| Pn140     | n.□0□□ Do not adjust vibration suppression automati-<br>cally during execution of autotuning without a<br>host reference, autotuning with a host refer-<br>ence, and custom tuning. |                                                                                                                                                                   | Immediately  | Tuping         |
| F11140    | n.□1□□<br>(default setting)                                                                                                                                                         | Adjust vibration suppression automatically<br>during execution of autotuning without a host<br>reference, autotuning with a host reference,<br>and custom tuning. | immediately  | Tuning         |

### Friction Compensation

Friction compensation compensates for changes in the following conditions.

- Changes in the viscous resistance of the lubricant, such as grease, on the sliding parts of the machine
- · Changes in the friction resistance resulting from variations in the machine assembly
- Changes in the friction resistance due to aging

The conditions for applying friction compensation depend on the mode selection.

| Mode Selection Settings                            | Friction Compensation                                                                 |  |
|----------------------------------------------------|---------------------------------------------------------------------------------------|--|
| 1: Standard                                        | Based on the setting of Pn408 = n.XDDD<br>(Friction Compensation Function Selection)* |  |
| 2: For position control                            | Adjusted with friction compensation.                                                  |  |
| 3: For position control (emphasis on overshooting) |                                                                                       |  |

| P     | arameter                    | Function                       | When Enabled | Classification |
|-------|-----------------------------|--------------------------------|--------------|----------------|
| Pn408 | n.0□□□<br>(default setting) | Disable friction compensation. | Immediately  | Setup          |
|       | n.1000                      | Enable friction compensation.  |              |                |

\* Refer to the following section for details.

Required Parameter Settings on page 8-67

8.6.7 Related Parameters

# 8.6.7 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute autotuning without a host reference.

Do not change the settings while autotuning without a host reference is being executed.

| Parameter | Name                                                            | Automatic Changes |
|-----------|-----------------------------------------------------------------|-------------------|
| Pn100     | Speed Loop Gain                                                 | Yes               |
| Pn101     | Speed Loop Integral Time Constant                               | Yes               |
| Pn102     | Position Loop Gain                                              | Yes               |
| Pn103     | Moment of Inertia Ratio                                         | Yes               |
| Pn121     | Friction Compensation Gain                                      | Yes               |
| Pn123     | Friction Compensation Coefficient                               | Yes               |
| Pn124     | Friction Compensation Frequency Correction                      | No                |
| Pn125     | Friction Compensation Gain Correction                           | Yes               |
| Pn401     | First Stage First Torque Reference Filter Time Constant         | Yes               |
| Pn408     | Torque-Related Function Selections                              | Yes               |
| Pn409     | First Stage Notch Filter Frequency                              | Yes               |
| Pn40A     | First Stage Notch Filter Q Value                                | Yes               |
| Pn40C     | Second Stage Notch Filter Frequency                             | Yes               |
| Pn40D     | Second Stage Notch Filter Q Value                               | Yes               |
| Pn140     | Model Following Control-Related Selections                      | Yes               |
| Pn141     | Model Following Control Gain                                    | Yes               |
| Pn142     | Model Following Control Gain Correction                         | Yes               |
| Pn143     | Model Following Control Bias in the Forward Direction           | Yes               |
| Pn144     | Model Following Control Bias in the Reverse Direction           | Yes               |
| Pn145     | Vibration Suppression 1 Frequency A                             | Yes               |
| Pn146     | Vibration Suppression 1 Frequency B                             | Yes               |
| Pn147     | Model Following Control Speed Feedforward Compensation          | Yes               |
| Pn160     | Anti-Resonance Control-Related Selections                       | Yes               |
| Pn161     | Anti-Resonance Frequency                                        | Yes               |
| Pn163     | Anti-Resonance Damping Gain                                     | Yes               |
| Pn531     | Program Jog Operation Travel Distance                           | No                |
| Pn533     | Program Jog Operation Movement Speed for Rotary Servo-<br>motor | No                |
| Pn585     | Program Jog Operation Movement Speed for Linear Servo-<br>motor | No                |
| Pn534     | Program Jog Operation Acceleration/Deceleration Time            | No                |
| Pn535     | Program Jog Operation Waiting Time                              | No                |
| Pn536     | Program Jog Operation Number of Movements                       | No                |

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

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8.7.1 Outline

# 8.7 Autotuning with a Host Reference

This section describes autotuning with a host reference.



Autotuning with a host reference makes adjustments based on the set speed loop gain (Pn100). Therefore, precise adjustments cannot be made if there is vibration when adjustments are started. Make adjustments after lowering the speed loop gain (Pn100) until vibration is eliminated.

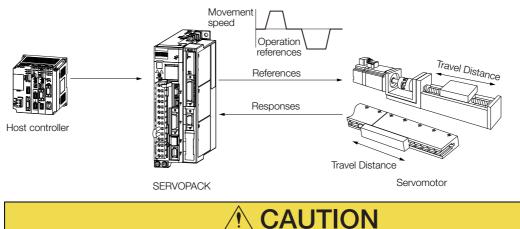
# 8.7.1 Outline

Autotuning with a host reference automatically makes optimum adjustments for operation references from the host controller.

The following items are adjusted automatically.

- Gains (e.g., speed loop gain and position loop gain)
- Filters (torque reference filter and notch filters)
- Friction compensation
- Anti-resonance control
- Vibration suppression

Refer to the following section for details on the parameters that are adjusted. (37 8.7.7 Related Parameters on page 8-40



 Because autotuning with a host reference adjusts the SERVOPACK during automatic operation, vibration or overshooting may occur. To ensure safety, make sure that you can perform an emergency stop at any time.

8.7.2 Restrictions

# 8.7.2 Restrictions

# Systems for Which Adjustments Cannot Be Made Accurately

Adjustments will not be made correctly for autotuning with a host reference in the following cases. Use custom tuning.

- When the travel distance for the reference from the host controller is equal to or lower than the setting of the positioning completed width (Pn522)
- Rotary Servomotors: When the movement speed for the reference from the host controller is equal to or lower than the setting of the rotation detection level (Pn502)
- Linear Servomotors: When the movement speed for the reference from the host controller is equal to or lower than the setting of the zero speed level (Pn581)
- When the time required to stop is 10 ms or less
- When the rigidity of the machine is low and vibration occurs when positioning is performed
- When the position integration function is used
- When mode switching is used
- When the positioning completed width (Pn522) is too narrow

Refer to the following sections for details on custom tuning.

🕼 8.8 Custom Tuning on page 8-41

### Preparations

Always check the following before you execute autotuning with a host reference.

- The servo must be in ready status.
- There must be no overtravel.
- The servo must be OFF.
- The gain switching selection must be set to disable automatic gain switching (Pn139 =  $n.\square\square\square0$ ).
- The first gains must be selected.
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- There must be no warnings.
- The tuning-less function must be disabled (Pn170 =  $n.\Box\Box\Box$ ).
- The parameters must not be write prohibited.

# 8.7.3 Applicable Tools

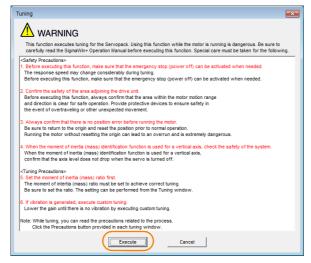
The following table lists the tools that you can use to perform autotuning with a host reference.

| Tool             | Fn No./Function Name | Operating Procedure Reference                                                   |
|------------------|----------------------|---------------------------------------------------------------------------------|
| Digital Operator | Fn202                | Σ-7-Series Digital Operator Operating Man-<br>ual (Manual No.: SIEP S800001 33) |
| SigmaWin+        | Tuning - Tuning      | 8.7.4 Operating Procedure on page 8-36                                          |

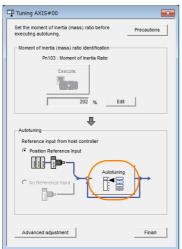
## 8.7.4 Operating Procedure

Use the following procedure to perform autotuning with a host reference.

- 1. Confirm that the moment of inertia ratio (Pn103) is set correctly.
- Click the Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **3.** Select Tuning in the Menu Dialog Box. The Tuning Dialog Box will be displayed. Click the **Cancel** Button to cancel tuning.
- 4. Click the Execute Button.



5. Select the **Position reference input** Option in the **Autotuning** Area and then click the **Autotuning** Button.



**Information** When the following dialog box is displayed, click the **OK** Button and then confirm that the correct moment of inertia ratio is set in Pn103 (Moment of Inertia Ratio).



6. Set the conditions in the Mode selection Box and the Mechanism selection Box, and then click the Next Button.

If you select the Start tuning using the default settings Check Box in the Tuning parameters Area, the tuning parameters will be returned to the default settings before tuning is started.

| Image: Setting Conditions AXIS#00                                                                                                                                                                                                                             | <br>Mode selection Bo<br>Set the mode.                        | х                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Set conditions.                                                                                                                                                                                                                                               |                                                               |                                                                                                                                                                                                                                              |
| Mode selection                                                                                                                                                                                                                                                | Mode Selection                                                | Description                                                                                                                                                                                                                                  |
| 2:For positioning     A gain adjustment specialized for positioning will be executed. In     addition, the following automatic adjustments can be executed. Model     following control, notch filter, anti-resonance control, and vibration     suppression. | 1: Standard                                                   | Standard gain adjustment is per-<br>formed. In addition to gain adjust-<br>ment, notch filters and anti-<br>resonance control are automatically<br>adjusted.                                                                                 |
| Mechanism selection  2:Ball screw mechanism or linear motor  Executes adjustment suitable for relatively high-rigidity mechanism, such as a ball screw or linear motor. Select this type if there is no applicable mechanism.                                 | 2: For positioning                                            | Tuning is performed for positioning<br>applications. In addition to gain<br>adjustment, model following control,<br>notch filters, anti-resonance control,<br>and vibration suppression are auto-<br>matically adjusted.                     |
| Tuning parameters                                                                                                                                                                                                                                             | 3: For positioning<br>especially to pre-<br>vent overshooting | Tuning is performed for positioning<br>applications with emphasis on elimi-<br>nating overshooting. In addition to<br>gain adjustment, notch filters, anti-<br>resonance control, and vibration sup-<br>pression are automatically adjusted. |
| Next > Cancel                                                                                                                                                                                                                                                 |                                                               |                                                                                                                                                                                                                                              |
|                                                                                                                                                                                                                                                               | Mechanism select                                              | ion Box                                                                                                                                                                                                                                      |
| <b>Tuning parameters</b> Box<br>Specify the parameters to use for tuning.                                                                                                                                                                                     |                                                               | ording to the machine element to                                                                                                                                                                                                             |
| If you select the Start tuning using the                                                                                                                                                                                                                      | If there is noise or if                                       | the gain does not increase, better                                                                                                                                                                                                           |
| default settings Check Box, the tuning                                                                                                                                                                                                                        |                                                               | ined by changing the rigidity type.                                                                                                                                                                                                          |
| parameters will be returned to the default settings before tuning is started.                                                                                                                                                                                 | Select the type acc                                           | ording to the following guidelines.                                                                                                                                                                                                          |
|                                                                                                                                                                                                                                                               | Mechanism<br>Selection                                        | Description                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                               | 1: Belt mechanism                                             | Tuning is performed for a mecha-<br>nism with relatively low rigidity, e.g.,<br>a belt.                                                                                                                                                      |
|                                                                                                                                                                                                                                                               | 2: Ball screw<br>mechanism or linear<br>motor                 | Tuning is performed for a mecha-<br>nism with relatively high rigidity, e.g.,<br>a ball screw or Linear Servomotor.<br>Use this setting if there is no other<br>appropriate setting.                                                         |
|                                                                                                                                                                                                                                                               | 3: Rigid model                                                | Tuning is performed for a mecha-<br>nism with high rigidity, e.g., a rigid<br>body system.                                                                                                                                                   |

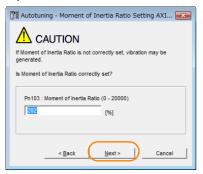
7. Click the Yes Button.

| Autotuning                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                |
| Tuning will be executed after resetting the tuning<br>parameters to their default values.<br>When tuning starts, the current tuning results will be<br>lost.<br>Do you want to execute tuning? |
| Yes No                                                                                                                                                                                         |

Tuning

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8. Input the correct moment of inertia ratio and click the Next Button.



**9.** First confirm safety around moving parts. Then turn ON the servo, enter a reference from the host controller, and click the **Start tuning** Button.

| B Autotuning - Automatic s         Waiting for execution         Oscillation level         Gain search         behaviour evaluation         Tuning completed | etting AXIS#00 Tuning Turn the servo on, input the reference from the controller, and then click the Start button. Start |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------|
|                                                                                                                                                              | Mode selection<br>2:For positioning                                                                                      |        |
| Notch filter                                                                                                                                                 | Mechanism selection                                                                                                      |        |
| OAnti-res Adj<br>Vib Suppress                                                                                                                                | 2:Ball screw mechanism or linear motor                                                                                   |        |
| Precautions                                                                                                                                                  | < Back Finish                                                                                                            | Cancel |

#### 10. Click the Yes Button.



Tuning will be executed.

Vibration that occurs during tuning will be detected automatically and suitable settings will be made for that vibration. When the settings have been completed, the indicators for the functions that were used will light at the lower left of the dialog box.

| Waiting for execution               | Tuning Executing tuning (Input the reference.) |
|-------------------------------------|------------------------------------------------|
|                                     |                                                |
| Oscillation level<br>measurement    | Cancel                                         |
|                                     |                                                |
| Gain search<br>behaviour evaluation |                                                |
|                                     |                                                |
| Tuning completed                    |                                                |
|                                     | Mode selection                                 |
|                                     | Mode Selection                                 |
|                                     | 2:For positioning                              |
|                                     |                                                |
| Notch filter                        | 2:For positioning                              |

8.7.5 Troubleshooting Problems in Autotuning with a Host Reference

### 11. When tuning has been completed, click the Finish Button.

The results of tuning will be set in the parameters and you will return to the Tuning Dialog Box.

This concludes the procedure to perform autotuning with a host reference.

# 8.7.5 Troubleshooting Problems in Autotuning with a Host Reference

The following tables give the causes of and corrections for problems that may occur in autotuning with a host reference.

### Autotuning with a Host Reference Was Not Performed

| Possible Cause                                          | Corrective Action                         |
|---------------------------------------------------------|-------------------------------------------|
| Main circuit power supply is OFF.                       | Turn ON the main circuit power supply.    |
| An alarm or warning occurred.                           | Remove the cause of the alarm or warning. |
| Overtraveling occurred.                                 | Remove the cause of overtraveling.        |
| The second gains were selected with the gain selection. | Disable automatic gain switching.         |
| The HWBB was activated.                                 | Release the HWBB.                         |

### Troubleshooting Errors

| Error                                                                                                                   | Possible Cause                                                                                          | Corrective Action                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The gain adjustments were not successfully completed.                                                                   | Machine vibration<br>occurs or positioning<br>completion is not stable<br>when the Servomotor<br>stops. | <ul> <li>Increase the setting of the positioning completed width (Pn522).</li> <li>Change the mode from 2 to 3.</li> <li>If machine vibration occurs, suppress the vibration with the anti-resonance control adjustment and the vibration suppression function.</li> </ul> |
| Positioning was not<br>completed within<br>approximately 10<br>seconds after posi-<br>tion adjustment was<br>completed. | The positioning com-<br>pleted width is too nar-<br>row.                                                | <ul> <li>Increase the setting of the positioning completed width<br/>(Pn522).</li> </ul>                                                                                                                                                                                   |

### ◆ Adjustment Results Are Not Satisfactory for Position Control

You may be able to improve the adjustment results by changing the settings of the positioning completed width (Pn522) and the electronic gear ratio (Pn20E/Pn210).

If satisfactory results are still not possible, adjust the overshoot detection level (Pn561). That may improve the adjustment results.

- Pn561 = 100% (default setting)
- This will allow tuning with overshooting that is equivalent to the positioning completed width. • Pn561 = 0%
- This will allow tuning to be performed without overshooting within the positioning completed width, but the positioning completed width may be extended.

|       | Overshoot Detection Level |              |                 |              |                |
|-------|---------------------------|--------------|-----------------|--------------|----------------|
| Pn561 | Setting Range             | Setting Unit | Default Setting | When Enabled | Classification |
|       | 0 to 100                  | 1%           | 100             | Immediately  | Setup          |

# 8.7.6 Automatically Adjusted Function Settings

These function settings are the same as for autotuning without a host reference. Refer to the following section.

( 8.6.6 Automatically Adjusted Function Settings on page 8-31

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8.7.7 Related Parameters

# 8.7.7 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute autotuning with a host reference.

Do not change the settings while autotuning with a host reference is being executed.

| Parameter | Name                                                    | Automatic Changes |
|-----------|---------------------------------------------------------|-------------------|
| Pn100     | Speed Loop Gain                                         | Yes               |
| Pn101     | Speed Loop Integral Time Constant                       | Yes               |
| Pn102     | Position Loop Gain                                      | Yes               |
| Pn103     | Moment of Inertia Ratio                                 | No                |
| Pn121     | Friction Compensation Gain                              | Yes               |
| Pn123     | Friction Compensation Coefficient                       | Yes               |
| Pn124     | Friction Compensation Frequency Correction              | No                |
| Pn125     | Friction Compensation Gain Correction                   | Yes               |
| Pn401     | First Stage First Torque Reference Filter Time Constant | Yes               |
| Pn408     | Torque-Related Function Selections                      | Yes               |
| Pn409     | First Stage Notch Filter Frequency                      | Yes               |
| Pn40A     | First Stage Notch Filter Q Value                        | Yes               |
| Pn40C     | Second Stage Notch Filter Frequency                     | Yes               |
| Pn40D     | Second Stage Notch Filter Q Value                       | Yes               |
| Pn140     | Model Following Control-Related Selections              | Yes               |
| Pn141     | Model Following Control Gain                            | Yes               |
| Pn142     | Model Following Control Gain Correction                 | Yes               |
| Pn143     | Model Following Control Bias in the Forward Direction   | Yes               |
| Pn144     | Model Following Control Bias in the Reverse Direction   | Yes               |
| Pn145     | Vibration Suppression 1 Frequency A                     | Yes               |
| Pn146     | Vibration Suppression 1 Frequency B                     | Yes               |
| Pn147     | Model Following Control Speed Feedforward Compensation  | Yes               |
| Pn160     | Anti-Resonance Control-Related Selections               | Yes               |
| Pn161     | Anti-Resonance Frequency                                | Yes               |
| Pn163     | Anti-Resonance Damping Gain                             | Yes               |

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

# 8.8 Custom Tuning

This section describes custom tuning.

# 8.8.1 Outline

You can use custom tuning to manually adjust the servo during operation using a reference input from the host controller. You can use it to fine-tune adjustments that were made with autotuning.

The following items are adjusted automatically.

- Gains (e.g., speed loop gain and position loop gain)
- Filters (torque reference filter and notch filters)
- Friction compensation
- Anti-resonance control

Refer to the following section for details on the parameters that are adjusted. **8.8.7** *Related Parameters* on page 8-48

There are two adjustment methods that you can use for custom tuning.

 Tuning Mode 0 (Setting Servo Gains Giving Priority to Stability) or 1 (Setting Servo Gains Giving Priority to Good Response)

These modes allow you to set stable control conditions for multiple servo gains by manipulating only one tuning level. Automatic setting of notch filters and anti-resonance control is provided if vibration is detected. Manual anti-resonance control adjustment is also possible during custom tuning.

 Tuning Mode 2 (Setting Servo Gains Giving Priority to Position Control Applications) or 3 (Setting Servo Gains Giving Priority to Preventing Overshooting in Position Control Applications)

Two tuning levels are manipulated to reduce positioning time even further and set multiple servo gains.

Model following control is used to reduce the positioning time. If vibration is detected, notch filters and anti-resonance control are automatically adjusted, and friction compensation is automatically set. Manual anti-resonance control adjustment and vibration suppression are also possible during custom tuning.



• Vibration or overshooting may occur during custom tuning. To ensure safety, make sure that you can perform an emergency stop at any time.

### 8.8.2 **Preparations**

Always check the following before you execute custom tuning.

- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- The tuning-less function must be disabled (Pn170 =  $n.\Box\Box\Box$ 0).
- The parameters must not be write prohibited.

Tuning

8.8.3 Applicable Tools

#### **Applicable Tools** 8.8.3

The following table lists the tools that you can use to perform custom tuning.

| Tool             | Fn No./Function Name | Operating Procedure Reference                                                   |
|------------------|----------------------|---------------------------------------------------------------------------------|
| Digital Operator | Fn203                | Ω Σ-7-Series Digital Operator Operating<br>Manual (Manual No.: SIEP S800001 33) |
| SigmaWin+        | Tuning - Tuning      | 8.8.4 Operating Procedure on page 8-42                                          |

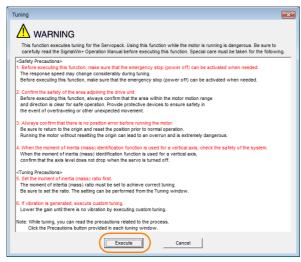
#### **Operating Procedure** 8.8.4

Use the following procedure to perform custom tuning.

| <ul> <li>Before you execute custom tuning, check the information provided in the SigmaWin+ operating manual.         Observe the following precautions.         Make sure that you can perform an emergency stop at any time.         When custom tuning is started, several parameters will be overwritten with the recommended settings, which may greatly affect the response before and after execution. Make sure that you can perform an emergency stop at any time.         Set the moment of inertia correctly before you execute custom tuning.         If the setting greatly differs from the actual moment of inertia, vibration may occur.         If you change the feedforward level, the new setting will not be used immediately. It will be used after positioning is completed.     </li> </ul> |                                                                                                              |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--|--|--|--|
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Confirm that the moment of inertia ratio (Pn103) is set correctly.                                           |  |  |  |  |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ol> <li>Click the Servo Drive Button in the workspace of the Main Window of the Sig-<br/>maWin+.</li> </ol> |  |  |  |  |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Select Tuning in the Menu Dialog Box.<br>The Tuning Dialog Box will be displayed.                            |  |  |  |  |

Click the **Cancel** Button to cancel tuning.

4. Click the Execute Button.



5. Click the Advanced adjustment Button.

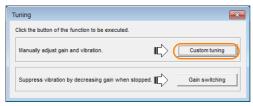
| Tuning AXIS#00                                                        |
|-----------------------------------------------------------------------|
| Set the moment of inertia (mass) ratio before Precautions Precautions |
| Moment of inertia (mass) ratio identification                         |
| Pn103 : Moment of Inertia Ratio                                       |
| Execute.                                                              |
| 100 % Edit                                                            |
| Autotuning                                                            |
| Reference input from host controller                                  |
| Position Reference Input                                              |
| C No Reference Input } ← ← Autotuning                                 |
|                                                                       |
|                                                                       |
| Advanced adjustment Finish                                            |

Information

When the following dialog box is displayed, click the  $\mathbf{OK}$  Button and then confirm that the correct moment of inertia ratio is set in Pn103 (Moment of Inertia Ratio).

| Tuning                                                                                                     | <b>×</b> |
|------------------------------------------------------------------------------------------------------------|----------|
|                                                                                                            |          |
| The moment of inertia (mass) ratio has never been changed from the setting.                                | default  |
| Set a correct moment of inertia (mass) ratio in the Moment of Inertia (M<br>window before starting tuning. |          |
| If an incorrect moment of inertia (mass) ratio is set, vibration may be g<br>during tuning.                | enerated |
| Do you want to continue tuning?                                                                            |          |
|                                                                                                            |          |

6. Click the Custom tuning Button.



8

7. Set the Tuning mode Box and Mechanism selection Box, and then click the Next Button.

| Custom Tuning - Mode selection AXIS#00       | T <sup>'</sup> | Tuning mode Box                                                                                     |                                                                                                                                                                                                                                 |
|----------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tuning mode                                  |                | Mode Selection                                                                                      | Description                                                                                                                                                                                                                     |
| Set servo gains for positioning application. |                | 0: Set servo gains<br>with priority given<br>to stability.                                          | This setting gives priority to stability<br>and preventing overshooting. In addi-<br>tion to gain adjustment, notch filters<br>and anti-resonance control (except<br>during torque control) are automatically<br>adjusted.      |
|                                              |                | 1: Set servo gains<br>with priority given<br>to response.                                           | Overshooting may occur because pri-<br>ority is given to response. In addition to<br>gain adjustment, notch filters and anti-<br>resonance control (except during<br>torque control) are automatically<br>adjusted.             |
|                                              |                | 2: Set servo gains<br>for positioning<br>application.                                               | Tuning is performed for positioning<br>applications. In addition to gain adjust<br>ment, notch filters, anti-resonance<br>control, and vibration suppression are<br>adjusted.                                                   |
| Next > Cancel                                |                | 3: Set servo gains<br>especially to pre-<br>vent overshooting<br>during positioning<br>application. | Tuning is performed for positioning<br>applications with emphasis on elimi-<br>nating overshooting. In addition to gair<br>adjustment, notch filters, anti-reso-<br>nance control, and vibration suppres-<br>sion are adjusted. |

#### Mechanism Selection Box

Select the type according to the machine element to drive.

If there is noise or if the gain does not increase, better results may be obtained by changing the rigidity type. Select the type according to the following guidelines.

| Mechanism Selection                     | Description                                                                                                                                                            |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1: Belt mechanism                       | Tuning is performed for a mechanism with relatively low rigidity, e.g., a belt.                                                                                        |
| 2: Ball screw mechanism or Linear motor | Tuning is performed for a mechanism with relatively high rigidity, e.g., a ball screw or Linear Servomotor. Use this setting if there is no other appropriate setting. |
| 3: Rigid body system                    | Tuning is performed for a mechanism with high rigidity, e.g., a rigid body system.                                                                                     |

Information The tuning modes that you can select depend on the SERVOPACK setting.

8. If the moment of inertia ratio is not set correctly, correct the setting and then click the Next Button.

| 📑 Custom Tuning - Moment of Inertia Ratio Setti 📧                              |  |
|--------------------------------------------------------------------------------|--|
|                                                                                |  |
| When Moment of Inertia Ratio is not correctly set, vibration may be generated. |  |
| Is Moment of Inertia Ratio correctly set?                                      |  |
| Pn103 : Moment of Inertia Ratio (0 - 20000)                                    |  |
| < Back Next > Cancel                                                           |  |

9. Turn ON the servo, enter a reference from the host controller, and then click the Start tuning Button.

Tuning Mode 0 or 1

#### Custom Tuning - Adust AXIS#00 uning mode 0 : Set servo gains with priority given to stability Mechanism selection 2 : Ball screw mechanism or linear motor Friction compensation Enable Gain status 1 gain Set the tuning level and start the tuning level 88883 uning level adju Setting the tuning too high can cause ŧ Finish Auto-settin Notch filte 1 step • Can 2 step inactive Anti-res Ctrl Adj Anti-res Adj Anti-res Ctrl Adi inactive Cancel < Back To Autotuning Completed. Cancel Precautions

#### Custom Tuning - Adust AXIS#00 - # × 2 : Set servo gains for po uning mode Mechanism sel 2 : Ball screw mechanism or linear motor riction compe Gain status 1 gain Tuning level Set the tuning level and start the tur Feed forward level (FF) ₹ ۸ FF level adjustment 8888 8 **`\_**] ase unti Ť 88 FB level adjustmen Notch filter 1 step 2 step inactive Yes Anti-res Ctrl Adj Anti-res Ctrl Adj Anti-res Adj Vib Suppress Finis Vib Suppress inactive Cancel Frequency 1 < Back To Autotuning Com Precautions Cancel

### **10.** Use the $\blacktriangle$ and $\blacktriangledown$ Buttons to change the tuning level.

Click the Back Button during tuning to restore the setting to its original value. The tuning level will return to the value from before when custom tuning was started.

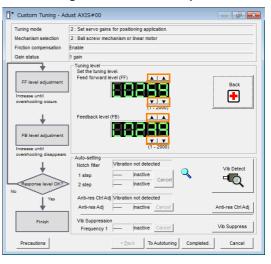
Tuning Mode 0 or 1

Increase the tuning level until overshooting occurs.

#### Custom Tuning - Adust AXIS#00 Tuning mode 0 : Set servo gains with priority given to sta 2 : Ball screw mechanism or linear motor Mechanism se Friction compensation Enable Gain status 1 gai Tuning level Set the tuning level. Tuning level ing level adju Back Ð Ŧ Vibr Notch fite -0 1 step inactive 2 step Anti-res Ctrl Adj Vibra Anti-res Adj inactive Ca Anti-res Ctrl Adj -----To Autotuning Comp Cancel Precautions ed.

### Tuning Mode 2 or 3

Increase the feedforward level until overshooting occurs and then increase the feedback level until overshooting is eliminated. Repeat these changes to make the adjustment.



Information

The new feedforward level will not be used until the positioning completed signal is output.

- 11. You can set the functions to suppress vibration (notch filters, automatic anti-resonance control setting, anti-resonance control adjustment, and autotuning with a host reference) as required.
  - Refer to the following section for details.
  - Vibration Suppression Functions on page 8-46

Tuning Mode 2 or 3

Tuning

#### 12. When tuning has been completed, click the Completed Button.

The values that were changed will be saved in the SERVOPACK and you will return to the Tuning Dialog Box.

| Tuning mode                                                                                                  | 0 : Set servo gains with priority given to stability.                 |
|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
|                                                                                                              |                                                                       |
| Mechanism selection                                                                                          | 2 : Ball screw mechanism or linear motor                              |
| Friction compensation                                                                                        | Enable                                                                |
| Gain status                                                                                                  | 1 gain                                                                |
| Tuning level adjustment<br>Setting the tuning level<br>too high can cause<br>vibration or abnormal<br>noise. | Set the luning level<br>Tuning level<br>Back<br>U - 2000)<br>Back     |
| Finish                                                                                                       |                                                                       |
| Finish                                                                                                       | Auto-setting<br>Noch flar                                             |
| Finish                                                                                                       | Notch filter Vibration not detected Vib Detect                        |
| Finish                                                                                                       | Notch filter Vibration not detected Vib Detect 1 step inactive Cancel |
| Finish                                                                                                       | Notch filter Vibration not detected Vib Detect                        |
| Finish                                                                                                       | Notch filter Vibration not detected Vib Detect 1 step inactive Cancel |

This concludes the procedure to set up custom tuning.

## **Vibration Suppression Functions**

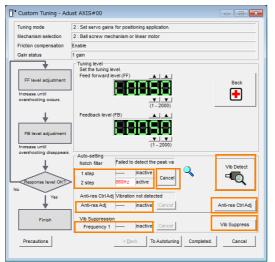
### Notch Filters and Automatic Anti-resonance Control Setting

If the vibration frequency that occurs when you increase the servo gains is at 1,000 Hz or higher, notch filters are effective to suppress vibration. If the vibration is between 100 Hz and 1,000 Hz, anti-resonance control is effective.

### Automatic Setting

To set vibration suppression automatically, use the parameters to enable notch filters and automatic anti-resonance control setting.

The notch filter frequency (stage 1 or 2) or anti-resonance control frequency that is effective for the vibration that was detected during tuning will be automatically set.



### • Auto-setting Cancel Buttons

The automatically set notch filter frequencies or the anti-resonance control frequencies may not always suppress vibration. Click the **Cancel** Button to reset the notch filter frequencies or the anti-resonance control frequencies to the values from just before these frequencies were set automatically.

When they are reset, vibration detection will start again.

• Vib Detect Button

While the notch filter or automatic anti-resonance control setting function is enabled, you can click the **Vib Detect** Button to manually detect vibration. When you click the **Vib Detect** Button, the SERVOPACK will detect vibration at that time, and set the notch filter frequency (stage 1 or 2) or anti-resonance control frequency that is effective for the detected vibration. You can also perform manual vibration detection even when the SERVOPACK does not detect vibration.

· Anti-res Ctrl Adj Button

You can use the **Anti-res Ctrl Adj** Button to execute the anti-resonance control adjustment if fine-tuning is required. Refer to the following section. **8.9** Anti-Resonance Control Adjustment on page 8-49

Vib Suppress Button

Click the **Vib Suppress** Button to suppress low and transient vibration (oscillation) of approximately 1 Hz to 100 Hz that occurs during positioning. Refer to the following section.

8.10 Vibration Suppression on page 8-54

### Autotuning with a Host Reference

You can perform autotuning with a host reference. Refer to the following section for details. 8.7 Autotuning with a Host Reference on page 8-34

# 8.8.5 Automatically Adjusted Function Settings

You cannot use vibration suppression functions at the same time. Other automatic function settings are the same as for autotuning without a host reference. Refer to the following section.

# 8.8.6 Tuning Example for Tuning Mode 2 or 3

| Step | Measurement Display Examples                                                    | Operation                                                                                                                                                                                                                                                                   |
|------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Position<br>deviation<br>Reference<br>speed<br>Positioning<br>completion signal | The positioning time is measured after the moment of inertia<br>ratio (Pn103) is set correctly.<br>Tuning is completed if the specifications are met.<br>The tuning results are saved in the SERVOPACK.                                                                     |
| 2    |                                                                                 | The positioning time will be reduced if the feedforward level is<br>increased.<br>Tuning is completed if the specifications are met. The tuning<br>results are saved in the SERVOPACK.<br>If overshooting occurs before the specifications are met, pro-<br>ceed to step 3. |
| 3    |                                                                                 | Overshooting will be reduced if the feedback level is increased.<br>If the overshooting is eliminated, proceed to step 4.                                                                                                                                                   |

Continued on next page.

luning

### 8.8.7 Related Parameters

Continued from previous page.

| Step | Measurement Display Examples | Operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4    |                              | The graph shows overshooting that occurred when the feed-<br>forward level was increased even more after step 3. In this<br>state, overshooting occurs, but the positioning settling time<br>is shorter. Tuning is completed if the specifications are met.<br>The tuning results are saved in the SERVOPACK. If over-<br>shooting occurs before the specifications are met, repeat<br>steps 3 and 4.<br>If vibration occurs before the overshooting is eliminated, the<br>vibration is suppressed with the notch filters and anti-reso-<br>nance control. |
| 5    | -                            | The tuning results are saved in the SERVOPACK.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

# 8.8.7 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute custom tuning.

| Parameter | Name                                                    | Automatic Changes |
|-----------|---------------------------------------------------------|-------------------|
| Pn100     | Speed Loop Gain                                         | Yes               |
| Pn101     | Speed Loop Integral Time Constant                       | Yes               |
| Pn102     | Position Loop Gain                                      | Yes               |
| Pn103     | Moment of Inertia Ratio                                 | No                |
| Pn121     | Friction Compensation Gain                              | Yes               |
| Pn123     | Friction Compensation Coefficient                       | Yes               |
| Pn124     | Friction Compensation Frequency Correction              | No                |
| Pn125     | Friction Compensation Gain Correction                   | Yes               |
| Pn401     | First Stage First Torque Reference Filter Time Constant | Yes               |
| Pn408     | Torque-Related Function Selections                      | Yes               |
| Pn409     | First Stage Notch Filter Frequency                      | Yes               |
| Pn40A     | First Stage Notch Filter Q Value                        | Yes               |
| Pn40C     | Second Stage Notch Filter Frequency                     | Yes               |
| Pn40D     | Second Stage Notch Filter Q Value                       | Yes               |
| Pn140     | Model Following Control-Related Selections              | Yes               |
| Pn141     | Model Following Control Gain                            | Yes               |
| Pn142     | Model Following Control Gain Correction                 | Yes               |
| Pn143     | Model Following Control Bias in the Forward Direction   | Yes               |
| Pn144     | Model Following Control Bias in the Reverse Direction   | Yes               |
| Pn145     | Vibration Suppression 1 Frequency A                     | No                |
| Pn146     | Vibration Suppression 1 Frequency B                     | No                |
| Pn147     | Model Following Control Speed Feedforward Compensation  | Yes               |
| Pn160     | Anti-Resonance Control-Related Selections               | Yes               |
| Pn161     | Anti-Resonance Frequency                                | Yes               |
| Pn163     | Anti-Resonance Damping Gain                             | Yes               |

Do not change the settings while custom tuning is being executed.

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

8.9.1 Outline

# 8.9 Anti-Resonance Control Adjustment

This section describes anti-resonance control.

# 8.9.1 Outline

Anti-resonance control increases the effectiveness of vibration suppression after custom tuning.

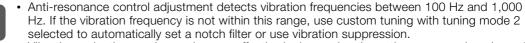
Anti-resonance control is effective for suppression of continuous vibration frequencies from 100 to 1,000 Hz that occur when the control gain is increased. Vibration can be eliminated by setting vibration frequencies through automatic detection or by manually setting them to adjust the damping gain. Input an operation reference and execute this anti-resonance control adjustment when there is vibration.

Anti-resonance control is automatically set by autotuning without a host reference or autotuning with a host reference. Use anti-resonance control adjustment only if fine-tuning is required or readjustment is required as a result of a failure to detect vibration.

Perform custom tuning if required to increase the response after performing anti-resonance control adjustment. If the control gain is increased, e.g., when custom tuning is performed, vibration may occur again. If that occurs, perform anti-resonance control adjustment again to fine-tune the parameters.

# 

- Related parameters will be set automatically when anti-resonance control adjustment is executed. This may greatly affect the response before and after execution. Make sure that you can perform an emergency stop at any time.
- Before you execute anti-resonance control adjustment, set the correct moment of inertia ratio (Pn103). If the setting greatly differs from the actual moment of inertia ratio, normal control of the machine may not be possible, and vibration may occur.



 Vibration reduction can be made more effective by increasing the anti-resonance damping gain (Pn163), but the vibration may become larger if the damping gain is too high. Increase the damping gain by approximately 0% to 200% in 10% increments while checking the effect on vibration. If vibration reduction is still insufficient at a gain of 200%, cancel the setting, and lower the control gain by using a different method, such as custom tuning.

# 8.9.2 Preparations

0

Always check the following before you execute anti-resonance control adjustment.

- The tuning-less function must be disabled (Pn170 =  $n.\Box\Box\Box$ 0).
- The test without a motor function must be disabled (Pn00C =  $n.\square\square\square$ ).
- The parameters must not be write prohibited.

8.9.3 Applicable Tools

# 8.9.3 Applicable Tools

The following table lists the tools that you can use to perform anti-resonance control adjustment.

| Tool             | Fn No./Function Name | Operating Procedure Reference                                                 |
|------------------|----------------------|-------------------------------------------------------------------------------|
| Digital Operator | Fn204                | Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Tuning - Tuning      | S.9.4 Operating Procedure on page 8-50                                        |

# 8.9.4 Operating Procedure

To execute anti-resonance control adjustment, an operation reference is input, and the adjustment is executed while vibration is occurring.

The following methods can be used to execute anti-resonance control adjustment.

- To automatically detect the vibration frequency
- To manually set the vibration frequency

Use the following procedure to perform anti-resonance control.

| <ul> <li>Before you execute anti-resonance control adjustment, check the information provided in the SigmaWin+ operating manual.<br/>Observe the following precautions.</li> <li>Make sure that you can perform an emergency stop at any time.<br/>Parameters will be set automatically when anti-resonance control adjustment is executed. This may greatly affect the response before and after execution. Make sure that you can perform an emergency stop (to turn OFF the power supply) at any time.</li> <li>Set the moment of inertia correctly before you execute anti-resonance control adjustment. If the setting greatly differs from the actual moment of inertia, effective vibration reduction may not be possible.</li> <li>If you have already performed anti-resonance control adjustment and then you change the frequency, the current anti-resonance control effect may be lost. Caution is particularly required when automatically detecting the vibration frequency.</li> <li>If effective vibration reduction is not achieved even after you execute anti-resonance control adjustment, cancel the function and lower the control gain by using a different method, such as custom tuning.</li> <li>Perform custom tuning separately if required to increase the response after performing anti-resonance control adjustment. If the servo gain is increased, e.g., when custom tuning is performed, vibration may occur again. If that occurs, perform anti-resonance control adjustment again to fine-tune the parameters.</li> </ul> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

# 1. Perform steps 1 to 8 of the procedure for custom tuning. Refer to the following section for details.

8.8.4 Operating Procedure on page 8-42

8.9.4 Operating Procedure

2. Click the Anti-res Ctrl Adj Button.

The rest of the procedure depends on whether you know the vibration frequency.

|                                                                                                             | dust AXIS#00                                                     |
|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Tuning mode                                                                                                 | 0 : Set servo gains with priority given to stability.            |
| Mechanism selection                                                                                         | 2 : Ball screw mechanism or linear motor                         |
| Friction compensation                                                                                       | Enable                                                           |
| Gain status                                                                                                 | 1 gain                                                           |
| Tuning level adjustmer<br>Setting the tuning level<br>too high can cause<br>vibration or abnormal<br>noise. |                                                                  |
|                                                                                                             | Auto-setting                                                     |
|                                                                                                             | Notch filter 1 step 2 step 860Hz active Cancel Anti-res Ctri Adi |
|                                                                                                             | Notch filter<br>1 step inactive<br>2 step 880Hz active Cancel    |

3. If you do not know the vibration frequency, click the Auto Detect Button. If you know the vibration frequency, click the Manual Set Button.

To Automatically Detect the Vibration Frequency

The frequency will be set.

| Determine frequency                                            | - Adjustment                      | -th-s.de                   | Anti-res Adj: Inactive                                                                             |
|----------------------------------------------------------------|-----------------------------------|----------------------------|----------------------------------------------------------------------------------------------------|
| Sick the Auto Detect button to utomatically set the frequency. | Auto Detect                       |                            |                                                                                                    |
| Set frequency                                                  | ו                                 | Before adjustment 760 (Hz) | i                                                                                                  |
| lick the Start adjustment button.                              | << Frequency >>                   |                            | Start adjustment                                                                                   |
| +                                                              |                                   |                            |                                                                                                    |
| Adjust damping gain                                            | ]                                 | (1-2000)                   | «Caution»<br>If a frequency significantly                                                          |
| norease (Damping Gain).                                        | < <damping gain="">&gt;</damping> | 888888 -                   | different from the value before<br>adjustment is set, the current<br>anti-resonance control effect |
| +                                                              |                                   |                            | may be lost. Once the vibration<br>problem is solved, do not                                       |
| Finish                                                         | 1                                 | (0-300)                    | increase damping gain.                                                                             |

| Determine frequency<br>lisk the Auto Detext button to<br>utomatically set the frequency.                   | Adjustment     Frequency Setting M     Auto Detect |                           | Anti-res                                                                                                                              | Adj: hactive                                                                              |
|------------------------------------------------------------------------------------------------------------|----------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Bel frequency<br>Ilis the Start adjustment buton.<br>Adjust camping gan<br>rossas (Damping Cain):<br>Finah | << Frequency >>                                    | Betre edjeatment (1) (PC) | Caution<br>If a frequency sk<br>different from the<br>adjustment is set<br>anti-resonance of<br>problem is solved<br>increase damping | prificantly<br>value before<br>the current<br>ontrol effect<br>the vibration<br>I, do not |
|                                                                                                            | Precautions                                        |                           | Finish                                                                                                                                | Cancel                                                                                    |

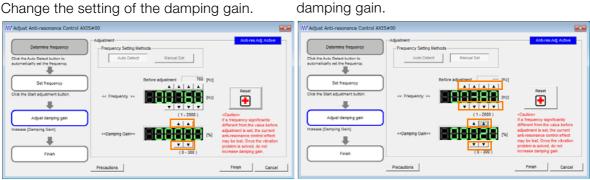
To Manually Set the Vibration Frequency

#### 4. Click the Start adjustment Button.

5. Use the ▲ and ▼ Buttons in the Adjustment Area to change the settings. Click the **Reset** Button during tuning to restore the setting to its original value. The tuning level will return to the value from before when custom tuning was started.

To Automatically Detect the Vibration Frequency

To Manually Set the Vibration Frequency Change the settings of the frequency and damping gain.



Tuning

#### 8.9.5 Related Parameters

#### 6. When the adjustment has been completed, click the Finish Button.

The values that were changed will be saved in the SERVOPACK and you will return to the Tuning Dialog Box.

|                                                                     | Adjustment            |                          | Anti-res Adj Active                                             |
|---------------------------------------------------------------------|-----------------------|--------------------------|-----------------------------------------------------------------|
| Determine frequency                                                 | - Frequency Setting M | ethods                   |                                                                 |
| Click the Auto Detect button to<br>automatically set the frequency. | Auto Detect           | Manual Set               |                                                                 |
| Set frequency                                                       | 1                     | Before adjustment 760 pt |                                                                 |
| Click the Start adjustment button.                                  | << Frequency >>       |                          | Reset                                                           |
|                                                                     |                       |                          |                                                                 |
| Adjust damping gain                                                 | ו                     | (1-2000)                 | «Caution»                                                       |
|                                                                     | )                     | <u> </u>                 | If a frequency significantly<br>different from the value before |
| Increase (Damping Gain).                                            | «Damping Gain»»       |                          | adjustment is set, the current<br>anti-resonance control effect |
| +                                                                   |                       |                          | may be lost. Once the vibration                                 |
| Ebish                                                               |                       | (0-300)                  | problem is solved, do not<br>increase damping gain.             |

This concludes the procedure to set up anti-resonance control.

### 8.9.5 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute anti-resonance control adjustment.

Do not change the settings while anti-resonance control adjustment is being executed.

| Parameter | Name                                             | Automatic Changes |
|-----------|--------------------------------------------------|-------------------|
| Pn160     | Anti-Resonance Control-Related Selections        | Yes               |
| Pn161     | Anti-Resonance Frequency                         | Yes               |
| Pn162     | Anti-Resonance Gain Correction                   | No                |
| Pn163     | Anti-Resonance Damping Gain                      | Yes               |
| Pn164     | Anti-Resonance Filter Time Constant 1 Correction | No                |
| Pn165     | Anti-Resonance Filter Time Constant 2 Correction | No                |

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

# 8.9.6 Suppressing Different Vibration Frequencies with Anti-resonance Control

When you use anti-resonance control and increase the control gain, for some mechanism, vibration can occur at a higher frequency than the frequency for which vibration was suppressed. If this occurs, you can suppress vibration for more than one frequency by adjusting Pn166 (Anti-Resonance Damping Gain 2).

Information

#### tion Guidelines for Vibration That Can Be Suppressed

- Anti-resonance frequency (Pn161): fa [Hz], Another vibration frequency that occurs when the control gain is increased: fb [Hz]
- Vibration frequencies: 100 Hz to 1,000 Hz
- Range of different vibration frequencies: 1 < (fb/fa)  $\leq$  3 to 4

### **Required Parameter Settings**

The following parameter settings are required to use anti-resonance control for more than one vibration frequency.

|       | Parameter                   | I                      | Description     |              | Wher<br>Enable  |                    | Classifi-<br>cation |
|-------|-----------------------------|------------------------|-----------------|--------------|-----------------|--------------------|---------------------|
| Pn160 | n.□□□0<br>(default setting) | Do not use anti-resona | ance control.   |              | After<br>restar |                    | Setup               |
|       | n.0001                      | Use anti-resonance co  | ontrol.         |              | 16314           | L                  |                     |
|       | Anti-Resonance Fr           | equency                |                 |              |                 |                    |                     |
| Pn161 | Setting Range               | Setting Unit           | Default Setting | When Ena     | abled           | Cla                | assification        |
|       | 10 to 20,000                | 0.1 Hz                 | 1000            | Immedia      | itely           |                    | Tuning              |
|       | Anti-Resonance Ga           | ain Correction         |                 |              |                 |                    |                     |
| Pn162 | Setting Range               | Setting Unit           | Default Setting | When Ena     | abled           | Cla                | assification        |
|       | 1 to 1,000                  | 1%                     | 100             | Immediately  |                 |                    | Tuning              |
|       | Anti-Resonance Da           | amping Gain            |                 |              |                 |                    |                     |
| Pn163 | Setting Range               | Setting Unit           | Default Setting | When Enabled |                 | bled Classificatio |                     |
|       | 0 to 300                    | 1%                     | 0               | Immedia      | Immediately     |                    | Tuning              |
|       | Anti-Resonance Fi           | lter Time Constant 1 C | orrection       |              |                 |                    |                     |
| Pn164 | Setting Range               | Setting Unit           | Default Setting | When Ena     | abled           | Cla                | assification        |
|       | -1,000 to 1,000             | 0.01 ms                | 0               | Immedia      | ately           |                    | Tuning              |
|       | Anti-Resonance Fi           | Iter Time Constant 2 C | orrection       |              |                 |                    |                     |
| Pn165 | Setting Range               | Setting Unit           | Default Setting | When Ena     | abled           | Cla                | assification        |
|       | -1,000 to 1,000             | 0.01 ms                | 0               | Immedia      | ately           |                    | Tuning              |
|       | Anti-Resonance Da           | amping Gain 2          |                 |              |                 |                    |                     |
| Pn166 | Setting Range               | Setting Unit           | Default Setting | When Ena     | abled           | Cla                | assification        |
|       | 0 to 1,000                  | 1%                     | 0               | Immedia      | ately           |                    | Tuning              |

### Adjustment Procedure for Suppressing Different Vibration Frequencies with Anti-resonance Control

Use the following procedure to make adjustments to suppress different vibration frequencies with anti-resonance control.

| Step | Operation                                                                                                                                                                                                                                                                                                     |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Use the gain adjustment and anti-resonance control.<br>Refer to the following section for details.<br>3.9.4 Operating Procedure on page 8-50                                                                                                                                                                  |
| 2    | If there is vibration at a higher frequency than the vibration suppressed with anti-resonance control in step 1, adjust Pn166 (Anti-Resonance Damping Gain 2).                                                                                                                                                |
| 3    | Adjust Pn166 (Anti-Resonance Damping Gain 2) while checking to see if vibration reduction is effective.<br>To adjust Pn166 (Anti-Resonance Damping Gain 2), increase the setting by 10% at a time starting from the value that resulted in Pn163 (Anti-Resonance Damping Gain) from the adjustment in step 1. |
| 4    | If the vibration disappears, the adjustment is completed.<br>However, if the vibration does not disappear even when you adjust Pn166 (Anti-Resonance<br>Damping Gain 2), reduce the tuning level or feedback level until vibration does not occur.                                                            |

8

8.10.1 Outline

## 8.10 Vibration Suppression

This section describes vibration suppression.

### 8.10.1 Outline

Important

You can use vibration suppression to suppress transient vibration at a low frequency from 1 Hz to 100 Hz, which is generated mainly when the machine vibrates during positioning. This is effective for vibration frequencies for which notch filters and anti-resonance control adjustment are not effective.

Vibration suppression is automatically set by autotuning without a host reference or autotuning with a host reference. Use vibration suppression only if fine-tuning is required or readjustment is required as a result of a failure to detect vibration. To execute vibration suppression, input an operation reference and execute the function when there is vibration.

Perform custom tuning if required to increase the response after performing vibration suppression.

| <ul> <li>Related parameters will be set automatically when vibration suppression is executed. This may greatly affect the response before and after execution. Make sure that you can perform an emergency stop at any time.</li> </ul>                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul> <li>Before you execute vibration suppression, set the correct moment of inertia ratio (Pn103)<br/>with autotuning without a host reference or another method. If the setting greatly differs<br/>from the actual moment of inertia ratio, normal control of the machine may not be possible,<br/>and vibration may occur.</li> </ul> |
|                                                                                                                                                                                                                                                                                                                                           |
| <ul> <li>Vibration suppression detects vibration frequencies between 1 Hz and 100 Hz.</li> <li>Frequency detection will not be performed if there is no vibration in the position deviation or if</li> </ul>                                                                                                                              |

 Frequency detection will not be performed if there is no vibration in the position deviation or if the vibration frequency is outside the range of detectable frequencies. If that is a problem, use a device such as a displacement meter or vibration sensor to measure the vibration frequency.

 If an automatically detected vibration frequency is not suppressed, the actual frequency and the detected frequency may be different. Fine-tune the detected frequency if necessary.

### Items That Influence Performance

If continuous vibration occurs while the Servomotor is stopping, vibration suppression cannot be used to suppress the vibration effectively. In this case, use anti-resonance control adjustment or custom tuning.

### **Detection of Vibration Frequencies**

Frequency detection may not be possible if vibration does not appear in the position deviation or the vibration that results from the position deviation is too small. You can adjust the detection sensitivity by changing the setting of the residual vibration detection width (Pn560), which is set as a percentage of the positioning completed width (Pn522). Perform the detection of vibration frequencies again after adjusting the setting of Pn560.

|       | Residual Vibration Detection Width |              |                 |              |                |
|-------|------------------------------------|--------------|-----------------|--------------|----------------|
| Pn560 | Setting Range                      | Setting Unit | Default Setting | When Enabled | Classification |
|       | 1 to 3,000                         | 0.1%         | 400             | Immediately  | Setup          |

Note: As a guideline, change the setting 10% at a time. If the setting of this parameter is lowered, the detection sensitivity will be increased. Vibration may not be detected accurately if the setting is too small.

Information The vibration frequencies that are automatically detected may vary somewhat with each positioning. Perform positioning several times and make adjustments while checking the effect of vibration suppression.

### 8.10.2 Preparations

Always check the following before you execute vibration suppression.

- The tuning-less function must be disabled (Pn170 =  $n.\Box\Box\Box$ 0).
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- The parameters must not be write prohibited.

### 8.10.3 Applicable Tools

The following table lists the tools that you can use to perform vibration suppression.

| Tool             | Fn No./Function Name | Operating Procedure Reference                                                   |
|------------------|----------------------|---------------------------------------------------------------------------------|
| Digital Operator | Fn205                | Ω Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Tuning - Tuning      | 8.10.4 Operating Procedure on page 8-55                                         |

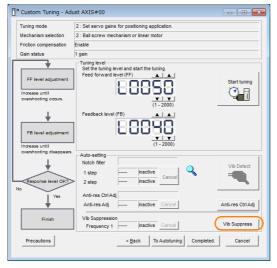
### 8.10.4 Operating Procedure

Use the following procedure to perform vibration suppression.

1. Perform steps 1 to 8 of the procedure for custom tuning. Refer to the following section for details.

8.8.4 Operating Procedure on page 8-42

2. Click the Vib Suppress Button.



#### 8.10.4 Operating Procedure

3. Click the Import Button or click ▲ and ▼ Button to manually adjust the set frequency. When you click the Import Button, the residual vibration frequency in the Servomotor is read as the set frequency. (The frequency can be read only when the residual vibration frequency is between 1.0 and 100.0.)

Frequency detection will not be performed if there is no vibration or if the vibration frequency is outside the range of detectable frequencies. If a vibration frequency is not detected, provide a means of measuring the vibration frequency. Important

| Vibration Suppression AXIS                                                                                                                                                                                                                    | #00                                                                          | <b>—</b>                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------|
| Determine the frequency<br>for setting.<br>Click the Import button.<br>Manual setting to also possible.<br>Set the frequency.<br>Click the Set button.<br>If the vibration problem could not<br>be solved.<br>Tinely adjust the frequency and | Adjustment<br>Residual Vibration Frequency<br>Set frequency<br>Set frequency | Vb Suppression: inactive |
| Finish                                                                                                                                                                                                                                        | ( 1.0 - 100.0 )                                                              | Finish Cancel            |

#### 4. Click the Set Button.



No settings related to vibration suppression are changed during operation. If the Servomotor does not stop within approximately 10 seconds after changing the setting, an update timeout will occur. The setting will be automatically returned to the previous value.

| 🦶 Vibration Suppression AXIS                                                                                                                                                     | #00                                                                           | × |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---|
| Determine the frequency<br>for setting.<br>Click the Import button.<br>Manual setting is also possible.                                                                          | Adjustment Vb Suppression Active Residual Vibration Frequency 9.0 (Hz) Import |   |
| Set the frequency.<br>Click the Set button.<br>If the vibration problem could not<br>be solved,<br>finely adjust the frequency and<br>then click the Set button again.<br>Finish | Set frequency                                                                 |   |
|                                                                                                                                                                                  | Precautions Finish Cancel                                                     |   |

If the vibration is not eliminated, use the  $\blacktriangle$  and  $\blacktriangledown$  Buttons for the set frequency to fine-tune the value and click the Set Button again.

| Vibration Suppression AXIS                                                                                                                        | #00                                        |                                                                         | ×                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------|-------------------------|
| Determine the frequency for setting.                                                                                                              | Adjustment<br>Residual Vibration Frequency | 9.0 [Hz]                                                                | Vib Suppression: Active |
| Click the Import button.<br>Manual setting is also possible.<br>Set the frequency.<br>Click the Set button.<br>If the vitration problem could not |                                            |                                                                         | Set Reset               |
| Finish                                                                                                                                            |                                            | [Hz]<br>V V V<br>1.0 - 100.0 )<br>k the Set button.Current value: 9.0 I |                         |
|                                                                                                                                                   | Precautions                                |                                                                         | Finish Cancel           |

Click the Reset Button during adjustment to restore the setting to its original value. The status from before when adjustment was started will be restored.

**5.** When the vibration has been eliminated, click the Finish Button. The updated value will be saved in the SERVOPACK.



Vibration suppression will be enabled in step 5. The Servomotor response, however, will change when the Servomotor comes to a stop with no reference input.

This concludes the procedure to set up vibration suppression.

### 8.10.5 Related Parameters

The following parameters are automatically adjusted or used as reference when you execute vibration suppression.

| Do not change | the settings while | vibration suppression | is being executed. |
|---------------|--------------------|-----------------------|--------------------|
|               |                    |                       |                    |

| Parameter | Name                                                   | Automatic Changes |
|-----------|--------------------------------------------------------|-------------------|
| Pn140     | Model Following Control-Related Selections             | Yes               |
| Pn141     | Model Following Control Gain                           | Yes               |
| Pn142     | Model Following Control Gain Correction                | No                |
| Pn143     | Model Following Control Bias in the Forward Direction  | No                |
| Pn144     | Model Following Control Bias in the Reverse Direction  | No                |
| Pn145     | Vibration Suppression 1 Frequency A                    | Yes               |
| Pn146     | Vibration Suppression 1 Frequency B                    | Yes               |
| Pn147     | Model Following Control Speed Feedforward Compensation | No                |
| Pn14A     | Vibration Suppression 2 Frequency                      | No                |
| Pn14B     | Vibration Suppression 2 Correction                     | No                |

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

8

8.11.1 Outline

## 8.11 Speed Ripple Compensation

This section describes speed ripple compensation.

### 8.11.1 Outline

Speed ripple compensation reduces the amount of ripple in the motor speed due to torque ripple or cogging torque. You can enable speed ripple compensation to achieve smoother operation. To enable it, you must set up ripple compensation on the SigmaWin+.

## 

• Speed ripple compensation requires operating the Servomotor and therefore presents hazards. Observe the following precautions.

Confirm safety around moving parts.

This function involves automatic operation. Make sure that you can perform an emergency stop (to turn OFF the power supply) at any time.



- Execute speed ripple compensation only after adjusting the gains.
- Reset speed ripple compensation after you replace the Servomotor or SERVOPACK.

• Execute speed ripple compensation after jog operation to a position that ensures a suitable range of motion.

## 8.11.2 Setting Up Speed Ripple Compensation

### Restrictions

The following restrictions apply to the setup for speed ripple compensation.

#### Systems for Which Execution Cannot Be Performed

There are no restrictions.

#### Systems for Which Adjustments Cannot Be Made Accurately

Systems for which there is not a suitable range of motion

#### Preparations

Always check the following before you set up speed ripple compensation.

- The main circuit power supply must be ON.
- The servo must be OFF.
- There must be no alarms or warnings.
- There must be no hard wire base block (HWBB).
- The parameters must not be write prohibited.

8.11.2 Setting Up Speed Ripple Compensation

### **Applicable Tools**

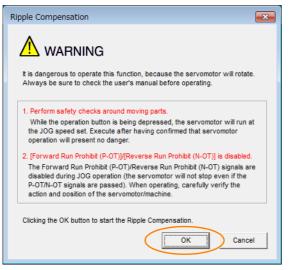
The following table lists the tools that you can use to set up speed ripple compensation.

| Tool             | Fn No./Function Name                                                   | Reference                       |
|------------------|------------------------------------------------------------------------|---------------------------------|
| Digital Operator | You cannot set up speed ripple compensation from the Digital Operator. |                                 |
| SigmaWin+        | Diagnostic – Ripple Compensation                                       | Gerating Procedure on page 8-59 |

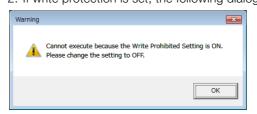
### **Operating Procedure**

Use the following procedure to set up speed ripple compensation.

- 1. Click the <u>Servo</u> Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Ripple Compensation in the Menu Dialog Box. The Ripple Compensation Dialog Box will be displayed.
- **3.** Click the **OK** Button.



Information1. Click the **Cancel** Button to cancel ripple compensation. The Main Window will return.2. If write protection is set, the following dialog box will be displayed.



Click the **OK** Button to cancel write prohibition.

8.11.2 Setting Up Speed Ripple Compensation

4. Click the Edit Button.

| leasure Writing Results Ve              | rification 🕶 Confirm | Noasurement                                |                       |
|-----------------------------------------|----------------------|--------------------------------------------|-----------------------|
| ian]                                    | v [plv]              | Ph304 : Jogging Spr<br>500<br>Please execu | te by 100(min-1) Edit |
| 4                                       |                      | 0 5                                        | ervo OFF              |
| 2                                       |                      | Forward                                    | Reverse               |
| 0                                       |                      |                                            | <b>_</b>              |
| -2                                      |                      |                                            | Write                 |
|                                         |                      | . <u>.  </u>                               |                       |
| v 0.0 60.0 120.0 180.0 240.0 30<br>Time |                      | Confirm-                                   | •                     |

5. Enter the jog operation speed in the Input Value Box and click the OK Button.

| Edit AXIS#00                                  | <b>—</b>  |
|-----------------------------------------------|-----------|
| Pn304 Jogging Speed                           |           |
| Input value 500 initial mittain 1 (0 - 10000) |           |
|                                               | OK Cancel |

6. Click the Servo ON Button.

| T Ripple Compensation AXIS#00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| Measure Writing Results Verification Confirm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Measurement<br>Ph304 : Jogging Speed                  |
| V (M) V (M)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 600 [min-1] Edt Please execute by 100[min-1] or less. |
| s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Servo OFF     Servo ON                                |
| 33<br>22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Forward Reverse                                       |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <u>+</u>                                              |
| .1<br>.2<br>.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Writing Results                                       |
| .3************************************                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                       |
| ↓ .5<br>↓ .5 | - Confirm                                             |
| Before adjustment     After adjustment     Jidiv]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Reset                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                       |

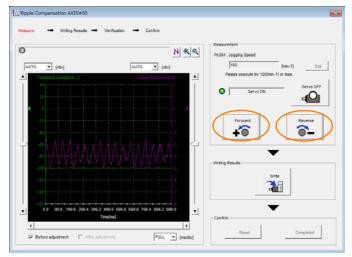
8.11.2 Setting Up Speed Ripple Compensation

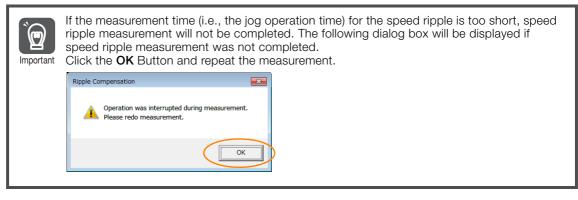
#### 7. Click the Forward Button or the Reverse Button.

Measurement operation is started.

The Servomotor shaft will rotate at the preset jogging speed while you hold down the **Forward** or **Reverse** Button and the speed ripple will be measured.

The feedback speed and torque reference graph will be displayed in the Ripple Compensation Dialog Box during jog operation.





- 8. After speed ripple measurement has been completed, click the Write Button. The ripple compensation value will be written to the SERVOPACK.
- 9. After writing has been completed, click the OK Button.

| Ripple Co | mpensation                                                                                                                                                     | × |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Í         | The Ripple Compensation value was written in.<br>Please measure again and verify.<br>If a verification result is good, please click the "Completed"<br>button. |   |
|           | ОК                                                                                                                                                             |   |

8

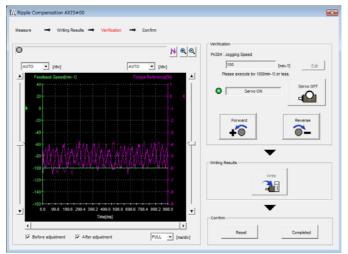
#### 8.11.3 Setting Parameters

#### 10. Click the Forward Button or the Reverse Button.

Verification operation is started.

The Servomotor shaft will rotate at the preset jogging speed while you hold down the **Forward** or **Reverse** Button.

The waveform with speed ripple compensation applied to it will be displayed.



#### 11. If the verification results are OK, click the Finish Button.

Information To discard the setup results, click the **Reset** Button.

This concludes the setup for speed ripple compensation.

### 8.11.3 Setting Parameters

The function is enabled when you perform the operating procedure on *Operating Procedure* on page 8-59. To cancel speed ripple compensation, use  $Pn423 = n.\square\square\square$  (Disable speed ripple compensation) to disable it.

| Pa    | rameter                     | Description                        | When<br>Enabled  | Classifi-<br>cation |
|-------|-----------------------------|------------------------------------|------------------|---------------------|
| Pn423 | n.□□□0<br>(default setting) | Disable speed ripple compensation. | Immedi-<br>ately | Setup               |
|       | n.0001                      | Enable speed ripple compensation.  |                  |                     |

If you enable speed ripple compensation, a compensation reference will be applied to reduce ripple even when stopped at a 0 speed reference. In speed control mode, this may result in the Servomotor moving slightly. To prevent this, set  $Pn423 = n.\Box X \Box \Box$  (Speed Ripple Compensation Selections) and Pn427 or Pn49F (Speed Ripple Compensation Enable Speed).

| Pa    | rameter                     | Description     | When<br>Enabled  | Classifi-<br>cation |
|-------|-----------------------------|-----------------|------------------|---------------------|
| Pn423 | n.□0□□<br>(default setting) | Speed reference | After<br>restart | Setup               |
|       | n.0100                      | Motor Speed     | restart          |                     |

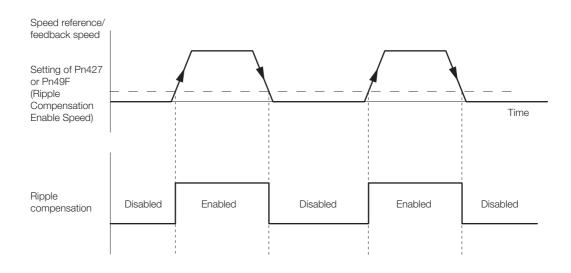
• For Rotary Servomotors

|       | Speed Ripple Compensation Enable Speed                                |         |   |             |        |  |
|-------|-----------------------------------------------------------------------|---------|---|-------------|--------|--|
| Pn427 | 27 Setting Range Setting Unit Default Setting When Enabled Classifica |         |   |             |        |  |
|       | 0 to 10,000                                                           | 1 min⁻¹ | 0 | Immediately | Tuning |  |

• For Linear Servomotors

|       | Speed Ripple Compensation Enable Speed                                    |        |   |             |        |  |  |
|-------|---------------------------------------------------------------------------|--------|---|-------------|--------|--|--|
| Pn49F | OF Setting Range Setting Unit Default Setting When Enabled Classification |        |   |             |        |  |  |
|       | 0 to 10,000                                                               | 1 mm/s | 0 | Immediately | Tuning |  |  |

8.11.3 Setting Parameters



### **Speed Ripple Compensation Warnings**

The speed ripple compensation value is specific to each Servomotor. If you replace the Servomotor while speed ripple compensation is enabled, an A.942 warning (Speed Ripple Compensation Information Disagreement) will occur to warn you.

- You can use any of the following methods to clear A.942.
- Reset the speed ripple compensation value on the SigmaWin+.
- Disable speed ripple compensation (Pn423 =  $n.\Box\Box\Box$ ).
- Disable detection of A.942 (Pn423 =  $n.\Box\Box1\Box$ ).

| Parameter |                                    | Description          |                  | Classifi-<br>cation |
|-----------|------------------------------------|----------------------|------------------|---------------------|
| Pn423     | n.□□0□<br>(default setting)        | Detect A.942 alarms. | After<br>restart | Setup               |
|           | n.□□1□ Do not detect A.942 alarms. |                      | Testart          |                     |

8

8.12.1 Automatic Gain Switching

## 8.12 Additional Adjustment Functions

This section describes the functions that you can use to make adjustments after you perform autotuning without a host reference, autotuning with a host reference, and custom tuning.

| Function                         | Reference |
|----------------------------------|-----------|
| Automatic Gain Switching         | page 8-64 |
| Friction Compensation            | page 8-67 |
| Current Control Mode Selection   | page 8-70 |
| Current Gain Level Setting       | page 8-70 |
| Speed Detection Method Selection | page 8-71 |
| Backlash Compensation            | page 8-71 |

### 8.12.1 Automatic Gain Switching

You can use gain switching to shorten the positioning time by increasing the gains during positioning and suppressing vibration by decreasing the gains while stopping.

| Parameter |                             | Function                          | When Enabled | Classification |
|-----------|-----------------------------|-----------------------------------|--------------|----------------|
| Pn139     | n.□□□0<br>(default setting) | Disable automatic gain switching. | Immediately  | Tuning         |
|           | n.□□□2                      | Enable automatic gain switching.  |              |                |

Note:  $Pn139 = n.\square\square\square1$  is a reserved parameter. Do not change.

### **Gain Switching Combinations**

| Selected<br>Gains  | Speed Loop<br>Gain                   | Speed Loop<br>Integral Time<br>Constant                | Position Loop<br>Gain                     | Torque Reference<br>Filter                                                  | Friction<br>Compensation<br>Gain                |
|--------------------|--------------------------------------|--------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------|
| Gain<br>Settings 1 | Speed Loop<br>Gain (Pn100)           | Speed Loop Inte-<br>gral Time Constant<br>(Pn101)      | Position Loop<br>Gain (Pn102)             | First Stage First<br>Torque Reference<br>Filter Time Con-<br>stant (Pn401)  | Friction Com-<br>pensation Gain<br>(Pn121)      |
| Gain<br>Settings 2 | Second<br>Speed Loop<br>Gain (Pn104) | Second Speed<br>Loop Integral Time<br>Constant (Pn105) | Second Posi-<br>tion Loop Gain<br>(Pn106) | First Stage Second<br>Torque Reference<br>Filter Time Con-<br>stant (Pn412) | Second Friction<br>Compensation<br>Gain (Pn122) |

Note: Automatic gain switching is not supported for the model following control gain and the model following control gain correction.

### **Switching Condition**

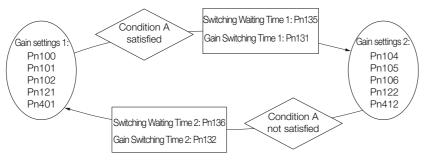
| Parameter |        | Switching<br>Condition    | Selected Gains                          | Switching<br>Waiting Time                 | Switching Time                    |
|-----------|--------|---------------------------|-----------------------------------------|-------------------------------------------|-----------------------------------|
| Pn139     | n.0002 | Condition A satisfied     | Gain settings 1 to gain set-<br>tings 2 | Gain Switching<br>Waiting Time 1<br>Pn135 | Gain Switching<br>Time 1<br>Pn131 |
| FIII39    |        | Condition A not satisfied | Gain settings 2 to gain set-<br>tings 1 | Gain Switching<br>Waiting Time 2<br>Pn136 | Gain Switching<br>Time 2<br>Pn132 |

Select one of the following settings for switching condition A.

8.12.1 Automatic Gain Switching

|    | Parameter |                                                                                      | Position Control Gain<br>Switching Condition A                  | For Control Methods<br>Other Than Position<br>Control (No Switching) | When<br>Enabled | Classification |
|----|-----------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------|-----------------|----------------|
|    |           | n.□□0□<br>(default setting)                                                          | /COIN (Positioning Comple-<br>tion Output) signal turns ON.     | Gain settings 1 used.                                                |                 | Tuning         |
|    | Pn139     | n.0010                                                                               | /COIN (Positioning Comple-<br>tion Output) signal turns<br>OFF. | Gain settings 2 used.                                                | - Immediately   |                |
| Dr |           | n.0020                                                                               | /NEAR (Near Output) signal turns ON.                            | Gain settings 1 used.                                                |                 |                |
|    |           | n.🗆 🗆 3 🗆                                                                            | /NEAR (Near Output) signal turns OFF.                           | Gain settings 2 used.                                                |                 |                |
|    | n.0040    | Position reference filter out-<br>put is 0 and position refer-<br>ence input is OFF. | Gain settings 1 used.                                           |                                                                      |                 |                |
|    |           | n.0050                                                                               | Position reference input is ON.                                 | Gain settings 2 used.                                                |                 |                |

Automatic Switching Pattern 1 (Pn139 =  $n.\Box\Box\Box$ 2)



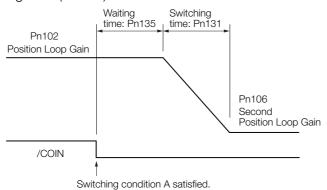
#### Information

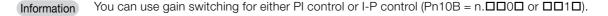
#### /COIN (Positioning Completion Output) Signal and /NEAR (Near Output) Signal A SERVOPACK with an INDEXER Module does not have /COIN (Positioning Completion Output) and /NEAR (Near Output) signals. Here, the following conditions are treated as the active signal status.

- /COIN (Positioning Completion Output) signal: The conditions for both Pn522 (Positioning Completed Width) and Pn207 (/COIN (Positioning Completion Output) Signal Output Timing) have been met.
- /NEAR (Near Output) signal: The current condition is equal to or less than the setting of Pn524 (Near Signal Width).

#### Relationship between the Waiting Times and Switching Times for Gain Switching

In this example, an ON /COIN (Positioning Completion) signal is set as condition A for automatic gain switching. The position loop gain is changed from the value in Pn102 (Position Loop Gain) to the value in Pn106 (Second Position Loop Gain). When the /COIN signal turns ON, the switching operation begins after the waiting time (Pn135). The switching operation changes the position loop gain linearly from the gain set in Pn102 to the gain set in Pn106 over the switching time (Pn131).





8.12.1 Automatic Gain Switching

### **Related Parameters**

|       | Speed Loop Gain                          |                      |                   |              |                |  |  |
|-------|------------------------------------------|----------------------|-------------------|--------------|----------------|--|--|
| Pn100 | Setting Range                            | Setting Unit         | Default Setting   | When Enabled | Classification |  |  |
|       | 10 to 20,000                             | 0.1 Hz               | 400               | Immediately  | Tuning         |  |  |
|       | Speed Loop Integra                       | I Time Constant      |                   |              |                |  |  |
| Pn101 | Setting Range                            | Setting Unit         | Default Setting   | When Enabled | Classification |  |  |
|       | 15 to 51,200                             | 0.01 ms              | 2,000             | Immediately  | Tuning         |  |  |
|       | Position Loop Gain                       |                      |                   |              |                |  |  |
| Pn102 | Setting Range                            | Setting Unit         | Default Setting   | When Enabled | Classification |  |  |
|       | 10 to 20,000                             | 0.1/s                | 400               | Immediately  | Tuning         |  |  |
|       | First Stage First Tor                    | que Reference Filter | Time Constant     |              |                |  |  |
| Pn401 | Setting Range                            | Setting Unit         | Default Setting   | When Enabled | Classification |  |  |
|       | 0 to 65,535                              | 0.01 ms              | 100               | Immediately  | Tuning         |  |  |
|       | Friction Compensation Gain               |                      |                   |              |                |  |  |
| Pn121 | Setting Range                            | Setting Unit         | Default Setting   | When Enabled | Classification |  |  |
|       | 10 to 1,000                              | 1%                   | 100               | Immediately  | Tuning         |  |  |
|       | Second Speed Loop Gain                   |                      |                   |              |                |  |  |
| Pn104 | Setting Range                            | Setting Unit         | Default Setting   | When Enabled | Classification |  |  |
|       | 10 to 20,000                             | 0.1 Hz               | 400               | Immediately  | Tuning         |  |  |
|       | Second Speed Loop Integral Time Constant |                      |                   |              |                |  |  |
| Pn105 | Setting Range                            | Setting Unit         | Default Setting   | When Enabled | Classification |  |  |
|       | 15 to 51,200                             | 0.01 ms              | 2,000             | Immediately  | Tuning         |  |  |
|       | Second Position Loop Gain                |                      |                   |              |                |  |  |
| Pn106 | Setting Range                            | Setting Unit         | Default Setting   | When Enabled | Classification |  |  |
|       | 10 to 20,000                             | 0.1/s                | 400               | Immediately  | Tuning         |  |  |
|       | First Stage Second                       | Torque Reference Fi  | ter Time Constant |              |                |  |  |
| Pn412 | Setting Range                            | Setting Unit         | Default Setting   | When Enabled | Classification |  |  |
|       | 0 to 65,535                              | 0.01 ms              | 100               | Immediately  | Tuning         |  |  |
|       | Second Friction Cor                      | mpensation Gain      |                   |              |                |  |  |
| Pn122 | Setting Range                            | Setting Unit         | Default Setting   | When Enabled | Classification |  |  |
|       | 10 to 1,000                              | 1%                   | 100               | Immediately  | Tuning         |  |  |

### Parameters Related to Automatic Gain Switching

|       | Gain Switching Time 1         |              |                 |              |                |  |  |
|-------|-------------------------------|--------------|-----------------|--------------|----------------|--|--|
| Pn131 | Setting Range                 | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 65,535                   | 1 ms         | 0               | Immediately  | Tuning         |  |  |
|       | Gain Switching Tim            | e 2          |                 |              |                |  |  |
| Pn132 | Setting Range                 | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 65,535                   | 1 ms         | 0               | Immediately  | Tuning         |  |  |
|       | Gain Switching Waiting Time 1 |              |                 |              |                |  |  |
| Pn135 | Setting Range                 | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 65,535                   | 1 ms         | 0               | Immediately  | Tuning         |  |  |
|       | Gain Switching Waiting Time 2 |              |                 |              |                |  |  |
| Pn136 | Setting Range                 | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 65,535                   | 1 ms         | 0               | Immediately  | Tuning         |  |  |

8.12.2 Friction Compensation

### **Related Monitoring**

- SigmaWin+
  - You can monitor gain switching with the status monitor or with tracing.
- Analog Monitors

| Parameter | Analog Monitor  | Monitor Name        | Output Value | Description                  |
|-----------|-----------------|---------------------|--------------|------------------------------|
| Pn006     | n. <b>DD</b> 0B | Active Gain Monitor | 1 V          | Gain settings 1 are enabled. |
| Pn007     | n.ЦЦ0В          | Active Gall MOHILO  | 2 V          | Gain settings 2 are enabled. |

### 8.12.2 Friction Compensation

Friction compensation is used to compensate for viscous friction fluctuations and regular load fluctuations.

You can automatically adjust friction compensation with autotuning without a host reference, autotuning with a host reference, or custom tuning, or you can manually adjust it with the following procedure.

### **Required Parameter Settings**

The following parameter settings are required to use friction compensation.

| Parameter |       | arameter                    | Function                       | When Enabled | Classification |
|-----------|-------|-----------------------------|--------------------------------|--------------|----------------|
|           | Pn408 | n.0□□□<br>(default setting) | Disable friction compensation. | Immediately  | Setup          |
|           |       | n.1000                      | Enable friction compensation.  |              |                |

|       | Friction Compensation Gain                 |                                       |                 |              |                |  |  |
|-------|--------------------------------------------|---------------------------------------|-----------------|--------------|----------------|--|--|
| Pn121 | Setting Range                              | Setting Unit                          | Default Setting | When Enabled | Classification |  |  |
|       | 10 to 1,000                                | 1%                                    | 100             | Immediately  | Tuning         |  |  |
|       | Second Friction Cor                        | npensation Gain                       |                 |              |                |  |  |
| Pn122 | Setting Range                              | Setting Unit                          | Default Setting | When Enabled | Classification |  |  |
|       | 10 to 1,000                                | 1%                                    | 100             | Immediately  | Tuning         |  |  |
|       | Friction Compensation Coefficient          |                                       |                 |              |                |  |  |
| Pn123 | Setting Range                              | Setting Unit                          | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 100                                   | 1%                                    | 0               | Immediately  | Tuning         |  |  |
|       | Friction Compensation Frequency Correction |                                       |                 |              |                |  |  |
| Pn124 | Setting Range                              | Setting Unit                          | Default Setting | When Enabled | Classification |  |  |
|       | -10,000 to 10,000                          | 0.1 Hz                                | 0               | Immediately  | Tuning         |  |  |
|       | Friction Compensat                         | Friction Compensation Gain Correction |                 |              |                |  |  |
| Pn125 | Setting Range                              | Setting Unit                          | Default Setting | When Enabled | Classification |  |  |
|       | 1 to 1,000                                 | 1%                                    | 100             | Immediately  | Tuning         |  |  |

### **Operating Procedure for Friction Compensation**

Use the following procedure to perform friction compensation.

## 

• Before you execute friction compensation, set the moment of inertia ratio (Pn103) as accurately as possible. If the setting greatly differs from the actual moment of inertia, vibration may occur.

#### 8.12.2 Friction Compensation

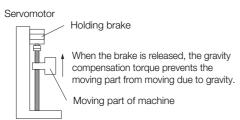
| Step | Operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| 1    | Set the following parameters related to friction compensation to their default settings.<br>Friction compensation gain (Pn121): 100<br>Second friction compensation gain (Pn122): 100<br>Friction compensation coefficient (Pn123): 0<br>Friction compensation frequency correction (Pn124): 0<br>Friction compensation gain correction (Pn125): 100<br>Note: Always use the default settings for the friction compensation frequency correction (Pn124) and friction com-<br>pensation gain correction (Pn125).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |  |  |  |  |
| 2    | <ul> <li>Gradually increase the friction compensation coefficient (Pn123) to check the effect of friction compensation. Note: Usually, set the friction compensation coefficient (Pn123) to 95% or less. If the effect is insufficient, increase the friction compensation gain (Pn121) by 10% increments until vibration stops.</li> <li>Effect of Adjusted Parameters</li> <li>Pn121: Friction Compensation Gain and Pn122: Second Friction Compensation Gain These parameters set the response to external disturbances. The higher the setting is, the better the response will be. If the machine has a resonance frequency, however, vibration may occur if the setting is too high.</li> <li>Pn123: Friction Compensation Coefficient This parameter sets the effect of friction compensation. The higher the setting is, the more effective friction compensation will be. If the setting is too high, however, vibration will occur more easily. Usually, set the value to 95% or less.</li> </ul> |  |  |  |  |  |
| 3    | Effect of Adjustments The following graphs show the response with and without adjustment.  Poor response because of friction Low friction Position deviation High friction Position reference speed Before Friction Compensation After Friction Compensation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |  |  |  |

8.12.3 Gravity Compensation

## 8.12.3 Gravity Compensation

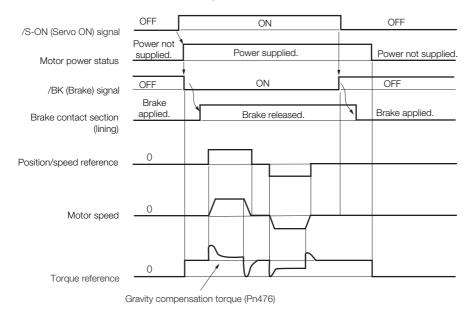
When the Servomotor is used with a vertical axis, gravity compensation prevents the moving part from falling due to the machine's own weight when the brake is released.

SERVOPACKs with software version 0023 or higher support gravity compensation.



A timing chart for when the moving part is raised then lowered is provided below. Refer to the following section for details on brake operation timing.

#### 5.11.1 Brake Operating Sequence on page 5-31



### **Required Parameter Settings**

The following parameter settings are required to use gravity compensation.

| Parameter |                             | Description                   |                 | When Enabled  | Classification |  |
|-----------|-----------------------------|-------------------------------|-----------------|---------------|----------------|--|
| Pn475     | n.□□□0<br>(default setting) | Disable gravity compensation. |                 | After restart | Setup          |  |
|           | n.0001                      | Enable gravity comper         | nsation.        |               |                |  |
|           | Gravity Compensation Torque |                               |                 |               |                |  |
| Pn476     | Setting Range               | Setting Unit                  | Default Setting | When Enabled  | Classification |  |
|           | -1,000 to 1,000             | 0.1%                          | 0               | Immediately   | Tuning         |  |

8.12.4 Current Control Mode Selection

### **Operating Procedure for Gravity Compensation**

Use the following procedure to perform gravity compensation.

- **1.** Set Pn475 to n. DDD1 (Enable gravity compensation).
- **2.** To enable changes to the settings, turn the power supply to the SERVOPACK OFF and ON again.
- **3.** Use SigmaWin+ or an analog monitor to find the torque reference value when the motor is stopped with the servo ON.
- 4. Set the torque reference value found in step 3 in Pn476 (Gravity Compensation Torque).
- **5.** Turn the servo ON and OFF a few times and fine-tune Pn476 so that the moving part of the machine does not fall.

### 8.12.4 Current Control Mode Selection

Current control mode selection reduces high-frequency noise while the Servomotor is being stopped.

The setting depends on the capacity of the SERVOPACK.

To use current control mode selection, use current control mode 2 (set Pn009 to  $n.\Box\Box1\Box$  or  $n.\Box\Box2\Box$ ).

• SERVOPACK Models SGD7S-R70A, -R90A, -1R6A, -2R8A, -3R8A, -5R5A, and -7R6A

| F     | Parameter                    | Meaning                                 | When Enabled  | Classification |
|-------|------------------------------|-----------------------------------------|---------------|----------------|
|       | n. 🗆 🗆 🗆                     |                                         | After restart | Tuning         |
| Pn009 | n. □□1□<br>(default setting) | Use current control mode 1.             |               |                |
|       | n. 🗆 🗆 2 🗆                   | Use current control mode 2 (low noise). |               |                |

• SERVOPACK Models SGD7S-120A, -180A, -200A, -330A, -470A, -550A, -590A, and -780A

| Parameter |                              | Meaning                                 | When Enabled  | Classification |
|-----------|------------------------------|-----------------------------------------|---------------|----------------|
|           | n. 🗆 🗆 🗆 🗆                   | Use current control mode 1.             |               | Tuning         |
| Pn009     | n. 0010<br>(default setting) | Use current control mode 2 (low noise). | After restart |                |
|           | n. 🗆 🗆 2 🗆                   |                                         |               |                |



If current control mode 2 is selected, the load ratio may increase while the Servomotor is being stopped.

### 8.12.5 Current Gain Level Setting

You can set the current gain level to reduce noise by adjusting the parameter for current control inside the SERVOPACK according to the speed loop gain (Pn100). The noise level can be reduced by decreasing the current gain level (Pn13D) from its default setting of 2,000% (disabled). However, if the setting is decreased, the level of noise will be lowered, but the response characteristic of the SERVOPACK will also be reduced. Adjust the current gain level within the range that maintains the SERVOPACK response characteristic.

|       | Current Gain Level |              |                 |              |                |  |
|-------|--------------------|--------------|-----------------|--------------|----------------|--|
| Pn13D | Setting Range      | Setting Unit | Default Setting | When Enabled | Classification |  |
|       | 100 to 2,000       | 1%           | 2,000           | Immediately  | Tuning         |  |

8.12.6 Speed Detection Method Selection

| Ì        |
|----------|
| Importan |

If the current gain level is changed, the response characteristic of the speed loop will also change. Servo tuning must therefore be performed again.

### 8.12.6 Speed Detection Method Selection

You can use the speed detection method selection to ensure smooth Servomotor speed changes during operation. To ensure smooth motor speed changes during operation, set Pn009 to  $n.\Box 1 \Box \Box$  (Use speed detection 2).

With a Linear Servomotor, you can reduce the noise level of the running motor when the linear encoder scale pitch is large.

| Parameter |            | Meaning                | When Enabled  | Classification |
|-----------|------------|------------------------|---------------|----------------|
| Pn009     | n.         | Use speed detection 1. | After restart | Tuning         |
|           | n. 🗆 1 🗆 🗆 | Use speed detection 2. |               |                |



If the speed detection method is changed, the response characteristic of the speed loop will also change. Servo tuning must therefore be performed again.

## 8.12.7 Speed Feedback Filter

You can set a first order lag filter for the speed feedback in the speed loop. This ensures smooth changes in the feedback speed to reduce vibration. If a large value is set, it will increase the delay and make response slower.

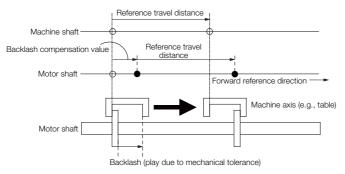
| Pn308 | Speed Feedback Filter Time Constant   |              |                 |              |                |  |  |
|-------|---------------------------------------|--------------|-----------------|--------------|----------------|--|--|
|       | Setting Range                         | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 65,535<br>(0.00 ms to 655.35 ms) | 0.01 ms      | 0<br>(0.00 ms)  | Immediately  | Setup          |  |  |

### 8.12.8 Backlash Compensation

### Outline

If you drive a machine that has backlash, there will be deviation between the travel distance in the position reference that is managed by the host controller and the travel distance of the actual machine. Use backlash compensation to add the backlash compensation value to the position reference and use the result to drive the Servomotor. This will ensure that the travel distance of the actual machine will be the same as the travel distance in the host controller.

Note: Backlash compensation can be used only with a Rotary Servomotor.



#### 8.12.8 Backlash Compensation

This parameter can be set to compensate for positioning offset caused by the backlash of gears.

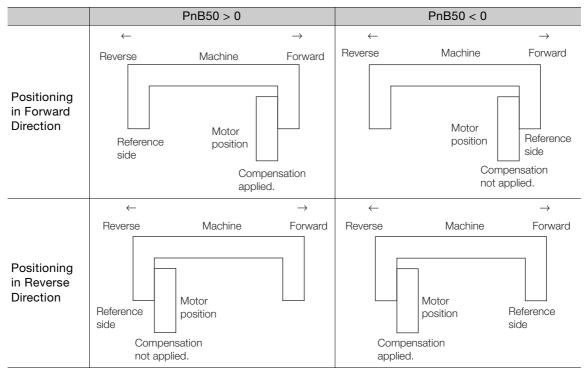
|       | Backlash Compensatic | n                |                 |              |
|-------|----------------------|------------------|-----------------|--------------|
| PnB50 | Setting Range        | Setting Unit     | Default Setting | When Enabled |
|       | -1000 to 1000        | 1 reference unit | 0               | Immediately  |

Specify the direction for compensation with the sign and the quantity of the compensation with a numeric value. If the sign is positive, compensation will be applied for forward positioning. If the sign is negative, compensation will be applied for reverse positioning. If the setting is changed, the new setting will be enabled from the next positioning.

When using an incremental encoder, the final direction used in homing generally serves as the reference direction and backlash compensation is applied in the opposite direction.

When using an absolute encoder, the initial direction of movement generally serves as the reference direction and backlash compensation is applied in the opposite direction.

Even when compensation is applied, the compensation will not be indicated in the target position monitor or any other monitor values. Only the actual motor positions will be subject to compensation.



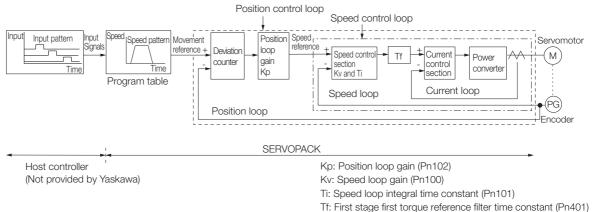
8.13.1 Tuning the Servo Gains

## 8.13 Manual Tuning

This section describes manual tuning.

## 8.13.1 Tuning the Servo Gains

### Servo Gains



In order to manually tune the servo gains, you must understand the configuration and characteristic of the SERVOPACK and adjust the servo gains individually. In most cases, if you greatly change any one parameter, you must adjust the other parameters again. To check the response characteristic, you must prepare a measuring instrument to monitor the output waveforms from the analog monitor.

The SERVOPACK has three feedback systems (the position loop, speed loop, and current loop), and the response characteristic must be increased more with the inner loops. If this relationship is not maintained, the response characteristic will suffer and vibration will occur more easily.

A sufficient response characteristic is ensured for the current loop. There is never a need for it to be adjusted by the user.

### Outline

You can use manual tuning to set the servo gains in the SERVOPACK to increase the response characteristic of the SERVOPACK and to reduce the positioning time.

Use manual tuning in the following cases.

- When tuning with autotuning without a host reference or autotuning with a host reference does not achieve the desired results
- When you want to increase the servo gains higher than the gains that resulted from autotuning without a host reference or autotuning with a host reference
- · When you want to determine the servo gains and moment of inertia ratio yourself

You start manual tuning either from the default parameter settings or from the gain settings that resulted from autotuning without a host reference or autotuning with a host reference.

8

8.13.1 Tuning the Servo Gains

### Applicable Tools

You can monitor the servo gains with the SigmaWin+ or with the analog monitor.

### Precautions

Vibration may occur while you are tuning the servo gains. We recommend that you enable vibration alarms (Pn310 =  $n.\square\square\square$ 2) to detect vibration. Refer to the following section for information on vibration detection.

3 6.10 Initializing the Vibration Detection Level on page 6-32

Vibration alarms are not detected for all vibration. Also, an emergency stop method is necessary to stop the machine safely when an alarm occurs. You must provide an emergency stop device and activate it immediately whenever vibration occurs.

### Tuning Procedure Example

| Step | Description                                                                                                                                                                 |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Adjust the first stage first torque reference filter time constant (Pn401) so that vibration does not occur.                                                                |
| 2    | Increase the position loop gain (Pn100) and reduce the speed loop integral time constant (Pn101) as far as possible within the range that does not cause machine vibration. |
| 3    | Repeat steps 1 and 2 and return the settings about 10% to 20% from the values that you set.                                                                                 |
| 4    | Increase the position loop gain (Pn102) within the range that does not cause vibration.                                                                                     |

Information If you greatly change any one servo gain parameter, you must adjust the other parameters again. Do not increase the setting of just one parameter. As a guideline, adjust the settings of the servo gains by approximately 5% each. As a rule, change the servo parameters in the following order.

- To Increase the Response Speed
- 1. Reduce the torque reference filter time constant.
- 2. Increase the speed loop gain.
- 3. Decrease the speed loop integral time constant.
- 4. Increase the position loop gain.
- To Reduce Response Speed and to Stop Vibration and Overshooting
- 1. Reduce the position loop gain.
- 2. Increase the speed loop integral time constant.
- 3. Decrease the speed loop gain.
- 4. Increase the torque filter time constant.

### **Adjusted Servo Gains**

You can set the following gains to adjust the response characteristic of the SERVOPACK.

- Pn100: Speed Loop Gain
- Pn101: Speed Loop Integral Time Constant
- Pn102: Position Loop Gain
- Pn401: First Stage First Torque Reference Filter Time Constant

#### Position Loop Gain

The position loop gain determines the response characteristic of the position loop in the SER-VOPACK. If you can increase the setting of the position loop gain, the response characteristic will improve and the positioning time will be shortened. However, you normally cannot increase the position loop gain higher than the inherit vibration frequency of the machine system. Therefore, to increase the setting of the position loop gain, you must increase the rigidity of the machine to increase the inherit vibration frequency of the machine.

|       | Position Loop Gain |              |                 |              |                |  |  |
|-------|--------------------|--------------|-----------------|--------------|----------------|--|--|
| Pn102 | Setting Range      | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 10 to 20,000       | 0.1/s        | 400             | Immediately  | Tuning         |  |  |

For machines for which a high position loop gain (Pn102) cannot be set, overflow alarms can Information occur during high-speed operation. If that is the case, you can increase the setting of the following parameter to increase the level for alarm detection.

Use the following condition as a guideline for determining the setting.

 $Pn520 \ge \frac{Maximum feed speed [reference units/s]}{2.0} \times 2.0$ Pn102 ÷ 10 (1/s)

If you use a position reference filter, transient deviation will increase due to the filter time constant. When you make the setting, consider deviation accumulation that may result from the filter.

|        | Position Deviation    | Overflow Alarm      | n Level         |              |                |
|--------|-----------------------|---------------------|-----------------|--------------|----------------|
| Pn520  | Setting Range         | Setting Unit        | Default Setting | When Enabled | Classification |
| 111020 | 1 to<br>1,073,741,823 | 1 reference<br>unit | 5,242,880       | Immediately  | Setup          |

#### Speed Loop Gain

This parameter determines the response characteristic of the speed loop. If the response characteristic of the speed loop is low, it becomes a delay factor for the position loop located outside of the speed loop. This will result in overshooting and vibration in the speed reference. Therefore, setting the speed loop gain as high as possible within the range that will not cause the machine system to vibrate will produce a stable servo system with a good response characteristic.

|       | Speed Loop Gain |              |                 |              |                     |  |  |
|-------|-----------------|--------------|-----------------|--------------|---------------------|--|--|
| Pn100 | Setting Range   | Setting Unit | Default Setting | When Enabled | Classifica-<br>tion |  |  |
|       | 10 to 20,000    | 0.1 Hz       | 400             | Immediately  | Tuning              |  |  |

Setting of Pn103 =  $\frac{\text{Load moment of inertia at motor shaft } (J_L)}{\text{Servomotor moment of inertia } (L_M)} \times 100(\%)$ 

The default setting of Pn103 (Moment of Inertia Ratio) is 100. Before you tune the servo, calculate the moment of inertia ratio with the above formula and set Pn103 to the calculation result.

|       | Moment of Inertia Ratio |              |                 |              |                     |  |
|-------|-------------------------|--------------|-----------------|--------------|---------------------|--|
| Pn103 | Setting Range           | Setting Unit | Default Setting | When Enabled | Classifica-<br>tion |  |
|       | 0 to 20,000             | 1%           | 100             | Immediately  | Tuning              |  |

#### Speed Loop Integral Time Constant

To enable response to even small inputs, the speed loop has an integral element. The integral element becomes a delay factor in the servo system. If the time constant is set too high, overshooting will occur, positioning settling time will increase, and the response characteristic will suffer.

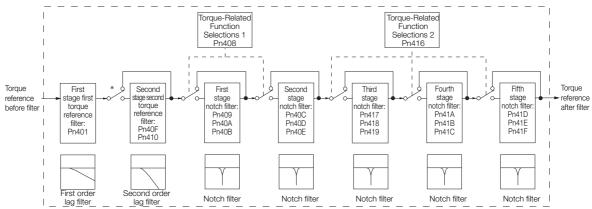
|       | Speed Loop Integral Time Constant |              |                 |              |                     |  |
|-------|-----------------------------------|--------------|-----------------|--------------|---------------------|--|
| Pn101 | Setting Range                     | Setting Unit | Default Setting | When Enabled | Classifica-<br>tion |  |
|       | 15 to 51,200                      | 0.01 ms      | 2,000           | Immediately  | Tuning              |  |

8.13.1 Tuning the Servo Gains

#### ◆ Torque Reference Filter

As shown in the following diagram, the torque reference filter contains a first order lag filter and notch filters arranged in series, and each filter operates independently.

The notch filters can be enabled and disabled with  $Pn408 = n.\Box X \Box X$  and  $Pn416 = n.\Box X X X$ .



\* The second stage second torque reference filter is disabled when Pn40F is set to 5,000 (default setting) and it is enabled when Pn40F is set to a value lower than 5,000.

#### Torque Reference Filter

If you suspect that machine vibration is being caused by the Servo Drive, try adjusting the torque reference filter time constant. This may stop the vibration. The lower the value, the better the control response characteristic will be, but there may be a limit depending on the machine conditions.

|       | First Stage First Torque Reference Filter Time Constant |                                                       |                 |              |                |  |  |
|-------|---------------------------------------------------------|-------------------------------------------------------|-----------------|--------------|----------------|--|--|
| Pn401 | Setting Range                                           | Setting Unit                                          | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 65,535                                             | 0.01 ms                                               | 100             | Immediately  | Tuning         |  |  |
|       | Second Stage Seco                                       | Second Stage Second Torque Reference Filter Frequency |                 |              |                |  |  |
| Pn40F | Setting Range                                           | Setting Unit                                          | Default Setting | When Enabled | Classification |  |  |
|       | 100 to 5,000                                            | 1 Hz                                                  | 5,000*          | Immediately  | Tuning         |  |  |
|       | Second Stage Second Torque Reference Filter Q Value     |                                                       |                 |              |                |  |  |
| Pn410 | Setting Range                                           | Setting Unit                                          | Default Setting | When Enabled | Classification |  |  |
|       | 50 to 100                                               | 0.01                                                  | 50              | Immediately  | Tuning         |  |  |

\* The filter is disabled if you set the parameter to 5,000.

#### Notch Filters

The notch filter can eliminate specific frequency elements generated by the vibration of sources such as resonance of the shaft of a ball screw.

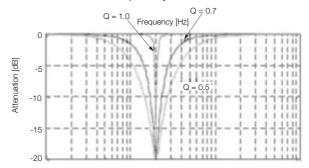
The notch filter puts a notch in the gain curve at the specific vibration frequency (called the notch frequency). The frequency components near the notch frequency can be reduced or removed with a notch filter.

Notch filters are set with three parameters for the notch filter frequency, notch filter Q value, and notch filter depth. This section describes the notch filter Q value and notch filter depth.

#### · Notch filter Q Value

The setting of the notch filter Q value determines the width of the frequencies that are filtered for the notch filter frequency. The width of the notch changes with the notch filter Q value. The larger the notch filter Q value is, the steeper the notch is and the narrower the width of frequencies that are filtered is.

The notch filter frequency characteristics for different notch filter Q values are shown below.

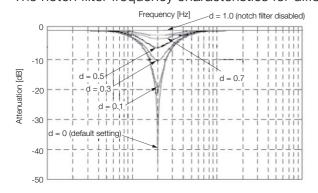


Note: The above notch filter frequency characteristics are based on calculated values and may be different from actual characteristics.

#### • Notch Filter Depth

The setting of the notch filter depth determines the depth of the frequencies that are filtered for the notch filter frequency. The depth of the notch changes with the notch filter depth. The smaller the notch filter depth is, the deeper the notch is, increasing the effect of vibration suppression. However, if the value is too small, vibration can actually increase.

The notch filter is disabled if the notch filter depth, d, is set to 1.0 (i.e., if Pn419 is set to 1,000). The notch filter frequency characteristics for different notch filter depths are shown below.



Note: The above notch filter frequency characteristics are based on calculated values and may be different from actual characteristics.

You can enable or disable the notch filter with Pn408 and Pn416.

| F      | Parameter                   | Meaning                            | When Enabled | Classification |
|--------|-----------------------------|------------------------------------|--------------|----------------|
|        | n.□□□0<br>(default setting) | Disable first stage notch filter.  |              |                |
| Pn408  | n.0001                      | Enable first stage notch filter.   |              |                |
| F11400 | n.□0□□<br>(default setting) | Disable second stage notch filter. |              | Setup          |
|        | n.0100                      | Enable second stage notch filter.  |              |                |
|        | n.□□□0<br>(default setting) | Disable third stage notch filter.  | Immediately  |                |
|        | n.0001                      | Enable third stage notch filter.   |              |                |
| Pn416  | n.□□0□<br>(default setting) | Disable fourth stage notch filter. |              |                |
|        | n.0010                      | Enable fourth stage notch filter.  |              |                |
|        | n.□0□□<br>(default setting) | Disable fifth stage notch filter.  |              |                |
|        | n.🗆 1 🗆 🗆                   | Enable fifth stage notch filter.   |              |                |

Set the machine vibration frequencies in the notch filter parameters.

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8.13.1 Tuning the Servo Gains

| Pn409         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           First Stage Notch Filter Q Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       | First Stage Notch F | ilter Frequency    |                 |              |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------|--------------------|-----------------|--------------|----------------|
| First Stage Notch Filter Q Value         Default Setting         When Enabled         Classification           50 to 1,000         0.01         70         Immediately         Tuning           First Stage Notch Filter Depth         Ph40B         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning           Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning           Second Stage Notch Filter C Value         Setting Range         Setting Context Setting         When Enabled         Classification           Second Stage Notch Filter Depth         Filter Depth         Tuning         Tuning           Pn40D         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning         Tuning           Third Stage Notch Filter Prequency         Filter Setting Range         Setting Unit         Default Setting         When Enabled         Classification           10 to 1,000         0.01         70                                                                                                                        | Pn409 | Setting Range       | Setting Unit       | Default Setting | When Enabled | Classification |
| Pn40A         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           First Stage Notch Filter Depth         Turning         Turning         Turning           Pn40B         First Stage Notch Filter Depth         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Turning           Second Stage Notch Filter Frequency         Second Stage Notch Filter Q Value         Turning         Second Stage Notch Filter Q Value           Pn400         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           So to 1,000         0.01         70         Immediately         Turning           Second Stage Notch Filter Q Value         Setting Range         Setting Range         Setting Value         Turning           Pn401         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           So to 1,000         0.001         0         Immediately         Turning           Third Stage Notch Filter Prequency         Mange         Setting Range                                                                                              |       | 50 to 5,000         | 1 Hz               | 5,000           | Immediately  | Tuning         |
| 50 to 1,000         0.01         70         Immediately         Tuning           First Stage Notch Filter Depth         First Stage Notch Filter Depth         Otto 1,000         0.001         0         Immediately         Tuning           Pn40B         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           Second Stage Notch Filter Frequency         Setting Range         Setting Range         Setting Range         Classification           Sot to 5,000         1 Hz         5,000         Immediately         Tuning           Second Stage Notch Filter Value         Ummediately         Tuning         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           Sot 0 1,000         0.01         70         Immediately         Tuning           Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning         Tuning           Third Stage Notch Filter Pequency         Fourth Stage Notch Filter Q Value         Tuning         Tuning           Pn418         Setting Range         Setting Unit         Default Setting         When Enabled         Classification                                                                                                               |       | First Stage Notch F | ilter Q Value      |                 |              |                |
| First Stage Notch Filter Depth         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning           Second Stage Notch Filter Frequency         Second Stage Notch Filter Prequency         Immediately         Tuning           Pn40C         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           50 to 5,000         1 Hz         5,000         Immediately         Tuning           Second Stage Notch Filter Q Value         When Enabled         Classification         50 to 1,000         0.01         70         Immediately         Tuning           Second Stage Notch Filter Pepth         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning           Third Stage Notch Filter Frequency         Thring Stage Setting Unit         Default Setting         When Enabled         Classification           50 to 5,000         1 Hz         5,000         Immediately         Tuning         Tuning           Third Stage Notch Filter Pepth         Setting Range         Setting Range         Setting Range         Setting Range         Classification                                                                                              | Pn40A | Setting Range       | Setting Unit       | Default Setting | When Enabled | Classification |
| Pn408         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           Pn400         Second Stage Notch Filter Frequency         0         Immediately         Tuning           Pn400         Setting Range         Setting Init         Default Setting         When Enabled         Classification           60 to 5,000         1 Hz         5,000         Immediately         Tuning           Second Stage Notch Filter Q Value         Second Stage Notch Filter Depth         Tuning         Second Stage Notch Filter Depth           Pn401         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.01         70         Immediately         Tuning           Third Stage Notch Filter Pepth         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           7 third Stage Notch Filter Q Value         Tuning         Third Stage Notch Filter Q Value         Tuning           Pn418         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           7 to 1,000         0.01         70         Immediately         Tuning           Pn418         Setting Range                                                                                                                   |       | 50 to 1,000         | 0.01               | 70              | Immediately  | Tuning         |
| 0 to 1,000         0.001         0         Immediately         Tuning           Second Stage Notch Filter Frequency         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           Pn400         Second Stage Notch Filter Q Value         Tuning         Second Stage Notch Filter Q Value           Pn400         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.01         70         Immediately         Tuning           Second Stage Notch Filter Q Value         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning           Setting Range         Setting Unit         Default Setting         When Enabled         Classification           50 to 5,000         1 Hz         5,000         Immediately         Tuning           Third Stage Notch Filter Depth         Tuning         Tuning         Tuning           Pn418         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           Pn419         Setting Range         Setting Unit         Default Setting         Wh                                                                                                                       |       | First Stage Notch F | ilter Depth        |                 |              | <u> </u>       |
| Second Stage Notch Filter Frequency         Default Setting         When Enabled         Classification           50 to 5,000         1 Hz         5,000         Immediately         Tuning           Second Stage Notch Filter Value         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           50 to 5,000         0.01         70         Immediately         Tuning           Second Stage Notch Filter Depth         Pn400         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning           Pn417         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           10 to 1,000         0.001         0         Immediately         Tuning           Third Stage Notch Filter Value         Tuning         Tuning         Tuning           Pn418         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           50 to 1,000         0.01         70         Immediately         Tuning           Pn418         Setting Range         Setting Unit         Default Setting         When Enabled <td>Pn40B</td> <td>Setting Range</td> <td>Setting Unit</td> <td>Default Setting</td> <td>When Enabled</td> <td>Classification</td> | Pn40B | Setting Range       | Setting Unit       | Default Setting | When Enabled | Classification |
| Pn40C         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           50 to 5,000         1 Hz         5,000         Immediately         Tuning           Second Stage Notch Filter Q Value         Pn40D         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           Pn40E         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           Pn40E         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           Pn40E         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           Third Stage Notch Filter Prequency         Tuning         Tuning         Tuning         Tuning           Pn417         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           50 to 5,000         1 Hz         5,000         Immediately         Tuning           Third Stage Notch Filter Q Value         Tuning         Tuning         Tuning           Pn418         Setting Range         Setting Unit         Default Setting         When Enabled         Classification <tr< td=""><td></td><td>0 to 1,000</td><td>0.001</td><td>0</td><td>Immediately</td><td>Tuning</td></tr<>                    |       | 0 to 1,000          | 0.001              | 0               | Immediately  | Tuning         |
| S0 to 5,000         1 Hz         5,000         Immediately         Tuning           Pn40D         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           50 to 1,000         0.01         70         Immediately         Tuning           Second Stage Notch Filter Depth         70         Immediately         Tuning           Pn40E         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning           Third Stage Notch Filter Pequency         Pn418         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           50 to 5,000         1 Hz         5,000         Immediately         Tuning           Third Stage Notch Filter Q Value         Tuning         Tuning         Tuning           Pn418         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           To 1,000         0.01         70         Immediately         Tuning           Pn418         Setting Range         Setting Unit         Default Setting         When Enabled         Classification                                                                                                                                                             |       | Second Stage Notc   | h Filter Frequency |                 |              |                |
| Second Stage Notch Filter Q Value         Default Setting         When Enabled         Classification           50 to 1,000         0.01         70         Immediately         Tuning           Second Stage Notch Filter Depth         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning           Pn40E         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning           Third Stage Notch Filter Prequency         Pn417         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           1/10 Stage Notch Filter Q Value         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           1/10 Stage Notch Filter Q Value         Tuning         Tuning         Tuning         Tuning           Pn418         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           1/10 Stage Notch Filter Poepth         Pn418         Setting Range         Setting Unit         Default Setting         When Ena                                                                                             | Pn40C | Setting Range       | Setting Unit       | Default Setting | When Enabled | Classification |
| Pn40DSetting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningSecond Stage Notch Filter DepthDefault SettingWhen EnabledClassification0 to 1,0000.0010ImmediatelyTuningPn40ESetting RangeSetting UnitDefault SettingWhen EnabledClassification0 to 1,0000.0010ImmediatelyTuningPn417Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 5,0001 Hz5,000ImmediatelyTuningPn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningPn419Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.01170ImmediatelyTuningFourth Stage Notch Filter DepthFourth Stage Notch Filter FrequencyTuningPn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 5,0001 Hz5,000ImmediatelyTuningFourth Stage Notch Filter Q ValueFourth Stage Notch Filter Q ValueTuningPn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningFourth Stage Notch Filter DepthFilth Stag                                                                                                                                                                                                                                                                                                                                                                                       |       | 50 to 5,000         | 1 Hz               | 5,000           | Immediately  | Tuning         |
| S0 to 1,0000.0170ImmediatelyTuningSecond Stage Notch Filter DepthSetting RangeSetting UnitDefault SettingWhen EnabledClassification0 to 1,0000.0010ImmediatelyTuningThird Stage Notch Filter FrequencySetting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 5,0001 Hz5,000ImmediatelyTuningThird Stage Notch Filter Q ValueTuningTuningTuningPn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningPn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningPn419Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 5,0001 Hz5,000ImmediatelyTuningFourth Stage Notch Filter PequencyFourth Stage Notch Filter Q ValuePn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningFourth Stage Notch Filter DepthFourth Stage Notch Filter DepthTuningPn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningFifth Stage Notch Filter Depth                                                                                                                                                                                                                                                                                                                                                                          |       | Second Stage Notc   | h Filter Q Value   |                 |              |                |
| Second Stage Notch Filter DepthPn40ESetting RangeSetting UnitDefault SettingWhen EnabledClassification0 to 1,0000.0010ImmediatelyTuningPn417Setting RangeSetting UnitDefault SettingWhen EnabledClassificationPn417Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 5,0001 Hz5,000ImmediatelyTuningPn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningPn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningPn419Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 5,0001 Hz5,000ImmediatelyTuningFourth Stage Notch Filter PrequencyPn41ASetting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 5,0001 Hz5,000ImmediatelyTuningTuningFourth Stage Notch Filter Q ValuePn416Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningTuningFourth Stage Notch Filter DepthPn416Setting RangeSetting UnitDefault SettingWhen EnabledClassification <tr< td=""><td>Pn40D</td><td>Setting Range</td><td>Setting Unit</td><td>Default Setting</td><td>When Enabled</td><td>Classification</td></tr<>                                                                                                                                                                                                                                            | Pn40D | Setting Range       | Setting Unit       | Default Setting | When Enabled | Classification |
| Pn40ESetting RangeSetting UnitDefault SettingWhen EnabledClassification0 to 1,0000.0010ImmediatelyTuningThird Stage Notch Filter FrequencySetting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 5,0001 Hz5,000ImmediatelyTuningThird Stage Notch Filter Q ValueTuningTuningTuningPn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningPn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningPn419Setting RangeSetting UnitDefault SettingWhen EnabledClassification0 to 1,0000.0010ImmediatelyTuningFourth Stage Notch Filter FrequencyPn414Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 5,0001 Hz5,000ImmediatelyTuningFourth Stage Notch Filter Q ValueFourth Stage Notch Filter Q ValueTuningPn416Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningFourth Stage Notch Filter PequencyFourth Stage Notch Filter PequencyTuningPn416Setting RangeSetting UnitDefault Setting                                                                                                                                                                                                                                                                                                                                                                          |       | 50 to 1,000         | 0.01               | 70              | Immediately  | Tuning         |
| 0 to 1,0000.0010ImmediatelyTuningThird Stage Notch Filter FrequencyPn417Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 5,0001 Hz5,000ImmediatelyTuningThird Stage Notch Filter Q ValuePn418Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningThird Stage Notch Filter DepthPn419Setting RangeSetting UnitDefault SettingWhen EnabledClassification0 to 1,0000.0010ImmediatelyTuningFourth Stage Notch Filter PrequencyPn414Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 5,0001 Hz5,000ImmediatelyTuningFourth Stage Notch Filter Q ValuePn416Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningFourth Stage Notch Filter DepthPn416Setting RangeSetting UnitDefault SettingWhen EnabledClassification50 to 1,0000.0170ImmediatelyTuningFifth Stage Notch Filter Depth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       |                     |                    |                 |              |                |

1 Important • Do not set notch filter frequencies (Pn409, Pn40C, Pn417, Pn41A, and Pn41D) that are close to the speed loop's response frequency. Set a frequency that is at least four times the speed loop gain (Pn100). (However, Pn103 (Moment of Inertia Ratio) must be set correctly. If the setting is not correct, vibration may occur and the machine may be damaged.

 Change the notch filter frequencies (Pn409, Pn40C, Pn417, Pn41A, and Pn41D) only while the Servomotor is stopped. Vibration may occur if a notch filter frequency is changed during operation.

### **Guidelines for Manually Tuning Servo Gains**

When you manually adjust the parameters, make sure that you completely understand the information in the product manual and use the following conditional expressions as guidelines. The appropriate values of the parameter settings are influenced by the machine specifications, so they cannot be determined universally. When you adjust the parameters, actually operate the machine and use the SigmaWin+ or analog monitor to monitor operating conditions. Even if the status is stable while the Servomotor is stopped, an unstable condition may occur when an operation reference is input. Therefore, input operation references and adjust the servo gains as you operate the Servomotor.

Stable gain: Settings that provide a good balance between parameters.

However, if the load moment of inertia is large and the machine system contains elements prone to vibration, you must sometimes use a setting that is somewhat higher to prevent the machine from vibrating.

Critical gain: Settings for which the parameters affect each other

Depending on the machine conditions, overshooting and vibration may occur and operation may not be stable. If the critical gain condition expressions are not met, operation will become more unstable, and there is a risk of abnormal motor shaft vibration and round-trip operation with a large amplitude. Always stay within the critical gain conditions.

If you use the torque reference filter, second torque reference filter, and notch filters together, the interference between the filters and the speed loop gain will be superimposed. Allow leeway in the adjustments.



The following adjusted value guidelines require that the setting of Pn103 (Moment of Inertia Ratio) is correctly set for the actual machine.

Tuning

#### ♦ When Pn10B = n.□□0□ (PI Control)

Guidelines are given below for gain settings 1.

The same guidelines apply to gain settings 2 (Pn104, Pn105, Pn106, and Pn412).

- Speed Loop Gain (Pn100 [Hz]) and Position Loop Gain (Pn102 [/s]) Stable gain: Pn102 [/s]  $\leq 2\pi \times$  Pn100/4 [Hz] Critical gain: Pn102 [/s]  $< 2\pi \times$  Pn100 [Hz]
- Speed Loop Gain (Pn100 [Hz]) and Speed Loop Integral Time Constant (Pn101 [ms]) Stable gain: Pn101 [ms] ≥ 4,000/(2π × Pn100 [Hz]) Critical gain: Pn101 [ms] > 1,000/(2π × Pn100 [Hz])
- Speed Loop Gain (Pn100 [Hz]) and First Stage First Torque Reference Filter Time Constant (Pn401 [ms])
   Stable gain: Pn401 [ms] < 1.000 ((2 + 2.8 Pn100 [Hz]) + 4)

Stable gain: Pn401 [ms]  $\leq$  1,000/(2 $\pi$  × Pn100 [Hz] × 4) Critical gain: Pn401 [ms] < 1,000/(2 $\pi$  × Pn100 [Hz] × 1) 8.13.1 Tuning the Servo Gains

- Speed Loop Gain (Pn100 [Hz]) and Second Stage Second Torque Reference Filter Frequency (Pn40F [Hz])
   Critical gain: Pn40F [Hz] > 4 × Pn100 [Hz]
   Note: Set the second stage second torque reference filter Q value (Pn410) to 0.70.
- Speed Loop Gain (Pn100 [Hz]) and First Stage Notch Filter Frequency (Pn409 [Hz]) (or Second Stage Notch Filter Frequency (Pn40C [Hz])) Critical gain: Pn409 [Hz] > 4 × Pn100 [Hz]
- Speed Loop Gain (Pn100 [Hz]) and Speed Feedback Filter Time Constant (Pn308 [ms]) Stable gain: Pn308 [ms]  $\leq$  1,000/(2 $\pi$  × Pn100 [Hz] × 4) Critical gain: Pn308 [ms] < 1,000/(2 $\pi$  × Pn100 [Hz] × 1)

#### • When $Pn10B = n.\Box\Box1\Box$ (I-P Control)

Guidelines are given below for gain settings 1.

The same guidelines apply to gain settings 2 (Pn104, Pn105, Pn106, and Pn412).

For I-P control, the relationships between the speed loop integral time constant, speed loop gain, and position loop gain are different from the relationships for PI control. The relationship between other servo gains is the same as for PI control.

- Speed Loop Gain (Pn100 [Hz]) and Speed Loop Integral Time Constant (Pn101 [ms]) Stable gain: Pn100 [Hz] ≥ 320/Pn101 [ms]
- Position Loop Gain (Pn102 [/s]) and Speed Loop Integral Time Constant (Pn101 [ms]) Stable gain: Pn102 [/s] ≤ 320/Pn101 [ms]

#### Information Selecting the Speed Loop Control Method (PI Control or I-P Control) Usually, I-P control is effective for high-speed positioning and high-speed, high-precision processing applications. With I-P control, you can use a lower position loop gain than for PI control to reduce the positioning time and reduce arc radius reduction. However, if you can use mode switching to change to proportional control to achieve the desired application, then using PI control would be the normal choice.

#### Decimal Points in Parameter Settings

For the SGD7S SERVOPACKs, decimal places are given for the settings of parameters on the Digital Operator and in the manual. For example with Pn100 (Speed Loop Gain), Pn100 = 40.0 is used to indicate a setting of 40.0 Hz. In the following adjusted value guidelines, the decimal places are also given.

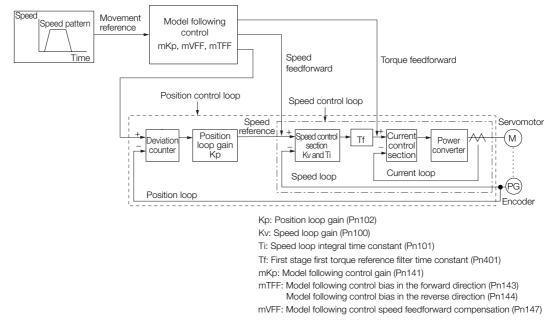
**Example** • Speed Loop Gain (Pn100 [Hz]) and Speed Loop Integral Time Constant (Pn101 [ms]) Stable gain: Pn101 [ms]  $\geq$  4,000/( $2\pi \times$  Pn100 [Hz]), therefore If Pn100 = 40.0 [Hz], then Pn101 = 4,000/( $2\pi \times$  40.0)  $\approx$  15.92 [ms].

### Model Following Control

You can use model following control to improve response characteristic and shorten positioning time. You can use model following control only with position control.

Normally, the parameters that are used for model following control are automatically set along with the servo gains by executing autotuning or custom tuning. However, you must adjust them manually in the following cases.

- · When the tuning results for autotuning or custom tuning are not acceptable
- When you want to increase the response characteristic higher than that achieved by the tuning results for autotuning or custom tuning
- · When you want to determine the servo gains and model following control parameters yourself



The block diagram for model following control is provided below.

#### ◆ Manual Tuning Procedure

Use the following tuning procedure for using model following control.

| Step | Description                                                                                                                                                                                                                                                                                                                                                |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Friction compensation must also be used. Set the friction compensation parameters. Refer to the following section for the setting procedure.                                                                                                                                                                                                               |
|      | Adjust the servo gains. Refer to the following section for an example procedure.                                                                                                                                                                                                                                                                           |
| 2    | <ul> <li>Note: 1. Set the moment of inertia ratio (Pn103) as accurately as possible.</li> <li>2. Refer to the guidelines for manually tuning the servo gains and set a stable gain for the position loop gain (Pn102).</li> <li><i>Guidelines for Manually Tuning Servo Gains</i> on page 8-79</li> </ul>                                                  |
| 3    | Increase the model following control gain (Pn141) as much as possible within the range in which overshooting and vibration do not occur.                                                                                                                                                                                                                   |
| 4    | If overshooting occurs or if the response is different for forward and reverse operation, fine-tune model following control with the following settings: model following control bias in the forward direction (Pn143), model following control bias in the reverse direction (Pn144), and model following control speed feedforward compensation (Pn147). |

Tuning

8.13.1 Tuning the Servo Gains

#### Related Parameters

Next we will describe the following parameters that are used for model following control.

- Pn140 (Model Following Control-Related Selections)
- Pn141 (Model Following Control Gain)
- Pn143 (Model Following Control Bias in the Forward Direction)
- Pn144 (Model Following Control Bias in the Reverse Direction)
- Pn147 (Model Following Control Speed Feedforward Compensation)

#### Model Following Control-Related Selections

Set  $Pn140 = n.\Box\Box\BoxX$  to specify whether to use model following control.

If you use model following control with vibration suppression, set Pn140 to  $n.\Box\Box1\Box$  or Pn140 =  $n.\Box\Box2\Box$ . When you also perform vibration suppression, adjust vibration suppression with custom tuning in advance.

Note: If you use vibration suppression (Pn140 = n.□□1□ or Pn140 = n.□□2□), always set Pn140 to n.□□□1 (Use model following control).

| Parameter |                             | Function                                                    | When Enabled | Classification |
|-----------|-----------------------------|-------------------------------------------------------------|--------------|----------------|
|           | n.□□□0<br>(default setting) | Do not use model following control.                         |              | Tuning         |
|           | n.0001                      | Use model following control.                                | Immediately  |                |
| Pn140     | n.□□0□<br>(default setting) | Do not perform vibration suppression.                       |              |                |
|           | n.0010                      | Perform vibration suppression for a specific frequency.     |              |                |
|           | n.0020                      | Perform vibration suppression for two specific frequencies. |              |                |

#### Model Following Control Gain

The model following control gain determines the response characteristic of the servo system. If you increase the setting of the model following control gain, the response characteristic will improve and the positioning time will be shortened. The response characteristic of the servo system is determined by this parameter, and not by Pn102 (Position Loop Gain).

|       | Model Following Control Gain |              |                 |              |                |  |  |
|-------|------------------------------|--------------|-----------------|--------------|----------------|--|--|
| Pn141 | Setting Range                | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 10 to 20,000                 | 0.1/s        | 500             | Immediately  | Tuning         |  |  |

Information For machines for which a high model following control gain cannot be set, the size of the position deviation in model following control will be determined by the setting of the model following control gain. For a machine with low rigidity, in which a high model following control gain cannot be set, position deviation overflow alarms may occur during high-speed operation. If that is the case, you can increase the setting of the following parameter to increase the level for alarm detection.

Use the following conditional expression for reference in determining the setting.

 $Pn \ 520 \ge \frac{Maximum \ feed \ speed \ [reference \ units/s]}{Pn \ 141/10 \ [1/s]} \times \ 2.0$ 

Ph 141/10[1/s]

|        | Position Deviation Overflow Alarm Level |                     |                 |              |                |  |  |
|--------|-----------------------------------------|---------------------|-----------------|--------------|----------------|--|--|
| Pn520  | Setting Range                           | Setting Unit        | Default Setting | When Enabled | Classification |  |  |
| FIIJZU | 1 to<br>1,073,741,823                   | 1 reference<br>unit | 5,242,880       | Immediately  | Setup          |  |  |

Model Following Control Bias in the Forward Direction and Model Following Control Bias in the Reverse Direction

If the response is different for forward and reverse operation, use the following parameters for fine-tuning.

If you decrease the settings, the response characteristic will be lowered but overshooting will be less likely to occur.

|       | Model Following Control Bias in the Forward Direction |              |                 |              |                |  |  |
|-------|-------------------------------------------------------|--------------|-----------------|--------------|----------------|--|--|
| Pn143 | Setting Range                                         | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 10,000                                           | 0.1%         | 1,000           | Immediately  | Tuning         |  |  |
|       | Model Following Control Bias in the Reverse Direction |              |                 |              |                |  |  |
| Pn144 | Setting Range                                         | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 10,000                                           | 0.1%         | 1,000           | Immediately  | Tuning         |  |  |

#### Model Following Control Bias in the Forward Direction

#### Model Following Control Speed Feedforward Compensation

If overshooting occurs even after you adjust the model following control gain, model following control bias in the forward direction, and model following control bias in the reverse direction, you may be able to improve performance by setting the following parameter.

If you decrease the settings, the response characteristic will be lowered but overshooting will be less likely to occur.

|       | Model Following Control Speed Feedforward Compensation |              |                 |              |                |  |
|-------|--------------------------------------------------------|--------------|-----------------|--------------|----------------|--|
| Pn147 | Setting Range                                          | Setting Unit | Default Setting | When Enabled | Classification |  |
|       | 0 to 10,000                                            | 0.1%         | 1,000           | Immediately  | Tuning         |  |

#### Model Following Control Type Selection

When you enable model following control, you can select the model following control type. Normally, set Pn14F to n. DDD1 (Use model following control type 2) (default setting). If compatibility with previous models is required, set Pn14F to n. DDD0 (Use model following control type 1).

| Parameter |                             | Meaning                             | When Enabled  | Classification |
|-----------|-----------------------------|-------------------------------------|---------------|----------------|
|           | n.□□□0                      | Use model following control type 1. |               |                |
| Pn14F     | n.□□□1<br>(default setting) | Use model following control type 2. | After restart | Tuning         |

Tuning

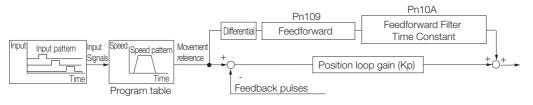
8.13.2 Compatible Adjustment Functions

### 8.13.2 Compatible Adjustment Functions

The compatible adjustment functions are used together with manual tuning. You can use these functions to improve adjustment results. These functions allow you to use the same functions as for  $\Sigma$ -III-Series SERVOPACKs to adjust  $\Sigma$ -7-Series SERVOPACKs.

### Feedforward

The feedforward function applies feedforward compensation to position control to shorten the positioning time.



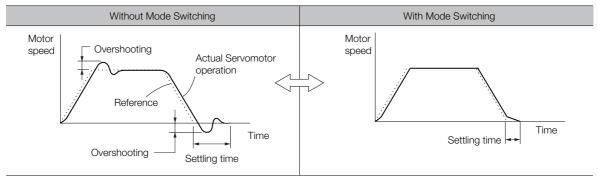
|  | Pn109 | Feedforward                      |              |                 |              |                |  |  |
|--|-------|----------------------------------|--------------|-----------------|--------------|----------------|--|--|
|  |       | Setting Range                    | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|  |       | 0 to 100                         | 1%           | 0               | Immediately  | Tuning         |  |  |
|  |       | Feedforward Filter Time Constant |              |                 |              |                |  |  |
|  | Pn10A | Setting Range                    | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|  |       | 0 to 6,400                       | 0.01 ms      | 0               | Immediately  | Tuning         |  |  |

Note: If you set the feedforward value too high, the machine may vibrate. As a guideline, use a setting of 80% or less.

# Mode Switching (Changing between Proportional and PI Control)

You can use mode switching to automatically change between proportional control and PI control.

Overshooting caused by acceleration and deceleration can be suppressed and the settling time can be reduced by setting the switching condition and switching levels.



8.13.2 Compatible Adjustment Functions

#### ♦ Related Parameters

Select the switching condition for mode switching with  $Pn10B = n.\Box\Box\BoxX$ .

| Parameter |                             | Mode Switching<br>Selection                           | Parameter That Sets the<br>Level |                      | When        | Classification |
|-----------|-----------------------------|-------------------------------------------------------|----------------------------------|----------------------|-------------|----------------|
|           |                             |                                                       | Rotary<br>Servomotor             | Linear<br>Servomotor | Enabled     | Classification |
|           | n.□□□0<br>(default setting) | Use the internal torque reference as the condition.   | Pn1                              | 0C                   | Immediately | Setup          |
|           | n.0001                      | Use the speed ref-<br>erence as the con-<br>dition.   | Pn10D                            | Pn181                |             |                |
| Pn10B     | n.0002                      | Use the accelera-<br>tion reference as the condition. | Pn10E                            | Pn182                |             |                |
|           | n.0003                      | Use the position deviation as the condition.          | Pn10F                            |                      |             |                |
|           | n.0004                      | Do not use mode switching.                            | _                                |                      |             |                |

#### Parameters That Set the Switching Levels

Rotary Servomotors

|       | Mode Switching Level for Torque Reference   |                        |                 |              |                |  |
|-------|---------------------------------------------|------------------------|-----------------|--------------|----------------|--|
| Pn10C | Setting Range                               | Setting Unit           | Default Setting | When Enabled | Classification |  |
|       | 0 to 800                                    | 1%                     | 200             | Immediately  | Tuning         |  |
|       | Mode Switching Level for Speed Reference    |                        |                 |              |                |  |
| Pn10D | Setting Range                               | Setting Unit           | Default Setting | When Enabled | Classification |  |
|       | 0 to 10,000                                 | 1 min <sup>-1</sup>    | 0               | Immediately  | Tuning         |  |
|       | Mode Switching Level for Acceleration       |                        |                 |              |                |  |
| Pn10E | Setting Range                               | Setting Unit           | Default Setting | When Enabled | Classification |  |
|       | 0 to 30,000                                 | 1 min <sup>-1</sup> /s | 0               | Immediately  | Tuning         |  |
|       | Mode Switching Level for Position Deviation |                        |                 |              |                |  |
| Pn10F | Setting Range                               | Setting Unit           | Default Setting | When Enabled | Classification |  |
|       | 0 to 10,000                                 | 1 reference unit       | 0               | Immediately  | Tuning         |  |

#### Linear Servomotors

|       | Mode Switching Level for Force Reference    |                     |                 |              |                |  |
|-------|---------------------------------------------|---------------------|-----------------|--------------|----------------|--|
| Pn10C | Setting Range                               | Setting Unit        | Default Setting | When Enabled | Classification |  |
|       | 0 to 800                                    | 1%                  | 200             | Immediately  | Tuning         |  |
|       | Mode Switching Level for Speed Reference    |                     |                 |              |                |  |
| Pn181 | Setting Range                               | Setting Unit        | Default Setting | When Enabled | Classification |  |
|       | 0 to 10,000                                 | 1 mm/s              | 0               | Immediately  | Tuning         |  |
|       | Mode Switching Level for Acceleration       |                     |                 |              |                |  |
| Pn182 | Setting Range                               | Setting Unit        | Default Setting | When Enabled | Classification |  |
|       | 0 to 30,000                                 | 1 mm/s <sup>2</sup> | 0               | Immediately  | Tuning         |  |
|       | Mode Switching Level for Position Deviation |                     |                 |              |                |  |
| Pn10F | Setting Range                               | Setting Unit        | Default Setting | When Enabled | Classification |  |
|       | 0 to 10,000                                 | 1 reference unit    | 0               | Immediately  | Tuning         |  |

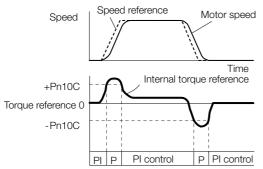
8

8.13.2 Compatible Adjustment Functions

#### Using the Internal Torque Reference as the Mode Switching Condition (Default Setting)

When the internal torque reference equals or exceeds the torque set for the mode switching level for torque reference (Pn10C), the speed loop is changed to P control.

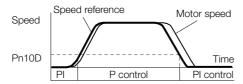
The default setting for the torque reference level is 200%.



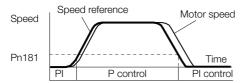
#### Using the Speed Reference as the Mode Switching Condition

Rotary Servomotors

When the speed reference equals or exceeds the speed set for the mode switching level for a speed reference (Pn10D), the speed loop is changed to P control.



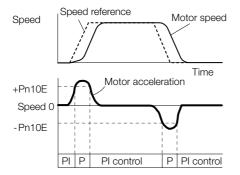
• Linear Servomotors When the speed reference equals or exceeds the speed set for the mode switching level for a speed reference (Pn181), the speed loop is changed to P control.



#### ■ Using the Acceleration as the Mode Switching Condition

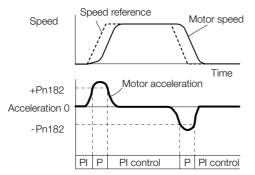
#### Rotary Servomotors

When the speed reference equals or exceeds the acceleration rate set for the mode switching level for acceleration (Pn10E), the speed loop is changed to P control.



#### · Linear Servomotors

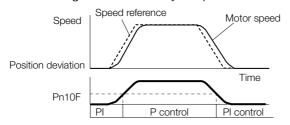
When the speed reference equals or exceeds the acceleration rate set for the mode switching level for acceleration (Pn182), the speed loop is changed to P control.



#### Using the Position Deviation as the Mode Switching Condition

When the position deviation equals or exceeds the value set for the mode switching level for position deviation (Pn10F), the speed loop is changed to P control.

This setting is enabled only for position control.



### **Position Integral**

The position integral is the integral function of the position loop. It is used for the electronic cams and electronic shafts when using the SERVOPACK with a Yaskawa MP3000-Series Machine Controller.

|       | Position Integral Time Constant |              |                 |              |                |  |
|-------|---------------------------------|--------------|-----------------|--------------|----------------|--|
| Pn11F | Setting Range                   | Setting Unit | Default Setting | When Enabled | Classification |  |
|       | 0 to 50,000                     | 0.1 ms       | 0               | Immediately  | Tuning         |  |

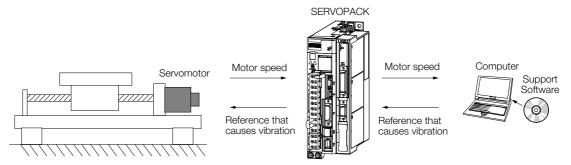
8.14.1 Mechanical Analysis

## 8.14 Diagnostic Tools

## 8.14.1 Mechanical Analysis

### **Overview**

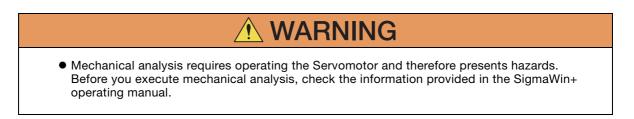
You can connect the SERVOPACK to a computer to measure the frequency characteristics of the machine. This allows you to measure the frequency characteristics of the machine without using a measuring instrument.



The Servomotor is used to cause machine vibration and then the speed frequency characteristics for the motor torque are measured. The measured frequency characteristics can be used to determine the machine resonance.

You determine the machine resonance for use in servo tuning and as reference for considering changes to the machine. The performance of the servo cannot be completely utilized depending on the rigidity of the machine. You may need to consider making changes to the machine. The information can also be used as reference for servo tuning to help you adjust parameters, such as the servo rigidity and torque filter time constant.

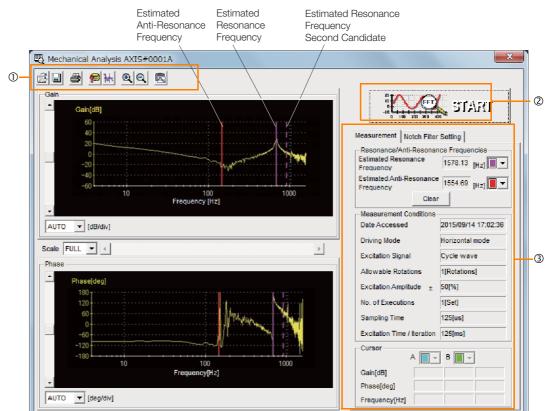
You can also use the information to set parameters, such as the notch filters.



## **Frequency Characteristics**

The Servomotor is used to cause the machine to vibrate and the frequency characteristics from the torque to the motor speed are measured to determine the machine characteristics. For a normal machine, the resonance frequencies are clear when the frequency characteristics are plotted on graphs with the gain and phase (Bode plots). The Bode plots show the size (gain) of the response of the machine to which the torque is applied, and the phase delay (phase) in the response for each frequency. Also, the machine resonance frequency can be determined from the maximum frequency of the valleys (anti-resonance) and peaks (resonance) of the gain and the phase delay.

For a Servomotor without a load or for a rigid mechanism, the gain and phase change gradually in the Bode plots.



① Toolbar

② START Button

Click the **START** Button to start analysis.

3 Measurement and Notch Filter Setting Tab Pages

Measurement Tab Page: Displays detailed information on the results of analysis.

Notch Filter Setting Tab Page: Displays the notch filter frequencies. You can set these values in the parameters.

## 8.14.2 Easy FFT

The machine is made to vibrate and a resonance frequency is detected from the generated vibration to set notch filters according to the detected resonance frequencies. This is used to eliminate high-frequency vibration and noise.

During execution of Easy FFT, a frequency waveform reference is sent from the SERVOPACK to the Servomotor to automatically cause the shaft to rotate multiple times within 1/4th of a rotation, thus causing the machine to vibrate.

Execute Easy FFT after the servo is turned OFF if operation of the SERVOPACK results in high-frequency noise and vibration.

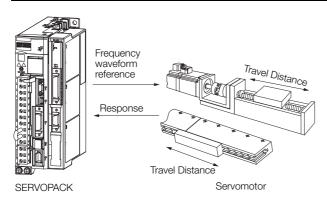
#### 8.14.2 Easy FFT

## \land WARNING

• Never touch the Servomotor or machine during execution of Easy FFT. Doing so may result in injury.

## 

• Use Easy FFT when the servo gain is low, such as in the initial stage of servo tuning. If you execute Easy FFT after you increase the gain, the machine may vibrate depending on the machine characteristics or gain balance.



Easy FFT is built into the SERVOPACK for compatibility with previous products. Normally use autotuning without a host reference for tuning.

### Preparations

Always check the following before you execute Easy FFT.

- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- There must be no alarms.
- There must be no hard wire base block (HWBB).
- The servo must be OFF.
- There must be no overtravel.
- An external reference must not be input.

## **Applicable Tools**

The following table lists the tools that you can use to perform EasyFFT.

| Tool             | Fn No./Function Name  | Operating Procedure Reference                                                 |
|------------------|-----------------------|-------------------------------------------------------------------------------|
| Digital Operator | Fn206                 | Ω-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Diagnostic – Easy FFT | Gerating Procedure on page 8-91                                               |

## **Operating Procedure**

Use the following procedure for Easy FFT.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Easy FFT in the Menu Dialog Box. The Easy FFT Dialog Box will be displayed. Click the Cancel Button to cancel Easy FFT. You will return to the main window.
- 3. Click the OK Button.



4. Click the Servo ON Button.

| 🖏 Easy FFT AXIS#00                                                                                                                                                          | <b>—</b>             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Servo OIVOFF operation                                                                                                                                                      | Servo ON             |
| Measurement start / Stopping operation<br>Measurement condition<br>Stimulus signal Frequency<br>Instruction amplitude 15 (%)<br>(1 - 800)<br>Rotation (moving)<br>Groward Y | Start                |
|                                                                                                                                                                             | [Hz]<br>[Hz]         |
|                                                                                                                                                                             | Measurement complete |

8.14.2 Easy FFT

 Select the instruction (reference) amplitude and the rotation direction in the Measurement condition Area, and then click the Start Button. The Servomotor shaft will rotate and measurements will start.

| 🖏 Easy FFT AXIS#00                     | ×                    |
|----------------------------------------|----------------------|
| Servo ON/OFF operation                 |                      |
| Servo ON                               | Servo OFF            |
| Measurement start / Stopping operation |                      |
| Measurement condition                  |                      |
| Stimulus signal Frequency              | Start<br>I           |
| Instruction amplitude 15 • [%]         |                      |
| (1 - 800)                              | <b>Q</b>             |
| Rotation (moving) Forward              |                      |
| Measurement result                     |                      |
| Detected resonance frequency           | [Hz]                 |
| Optimal notch filter frequency         | [Hz]                 |
| Notch filter selection                 |                      |
|                                        |                      |
|                                        | Measurement complete |

When measurements have been completed, the measurement results will be displayed.

6. Check the results in the Measurement result Area and then click the Measurement complete Button.

| 🔁 Easy FFT AXIS#00                                                                                                                                                   | ×                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Servo ON/OFF operation                                                                                                                                               | Servo OFF            |
| Measurement start / Stopping operation<br>Measurement condition<br>Stimulus signal Frequency<br>Instruction ampiltude 15<br>(1 - 800)<br>Rotation (moving) Forward V | [%]                  |
| Measurement result Detected resonance frequency 502                                                                                                                  | 2 [Hz]               |
| Optimal notch filter frequency 502                                                                                                                                   | 2 [Hz]               |
| Noton filter selection                                                                                                                                               | Measurement complete |

8.14.2 Easy FFT

7. Click the **Result Writing** Button if you want to set the measurement results in the parameters.

| Easy FFT AXIS#00                                                                |  |  |  |  |
|---------------------------------------------------------------------------------|--|--|--|--|
| Notch filter selection                                                          |  |  |  |  |
| Pn408:Torque-Related Function Selections digit 0 Notch Filter Selection 1       |  |  |  |  |
| 0:Disable first stage notch filter.                                             |  |  |  |  |
| -                                                                               |  |  |  |  |
| ▼                                                                               |  |  |  |  |
| 1:Enable first stage notch filter.                                              |  |  |  |  |
|                                                                                 |  |  |  |  |
| Notch filter frequency                                                          |  |  |  |  |
| Pn409:First Stage Notch Filter Frequency                                        |  |  |  |  |
| 5000 [Hz] <b>5</b> 02 [Hz]                                                      |  |  |  |  |
|                                                                                 |  |  |  |  |
|                                                                                 |  |  |  |  |
| Please click a button, when you reflect a measurement result in User Parameter. |  |  |  |  |
| Result Writing                                                                  |  |  |  |  |

This concludes the procedure to set up Easy FFT.

### **Related Parameters**

The following parameters are automatically adjusted or used as reference when you execute Easy FFT.

Do not change the settings of these parameters during execution of Easy FFT.

| Parameter | Name                                | Automatic Changes |
|-----------|-------------------------------------|-------------------|
| Pn408     | Torque-Related Function Selections  | Yes               |
| Pn409     | First Stage Notch Filter Frequency  | Yes               |
| Pn40A     | First Stage Notch Filter Q Value    | No                |
| Pn40C     | Second Stage Notch Filter Frequency | Yes               |
| Pn40D     | Second Stage Notch Filter Q Value   | No                |
| Pn456     | Sweep Torque Reference Amplitude    | No                |

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

8.14 Diagnostic Tools

8.14.2 Easy FFT

# Monitoring

9

This chapter provides information on monitoring SERVO-PACK product information and SERVOPACK status.

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9.1.1 Items That You Can Monitor

## 9.1 Monitoring Product Information

## 9.1.1 Items That You Can Monitor

| Monitor Items                 |                                                                                                                                        |  |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--|
| Information on SERVOPACKs     | <ul> <li>Model/Type</li> <li>Serial Number</li> <li>Manufacturing Date</li> <li>Software version (SW Ver.)</li> <li>Remarks</li> </ul> |  |
| Information on Servomotors    | <ul> <li>Model/Type</li> <li>Serial Number</li> <li>Manufacturing Date</li> <li>Remarks</li> </ul>                                     |  |
| Information on Encoders       | <ul> <li>Model/Type</li> <li>Serial Number</li> <li>Manufacturing Date</li> <li>Software version (SW Ver.)</li> <li>Remarks</li> </ul> |  |
| Information on Option Modules | <ul> <li>Model/Type</li> <li>Serial Number</li> <li>Manufacturing Date</li> <li>Software version (SW Ver.)</li> <li>Remarks</li> </ul> |  |

## 9.1.2 Operating Procedures

Use the following procedure to display the Servo Drive product information.

• Select *Read Product Information* in the Menu Dialog Box of the SigmaWin+. The Read Product Information Window will be displayed.

| Product Information   | Export                                              |                 |                    |         |                                    |  |
|-----------------------|-----------------------------------------------------|-----------------|--------------------|---------|------------------------------------|--|
| - 0001-SGD7S-1R6AE0A  |                                                     |                 |                    |         |                                    |  |
| SERVOPACK             | Model/Type                                          | Serial Number   | Manufacturing Date | SW Ver. | Remarks                            |  |
| SERVOPACK             | SGD7S-1R6AE0A<br>(Command-Option module type single |                 | 2015.01            | 001D    | [Specification] : Standard         |  |
| 1otor                 | Model/Type                                          | Number          | Manufacturing Date | SW Ver. | Remarks                            |  |
| Motor                 | SGM7J-02A7A21                                       | 20131204        | 2013.12            |         | [Resolution]: 16777216 [Pulse/rev] |  |
| Encoder               | UTTAI-B24RH                                         |                 | 2013.12            | 0001    | [Encoder type] : absolute          |  |
| Command Option Module | Model/Type                                          | Serial Number   | Manufacturing Date | SW Ver. | Remarks                            |  |
| Option Module         | SGDV-OCA03A<br>(INDEXER)                            | D0146D352110007 | 2014.06            | 0006    |                                    |  |
|                       |                                                     |                 |                    |         |                                    |  |
|                       |                                                     |                 |                    |         |                                    |  |

Information With the Digital Operator, you can use Fn011, Fn012, and Fn01E to monitor this information. Refer to the following manual for the differences in the monitor items compared with the SigmaWin+.

Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

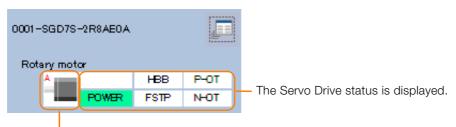
9.2.1 Servo Drive Status

## 9.2 Monitoring SERVOPACK Status

## 9.2.1 Servo Drive Status

Use the following procedure to display the Servo Drive status.

• Start the SigmaWin+. The Servo Drive status will be automatically displayed when you go online with a SERVOPACK.



The Servomotor type is displayed.

## 9.2.2 Monitoring Operation, Status, and I/O

## Items That You Can Monitor

The items that you can monitor on the Operation Pane, Status Pane, and I/O Pane are listed below.

Operation Pane

| Monitor Items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <ul> <li>Error Monitor</li> <li>Current issue position</li> <li>Current motor position</li> <li>Target position</li> <li>Target distance</li> <li>Registration target position</li> <li>Registration target distance</li> <li>Program step</li> <li>Program event lapse time</li> <li>Program loop pass through time</li> <li>Number of serial command receipt letter</li> <li>Number of serial command transmission error letter</li> <li>Number of serial command transmission letter</li> <li>Motor Speed</li> <li>Speed Reference</li> <li>Internal Torque Reference</li> <li>Angle of Rotation 1 (number of encoder pulses from origin within one encoder rotation)</li> <li>Angle of Rotation 2 (angle from origin within one encoder rotation)</li> </ul> | <ul> <li>Input Reference Pulse Speed</li> <li>Deviation Counter (Position Deviation)</li> <li>Cumulative Load</li> <li>Regenerative Load</li> <li>Power Consumption</li> <li>Consumed Power</li> <li>Cumulative Power Consumption</li> <li>DB Resistor Consumption Power</li> <li>Absolute Encoder Multiturn Data</li> <li>Absolute Encoder Position within One Rotation</li> <li>Absolute Encoder (Lower)</li> <li>Absolute Encoder (Upper)</li> <li>Input Reference Pulse Counter</li> <li>Feedback Pulse Counter</li> <li>Fully Closed Feedback Pulse Counter</li> <li>Total Operating Time</li> </ul> |  |

#### 9.2.2 Monitoring Operation, Status, and I/O

Status Pane

| Monitor Items                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <ul> <li>Main Circuit</li> <li>Encoder (PGRDY)</li> <li>Motor Power (Request)</li> <li>Motor Power ON</li> <li>Dynamic Brake (DB)</li> <li>Rotation (Movement) Direction</li> <li>Mode Switch</li> <li>Speed Reference (V-Ref)</li> <li>Torque Reference (T-Ref)</li> <li>Position Reference (PULS)</li> <li>Position Reference Direction</li> <li>Surge Current Limiting Resistor Short Relay</li> </ul> | <ul> <li>Regenerative Transistor</li> <li>Regenerative Error Detection</li> <li>AC Power ON</li> <li>Overcurrent</li> <li>Origin Not Passed</li> <li>/INPOSITION (Positioning completed) state</li> <li>NEAR (Positioning Proximity) state</li> <li>DEN (Command Distribution Completed) state</li> <li>Positioning is Interrupting or the Program Operation<br/>is Interrupting</li> <li>Program Operation state</li> <li>Current (Torque) Limit state</li> <li>Main Power state</li> </ul> |  |

#### • I/O Pane

| Monit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | tor Items                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <ul> <li>/S-ON (Servo ON Input Signal)</li> <li>P-OT (Forward Drive Prohibit Input Signal)</li> <li>N-OT (Reverse Drive Prohibit Input Signal)</li> <li>/ALM-RST (Alarm Reset Input Signal)</li> <li>/DEC (Homing Deceleration Switch Input Signal)</li> <li>/RGRT (Registration Input) signal</li> <li>/MODE 0/1 (Mode Switch Input) signal</li> <li>/START-STOP (Program Table Operation Start-<br/>Stop Input) signal</li> <li>/PGMRES (Program Table Operation Reset<br/>Input) signal</li> <li>/SEL0 (Program Step Selection Input 0) signal</li> <li>/SEL1 (Program Step Selection Input 1) signal</li> <li>/SEL2 (Program Step Selection Input 2) signal</li> <li>/SEL3 (Program Step Selection Input 3) signal</li> <li>/SEL4 (Program Step Selection Input 4) signal</li> <li>/SEL5 (Program Step Selection Input 5) signal</li> <li>/SEL5 (Program Step Selection Input 6) signal</li> <li>/SEL7 (Program Step Selection Input 7) signal</li> <li>/JCGP (Forward Jog Input) signal</li> <li>/JOGP (Forward Jog Input) signal</li> <li>/JOGN (Reverse Jog Input) signal</li> <li>/JOG1 (Jog Speed Table Selection Input 1) signal</li> <li>/JOG2 (Jog Speed Table Selection Input 2) signal</li> <li>/JOG3 (Jog Speed Table Selection Input 3) signal</li> </ul> | <ul> <li>Signal)</li> <li>PBO (Encoder Divided Pulse Output Phase E Signal)</li> <li>PCO (Encoder Divided Pulse Output Phase C Signal)</li> <li>/ALO1, /ALO2, and /ALO3 (Alarm Code Output signals</li> <li>/INPOSITION (Positioning Completion Output signal</li> <li>/POUT0 (Programmable Output 0) signal</li> <li>/POUT1 (Programmable Output 1) signal</li> <li>/POUT2 (Programmable Output 2) signal</li> <li>/POUT3 (Programmable Output 3) signal</li> <li>/POUT4 (Programmable Output 4) signal</li> <li>/POUT5 (Programmable Output 5) signal</li> <li>/POUT6 (Programmable Output 6) signal</li> <li>/POUT7 (Programmable Output 7) signal</li> </ul> | 3<br>C<br>but) |

9.2.3 I/O Signals Status Monitor

## **Operating Procedure**

Use the following procedure to display the Operation Monitor, Status Monitor, and I/O Monitor for the SERVOPACK.

• Select *Monitor* in the Menu Dialog Box of the SigmaWin+. The Operation Pane, Status Pane, and I/O Pane will be displayed in the Monitor Window.

|                | Monitor                                                                                                                  |                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SKAWA S∎maWrr+               |                                                    | • 9 |
|----------------|--------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------|-----|
|                | Operation                                                                                                                |                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                              |                                                    |     |
| -5GD75-2R8AE0A | Control                                                                                                                  | 1/F 🖌                                                                                 | Item 🖌                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Unit                         | 0001-SGD<br>Axis A                                 |     |
| 9              | PRE 1990 110                                                                                                             | Common                                                                                | Motor rotating speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | min-1                        | 0                                                  |     |
| HBS P-OT       | 1979                                                                                                                     | Common                                                                                | Speed reference                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | min-1                        | 0                                                  |     |
| POWR FSIP NOT  | FOS 510 110                                                                                                              | Common                                                                                | Input reference pulse speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | min-1                        | 0                                                  |     |
|                | 105 500 110                                                                                                              | Common                                                                                | Position error amount                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | reference un                 | 0                                                  |     |
|                | FOR 510 110                                                                                                              | Common                                                                                | Accumulated load ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 96                           | 0                                                  |     |
|                | 105 510 110                                                                                                              | Common                                                                                | Regenerative load ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 96                           | 0                                                  |     |
|                |                                                                                                                          | Common                                                                                | Power consumed by DB resi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 96                           | 0                                                  |     |
|                | PO5 570 18Q                                                                                                              | Common                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                              |                                                    |     |
|                | Status 1/0                                                                                                               | Common                                                                                | Current Alarm State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -                            | Normal                                             |     |
|                |                                                                                                                          | Common                                                                                | and the second se |                              | Normal<br>0001-SGD<br>Axis A                       |     |
|                | Status / 1/0<br>Status                                                                                                   | Common                                                                                | Current Alarm State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                              | 0001-SGD                                           |     |
|                | Status 1/0<br>Status 1/0<br>Status                                                                                       | Common<br>I/F ✓<br>Common                                                             | Current Alarm State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                              | 0001-SGD<br>Axis A                                 |     |
|                | Rds     SHD     L/O       Status     L/O       Status     L/O       Control     IOS       IOS     SHD     IOC            | Common<br>I/F ✓<br>Common                                                             | Current Alarm State Item  V Dynamic Brake (DB)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -<br>ON(ALL)                 | 0001-SGD<br>Axis A<br>ON                           |     |
|                | Rds     SHD     L/O       Status     L/O       Status     L/O       Control     IOS       IOS     SHD     IOC            | Common<br>I/F ✓<br>Common<br>Common                                                   | Current Alarm State                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -<br>ON(ALL)<br>-            | 0001-SGD<br>Axis A<br>ON<br>OFF                    |     |
|                | Status L/O<br>Status L/O<br>Control<br>1005 Statu STO<br>1005 Statu STO<br>1005 Statu STO                                | Common<br>I/F V<br>Common<br>Common<br>Common<br>Common                               | Current Alarm State Item Upnamic Brake (DB) Origin not Passed /COIN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ON(ALL)<br>-<br>ON(ALL)      | 0001-SGD<br>Axis A<br>ON<br>OFF<br>ON              |     |
|                | Status D'O<br>Status D'O<br>Status<br>Control<br>1935 Status<br>1935 Status<br>1935 Status<br>1935 Status<br>1935 Status | Common<br>I/F ✓<br>Common<br>Common<br>Common<br>Common                               | Current Alarm State Item Dynamic Brake (DB) Origin not Passed /COIN /V-CMP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ON(ALL)<br>-<br>ON(ALL)<br>- | 0001-SGD<br>Axis A<br>ON<br>OFF<br>ON<br>OFF       |     |
|                | Status D'O<br>Status D'O<br>Status<br>Control<br>1935 Status<br>1935 Status<br>1935 Status<br>1935 Status<br>1935 Status | Common<br>I/F ✓<br>Common<br>Common<br>Common<br>Common<br>Common<br>Common<br>Common | Current Alarm State Item Upnamic Brake (DB) Origin not Passed /COIN //-CMP /S-RDY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ON(ALL)<br>-<br>ON(ALL)<br>- | 0001-SGD<br>Axis A<br>ON<br>OFF<br>ON<br>OFF<br>ON |     |

Information You can flexibly change the contents that are displayed in the Monitor Window. Refer to the following manual for details.

C Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

## 9.2.3 I/O Signals Status Monitor

Use the following procedure to check the status of the I/O signals.

- 1. Click the <u>J</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select I/O Signal Allocation in the Menu Dialog Box. The I/O Signal Allocation Window will be displayed.

#### 9.2.3 I/O Signals Status Monitor

3. Click the Input Signal Tab.

| 01-SGD75-      | R70F20A              |                      |                                    |             |                                                 |            |        |                                        |         |                                                                   |                                                                                                                                                                                |           |
|----------------|----------------------|----------------------|------------------------------------|-------------|-------------------------------------------------|------------|--------|----------------------------------------|---------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Write          | Change               | Displa               | y List                             |             |                                                 |            |        |                                        |         |                                                                   |                                                                                                                                                                                |           |
|                | Method<br>locate Sig |                      |                                    |             |                                                 |            |        |                                        |         |                                                                   |                                                                                                                                                                                |           |
| t Signal Ou    |                      |                      |                                    |             |                                                 |            | Manual |                                        |         |                                                                   |                                                                                                                                                                                |           |
| Signal         |                      |                      |                                    |             |                                                 | <b>-</b> à |        |                                        |         |                                                                   |                                                                                                                                                                                |           |
|                |                      |                      |                                    |             |                                                 |            |        |                                        |         |                                                                   |                                                                                                                                                                                |           |
|                | xis Nam              | Status               |                                    |             |                                                 |            |        | Signal Connection<br>O Signal Connecto |         | es and Euroctions                                                 |                                                                                                                                                                                |           |
| N1-13          |                      | Hi                   |                                    |             |                                                 |            |        |                                        |         |                                                                   |                                                                                                                                                                                | _         |
| N1-7<br>N1-8   |                      | H                    |                                    |             |                                                 |            | 4.5    | 1/0 SI                                 | ignal   | Connection                                                        | S                                                                                                                                                                              |           |
| N1-9           | Axis A               | н                    |                                    |             |                                                 | -          |        |                                        |         |                                                                   |                                                                                                                                                                                |           |
| N1-10          |                      | н                    |                                    |             |                                                 |            | 4.5.1  | I/O Sig                                | nal Co  | onnector (CN1)                                                    | Names and Functions                                                                                                                                                            | \$        |
| N1-11<br>N1-12 |                      | Hi                   |                                    |             |                                                 |            |        | The followin<br>default sett           |         | ves the pin numbers, na                                           | ames, and functions the I/Ö signal pin                                                                                                                                         | s for the |
|                |                      | -                    |                                    |             |                                                 |            |        |                                        |         |                                                                   |                                                                                                                                                                                |           |
| llocation I    | Method               | User                 | allocations                        |             |                                                 |            |        | Input S                                |         |                                                                   |                                                                                                                                                                                |           |
|                | xis Nam              | Allocation           | 1                                  | Polarity    | Status                                          |            |        |                                        |         | ven in parentheses.                                               | for a first                                                                                                                                                                    | Defenses  |
| DT             |                      | Possible             | Always inactive                    |             | Allow Forward Run                               |            |        | Signal<br>/Si1*                        | Pin No. | Name<br>General-purpose                                           | Function                                                                                                                                                                       | Reference |
| -CL            |                      | Possible<br>Possible | Always inactive                    |             | Allow Reverse Run<br>No Forward External Torque |            |        | (P-OT)                                 | 7       | Sequence Input 1 (For-<br>ward Drive Prohibit Input)              | You can allocate the input signal to use<br>with a parameter.                                                                                                                  |           |
| -CL            |                      | Possible             | Always inactive<br>Always inactive |             | No Forward External Torque                      |            |        | /522*                                  |         | General-purpose                                                   | <ul> <li>(Stops Servomotor drive (to prevent over-<br/>trave) when the moving part of the</li> </ul>                                                                           | page 5-27 |
| CC CC          | Axis A               | Possible             | CN1-9                              | -<br>Normal | Deceleration Limit Switch In                    |            |        | (N-OT)                                 | 8       | Sequence Input 2<br>(Reverse Drive Prohibit                       | machine exceeds the range of move-<br>ment.)                                                                                                                                   |           |
| XT1            |                      | Possible             | CN1-10                             | Normal      | No EXT1 Interrupt Request                       |            |        |                                        |         | Input)<br>General-purpose                                         | You can allocate the input signal to use                                                                                                                                       |           |
| XT2            |                      |                      | CN1-11                             | Normal      | No EXT2 Interrupt Request                       |            |        | /SI3*<br>(/DEC)                        | 9       | Sequence Input 3 (Ori-<br>gin Return Deceleration                 | with a parameter.<br>(Connects the deceleration limit switch for                                                                                                               | -         |
| XT3            |                      | Possible             | CN1-12                             | Normal      | No EXT3 Interrupt Request                       |            |        | ( mea)                                 |         | Switch Input)                                                     | origin return.)                                                                                                                                                                |           |
| TP             |                      | Possible             | Always inactive                    |             | Emergency stop off                              |            |        | /SI4*<br>(/EXT1)                       | 10      | General-purpose<br>Sequence Input 4 (Exter-<br>nal Latch Input 1) |                                                                                                                                                                                |           |
|                |                      |                      |                                    |             |                                                 |            |        | /\$15*<br>(/EXT2)                      | 11      | General-purpose<br>Sequence Input 5 (Exter-<br>nal Latch Input 2) | You can allocate the input signals to use<br>with parameters.<br>(Connect the external signals that latch<br>the current feedback pulse counter.)                              | -         |
|                |                      |                      |                                    |             |                                                 |            |        | /SI6*<br>(/EXT3)                       | 12      | General-purpose<br>Sequence Input 6 (Exter-<br>nal Latch Input 3) | , the current resource pulse counter.)                                                                                                                                         |           |
|                |                      |                      |                                    |             |                                                 |            |        | /\$10*                                 | 13      | General-purpose<br>Sequence Input 0                               | You can allocate the input signal to use<br>with a parameter.<br>(Used for general-purpose input. You can<br>monitor this signal in the I/O monitor field<br>of MECH4TROLINK.) | -         |
|                |                      |                      |                                    |             |                                                 |            |        |                                        |         |                                                                   | Inputs the sequence input signal power                                                                                                                                         |           |
|                |                      |                      |                                    |             |                                                 |            |        | +24VIN                                 | 6       | Sequence Input Signal<br>Power Supply Input                       | supply.<br>Allowable voltage range: 24 VDC ±20%<br>The 24-VDC power supply is not provided<br>by Yaskawa.                                                                      | -         |

Check the status of the input signals.

#### 4. Click the Output Signal Tab.



Check the status of the output signals.

Information

- You can also use the above window to check wiring.
- Checking Input Signal Wiring Change the signal status at the host controller. If the input signal status on the window changes accordingly, then the wiring is correct.
- Checking Output Signal Wiring
   Click the Force Output Mode Button. This will fe
- Click the **Force Output Mode** Button. This will force the output signal status to change. If the signal status at the host controller changes accordingly, then the wiring is correct. You cannot use the **Force Output Mode** Button while the servo is ON. For details, refer to the following manual.
- AC Servo Drive Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

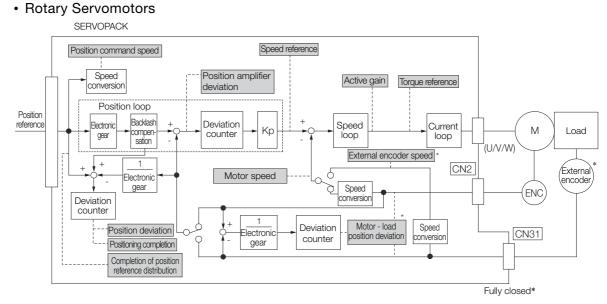
9.3.1 Items That You Can Monitor

## 9.3 Monitoring Machine Operation Status and Signal Waveforms

To monitor waveforms, use the SigmaWin+ trace function or a measuring instrument, such as a memory recorder.

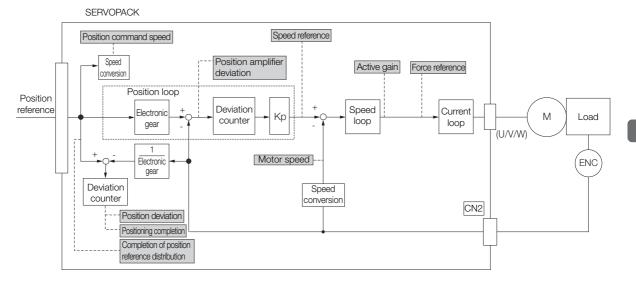
## 9.3.1 Items That You Can Monitor

You can use the SigmaWin+ or a measuring instrument to monitor the shaded items in the following block diagram.



\* This speed is available when fully-closed loop control is being used.

#### Linear Servomotors



Monitoring

9.3.2 Using the SigmaWin+

## 9.3.2 Using the SigmaWin+

This section describes how to trace data and I/O with the SigmaWin+.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Trace in the Menu Dialog Box. The Trace Dialog Box will be displayed.



## **Trace Objects**

You can trace the following items.

Data Tracing

| Trace Objects                                                                                                                                                                                             |                                                                                                                                                                                                                                    |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| <ul> <li>Torque Reference</li> <li>Feedback Speed</li> <li>Reference Speed</li> <li>Position Reference Speed</li> <li>Position Error (Deviation)</li> <li>Position Amplifier Error (Deviation)</li> </ul> | <ul> <li>Motor - Load Position Deviation</li> <li>Speed Feedforward</li> <li>Torque Feedforward</li> <li>Effective (Active) Gain</li> <li>Main Circuit DC Voltage</li> <li>External Encoder Speed</li> <li>Control Mode</li> </ul> |  |  |

9.3.2 Using the SigmaWin+

#### • I/O Tracing

|                  | Trace Objects                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input<br>Signals | <ul> <li>/S-ON (Servo ON Input Signal)</li> <li>P-OT (Forward Drive Prohibit Input Signal)</li> <li>N-OT (Reverse Drive Prohibit Input Signal)</li> <li>/ALM-RST (Alarm Reset Input Signal)</li> <li>/DEC (Homing Deceleration Switch Input Signal)</li> <li>/HWBB1 (Hard Wire Base Block Input 1 Signal)</li> <li>/HWBB2 (Hard Wire Base Block Input 2 Signal)</li> <li>/RGRT (Registration Input) signal</li> <li>/HOME (Homing Input) signal</li> </ul> | Output<br>Signals  | <ul> <li>ALM (Servo Alarm Output Signal)</li> <li>/S-RDY (Servo Ready Output Signal)</li> <li>/BK (Brake Output Signal)</li> <li>/WARN (Warning Output Signal)</li> <li>PAO (Encoder Divided Pulse Output Phase A Signal)</li> <li>PBO (Encoder Divided Pulse Output Phase B Signal)</li> <li>PCO (Encoder Divided Pulse Output Phase C Signal)</li> <li>/ALO1, /ALO2, and /ALO3 (Alarm Code Output) signals</li> <li>/INPOSITION (Positioning Completion Output) signal</li> </ul> |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Internal<br>Status | <ul> <li>ACON (Main Circuit ON Signal)</li> <li>PDETCMP (Polarity Detection Completed Signal)</li> <li>DEN (Position Reference Distribution Completed Signal)</li> </ul>                                                                                                                                                                                                                                                                                                            |

## 9.3.3 Using the Analog Monitors

Connect a measuring instrument, such as a memory recorder, to the analog monitor connector (CN5) on the SERVOPACK to monitor analog signal waveforms. The measuring instrument is not provided by Yaskawa.

Refer to the following section for details on the connection. (37 4.8.3 Analog Monitor Connector (CN5) on page 4-50

## Setting the Monitor Object

Use  $Pn006 = n.\square\squareXX$  and  $Pn007 = n.\square\squareXX$  (Analog Monitor 1 and 2 Signal Selections) to set the items to monitor.

| Line Color         | Signal           | Parameter Setting |
|--------------------|------------------|-------------------|
| White              | Analog monitor 1 | Pn006 = n.□□XX    |
| Red                | Analog monitor 2 | Pn007 = n.□□XX    |
| Black<br>(2 lines) | GND              | -                 |

| Parameter   |                                            |                                                  | Description                                                                                                  |                                                                        |
|-------------|--------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| ı aı        | ameter                                     | Monitor Signal                                   | Output Unit                                                                                                  | Remarks                                                                |
|             | n.□□00<br>(default<br>setting of<br>Pn007) | Motor Speed                                      | <ul> <li>Rotary Servomotor: 1 V/1,000 min<sup>-1</sup></li> <li>Linear Servomotor: 1 V/1,000 mm/s</li> </ul> | -                                                                      |
|             | n.□□01                                     | Speed Reference                                  | <ul> <li>Rotary Servomotor:1 V/1,000 min<sup>-1</sup></li> <li>Linear Servomotor:1 V/1,000 mm/s</li> </ul>   | _                                                                      |
|             | n.□□02<br>(default<br>setting of<br>Pn006) | Torque Reference                                 | 1 V/100% rated torque                                                                                        | -                                                                      |
|             | n.□□03                                     | Position Deviation                               | 0.05 V/Reference unit                                                                                        | _                                                                      |
|             | n.□□04                                     | Position Amplifier<br>Deviation                  | 0.05 V/encoder pulse unit                                                                                    | Position deviation<br>after electronic gear<br>conversion              |
|             | n.□□05                                     | Position Command<br>Speed                        | <ul> <li>Rotary Servomotor:1 V/1,000 min<sup>-1</sup></li> <li>Linear Servomotor:1 V/1,000 mm/s</li> </ul>   | -                                                                      |
| Pn006<br>or | n.□□06                                     | Reserved parameter (Do not change.)              | -                                                                                                            | _                                                                      |
| Pn007       | n.ロロ07                                     | Motor - Load Position<br>Deviation               | 0.01 V/Reference unit                                                                                        | _                                                                      |
|             | n.□□08                                     | Positioning Completion                           | Positioning completed: 5 V<br>Positioning not completed: 0 V                                                 | Completion is indi-<br>cated by the output<br>voltage.                 |
|             | n.□□09                                     | Speed Feedforward                                | <ul> <li>Rotary Servomotor:1 V/1,000 min<sup>-1</sup></li> <li>Linear Servomotor:1 V/1,000 mm/s</li> </ul>   | _                                                                      |
|             | n.□□0A                                     | Torque Feedforward                               | 1 V/100% rated torque                                                                                        | -                                                                      |
|             | n.□□0B                                     | Active Gain*                                     | 1st gain: 1 V<br>2nd gain: 2 V                                                                               | The gain that is<br>active is indicated<br>by the output volt-<br>age. |
|             | n.□□0C                                     | Completion of Position<br>Reference Distribution | Distribution completed: 5 V<br>Distribution not completed: 0 V                                               | Completion is indi-<br>cated by the output<br>voltage.                 |
|             | n.□□0D                                     | External Encoder<br>Speed                        | 1 V/1,000 min <sup>-1</sup>                                                                                  | Value calculated at the motor shaft                                    |
|             | n.□□10                                     | Main Circuit DC Voltage                          | 1 V/100 V (main circuit DC voltage)                                                                          | -                                                                      |

\* Refer to the following section for details.

8.12.1 Automatic Gain Switching on page 8-64

## **Changing the Monitor Factor and Offset**

You can change the monitor factors and offsets for the output voltages for analog monitor 1 and analog monitor 2. The relationships to the output voltages are as follows:

| Analog monitor 1                                | Analog Monitor 1 Signal      | Analog Monitor 1                          | Analog Monitor 1       |
|-------------------------------------------------|------------------------------|-------------------------------------------|------------------------|
| output voltage = $(-1) \times \langle$          | Selection (Pn006 = n.□□XX) × | Magnification (Pn552) <sup>+</sup>        | Offset Voltage (Pn550) |
| Analog monitor 2 = $(-1) \times$ output voltage |                              | Analog Monitor 2<br>Magnification (Pn553) | Analog Monitor 2       |

The following parameters are set.

-6000

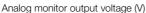
-6 V

|       | Analog Monitor 1 Of | fset Voltage |                 |              |                |
|-------|---------------------|--------------|-----------------|--------------|----------------|
| Pn550 | Setting Range       | Setting Unit | Default Setting | When Enabled | Classification |
|       | -10,000 to 10,000   | 0.1 V        | 0               | Immediately  | Setup          |
|       | Analog Monitor 2 Of | fset Voltage |                 |              |                |
| Pn551 | Setting Range       | Setting Unit | Default Setting | When Enabled | Classification |
|       | -10,000 to 10,000   | 0.1 V        | 0               | Immediately  | Setup          |
|       | Analog Monitor 1 Ma | agnification |                 |              |                |
| Pn552 | Setting Range       | Setting Unit | Default Setting | When Enabled | Classification |
|       | -10,000 to 10,000   | ×0.01        | 100             | Immediately  | Setup          |
|       | Analog Monitor 2 Ma | agnification |                 |              |                |
| Pn553 | Setting Range       | Setting Unit | Default Setting | When Enabled | Classification |
|       | -10,000 to 10,000   | ×0.01        | 100             | Immediately  | Setup          |

• Example for Setting the Item to Monitor to the Motor Speed (Pn006 = n.□□00) Example

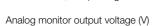
When Pn552 = 100 (Setting Unit: ×0.01)

When Pn552 = 1,000 (Setting Unit: ×0.01)









9

#### Approx. +10 V +8 V +6 V +6 V + 6000 +600 +800 Motor speed Motor speed $(min^{-1})$ -800 -600 $(\min^{-1})$ -6 V -8 V Approx. -10 V Note: The effective linearity range is ±8 V. The resolution is 16 bits.

## Adjusting the Analog Monitor Output

You can manually adjust the offset and gain for the analog monitor outputs for the torque reference monitor and motor speed monitor.

The offset is adjusted to compensate for offset in the zero point caused by output voltage drift or noise in the monitoring system.

The gain is adjusted to match the sensitivity of the measuring system.

The offset and gain are adjusted at the factory. You normally do not need to adjust them.

#### Adjustment Example

An example of adjusting the output of the motor speed monitor is provided below.

| Offset Adju             | istment                                | Gain Adju                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | stment                                                                   |  |
|-------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|--|
| Analog monitor output   | voltage<br>t adjustment<br>Motor speed | Analog monitor output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Voltage<br>Gain<br>adjustment<br>000 [min <sup>-1</sup> ]<br>Motor speed |  |
| Item                    | Specification                          | Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Specification                                                            |  |
| Offset Adjustment Range | -2.4 V to 2.4 V                        | Gain Adjustment Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 100 ±50%                                                                 |  |
| Adjustment Unit         | 18.9 mV/LSB                            | Adjustment Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.4%/LSB                                                                 |  |
|                         |                                        | <ul> <li>The gain adjustment range is made using a 100% of put value (gain adjustment of 0) as the reference value with an adjustment range of 50% to 150%.</li> <li>A setting example is given below.</li> <li>Setting the Adjustment Value to -125 100 + (-125 × 0.4) = 50 [%]<br/>Therefore, the monitor output voltage goes to 50% of the original value.</li> <li>Setting the Adjustment Value to 125 100 + (125 × 0.4) = 150 [%]<br/>Therefore, the monitor output voltage goes to 150% of the original value.</li> </ul> |                                                                          |  |

**Information** • The adjustment values do not use parameters, so they will not change even if the parameter settings are initialized.

- Adjust the offset with the measuring instrument connected so that the analog monitor output value goes to zero. The following setting example achieves a zero output.
  - While power is not supplied to the Servomotor, set the monitor signal to the torque reference.
  - In speed control, set the monitor signal to the position deviation.

### Preparations

Always check the following before you adjust the analog monitor output.

• The parameters must not be write prohibited.

#### ♦ Applicable Tools

You can use the following tools to adjust analog monitor outputs.

• Offset Adjustment

| Tool             | Fn No./Function Name                         | Operating Procedure Reference                                                 |
|------------------|----------------------------------------------|-------------------------------------------------------------------------------|
| Digital Operator | Fn00C                                        | Ω-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Others – Adjust the Analog<br>Monitor Output | G                                                                             |

• Gain Adjustment

| Tool             | Fn No./Function Name                         | Operating Procedure Reference                                                   |
|------------------|----------------------------------------------|---------------------------------------------------------------------------------|
| Digital Operator | Fn00D                                        | Ω Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Others – Adjust the Analog<br>Monitor Output |                                                                                 |

#### ♦ Operating Procedure

Use the following procedure to adjust the analog monitor output.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Adjust the Analog Monitor Output in the Menu Dialog Box. The Adjust the Analog Monitor Output Dialog Box will be displayed.
- 3. Click the Zero Adjustment or Gain Adjustment Tab.

| Adjust the Analog Monitor Output AXIS#00           |
|----------------------------------------------------|
|                                                    |
| Zero Adjustment Gain Adjustment                    |
| Channel CH1                                        |
| 0 Offset +1 ᠿ∱<br>-1 ᠿ∤                            |
| Monitor Signal Torque reference (1 V/100% rated to |

**4.** While watching the analog monitor, use the +1 and -1 Buttons to adjust the offset. There are two channels: CH1 and CH2. If necessary, click the down arrow on the **Channel** Box and select the channel.

| Search Adjust the Analog Monitor Output AXIS#00    |
|----------------------------------------------------|
|                                                    |
| Zero Adjustment Gain Adjustment                    |
| Analog Monitor Output Offset                       |
| Channel CH1                                        |
|                                                    |
| Monitor Signal Torque reference (1 V/100% rated to |

This concludes adjusting the analog monitor output.

9.4.1 Items That You Can Monitor

## 9.4 Monitoring Product Life

## 9.4.1 Items That You Can Monitor

| Monitor Item                                        | Description                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SERVOPACK Installation<br>Environment               | <ul> <li>The operating status of the SERVOPACK in terms of the installation environment is displayed. Implement one or more of the following actions if the monitor value exceeds 100%.</li> <li>Lower the surrounding temperature.</li> <li>Decrease the load.</li> </ul>                                            |
| Servomotor Installation<br>Environment              | <ul> <li>The operating status of the SERVOPACK in terms of the installation environment is displayed. Implement one or more of the following actions if the monitor value exceeds 100%.</li> <li>Lower the surrounding temperature.</li> <li>Decrease the load.</li> </ul>                                            |
| Built-in Fan Service Life<br>Prediction             | The unused status of the SERVOPACK is treated as the 100% value. The value decreases each time the main circuit power supply is turned ON and each time the servo is turned OFF. Use a monitor value of 0% as a guideline for the replacement period. Refer to the following section for part replacement guidelines. |
| Capacitor Service Life<br>Prediction                | The unused status of the SERVOPACK is treated as the 100% value. The value decreases each time the main circuit power supply is turned ON and each time the servo is turned OFF. Use a monitor value of 0% as a guideline for the replacement period. Refer to the following section for part replacement guidelines. |
| Surge Prevention Circuit<br>Service Life Prediction | The unused status of the SERVOPACK is treated as the 100% value. The value decreases each time the main circuit power supply is turned ON and each time the servo is turned OFF. Use a monitor value of 0% as a guideline for the replacement period. Refer to the following section for part replacement guidelines. |
| Dynamic Brake Circuit<br>Service Life Prediction    | The unused status of the SERVOPACK is treated as the 100% value. The value decreases each time the main circuit power supply is turned ON and each time the servo is turned OFF. Use a monitor value of 0% as a guideline for the replacement period. Refer to the following section for part replacement guidelines. |

9.4.2 Operating Procedure

## 9.4.2 Operating Procedure

Use the following procedure to display the installation environment and service life prediction monitor dialog boxes.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Life Monitor in the Menu Dialog Box.

The Life Monitor Dialog Box will be displayed.

Information With the Digital Operator, you can use Un025 to Un02A to monitor this information.

| C Life Monitor AXIS#00                 |                 |           |            |                |            |   |
|----------------------------------------|-----------------|-----------|------------|----------------|------------|---|
| Installation Environment Monitor       |                 |           |            |                |            |   |
| Servopack Motor<br>Good(55%) Good(59%) |                 |           |            |                |            |   |
| Life Predi                             | ction Monitor — |           |            |                |            | - |
|                                        | Built-in Fan    | Capacitor | Surge Prev | ention Circuit | DB Circuit |   |
| 100                                    | 10              | 0         | 100        | 100            |            |   |
|                                        | 99.99%          | 99.98%    | 99.        | 98%            | 99.97%     |   |
| 0                                      |                 | 0         | 0          | 0              |            |   |
|                                        |                 |           |            |                | Close      |   |

 A value of 100% indicates that the SERVOPACK has not yet been used. The percentage decreases as the SERVOPACK is used and reaches 0% when it is time to replace the SERVOPACK.

9.4.3 Preventative Maintenance

## 9.4.3 Preventative Maintenance

You can use preventative maintenance warnings for preventative maintenance. The SERVO-PACK can notify the host controller when it is time to replace any of the main parts.

## Preventative Maintenance Warning

An A.9b0 warning (Preventative Maintenance Warning) is detected when any of the following service life prediction values drops to 10% or less: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, and dynamic brake circuit life. You can change the setting of Pn00F =  $n.\square\square\square\squareX$  to enable or disable these warnings.

| Parameter |                             | Description                                      | When<br>Enabled  | Classifi-<br>cation |
|-----------|-----------------------------|--------------------------------------------------|------------------|---------------------|
| Pn00F     | n.□□□0<br>(default setting) | Do not detect preventative maintenance warnings. | After<br>restart | Setup               |
|           | n.0001                      | Detect preventative maintenance warnings.        | restart          |                     |

9.5.1 Data for Which Alarm Tracing Is Performed

#### **Alarm Tracing** 9.5

Alarm tracing records data in the SERVOPACK from before and after an alarm occurs. This data helps you to isolate the cause of the alarm.

You can display the data recorded in the SERVOPACK as a trace waveform on the SigmaWin+.

- Alarms that occur when the power supply is turned ON are not recorded.Alarms that occur during the recording of alarm trace data are not recorded. Information
  - - Alarms that occur while utility functions are being executed are not recorded.
    - Alarms that occur while the data tracing function of the SigmaWin+ is being executed are not recorded.

#### Data for Which Alarm Tracing Is Performed 9.5.1

Two types of data are recorded for alarm tracing: numeric data and I/O signal ON/OFF data.

| Numeric Data                  | ON/OFF Data                           |
|-------------------------------|---------------------------------------|
| Torque reference              | ALM                                   |
| Feedback speed                | Servo ON command (/S-ON)              |
| Reference speed               | Proportional control command (/P-CON) |
| Position reference speed      | Forward torque command (/P-CL)        |
| Position deviation            | Reverse torque command (/N-CL)        |
| Motor-load position deviation | G-SEL1 signal (/G-SEL1)               |
| Main circuit bus voltage      | ACON                                  |

#### Applicable Tools 9.5.2

The following table lists the tools that you can use to perform alarm tracing.

| Tool             | Fn No./Function Name                                                                                  | Operating Procedure Reference                                    |  |  |  |
|------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|--|--|--|
| Digital Operator | You cannot display alarm tracin                                                                       | You cannot display alarm tracing data from the Digital Operator. |  |  |  |
| SigmaWin+        | Troubleshooting – Alarm<br>TraceCEngineering Tool SigmaWin+ Operatio<br>(Manual No.: SIET S800001 34) |                                                                  |  |  |  |

9.5 Alarm Tracing

9.5.2 Applicable Tools

# Fully-Closed Loop Control

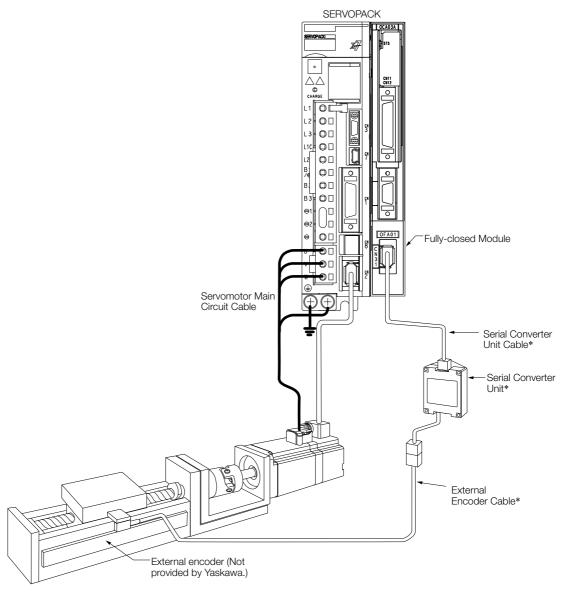
This chapter provides detailed information on performing fully-closed loop control with the SERVOPACK.

| 10.1 | Fully- | Closed System 10-2                                                           |
|------|--------|------------------------------------------------------------------------------|
| 10.2 | SERV   | OPACK Commissioning Procedure 10-3                                           |
| 10.3 | Param  | eter Settings for Fully-Closed Loop Control 10-5                             |
|      | 10.3.1 | Control Block Diagram for Fully-Closed                                       |
|      | 10.3.2 | Loop Control 10-5<br>Setting the Motor Direction and the Machine             |
|      | 10.3.3 | Movement Direction                                                           |
|      |        | Pitches 10-6                                                                 |
|      | 10.3.4 | Setting the PAO, PBO, and PCO<br>(Encoder Divided Pulse Output) Signals 10-7 |
|      | 10.3.5 | Electronic Gear Setting 10-8                                                 |
|      | 10.3.6 | Alarm Detection Settings 10-9                                                |
|      | 10.3.7 | Analog Monitor Signal Settings 10-10                                         |
|      | 10.3.8 | Setting to Use an External Encoder                                           |
|      |        | for Speed Feedback 10-10                                                     |

## 10.1 Fully-Closed System

With a fully-closed system, an externally installed encoder is used to detect the position of the controlled machine and the machine's position information is fed back to the SERVOPACK. High-precision positioning is possible because the actual machine position is fed back directly. With a fully-closed system, looseness or twisting of mechanical parts may cause vibration or oscillation, resulting in unstable positioning.

Refer to the following manual for details on Fully-closed Modules.  $\square \Sigma$ -7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32) The following figure shows an example of the system configuration.



\* The connected devices and cables depend on the type of external linear encoder that is used.

Note: Refer to the following section for details on connections that are not shown above, such as connections to power supplies and peripheral devices.

Duct-ventilated SERVOPACKs on page 2-25

## **10.2 SERVOPACK Commissioning Procedure**

First, confirm that the SERVOPACK operates correctly with semi-closed loop control, and then confirm that it operates correctly with fully-closed loop control. The commissioning procedure for the SERVOPACK for fully-closed loop control is given below.

Con-**Required Parameter** Step Description Operation trolling Settings Device Set the parameters so that the Check operation of the SERVOPACK operates correctly in entire sequence with semi-closed loop control without a Pn000 (Basic Function semi-closed loop control load and check the following Select Switch 0) and without a load. points. Set Pn002 to n.0 DD to Pn001 (Basic Function Items to Check specify semi-closed loop control. Select Switch 1) · Power supply circuit • Pn002 = n.X · Are there any errors in the SERwiring VOPACK? (External Encoder Servomotor wiring Does iog operation function cor-Usage) SERVO-Encoder wiring Pn20E (Electronic Gear rectly when you operate the PACK or • Wiring of I/O signal 1 SERVOPACK without a load? Ratio (Numerator)) host conlines from the host con-• Do the I/O signals turn ON and • Pn210 (Electronic Gear troller troller OFF correctly? Ratio (Denominator)) Servomotor rotation · Is power supplied to the Servo- PnB03 to PnB12) direction, motor speed, motor after the /S-ON signal is (Input Signal Selections) and multiturn data PnB15 to PnB1E) sent? · Operation of safety • Does the Servomotor operate (Output Signal Selecmechanisms, such as correctly when a position refertions) the brakes and the ence is input by the host controlovertravel mechanisms ler? Check operation with the Servomotor connected to the machine with semi-closed loop control. Connect the Servomotor to the machine. Set the moment of inertia Items to Check Initial response of the ratio in Pn103 using autotuning system connected to without a host reference. Pn103 (Moment of Inertia Host con-2 the machine Check that the machine's move-Ratio) troller Movement direction, ment direction, travel distance, and travel distance, and movement speed agree with the movement speed as references from the host controller. specified by the references from the host controller Set the parameters related to fully-• Pn002 = n.X closed loop control and move the (External Encoder machine with your hand without Usage) turning ON the power supply to the • Pn20A (Number of Servomotor. Check the following External Scale Pitches) status with the Digital Operator or Pn20E (Electronic Gear SigmaWin+. Check the external Ratio (Numerator)) • Does the fully-closed feedback encoder. Pn210 (Electronic Gear pulse counter count up when the Items to Check Ratio (Denominator)) Servomotor moves in the forward 3 Is the signal from the Pn281 (Encoder Output direction? external encoder Resolution) · Is the travel distance of the received correctly? Pn51B (Motor-Load machine visually about the same Position Deviation Overas the amount counted by the flow Detection Level) fully-closed feedback pulse Pn522 (Positioning) counter? Completed Width) Note: The unit for the fully-closed feedback pulse counter is pulses, • Pn52A (Multiplier per which is equivalent to the exter-Fully-closed Rotation) nal encoder sine wave pitch.

Continued on next page.

Continued from previous page.

| Step | Description                                                                                                                                        | Operation                                                                                                                                                                                                                              | Required Parameter<br>Settings                                  | Con-<br>trolling         |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|--------------------------|
| 4    | Perform a program jog<br>operation.<br>Items to Check<br>Does the fully-closed<br>system operate correctly<br>for the SERVOPACK<br>without a load? | Perform a program jog operation<br>and confirm that the travel dis-<br>tance is the same as the reference<br>value in Pn531.<br>When you perform program jog<br>operation, start from a low speed<br>and gradually increase the speed. | Pn530 to Pn536 (program<br>jog operation-related<br>parameters) | Device<br>SERVO-<br>PACK |
| 5    | Operate the SERVO-<br>PACK.<br>Items to Check<br>Does the fully-closed<br>system operate correctly,<br>including the host con-<br>troller?         | Input a position reference and con-<br>firm that the SERVOPACK oper-<br>ates correctly.<br>Start from a low speed and gradu-<br>ally increase the speed.                                                                               | -                                                               | Host con-<br>troller     |

10.3.1 Control Block Diagram for Fully-Closed Loop Control

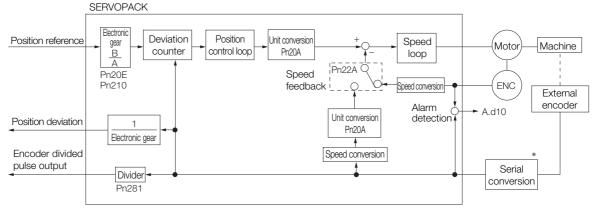
## 10.3 Parameter Settings for Fully-Closed Loop Control

This section describes the parameter settings that are related to fully-closed loop control.

| Parameter to Set | Setting                                                                     | Reference  |  |
|------------------|-----------------------------------------------------------------------------|------------|--|
| Pn000 = n.□□□X   | Motor direction                                                             | paga 10 5  |  |
| Pn002 = n.X□□□   | External encoder usage method                                               | page 10-5  |  |
| Pn20A            | Number of external scale pitches                                            | page 10-6  |  |
| Pn281            | Encoder divided pulse output signals (PAO, PBO, and PCO) from the SERVOPACK | page 10-7  |  |
| Pn20E and Pn210  | Electronic gear ratio                                                       | page 5-41  |  |
| Pn51B            | Motor-Load Position Deviation Overflow Detection Level                      | paga 10.0  |  |
| Pn52A            | Multiplier for fully-closed rotation                                        | page 10-9  |  |
| Pn006/Pn007      | Analog monitor signal                                                       | page 10-10 |  |
| Pn22A = n.X□□□   | Speed feedback method during fully-closed loop control                      | page 10-10 |  |

## 10.3.1 Control Block Diagram for Fully-Closed Loop Control

The control block diagram for fully-closed loop control is provided below.



\* The connected device depends on the type of external encoder.

Note: You can use either an incremental or an absolute encoder. If you use an absolute encoder, set Pn002 to n.  $\Box 1 \Box \Box$  (Use the absolute encoder as an incremental encoder).

# 10.3.2 Setting the Motor Direction and the Machine Movement Direction

You must set the motor direction and the machine movement direction. To perform fully-closed loop control, you must set the motor rotation direction with both  $Pn000 = n.\square\square\squareX$  (Direction Selection) and  $Pn002 = n.X\square\square\square$  (External Encoder Usage).

| Parameter                                    |           |                        | Pn002 = n.XDDD (External Encoder Usage) |                      |                     |                      |
|----------------------------------------------|-----------|------------------------|-----------------------------------------|----------------------|---------------------|----------------------|
|                                              |           |                        | n.1000                                  |                      | n.3000              |                      |
| Pn000<br>=n.□□□X<br>(Direction<br>Selection) |           | Reference<br>direction | Forward reference                       | Reverse<br>reference | Forward reference   | Reverse<br>reference |
|                                              | n.🗆 🗆 🗆 0 | Motor direction        | CCW                                     | CW                   | CCW                 | CW                   |
|                                              |           | External<br>encoder    | Forward movement                        | Reverse<br>movement  | Reverse<br>movement | Forward movement     |
|                                              | n.0001    | Reference<br>direction | Forward reference                       | Reverse<br>reference | Forward reference   | Reverse<br>reference |
|                                              |           | Motor direction        | CW                                      | CCW                  | CW                  | CCW                  |
|                                              |           | External<br>encoder    | Reverse<br>movement                     | Forward<br>movement  | Forward<br>movement | Reverse<br>movement  |

10.3.3 Setting the Number of External Encoder Scale Pitches

- Phase B leads in the divided pulses for a forward reference regardless of the setting of Pn000 =  $n.\Box\Box\BoxX$ .
- Forward direction: The direction in which the pulses are counted up.
- Reverse direction: The direction in which the pulses are counted down.

## **Related Parameters**

### ♦ Pn000 = n.□□□X

Refer to the following section for details. 5.4 Motor Direction Setting on page 5-15

### ♦ Pn002 = n.X□□□

When you perform fully-closed loop control, set Pn002 to  $n.1\square\square\square$  or  $n.3\square\square\square$ .

| Parameter |                                  | Name                      | Meaning                                                             | When<br>Enabled | Classifi-<br>cation |
|-----------|----------------------------------|---------------------------|---------------------------------------------------------------------|-----------------|---------------------|
| Pn002     | n.0□□□<br>(default set-<br>ting) | External<br>Encoder Usage | Do not use an external encoder.                                     |                 |                     |
|           | n.1000                           |                           | External encoder moves in forward direction for CCW motor rotation. | After restart   | Setup               |
|           | n.2000                           |                           | Reserved parameter (Do not change.)                                 |                 |                     |
|           | n.3000                           |                           | External encoder moves in reverse direction for CCW motor rotation. |                 |                     |
|           | n.4000                           |                           | Reserved parameter (Do not change.)                                 |                 |                     |

Information Determine the setting of  $Pn002 = n.X \square \square \square$  as described below.

- Set Pn000 to n. DDD (Use the direction in which the linear encoder counts up as the forward direction) and set Pn002 to n.1DDD (The external encoder moves in the forward direction for CCW motor rotation).
- Manually rotate the motor shaft counterclockwise.
- If the fully-closed feedback pulse counter counts up, do not change the setting of Pn002 (Pn002 = n.1□□□).
- If the fully-closed feedback pulse counter counts down, set Pn002 to n.3

## 10.3.3 Setting the Number of External Encoder Scale Pitches

Set the number of external encoder scale pitches per Servomotor rotation in Pn20A.

## Setting Example

- Number of external encoder Specifications pitches per Servomotor rotation External encoder scale pitch: 20 µm External encoder Ball screw lead: 30 mm (scale pitch: 20 μm) Workpiece position Workpiece position before movement after movement If the external encoder is connected directly to ⊢ =Mt the Servomotor, the setting will be 1,500 (30 mm/0.02 mm = 1,500).Ball screw lead: 30 mm Note: 1. If there is a fraction, round off the digits below the decimal point. 2. If the number of external encoder scale pitches per Servomotor rotation is not an integer, there will be devi-
  - 2. If the number of external encoder scale pitches per Servomotor rotation is not an integer, there will be deviation in the position loop gain (Kp), feedforward, and position reference speed monitor. This is not relevant for the position loop and it therefore does not interfere with the position accuracy.

10.3.4 Setting the PAO, PBO, and PCO (Encoder Divided Pulse Output) Signals

### **Related Parameter**

| Pn20A | Number of External Scale Pitches |                               |                 |               |                |  |  |
|-------|----------------------------------|-------------------------------|-----------------|---------------|----------------|--|--|
|       | Setting Range                    | Setting Unit                  | Default Setting | When Enabled  | Classification |  |  |
|       | 4 to 1,048,576                   | 1 scale pitch/revo-<br>lution | 32,768          | After restart | Setup          |  |  |

# 10.3.4 Setting the PAO, PBO, and PCO (Encoder Divided Pulse Output) Signals

Set the position resolution in Pn281 (Encoder Output Resolution). Enter the number of phase A and phase B edges for the setting.

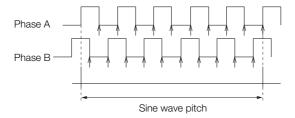
## Setting Example

Specifications External encoder scale pitch: 20 μm Ball screw lead: 30 mm Speed:1,600 mm/s

If a single pulse (multiplied by 4) is output for 1  $\mu$ m, the setting would be 20.

If a single pulse (multiplied by 4) is output for 0.5  $\mu$ m, the setting would be 40.

The encoder divided pulse output would have the following waveform if the setting is 20.



"1" indicates the edge positions. In this example, the set value is 20 and therefore the number of edges is 20.

Note: The upper limit of the encoder signal output frequency (multiplied by 4) is 6.4 Mpps. Do not set a value that would cause the output to exceed 6.4 Mpps. If the output exceeds the upper limit, an A.511 alarm (Overspeed of Encoder Output Pulse Rate) will be out-

put.

Example If the setting is 20 and the speed is 1,600 mm/s, the output frequency would be 1.6 Mpps

 $\frac{1600 \text{ mm/s}}{0.001 \text{ mm}} = 1,600,000 = 1.6 \text{ Mpps}$ 

Because 1.6 Mpps is less than 6.4 Mpps, this setting can be used.

## **Related Parameter**

|       | Encoder Output Resolution |              |                 |               |                |  |  |
|-------|---------------------------|--------------|-----------------|---------------|----------------|--|--|
| Pn281 | Setting Range             | Setting Unit | Default Setting | When Enabled  | Classification |  |  |
|       | 1 to 4,096                | 1 edge/pitch | 20              | After restart | Setup          |  |  |

Note: 1. The maximum setting for the encoder output resolution is 4,096.

If the resolution of the external encoder exceeds 4,096, pulse output will no longer be possible at the resolution given in *Feedback Resolution of Linear Encoder* on page 5-44.

2. If the setting of Pn281 exceeds the resolution of the external encoder, the A.041 alarm (Encoder Output Pulse Setting Error) will be output.

10.3.5 Electronic Gear Setting

## 10.3.5 Electronic Gear Setting

Refer to the following section for details. 5.14 Electronic Gear Settings on page 5-41 With fully-closed loop control, the same setting as for a Linear Servomotor is used.

10.3.6 Alarm Detection Settings

## 10.3.6 Alarm Detection Settings

This section describes the alarm detection settings (Pn51B and Pn52A).

# Pn51B (Motor-Load Position Deviation Overflow Detection Level)

This setting is used to detect the difference between the feedback position of the Servomotor encoder and the feedback load position of the external encoder for fully-closed loop control. If the detected difference exceeds the setting, an A.d10 alarm (Motor-Load Position Error Overflow) will be output.

| Pn51B | Motor-Load Position Deviation Overflow Detection Level |                  |                 |              |                |  |  |
|-------|--------------------------------------------------------|------------------|-----------------|--------------|----------------|--|--|
|       | Setting Range                                          | Setting Unit     | Default Setting | When Enabled | Classification |  |  |
|       | 0 to<br>1,073,741,824                                  | 1 reference unit | 1000            | Immediately  | Setup          |  |  |

Note: If you set this parameter to 0, A.d10 alarms will not be output and the machine may be damaged.

## Pn52A (Multiplier per Fully-closed Rotation)

Set the coefficient of the deviation between the Servomotor and the external encoder per Servomotor rotation.

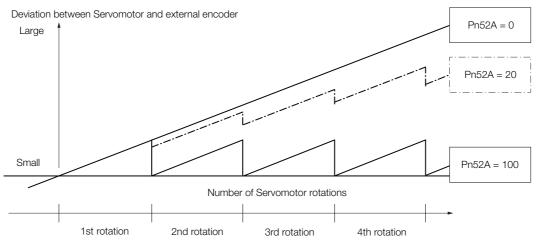
This setting can be used to prevent the Servomotor from running out of control due to damage to the external encoder or to detect belt slippage.

### ♦ Setting Example

Increase the value if the belt slips or is twisted excessively.

If this parameter is set to 0, the external encoder value will be read as it is.

If you use the default setting of 20, the second rotation will start with the deviation for the first Servomotor rotation multiplied by 0.8.



### Related Parameter

|       | Multiplier per Fully-closed Rotation |              |                 |              |                |  |  |
|-------|--------------------------------------|--------------|-----------------|--------------|----------------|--|--|
| Pn52A | Setting Range                        | Setting Unit | Default Setting | When Enabled | Classification |  |  |
|       | 0 to 100                             | 1%           | 20              | Immediately  | Setup          |  |  |

10.3.7 Analog Monitor Signal Settings

## 10.3.7 Analog Monitor Signal Settings

You can monitor the position deviation between the Servomotor and load with an analog monitor.

| Parameter |        | Name | Meaning                                                                         | When<br>Enabled | Classifi-<br>cation |
|-----------|--------|------|---------------------------------------------------------------------------------|-----------------|---------------------|
| Pn006     | n.ロロ07 |      | Position deviation between motor and load (output unit: 0.01 V/reference unit). | Immedi-         | Setup               |
| Pn007     | n.□□07 |      | Position deviation between motor and load (output unit: 0.01 V/reference unit). | ately           |                     |

## 10.3.8 Setting to Use an External Encoder for Speed Feedback

For fully-closed loop control, you normally set a parameter to specify using the motor encoder speed (Pn22A =  $n.0\square\square\square$ ).

If you will use a Direct Drive Servomotor and a high-resolution external encoder, set the parameter to specify using the speed of the external encoder ( $Pn22A = n.1 \square \square \square$ ).

| Parameter |                                  | Meaning                     | When<br>Enabled | Classification |
|-----------|----------------------------------|-----------------------------|-----------------|----------------|
| Pn22A     | n.0□□□<br>(default set-<br>ting) | Use motor encoder speed.    | After restart   | Setup          |
|           | n.1000                           | Use external encoder speed. |                 |                |

Note: This parameter cannot be used if Pn002 is set to n.0 [[] (Do not use external encoder).

# **Safety Functions**

This chapter provides detailed information on the safety functions of the SERVOPACK.

(11)

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11.1.1 Safety Functions

## **11.1 Introduction to the Safety Functions**

#### 11.1.1 Safety Functions

Safety functions are built into the SERVOPACK to reduce the risks associated with using the machine by protecting workers from the hazards of moving machine parts and otherwise increasing the safety of machine operation.

Especially when working in hazardous areas inside guards, such as for machine maintenance, the safety function can be used to avoid hazardous moving machine parts.

Refer to the following section for information on the safety function and safety parameters. *Compliance with UL Standards, EU Directives, UK Regulations, and Other Safety Standards* on page xxvi



Products that display the TÜV mark on the nameplate have met the safety standards.

## 11.1.2 Precautions for Safety Functions

#### WARNING To confirm that the HWBB function satisfies the safety requirements of the system, you must conduct a risk assessment of the system. Incorrect use of the safety function may cause injury. • The Servomotor will move if there is an external force (e.g., gravity on a vertical axis) even when the HWBB function is operating. Use a separate means, such as a mechanical brake, that satisfies the safety requirements. Incorrect use of the safety function may cause injury. • While the HWBB function is operating, the Servomotor may move within an electric angle of 180° or less as a result of a SERVOPACK failure. Use the HWBB function for an application only after confirming that movement of the Servomotor will not result in a hazardous condition. Incorrect use of the safety function may cause injury. • The dynamic brake and the brake signal are not safety-related elements. You must design the system so that SERVOPACK failures will not cause a hazardous condition while the HWBB function is operating. Incorrect use of the safety function may cause injury. • Connect devices that satisfy the safety standards for the signals for safety functions. Incorrect use of the safety function may cause injury. The HWBB function does not shut OFF the power to the SERVOPACK or electrically isolate it. Implement measures to shut OFF the power supply to the SERVOPACK before you perform maintenance on it.

There is a risk of electric shock.

11.2.1 Risk Assessment

# 11.2 Hard Wire Base Block (HWBB)

A hard wire base block (abbreviated as HWBB) is a safety function that is designed to shut OFF the current to the Servomotor with a hardwired circuit.

The drive signals to the Power Module that controls the motor current are controlled by the circuits that are independently connected to the two input signal channels to turn OFF the Power Module and shut OFF the motor current.

For safety function signal connections, the input signal is the 0-V common and the output signal is a source output.

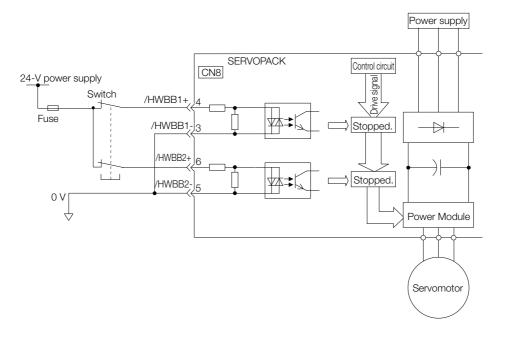
This is opposite to other signals described in this manual.

To avoid confusion, the ON and OFF status of signals for the safety function are defined as follows:

ON: The state in which the relay contacts are closed or the transistor is ON and current flows into the signal line.

OFF: The state in which the relay contacts are open or the transistor is OFF and no current flows into the signal line.

The input signal uses the 0-V common. The following figure shows a connection example.



#### 11.2.1 Risk Assessment

When using the HWBB, you must perform a risk assessment of the servo system in advance to confirm that the safety level of the standards is satisfied. Refer to the following section for details on the standards.

🕼 Compliance with UL Standards, EU Directives, UK Regulations, and Other Safety Standards on page xxvi

Note: To meet performance level e (PLe) in EN ISO 13849-1 and SIL3 in IEC 61508, the EDM1 signal must be monitored by the host controller. If the EDM1 signal is not monitored by the host controller, the level will be safety performance level c (PLc) and SIL1.

The following hazards exist even when the HWBB is operating. These hazards must be included in the risk assessment.

- The Servomotor will move if an external force is applied to it (for example, gravity on a vertical axis). Implement measures to hold the Servomotor, such as installing a separate mechanical brake.
- If a failure occurs such as a Power Module failure, the Servomotor may move within an electric angle of 180°. Ensure safety even if the Servomotor moves.

The rotational angle or travel distance depends on the type of Servomotor as follows:

• Rotary Servomotor: 1/6 rotation max. (rotational angle calculated at the motor shaft)

11.2.2 Hard Wire Base Block (HWBB) State

- Direct Drive Servomotor: 1/20 rotation max. (rotational angle calculated at the motor shaft)
- Linear Servomotor: 50 mm max.
- The HWBB does not shut OFF the power to the SERVOPACK or electrically isolate it. Implement measures to shut OFF the power supply to the SERVOPACK before you perform maintenance on it.

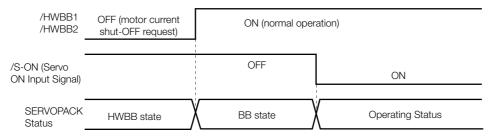
## 11.2.2 Hard Wire Base Block (HWBB) State

The SERVOPACK will be in the following state if the HWBB operates. If the /HWBB1 or /HWBB2 signal turns OFF, the HWBB will operate and the SERVOPACK will enter a HWBB state.

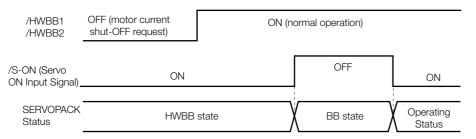
| /HWBB1<br>/HWBB2                    | ON (nor         | mal operation) | OFF (motor current shut-OFF request) |
|-------------------------------------|-----------------|----------------|--------------------------------------|
| /S-ON<br>(Servo ON<br>Input Signal) | ON              | OFF            |                                      |
| SERVOPACK<br>Status                 | Operating state | BB state       | HWBB state                           |

## 11.2.3 Resetting the HWBB State

Normally, after the /S-ON (Servo ON) signal is turned OFF and power is no longer supplied to the Servomotor, the /HWBB1 and /HWBB2 signals will turn OFF and the SERVOPACK will enter the HWBB state. If you turn ON the /HWBB1 and /HWBB2 signals in this state, the SER-VOPACK will enter a base block (BB) state and will be ready to acknowledge the /S-ON signal.



If the /HWBB1 and /HWBB2 signals are OFF and the /S-ON (Servo ON Input) signal is input, the HWBB state will be maintained even after the /HWBB1 and /HWBB2 signals are turned ON. Turn OFF the /S-ON signal to place the SERVOPACK in the BB state and then turn ON the /S-ON signal again.



Note: 1. If the SERVOPACK is placed in the BB state while the main circuit power supply is OFF, the HWBB state will be maintained until the /S-ON (Servo ON) signal is turned OFF.

2. If the /S-ON (Servo ON) signal is set to be always active (Pn50A = n.□□7□), you cannot reset the HWBB state. Do not set this value if you are using the HWBB.

11.2.4 Detecting Errors in HWBB Signal

## 11.2.4 Detecting Errors in HWBB Signal

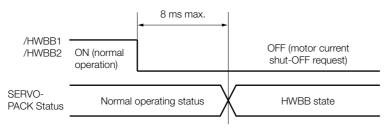
If only the /HWBB1 or the /HWBB2 signal is input, an A.Eb1 alarm (Safety Function Signal Input Timing Error) will occur unless the other signal is input within 10 seconds. This makes it possible to detect failures, such as disconnection of an HWBB signal.



• The A.Eb1 alarm (Safety Function Signal Input Timing Error) is not a safety-related element. Keep this in mind when you design the system.

## 11.2.5 HWBB Input Signal Specifications

If an HWBB is requested by turning OFF the two HWBB input signal channels (/HWBB1 and / HWBB2), the power supply to the Servomotor will be turned OFF within 8 ms.

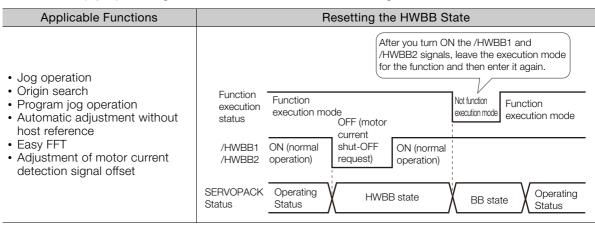


Note: 1. The OFF status is not recognized if the OFF interval of the /HWBB1 or /HWBB2 signal is 0.5 ms or shorter. 2. You can check the status of the input signals by using monitor displays.

#### 11.2.6 Operation without a Host Controller

The HWBB will operate even for operation without a host controller.

However, if the HWBB operates during execution of the following functions, leave the execution mode for the function and then enter it again to restart operation. Operation will not be restarted simply by turning OFF the /HWBB1 and /HWBB2 signals.

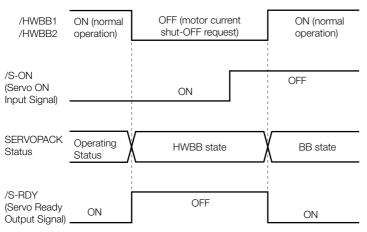


11.2.7 /S-RDY (Servo Ready Output) Signal

#### 11.2.7 /S-RDY (Servo Ready Output) Signal

The /S-ON (Servo ON) signal will not be acknowledged in the HWBB state. Therefore, the Servo Ready Output Signal will turn OFF. The Servo Ready Output Signal will turn ON if both the /HWBB1 and /HWBB2 signals are ON and the /S-ON signal is turned OFF (BB state).

The following example is for when a servo alarm does not occur when the main circuit power supply is turned ON.



## 11.2.8 /BK (Brake Output) Signal

If the HWBB operates when the /HWBB1 or /HWBB2 signal is OFF, the /BK (Brake) signal will turn OFF. At that time, the setting in Pn506 (Brake Reference - Servo OFF Delay Time) will be disabled. Therefore, the Servomotor may be moved by external force until the actual brake becomes effective after the /BK signal turns OFF.



• The brake signal is not a safety-related element. You must design the system so that a hazardous condition does not occur even if the brake signal fails in the HWBB state. Also, if a Servomotor with a Brake is used, keep in mind that the brake in the Servomotor is used only to prevent the moving part from being moved by gravity or an external force and it cannot be used to stop the Servomotor.

11.2.9 Stopping Methods

## 11.2.9 Stopping Methods

If the /HWBB1 or /HWBB2 signal turns OFF and the HWBB operates, the Servomotor will stop according to the stop mode that is set for stopping the Servomotor when the servo turns OFF (Pn001 =  $n.\square\square\squareX$ ). However, if the dynamic brake is enabled (Pn001 =  $n.\square\square\squareO$  or  $n.\square\square\square$ ), observe the following precautions.



- The dynamic brake is not a safety-related element. You must design the system so that a hazardous condition does not occur even if the Servomotor coasts to a stop in the HWBB state. Normally, we recommend that you use a sequence that returns to the HWBB state after stopping for a reference.
- If the application frequently uses the HWBB, stopping with the dynamic brake may result in the deterioration of elements in the SERVOPACK. To prevent internal elements from deteriorating, use a sequence in which the HWBB state is returned to after the Servomotor has come to a stop.

#### 11.2.10 ALM (Servo Alarm) Signal and /ALO1, /ALO2, and /ALO3 (Alarm Code Output) Signals

The ALM (Servo Alarm) signal and the /ALO1, /ALO2, and /ALO3 (Alarm Code Output) signals are not output in the HWBB state.

11.3.1 EDM1 Output Signal Specifications

# 11.3 EDM1 (External Device Monitor)

The EDM1 (External Device Monitor) signal is used to monitor failures in the HWBB. Connect the monitor signal as a feedback signal, e.g., to the Safety Unit.

Note: To meet performance level e (PLe) in EN ISO 13849-1 and SIL3 in IEC 61508, the EDM1 signal must be monitored by the host controller. If the EDM1 signal is not monitored by the host controller, the level will be safety performance level c (PLc) and SIL1.

#### • Failure Detection Signal for EDM1 Signal

The relationship between the EDM1, /HWBB1, and /HWBB2 signals is shown below.

Detection of failures in the EDM1 signal circuit can be achieved by using the status of the /HWBB1, /HWBB2, and EDM1 signals in the following table. A failure can be detected by checking the failure status, e.g., when the power supply is turned ON.

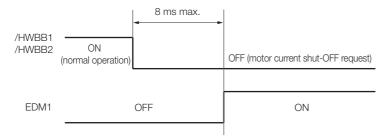
| Signal | Logic |     |     |     |  |
|--------|-------|-----|-----|-----|--|
| /HWBB1 | ON    | ON  | OFF | OFF |  |
| /HWBB2 | ON    | OFF | ON  | OFF |  |
| EDM1   | OFF   | OFF | OFF | ON  |  |

|  | NARN | <b>NING</b> |
|--|------|-------------|
|--|------|-------------|

• The EDM1 signal is not a safety output. Use it only for monitoring for failures.

#### 11.3.1 EDM1 Output Signal Specifications

If an HWBB is requested by turning OFF the two HWBB input signal channels (/HWBB1 and /HWBB2) when the safety function is operating normally, the EDM1 output signal will be turned ON within 8 ms.



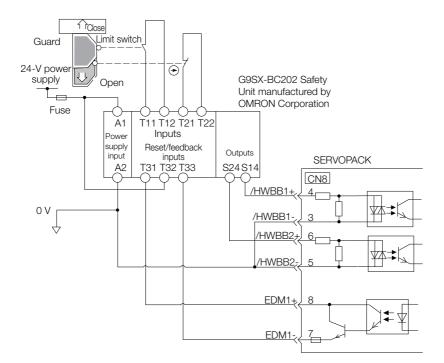
11.4.1 Connection Example

# **11.4 Applications Examples for Safety Functions**

This section provides examples of using the safety functions.

## 11.4.1 Connection Example

In the following example, a Safety Unit is used and the HWBB operates when the guard is opened.



When the guard is opened, both the /HWBB1 and the /HWBB2 signals turn OFF, and the EDM1 signal turns ON. Because the feedback circuit is ON while the guard is closed, the Safety Unit is reset, the /HWBB1 and the / HWBB2 signals turn ON, and the operation is enabled.

Note: The EDM1 signal is used as a source output. Connect the EDM1 so that the current flows from EMD1+ to EMD1-.

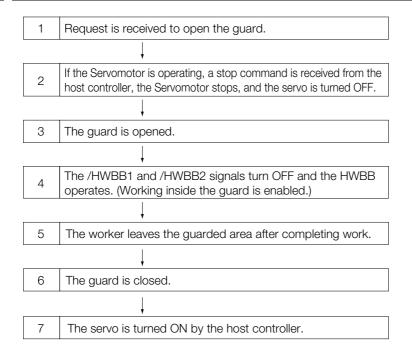
#### 11.4.2 Failure Detection Method

If a failure occurs (e.g., the /HWBB1 or the /HWBB2 signal remains ON), the Safety Unit is not reset when the guard is closed because the EDM1 signal remains OFF. Therefore starting is not possible and a failure is detected.

In this case the following must be considered: an error in the external device, disconnection of the external wiring, short-circuiting in the external wiring, or a failure in the SERVOPACK. Find the cause and correct the problem.

11.4.3 Procedure

## 11.4.3 Procedure



# **11.5 Validating Safety Functions**

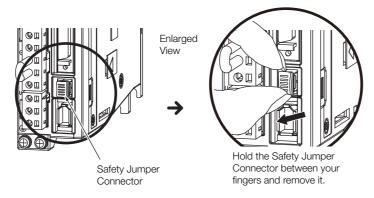
When you commission the system or perform maintenance or SERVOPACK replacement, you must always perform the following validation test on the HWBB function after completing the wiring. (It is recommended that you keep the confirmation results as a record.)

- When the /HWBB1 and /HWBB2 signals turn OFF, confirm that the Digital Operator displays **Hbb** and that the Servomotor does not operate.
- Monitor the ON/OFF status of the /HWBB1 and /HWBB2 signals. If the ON/OFF status of the signals do not coincide with the display, the following must be considered: an error in the external device, disconnection of the external wiring, short-circuiting in the external wiring, or a failure in the SERVOPACK. Find the cause and correct the problem.
- Confirm that the EDM1 signal is OFF while in normal operation by using the feedback circuit input display of the connected device.

# **11.6 Connecting a Safety Function Device**

Use the following procedure to connect a safety function device.

1. Remove the Safety Jumper Connector from the connector for the safety function device (CN8).



- 2. Connect the safety function device to the connector for the safety function device (CN8).
- Note: If you do not connect a safety function device, leave the Safety Jumper Connector connected to the connector for the safety function device (CN8). If the SERVOPACK is used without the Safety Jumper Connector connected to CN8, no current will be supplied to the Servomotor and no motor torque will be output. In this case, **Hbb** will be displayed on the Digital Operator.

# Settings for the INDEXER Module

This chapter provides detailed information on the moving mode and coordinate settings, reference settings, and origin settings.

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12.1.1 When the Coordinates are the Linear Type

# **12.1 Moving Mode and Coordinate Settings**

Use the following parameters to set the moving mode and the coordinates.

| Pa                                                                                                                                                        | Parameter |                   |                       | Meaning                                                                |                     |               |               | n<br>ed | Classifica-<br>tion |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------|-----------------------|------------------------------------------------------------------------|---------------------|---------------|---------------|---------|---------------------|
| `                                                                                                                                                         |           | fault<br>ting)    | Sets coo              | Sets coordinates to linear type.                                       |                     |               |               |         |                     |
| PnB20                                                                                                                                                     | 1         |                   | Sets coo<br>shortest  | ordinates to rotary ty path.                                           | ype. Moving mode is | s set as      | After res     | start   | Setup               |
|                                                                                                                                                           | 2         |                   | Sets coo<br>set as fo | ordinates to rotary ty<br>prward.                                      | ype. Moving mode is | s always      |               |         |                     |
|                                                                                                                                                           | 3         |                   |                       | Sets coordinates to rotary type. Moving mode is always set as reverse. |                     |               |               |         |                     |
| <ul> <li>Linear coordinates (PnB20 = 0): Forward Software Limit (P-LS)</li> <li>Rotational coordinates (PnB20 ≠ 0): Last Rotational Coordinate</li> </ul> |           |                   |                       |                                                                        |                     |               |               |         |                     |
| PnB21                                                                                                                                                     | Ī         | Setting           | Range                 | Setting Unit                                                           | Default Setting     | When E        | hen Enabled   |         | ssification         |
|                                                                                                                                                           | -         | -99,999<br>99,999 | ,                     | 1 reference unit                                                       | 99,999,999          | After r       | After restart |         | Setup               |
|                                                                                                                                                           |           |                   |                       | es (PnB20 = 0): Rev<br>inates (PnB20 ≠ 0):                             |                     |               |               |         |                     |
| PnB23                                                                                                                                                     |           | Setting           | Range                 | Setting Unit                                                           | Default Setting     | When E        | nabled        | Cla     | ssification         |
|                                                                                                                                                           |           | -99,999<br>99,999 |                       | 1 reference unit                                                       | -99,999,999         | After restart |               |         | Setup               |
|                                                                                                                                                           |           |                   |                       | ncremental encoder:<br>bsolute encoder: Al                             |                     | set           |               |         |                     |
| PnB25                                                                                                                                                     | Ī         | Setting           | Range                 | Setting Unit                                                           | Default Setting     | When E        | nabled        | Cla     | ssification         |
|                                                                                                                                                           |           | -99,999<br>99,999 | ·                     | 1 reference unit                                                       | 0                   | After r       | estart        |         | Setup               |

\* If you set PnB54 to 1 (Enable Expansion Mode), the parameter setting range will change. Refer to the following section for details.

32.4 Speed/Position Expansion Function Setting on page 12-8

#### 12.1.1 When the Coordinates are the Linear Type

When using the linear type coordinates such as with a ball screw, set PnB20 to 0 and set the forward software limit (P-LS) in PnB21and the reverse software limit (N-LS) in PnB23.

An error will occur if the positioning target position exceeds one of the software limits.

An error will also occur if +/-INFINITE is set for the target position (POS) in the program table.

If the Servomotor reaches a software limit while a jog command is being sent or during jog speed table operation, the Servomotor will stop at the deceleration rate set in PnB2B.

If both PnB21 and PnB23 are set to 0, the software limit function will be disabled.

The software limit function is enabled after completion of homing. If, however, PnB31 is set to 0 (no homing), the software limit function will be enabled when the control power supply is turned ON. The software limit function will also be enabled as soon as the ZSET serial command is executed.



12.1.2 When the Coordinates are the Rotary Type

## 12.1.2 When the Coordinates are the Rotary Type

When using a rotary type coordinates such as with a rotary table, set PnB20 to 1 (shortest path), to 2 (forward), or to 3 (reverse). Then set the end point of rotational coordinates in PnB21 and the starting point of rotational coordinates in PnB23.

The software limit function will be disabled.

( )

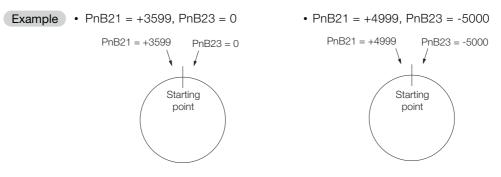
Important

If PnB20 is set to 1 (shortest path), the motor will rotate in the shortest direction (forward or reverse) when the target position is specified as an absolute position.

If PnB20 is set to 2 (forward), the motor will always rotate in the forward direction when the target position is specified as an absolute position.

If PnB20 is set to 3 (reverse), the motor will always rotate in the reverse direction when the target position is specified as an absolute position.

If the target position is specified as an relative position, the motor will rotate in the specified direction regardless of the setting of PnB20.



Even when equipment like a rotary table is used, if multiple turns cannot be performed set the coordinate as linear type (PnB20 = 0).

In this case, the values set in PnB21 and PnB23 are the values of the soft limits.

When using rotary type coordinates and an absolute encoder, set the multiturn limit (Pn205). Refer to the following section for information on the multiturn limit settings.

12.2.1 Motor Speed

# **12.2 Settings for References**

## 12.2.1 Motor Speed

For program table operation, the positioning speed is registered in SPD and the registration speed is registered in RSPD. For jog speed table operation, the jog speed is registered in JSPD.

For operation with serial command communications, the positioning speed is specified with the SPD command and the registration speed is specified with the RSPD command. You can omit the SPD command or PSPD command. If you do, the setting of the following PnB27 parameter (Positioning/Registration Speed) is used.

The speed is set in units of 1,000 reference units/min.

|         | Positioning/Registration Speed |                              |                 |               |                |  |  |
|---------|--------------------------------|------------------------------|-----------------|---------------|----------------|--|--|
| PnB27   | Setting Range                  | Setting Unit                 | Default Setting | When Enabled  | Classification |  |  |
| 1 11027 | 1 to 99,999,999*               | 1,000 reference<br>units/min | 1,000           | After restart | Setup          |  |  |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be 1 to 199,999,999. Refer to the following section for details.

32.4 Speed/Position Expansion Function Setting on page 12-8

**Example** The following calculation applies if the reference unit is 0.01 mm and the positioning speed is 15 m/min.

 $\frac{15,000 \text{ mm/min}}{0.01 \text{ mm}} = 1,500,000 \text{ reference units/min}$ 

Thus, the positioning speed setting is 1,500 [1,000 reference units/min].

#### 12.2.2 Acceleration Rate and Deceleration Rate

For program table operation, the acceleration rate is set in ACC and the deceleration rate is set in DEC.

For jog speed table operation or operation with serial communications, the settings of the following PnB29 parameter (Acceleration Rate) and PnB2B parameter (Deceleration Rate) are used.

In serial command communications, the ACC command sets PnB29 (Acceleration Rate) and the DEC command sets PnB2B (Deceleration Rate).

The acceleration and deceleration rates are set in units of 1,000 reference units/min/ms.

|       | Acceleration Rate |                                   |                 |              |                |  |  |
|-------|-------------------|-----------------------------------|-----------------|--------------|----------------|--|--|
| PnB29 | Setting Range     | Setting Unit                      | Default Setting | When Enabled | Classification |  |  |
|       | 1 to 99,999,999*  | 1,000 (reference<br>units/min)/ms | 1,000           | Immediately  | Setup          |  |  |
|       |                   |                                   |                 |              |                |  |  |
|       | Deceleration Rate |                                   |                 |              |                |  |  |
| PnB2B | Setting Range     | Setting Unit                      | Default Setting | When Enabled | Classification |  |  |
|       | 1 to 99,999,999*  | 1,000 (reference<br>units/min)/ms | 1,000           | Immediately  | Setup          |  |  |

\* If you set PnB54 to 1 (Enable Expansion Mode), the parameter setting range will change. Refer to the following section for details.

32.4 Speed/Position Expansion Function Setting on page 12-8

12.2.3 Smoothing

```
Example
```

The following calculation applies if the reference unit is 0.01 mm and the acceleration time from 0 m/min to 15 m/min is 100 ms.

 $\frac{15,000 \text{ mm/min}}{0.01 \text{ mm}} = 1,500,000 \text{ reference units/min}$   $\frac{1,500,000 \text{ reference units/min}}{100 \text{ ms}} = 15,000 \text{ [(reference units/min)/ms]}$ 

Thus, the acceleration setting is 15 [1,000 reference units/min].



Set the acceleration and deceleration so that the values of the two settings do not differ greatly. If they differ greatly, the machine will not accelerate in accordance with the settings. For example, if PnB29 is set to 99999999 and PnB2B is set to 1, then the machine's performance will be unpredictable.

#### 12.2.3 Smoothing

Smoothing allows you to apply a filter to the position reference to produce smoother Servomotor acceleration and deceleration.

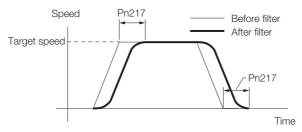
Note: Smoothing does not affect the travel distance.

The following parameters are related to smoothing.

|          | Average Position Reference Movement Time |              |                 |                                   |                |  |
|----------|------------------------------------------|--------------|-----------------|-----------------------------------|----------------|--|
| Pn217    | Setting Range                            | Setting Unit | Default Setting | When Enabled                      | Classification |  |
| 1 112 17 | 0 to 10,000                              | 0.1 ms       | 0*              | Immediately after the motor stops | Setup          |  |

\* The filter is disabled if you set the parameter to 0.

Note: Change the setting only when the Servomotor is stopped.



12.3.1 When Using an Absolute Encoder

# 12.3 Origin Settings

It is necessary to define a reference position to operate a device or machine. This is done with origin settings.

The origin settings depend on whether an absolute encoder or an incremental encoder is used.

#### 12.3.1 When Using an Absolute Encoder

If you use an absolute encoder, it is not necessary to set the origin every time the power supply to the equipment is turned ON.

However, when you set up the equipment, you must set PnB25 to the offset between the origin of the absolute encoder and the position of the origin of the reference coordinate system (called the machine coordinate system).

When you start a system that uses an absolute encoder, you must initialize the absolute encoder and adjust the position of the machine origin. Then you must set the offset that defines the origin of the reference coordinates.

| <ul><li>When using an incremental encoder: Origin</li><li>When using an absolute encoder: Absolute Encoder Offset</li></ul> |                               |                  |                 |               |                |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------|-----------------|---------------|----------------|
| PnB25                                                                                                                       | Setting Range                 | Setting Unit     | Default Setting | When Enabled  | Classification |
|                                                                                                                             | -99,999,999 to<br>99,999,999* | 1 reference unit | 0               | After restart | Setup          |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be -1,073,741,823 to +1,073,741,823. Refer to the following section for details.

3 12.4 Speed/Position Expansion Function Setting on page 12-8

Perform one of the following operations to set the offset.

- Execute the ZSET serial command.
- Execute utility function FnB09.
- Calculate the value and set it in PnB25.

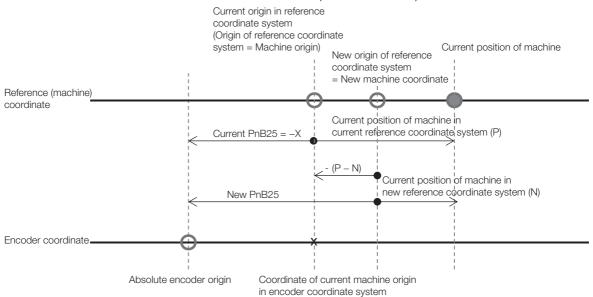
The relationship between the origin of the absolute encoder and the machine origin coordinate system is shown in the following figure. Use the following formula to find a new absolute encoder offset.

#### PnB25 = Current PnB25 + N - P

N: Current position of machine in new reference coordinate system If this position is to be defined as the origin, then normally N is 0.

P: Current position of machine in current reference coordinate system

You can use the PON or MON1 serial command (described later) to monitor this value.



12.3.2 When Using an Incremental Encoder

When using the linear type coordinate (PnB20 = 0), set the calculated value in PnB25.

When using a rotary type coordinate (PnB20  $\neq$  0), set the results in PnB25 after performing the following calculations so that the following relationships are satisfied: PnB23  $\leq$  PnB25  $\leq$  PnB21.

- If the results is smaller than PnB23 (the starting point of the rotational coordinates), add the width of the coordinates (PnB21 – PnB23 + 1).
- If the results is larger than PnB21 (the end point of the rotational coordinates), subtract the width of the coordinates (PnB21 PnB23 + 1).

Refer to the following section for information on setting up an absolute encoder. 5.15 Resetting the Absolute Encoder on page 5-48



You must define the origin again if you change the settings of any of the following parameters: Pn20E, Pn210, Pn205, PnB20, or PnB25. Always turn the power supply OFF and ON again before you set the origin to enable changes to these parameters.

#### 12.3.2 When Using an Incremental Encoder

If you use an incremental encoder, you must set the origin every time the power supply to the equipment is turned ON.

Homing is used to define the machine origin. Refer to the following section for details on homing.

*3.2 Homing* on page 13-4

The setting of PnB25 is set as the current value when the power supply is turned ON or when homing is completed.

|       | <ul><li>When using an incremental encoder: Origin</li><li>When using an absolute encoder: Absolute Encoder Offset</li></ul> |                  |                 |               |                |  |
|-------|-----------------------------------------------------------------------------------------------------------------------------|------------------|-----------------|---------------|----------------|--|
| PnB25 | Setting Range                                                                                                               | Setting Unit     | Default Setting | When Enabled  | Classification |  |
|       | -99,999,999 to<br>99,999,999*                                                                                               | 1 reference unit | 0               | After restart | Setup          |  |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be -1,073,741,823 to +1,073,741,823. Refer to the following section for details.

2.4 Speed/Position Expansion Function Setting on page 12-8



12.4.1 Parameters

# 12.4 Speed/Position Expansion Function Setting

The speed/position expansion function uses a 24-bit encoder to perform optimum positioning. To do so, the setting ranges are expanded for speed parameters, position parameters, and serial command data.

This function is supported for INDEXER Modules with software version 0007 or higher.

If you set PnB54 to 1 (Enable Expansion Mode), the setting ranges for parameters, serial commands, and program tables, the number of display digits for monitor commands, and the number of display digits on the Digital Operator will be expanded. Details are provided below.

#### 12.4.1 Parameters

|                  |                                                                                                                                                                    | Setting                                  | Ranges                               |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------|
| Parameter<br>No. | Name                                                                                                                                                               | PnB54 = 0<br>(Disable<br>Expansion Mode) | PnB54 = 1 (Enable<br>Expansion Mode) |
| PnB21            | <ul> <li>Linear coordinates (PnB20 = 0):<br/>Forward Software Limit (P-LS)</li> <li>Rotational coordinates (PnB20 ≠ 0):<br/>Last Rotational Coordinate</li> </ul>  | -99,999,999 to<br>+99,999,999            | -536,870,911 to<br>+536,870,911      |
| PnB23            | <ul> <li>Linear coordinates (PnB20 = 0):<br/>Reverse Software Limit (N-LS)</li> <li>Rotational coordinates (PnB20 ≠ 0):<br/>First Rotational Coordinate</li> </ul> | -99,999,999 to<br>+99,999,999            | -536,870,911 to<br>+536,870,911      |
| PnB25            | <ul> <li>When using an incremental encoder: Origin</li> <li>When using an absolute encoder:<br/>Absolute Encoder Offset</li> </ul>                                 | -99,999,999 to<br>+99,999,999            | -1,073,741,823 to<br>+1,073,741,823  |
| PnB27            | Positioning/Registration Speed                                                                                                                                     | 1 to 99,999,999                          | 1 to 199,999,999                     |
| PnB29            | Acceleration Rate                                                                                                                                                  | 1 to 99,999,999                          | 1 to 199,999,999                     |
| PnB2B            | Deceleration Rate                                                                                                                                                  | 1 to 99,999,999                          | 1 to 199,999,999                     |
| PnB33            | Homing Movement Speed                                                                                                                                              | 1 to 99,999,999                          | 1 to 199,999,999                     |
| PnB35            | Homing Approach Speed                                                                                                                                              | 1 to 99,999,999                          | 1 to 199,999,999                     |
| PnB37            | Homing Creep Speed                                                                                                                                                 | 1 to 99,999,999                          | 1 to 199,999,999                     |
| PnB39            | Homing Final Travel Distance                                                                                                                                       | -99,999,999 to<br>+99,999,999            | -1,073,741,823 to<br>+1,073,741,823  |

## 12.4.2 Serial Commands

#### **Speed Commands**

| PnB54 = 0 (I                  | Disable Expansion Mode)                                       | PnB54 = 1 (Enable Expansion Mode) |                                                                |  |  |  |
|-------------------------------|---------------------------------------------------------------|-----------------------------------|----------------------------------------------------------------|--|--|--|
| Serial Command                | Setting Range                                                 | Serial Command                    | Setting Range                                                  |  |  |  |
| SPDnnnnnnn                    | 1 ≤ nnnnnnnn ≤ 99,999,999<br>[1,000 reference units/min]      | SPDnnnnnnnn                       | 1 ≤ nnnnnnnn ≤ 199,999,999<br>[1,000 reference units/min]      |  |  |  |
| ACCnnnnnnn                    | 1 ≤ nnnnnnnn ≤ 99,999,999<br>[1,000 (reference units/min)/ms] | ACCnnnnnnnn                       | 1 ≤ nnnnnnnn ≤ 199,999,999<br>[1,000 (reference units/min)/ms] |  |  |  |
| DECnnnnnnn                    | 1 ≤ nnnnnnnn ≤ 99,999,999<br>[1,000 (reference units/min)/ms] | DECnnnnnnnn                       | 1 ≤ nnnnnnnn ≤ 199,999,999<br>[1,000 (reference units/min)/ms] |  |  |  |
| RSPDnnnnnnn                   | 1 ≤ nnnnnnnn ≤ 99,999,999<br>[1,000 reference units/min]      | RSPDnnnnnnnn                      | 1 ≤ nnnnnnnn ≤ 199,999,999<br>[1,000 reference units/min]      |  |  |  |
| JOGPnnnnnnnn,<br>JOGNnnnnnnnn | 1 ≤ nnnnnnnn ≤ 99,999,999<br>[1,000 reference units/min]      | JOGPnnnnnnnnn,<br>JOGNnnnnnnnnn   | 1 ≤ nnnnnnnn ≤ 199,999,999<br>[1,000 reference units/min]      |  |  |  |
| RJOGPnnnnnnn,<br>RJOGNnnnnnnn | 1 ≤ nnnnnnn ≤ 99,999,999<br>[1,000 reference units/min]       | RJOGPnnnnnnnnn,<br>RJOGNnnnnnnnnn | 1 ≤ nnnnnnnn ≤ 199,999,999<br>[1,000 reference units/min]      |  |  |  |

12.4.3 Program Tables, ZONE Tables, and JOG Speed Tables

#### **Position Commands**

| PnB54 = 0 (D                           | Disable Expansion Mode)                                           | PnB54 = 1 (E                                  | nable Expansion Mode)                                                |  |  |  |
|----------------------------------------|-------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------|--|--|--|
| Serial Command                         | Setting Range                                                     | Serial Command                                | Setting Range                                                        |  |  |  |
| POS (±) nnnnnnnn,<br>POSA (±) nnnnnnnn | -99,999,999 ≤ nnnnnnnn ≤<br>+99,999,999 [1 reference unit]        | POS (±)<br>nnnnnnnn,<br>POSA (±)<br>nnnnnnnnn | -1,073,741,823 ≤<br>nnnnnnnnn ≤ +1,073,741,823<br>[1 reference unit] |  |  |  |
| POSI (±) nnnnnnn                       | -99,999,999 ≤ nnnnnnnn ≤<br>+99,999,999 [1 reference unit]        | POSI (±)<br>nnnnnnnnn                         | -1,073,741,823 ≤<br>nnnnnnnnn ≤ +1,073,741,823<br>[1 reference unit] |  |  |  |
| ST (±) nnnnnnnn,<br>STA (±) nnnnnnn    | -99,999,999 ≤ nnnnnnnn ≤<br>+99,999,999 [1 reference unit]        | ST (±) nnnnnnnnn,<br>STA (±) nnnnnnnnn        | -1,073,741,823 ≤<br>nnnnnnnnn ≤ +1,073,741,823<br>[1 reference unit] |  |  |  |
| STI (±) nnnnnnn                        | -99,999,999 ≤ nnnnnnnn ≤<br>+99,999,999 [1 reference unit]        | STI (±) nnnnnnnnn                             | -1,073,741,823 ≤<br>nnnnnnnnn ≤ +1,073,741,823<br>[1 reference unit] |  |  |  |
| RDSTnnnnnnn                            | nnnn $0 \le nnnnnnn \le 99,999,999$ RDSTnnnnnn [1 reference unit] |                                               | 0 ≤ nnnnnnnnn ≤<br>1,073,741,823<br>[1 reference unit]               |  |  |  |
| RS (±) nnnnnnnn,<br>RSA (±) nnnnnnn    | -99,999,999 ≤ nnnnnnnn ≤<br>+99,999,999 [1 reference unit]        | RS (±) nnnnnnnnn,<br>RSA (±)<br>nnnnnnnnn     | -1,073,741,823 ≤<br>nnnnnnnnn ≤ +1,073,741,823<br>[1 reference unit] |  |  |  |
| RSI (±) nnnnnnn                        | -99,999,999 ≤ nnnnnnn ≤<br>+99,999,999 [1 reference unit]         | RSI (±) nnnnnnnnn                             | -1,073,741,823 ≤<br>nnnnnnnnn ≤ +1,073,741,823<br>[1 reference unit] |  |  |  |
| ZSET (±) nnnnnnn                       | -99,999,999 ≤ nnnnnnnn ≤<br>+99,999,999 [1 reference unit]        | ZSET (±)<br>nnnnnnnnn                         | -1,073,741,823 ≤<br>nnnnnnnnn ≤ +1,073,741,823<br>[1 reference unit] |  |  |  |

## 12.4.3 Program Tables, ZONE Tables, and JOG Speed Tables

#### **Program Tables**

#### ♦ Write Commands

| PnB5                 | 54 = 0 (Disable Expansion Mode)                                                                                                                                                                                                                                                                         | PnB                    | 54 = 1 (Enable Expansion Mode)                                                                                                                                                                                                                                                                                                     |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Serial<br>Command    | Setting Range                                                                                                                                                                                                                                                                                           | Serial<br>Command      | Setting Range                                                                                                                                                                                                                                                                                                                      |
| POSTsss =<br>nnnnnnn | Annnnnnn:<br>Absolute position [1 reference unit]<br>$(-99,999,999 \le nnnnnnn \le +99,999,999)$<br>Innnnnnn:<br>Relative distance [1 reference unit]<br>$(-99,999,999 \le nnnnnnn \le +99,999,999)$<br>Snnnnnnn:<br>Consecutive stop [1 reference unit]<br>$(-99,999,999 \le nnnnnnn \le +99,999,999)$ | POSTsss =<br>nnnnnnnnn | Annnnnnnn:<br>Absolute position [1 reference unit]<br>$(-1,073,741,823 \le nnnnnnnnn \le +1,073,741,823)$<br>Innnnnnnn:<br>Relative distance [1 reference unit]<br>$(-1,073,741,823 \le nnnnnnnnn \le +1,073,741,823)$<br>Snnnnnnnn:<br>Consecutive stop [1 reference unit]<br>$(-1,073,741,823 \le nnnnnnnnn \le +1,073,741,823)$ |
| SPDTsss =            | 1 ≤ nnnnnnnn ≤ 99,999,999                                                                                                                                                                                                                                                                               | SPDTsss =              | 1 ≤ nnnnnnnnn ≤ 199,999,999                                                                                                                                                                                                                                                                                                        |
| nnnnnnn              | [1,000 reference units/min]                                                                                                                                                                                                                                                                             | nnnnnnnn               | [1,000 reference units/min]                                                                                                                                                                                                                                                                                                        |
| RDSTTsss = nnnnnnn   | 0 ≤ nnnnnnnn ≤ 99,999,999                                                                                                                                                                                                                                                                               | RDSTsss =              | $0 \le nnnnnnnnn \le 1,073,741,823$                                                                                                                                                                                                                                                                                                |
|                      | [1 reference unit]                                                                                                                                                                                                                                                                                      | nnnnnnnnn              | [1 reference unit]                                                                                                                                                                                                                                                                                                                 |
| RSPDTsss =           | 1 ≤ nnnnnnnn ≤ 99,999,999                                                                                                                                                                                                                                                                               | RSPDTsss =             | 1 ≤ nnnnnnnn ≤ 199,999,999                                                                                                                                                                                                                                                                                                         |
| nnnnnnn              | [1,000 reference units/min]                                                                                                                                                                                                                                                                             | nnnnnnnn               | [1,000 reference units/min]                                                                                                                                                                                                                                                                                                        |
| ACCTsss =            | 1 ≤ nnnnnnnn ≤ 99,999,999                                                                                                                                                                                                                                                                               | ACCTsss =              | 1 ≤ nnnnnnnn ≤ 199,999,999                                                                                                                                                                                                                                                                                                         |
| nnnnnnn              | [1,000 (reference units/min)/ms]                                                                                                                                                                                                                                                                        | nnnnnnnn               | [1,000 (reference units/min)/ms]                                                                                                                                                                                                                                                                                                   |

Continued on next page.

#### 12.4.3 Program Tables, ZONE Tables, and JOG Speed Tables

Continued from previous page.

| PnB               | 54 = 0 (Disable Expansion Mode)  | PnB54 = 1 (Enable Expansion Mode) |                                  |  |  |  |
|-------------------|----------------------------------|-----------------------------------|----------------------------------|--|--|--|
| Serial<br>Command | Setting Range                    | Serial<br>Command                 | Setting Range                    |  |  |  |
| DECTsss =         | 1 ≤ nnnnnnn ≤ 99,999,999         | DECTsss =                         | 1 ≤ nnnnnnnn ≤ 199,999,999       |  |  |  |
| nnnnnnn           | [1,000 (reference units/min)/ms] | nnnnnnnn                          | [1,000 (reference units/min)/ms] |  |  |  |

#### ♦ Read Commands

| Serial   | Display (Ackr                                                                                                                                                                                                                                                                       | nowledgment)                                                                                                                                                                                                                                                                                                               |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command  | PnB54 = 0 (Disable Expansion Mode)                                                                                                                                                                                                                                                  | PnB54 = 1 (Enable Expansion Mode)                                                                                                                                                                                                                                                                                          |
| POSTsss  | POST123 = A + 12345678 [CR] [LF]<br>POST123 = I + 12345678 [CR] [LF]<br>POST123 = S + 12345678 [CR] [LF]<br>POST123 = +INFINITE [SP] [CR] [LF]<br>POST123 = STOP [SP] [SP] [SP] [SP] [SP]<br>[SP] [CR] [LF]<br>POST123 = -[SP] [SP] [SP] [SP] [SP] [SP]<br>[SP] [SP] [SP] [CR] [LF] | POST123 = A + 1234567890 [CR] [LF]<br>POST123 = I + 1234567890 [CR] [LF]<br>POST123 = S + 1234567890 [CR] [LF]<br>POST123 = +INFINITE [SP] [SP] [SP] [CR]<br>[LF]<br>POST123 = STOP [SP] [SP] [SP] [SP] [SP]<br>[SP] [SP] [SP] [CR] [LF]<br>POST123 = -[SP] [SP] [SP] [SP] [SP] [SP]<br>[SP] [SP] [SP] [SP] [SP] [SP] [SP] |
| SPDTsss  | SPDT123 = 12345678 [CR] [LF]                                                                                                                                                                                                                                                        | SPDT123 = 1234567890 [CR] [LF]                                                                                                                                                                                                                                                                                             |
| RDSTTsss | RDSTT123 = 12345678 [CR] [LF]<br>RDSTT123 = -[SP] [SP] [SP] [SP] [SP] [SP]<br>[SP] [CR] [LF]                                                                                                                                                                                        | RDSTT123 = 1234567890 [CR] [LF]<br>RDSTT123 = -[SP] [SP] [SP] [SP] [SP] [SP]<br>[SP] [SP] [SP] [CR] [LF]                                                                                                                                                                                                                   |
| RSPDTsss | RSPDT123 = 12345678 [CR] [LF]                                                                                                                                                                                                                                                       | RSPDT123 = 1234567890 [CR] [LF]                                                                                                                                                                                                                                                                                            |
| ACCTsss  | ACCTsss = 12345678 [CR] [LF]<br>ACCTsss = : [SP] [SP] [SP] [SP] [SP] [SP]<br>[SP] [CR] [LF]                                                                                                                                                                                         | ACCTsss = 1234567890 [CR] [LF]<br>ACCTsss = : [SP] [SP] [SP] [SP] [SP] [SP]<br>[SP] [SP] [SP] [CR] [LF]                                                                                                                                                                                                                    |
| DECTsss  | DECTsss = 12345678 [CR] [LF]<br>DECTsss = : [SP] [SP] [SP] [SP] [SP] [SP]<br>[SP] [CR] [LF]                                                                                                                                                                                         | DECTsss = 1234567890 [CR] [LF]<br>DECTsss = : [SP] [SP] [SP] [SP] [SP] [SP]<br>[SP] [SP] [SP] [CR] [LF]                                                                                                                                                                                                                    |

#### **ZONE** Tables

#### ♦ Write Commands

| PnB54 = 0 (D   | isable Expansion Mode)   | PnB54 = 1 (Enable Expansion Mode) |                            |  |  |  |  |
|----------------|--------------------------|-----------------------------------|----------------------------|--|--|--|--|
| Serial Command | Setting Range            | Serial Command                    | Setting Range              |  |  |  |  |
| ZONEPTzz =     | -99,999,999 ≤ nnnnnnnn ≤ | ZONEPTzz =                        | -1,073,741,823 ≤ nnnnnnnnn |  |  |  |  |
| nnnnnnn        | +99,999,999              | nnnnnnnnn                         | ≤ +1,073,741,823           |  |  |  |  |
| ZONENTzz =     | -99,999,999 ≤ nnnnnnnn ≤ | ZONENTzz =                        | -1,073,741,823 ≤ nnnnnnnnn |  |  |  |  |
| nnnnnnn        | +99,999,999              | nnnnnnnnn                         | ≤ +1,073,741,823           |  |  |  |  |

#### Read Commands

| Serial   | Display (Acknowledgment)           |                                   |  |  |  |  |  |  |  |  |
|----------|------------------------------------|-----------------------------------|--|--|--|--|--|--|--|--|
| Command  | PnB54 = 0 (Disable Expansion Mode) | PnB54 = 1 (Enable Expansion Mode) |  |  |  |  |  |  |  |  |
| ZONEPTzz | ZONEPT123 = +12345678 [CR] [LF]    | ZONEPT123 = +1234567890 [CR] [LF] |  |  |  |  |  |  |  |  |
| ZONENTzz | ZONENT123 = +12345678 [CR] [LF]    | ZONENT123 = +1234567890 [CR] [LF] |  |  |  |  |  |  |  |  |

12.4.4 Parameter Editing Commands

## **JOG Speed Tables**

#### ♦ Write Commands

| PnB54 = 0 (D   | isable Expansion Mode)      | PnB54 = 1 (Enable Expansion Mode) |                             |  |  |  |
|----------------|-----------------------------|-----------------------------------|-----------------------------|--|--|--|
| Serial Command | Setting Range               | Serial Command Setting Range      |                             |  |  |  |
| JSPDTdd =      | 1 ≤ nnnnnnnn ≤ 99,999,999   | JSPDTdd =                         | 1 ≤ nnnnnnnn ≤ 199,999,999  |  |  |  |
| nnnnnnn        | [1,000 reference units/min] | nnnnnnnn                          | [1,000 reference units/min] |  |  |  |

#### Read Commands

| Serial  | Display (Acknowledgment)           |                                   |  |  |  |  |  |  |  |
|---------|------------------------------------|-----------------------------------|--|--|--|--|--|--|--|
| Command | PnB54 = 0 (Disable Expansion Mode) | PnB54 = 1 (Enable Expansion Mode) |  |  |  |  |  |  |  |
| JSPDTdd | JSPDT123 = 12345678 [CR] [LF]      | JSPDT123 = 1234567890 [CR] [LF]   |  |  |  |  |  |  |  |

## 12.4.4 Parameter Editing Commands

The following table shows the maximum number of digits. The actual number of digits depends on the setting range of the written parameter.

| Serial Command                     |                                   |  |  |  |  |  |  |  |
|------------------------------------|-----------------------------------|--|--|--|--|--|--|--|
| PnB54 = 0 (Disable Expansion Mode) | PnB54 = 1 (Enable Expansion Mode) |  |  |  |  |  |  |  |
| PRMppp = (±)nnnnnnn                | PRMppp = (±)nnnnnnnn              |  |  |  |  |  |  |  |
| TRMppp = (±)nnnnnnn                | TRMppp = (±)nnnnnnnn              |  |  |  |  |  |  |  |

## 12.4.5 Monitor Commands

|                                                                 | Display (Ack                          | nowledgment)                                               |  |  |
|-----------------------------------------------------------------|---------------------------------------|------------------------------------------------------------|--|--|
| Serial Command                                                  | PnB54 = 0<br>(Disable Expansion Mode) | PnB54 = 1<br>(Enable Expansion Mode)                       |  |  |
| PUN or MON1<br>(Position Reference Current<br>Position Monitor) | PUN = +12345678 [CR] [LF]             | PUN = +1234567890 [CR] [LF]                                |  |  |
| PFB or MON7<br>(Monitor Current Position<br>Monitor)            | PFB = +12345678 [CR] [LF]             | PFB = +1234567890 [CR] [LF]<br>POS = +1234567890 [CR] [LF] |  |  |
| POS or MON8<br>(Positioning Target Position<br>Monitor)         | POS = +12345678 [CR] [LF]             |                                                            |  |  |
| DST or MON9<br>(Positioning Distance Monitor)                   | DST = +12345678 [CR] [LF]             | DST = +1234567890 [CR] [LF]                                |  |  |
| RPOS or MON10<br>(Registration Target Position<br>Monitor)      | RPOS = +12345678 [CR] [LF]            | RPOS = +1234567890 [CR] [LF]                               |  |  |
| RDST or MON11<br>(Registration Distance Monitor)                | RDST = 12345678 [CR] [LF]             | RDST = 1234567890 [CR] [LF]                                |  |  |
| PER or MON2<br>(Position Deviation Monitor)                     | PER = +12345678 [CR] [LF]             | PER = +1234567890 [CR] [LF]                                |  |  |

12.4.6 Digital Operator Displays

## 12.4.6 Digital Operator Displays

If the number of display digits is exceeded when Expansion Mode is enabled, the table name will be abbreviated.

• POS (Target Position)

Display When Expansion Mode Is Disabled

|   | В | В | _      |   |   |   |   | -            | Ρ | G   | М   |   | Е | d | i | t | - |   | В |
|---|---|---|--------|---|---|---|---|--------------|---|-----|-----|---|---|---|---|---|---|---|---|
|   | Ρ | 0 | S      | þ | 0 | 0 | = | А            | + | 1   | 2   | З | 4 | 5 | 6 | 7 | 8 |   | Ρ |
|   | Ρ | Ο | S<br>S | þ | 0 | 1 | = |              | + | 1   | 2   | З | 4 | 5 | 6 | 7 | 8 |   | Ρ |
|   | Ρ | Ο | S      | D | 0 | 2 | = | S            | + | 1   | 2   | З | 4 | 5 | 6 | 7 | 8 | ∕ | Ρ |
|   | Ρ | 0 | S      | b | 0 | 3 | = | S            | Т | 0   | Ρ   |   |   |   |   |   |   |   | Ρ |
| Г |   |   | т      |   |   |   |   | - <b>-</b> 1 |   | а Г | -:- |   |   |   |   |   |   |   | _ |

Display When Expansion Mode Is Enabled

|   | B                |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   | - |
|---|------------------|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|
|   | Ρ                | 0 | 0 | 0 | = | А | $^+$ | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| ~ | Ρ                | 0 | 0 | 1 | = | I | $^+$ | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 7 | Ρ                | 0 | 0 | 2 | = | S | $^+$ | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|   | P<br>P<br>P<br>P | 0 | 0 | З | = | S | Т    | Ο | Ρ |   |   |   |   |   |   |   |   |
|   |                  | _ |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |

• RDST (Registration Distance)

| Display When Expansion Mode Is Disabled |     |     |   |   |   |   |   |   |   |   |   |   |  |
|-----------------------------------------|-----|-----|---|---|---|---|---|---|---|---|---|---|--|
| <u>B</u> B                              |     |     | - | Ρ | G | Μ |   | Е | d | i | t | - |  |
| R D S T<br>R D S T<br>R D S T           | 0 ( | 0 C | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 |   |  |
| RDST                                    | 0 ( | D 1 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 |   |  |
| RDST                                    | 0 ( | 2 2 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 |   |  |
| RDST                                    | 0 ( | ) З | = | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |   |  |

|            | В | В |   |   |   |   |   | - | Ρ | G | Μ |   | Е | d | i | t | - |
|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|            | R | D | Т | 0 | 0 | 0 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| $\square$  | R | D | Т | 0 | 0 | 1 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| <b>_</b> / | R | D | Т | 0 | 0 | 2 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| $\Box$     | R | D | Т | 0 | 0 | З | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
|            |   |   | _ |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

Display When Expansion Mode Is Enabled

• RSPD (Registration Speed)

Display When Expansion Mode Is Disabled

| 1 | _ | - |   |   |   |   |   |   | _ | - |   |   | _ |   |   |   |   | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|   | ₽ | В |   |   |   |   |   |   |   |   | Μ |   |   |   |   |   | - |   |
|   | R | S | Ρ | D | 0 | 0 | 0 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 |   |   |
|   | R | S | Ρ | D | 0 | 0 | 1 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 |   |   |
|   | R | S | Ρ | D | 0 | 0 | 2 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 |   | / |
|   | R | S | Ρ | D | 0 | 0 | З | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 |   |   |
|   |   |   |   | - |   |   |   |   |   |   |   |   |   |   |   |   |   | 1 |

| • | JSPD | (JOG | Speed) |
|---|------|------|--------|
|---|------|------|--------|

Display When Expansion Mode Is Disabled

| BB                         |     |     | D  |    |   |   |
|----------------------------|-----|-----|----|----|---|---|
| JSPDOO                     | 0 = | 12  | 34 | 56 | 7 | 8 |
| J S P D 0 0<br>J S P D 0 0 | 1 = | 12  | 34 | 56 | 7 | 8 |
| JSPD00                     | 2 = | 1 2 | 34 | 56 | 7 | 8 |
| JSPD00<br>JSPD00           | 3 = | 12  | 34 | 56 | 7 | 8 |

Display When Expansion Mode Is Enabled

| В |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | - |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R | S | Ρ | 0 | 0 | 0 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| R | S | Ρ | 0 | 0 | 1 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| R | S | Ρ | 0 | 0 | 2 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| R | S | Ρ | 0 | 0 | З | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

Display When Expansion Mode Is Enabled

|           | В | В | _ |   |   |   | - | J | S | Ρ | D |   | Е | d | i | t | - |
|-----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|           | J | S | Ρ | 0 | 0 | 0 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| $\square$ | J | S | Ρ | 0 | 0 | 1 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 5         | J | S | Ρ | 0 | 0 | 2 | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| $\Box$    | J | S | Р | 0 | 0 | З | = | 1 | 2 | З | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

# Operation with Digital I/O

This chapter provides detailed information on homing, positioning with a program table, registration, constant speed operation with a jog speed table, and ZONE outputs.

(13)

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# **13.1 Operation Functions**

The following five operation functions are provided.

Homing

Homing is used to define the machine origin when the power supply is turned ON to equipment that uses an incremental encoder.

Homing is not required for equipment that uses an absolute encoder because the positional relationship between the origin of the absolute encoder and the machine origin is set in a parameter.

• Positioning with a Program Table You can register (program) positioning patterns in a table in advance and then use specifica-

tions from the host controller to specify the operation pattern to perform operation.

- Registration If a trigger signal (/RGRT) is input from an external device during positioning, the motor will be moved for the registration distance (RDST) that is registered in the program table.
- Constant Speed Operations with a Jog Speed Table
- This function supports constant-speed operation at preset jog speeds.
- ZONE Outputs

This function outputs a zone number to indicate when the motor is within a preset zone. The lower four programmable outputs are assigned.

13.2.1 I/O Signals Related to Homing

# 13.2 Homing

Homing is used to define the machine origin when the power supply is turned ON to equipment that uses an incremental encoder. Turn OFF (mode 1) the /MODE 0/1 (Mode Selection Input) signal to enable performing homing. In mode 1, CN11-5 will be the /HOME (Homing Input) signal.

# **WARNING**

 If you are using an incremental encoder, always perform homing before you start program table operation. If you perform program table operation without performing homing, positions cannot be managed so correct positioning may not be possible. Unexpected machine operation, failure, or personal injury may occur.

## 13.2.1 I/O Signals Related to Homing

The following I/O signals are related to homing.

#### Input Signals Related to Homing

| Input Signal | Description                                                                                                               | Reference |
|--------------|---------------------------------------------------------------------------------------------------------------------------|-----------|
| /MODE 0/1    | ON: Mode 0 (program table operation)<br>OFF: Mode 1 (jog speed table operation or homing)                                 | page 6-4  |
| /HOME        | The /HOME signal is turned ON to start homing.                                                                            | page 6-5  |
| /DEC         | The /DEC signal is used to change the homing speed, but its function depends on the setting of the homing method (PnB31). | page 6-3  |

#### **Output Signals Related to Homing**

| Output Signal | Description                                                                                                                                                                                                                                                     | Reference |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| /INPOSITION   | This signal turns ON when the current position is within the positioning completed width of the target position (final travel distance). It also turns ON when the Servomotor stops after positioning is canceled, even if the target position was not reached. | page 6-9  |



Homing is not performed for an absolute encoder. Therefore, error E61E (Encoder Mismatch Error) will occur if the /HOME signal turns ON.

## 13.2.2 Parameters Related to Homing

#### Parameter That Specifies the Homing Method

Specify the homing method with PnB31.

| F     | Parameter                   | Meaning                                                                                        | When Enabled  | Classifica-<br>tion |
|-------|-----------------------------|------------------------------------------------------------------------------------------------|---------------|---------------------|
|       | 0<br>(default set-<br>ting) | The current position when the power supply is turned ON is the origin. Homing is not executed. |               |                     |
| PnB31 | 1                           | The /DEC signal and encoder phase C are used for performing homing.                            | After restart | Setup               |
|       | 2                           | Only the /DEC signal is used for performing homing.                                            |               |                     |
|       | 3                           | Only the encoder phase C is used for performing homing.                                        |               |                     |

Note: An Illegal Homing Command Error (E5DE) will occur if homing is attempted while PnB31 is set to 0.

#### Parameter That Specifies the Homing Direction

Specify whether to perform homing in the forward or in the reverse direction with  $PnB32 = n.\Box\Box\BoxX$ .

| Parameter |                        | Meaning                                  | When Enabled | Classifica-<br>tion |
|-----------|------------------------|------------------------------------------|--------------|---------------------|
| PnB32     | 0<br>(default setting) | Perform homing in the forward direction. | Immediately  | Setup               |
|           | 1                      | Perform homing in the reverse direction. |              |                     |

#### Parameter That Specifies the Origin

The value specified in PnB25 will be set as the current value when homing is completed.

|       | Origin                     |                     |                    |               |                     |
|-------|----------------------------|---------------------|--------------------|---------------|---------------------|
| PnB25 | Setting Range              | Setting Unit        | Default<br>Setting | When Enabled  | Classifica-<br>tion |
|       | -99,999,999 to 99,999,999* | 1 reference<br>unit | 0                  | After restart | Setup               |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be -1,073,741,823 to +1,073,741,823. Refer to the following section for details.

12.4 Speed/Position Expansion Function Setting on page 12-8

#### Parameter That Specifies the Homing Movement Speed

The following parameter sets the homing movement speed.

|       | Homing Movement Speed |                                |                    |              |                     |
|-------|-----------------------|--------------------------------|--------------------|--------------|---------------------|
| PnB33 | Setting Range         | Setting Unit                   | Default<br>Setting | When Enabled | Classifica-<br>tion |
|       | 1 to 99,999,999*      | 1,000 refer-<br>ence units/min | 1,000              | Immediately  | Setup               |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be 1 to 199,999,999. Refer to the following section for details.

12.4 Speed/Position Expansion Function Setting on page 12-8

Operation with Digital I/O

13.2.2 Parameters Related to Homing

#### Parameter That Specifies the Homing Approach Speed

The following parameter sets the homing approach speed for homing. Operation details, such as changing to this speed, depends on the homing method.

|       | Homing Approach Speed |                                |                    |              |                     |
|-------|-----------------------|--------------------------------|--------------------|--------------|---------------------|
| PnB35 | Setting Range         | Setting Unit                   | Default<br>Setting | When Enabled | Classifica-<br>tion |
|       | 1 to 99,999,999*      | 1,000 refer-<br>ence units/min | 1,000              | Immediately  | Setup               |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be 1 to 199,999,999. Refer to the following section for details.

32.4 Speed/Position Expansion Function Setting on page 12-8

#### ◆ Parameter That Specifies the Homing Creep Speed

The following parameter sets the homing creep speed. Operation details, such as changing to this speed, depends on the homing method.

|       | Homing Creep Speed |                                |                    |              |                     |
|-------|--------------------|--------------------------------|--------------------|--------------|---------------------|
| PnB37 | Setting Range      | Setting Unit                   | Default<br>Setting | When Enabled | Classifica-<br>tion |
|       | 1 to 99,999,999*   | 1,000 refer-<br>ence units/min | 1,000              | Immediately  | Setup               |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be 1 to 199,999,999. Refer to the following section for details.

32.4 Speed/Position Expansion Function Setting on page 12-8

#### Parameter That Specifies the Homing Final Travel Distance

This parameter sets the travel distance after the motor changes to the creep speed. The stopping position when this travel is completed is set as the setting of PnB25.

If a negative value is set, the movement direction will be reversed after the motor changes to the creep speed.

|       | Homing Final Travel Distance |                     |                    |              |                     |
|-------|------------------------------|---------------------|--------------------|--------------|---------------------|
| PnB39 | Setting Range                | Setting Unit        | Default<br>Setting | When Enabled | Classifica-<br>tion |
|       | -99,999,999 to 99,999,999*   | 1 reference<br>unit | 0                  | Immediately  | Setup               |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be -1,073,741,823 to +1,073,741,823. Refer to the following section for details.

3 12.4 Speed/Position Expansion Function Setting on page 12-8

## 13.2.3 Homing Procedures

Homing will start when the /HOME signal turns ON. Homing will be stopped if the /HOME signal turns OFF. If the /HOME signal turns ON while homing is stopped, homing will be restarted from where it was stopped.

If a jog speed table operation is performed with the /JOGP or /JOGN signal or if the mode is changed with the /MODE 0/1 signal while homing is stopped, homing will be canceled.

When PnB31 is set to 0 (the current position when the power supply is turned ON is the origin; homing is not executed), the origin position is defined as soon as the control power supply is turned ON.

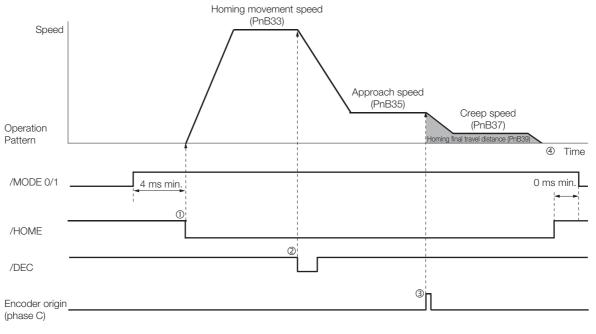
The smaller of the settings of PnB29 and PnB2B is used as the acceleration and deceleration rates for homing.

There are three different origin patterns depending on the homing method that is specified in PnB31.

The v procedure for each method is given in this section.

# Using the /DEC Signal and Encoder Origin (Phase C) for Homing (PnB31 = 1)

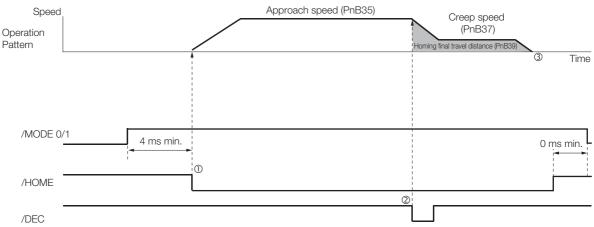
- Turn ON the /HOME signal. Homing starts. The motor will rotate in the direction specified in PnB32 (Homing Direction) at the speed specified in PnB33 (Homing Movement Speed).
- ② When the /DEC signal turns ON, the motor changes to the approach speed.
- ③ When the encoder's origin signal (phase C) is detected, the motor decelerates to the creep speed.
- ④ Homing is completed after the motor moves the final travel distance. Set PnB25 to the value of the current position where the motor is stopped.



13.2.3 Homing Procedures

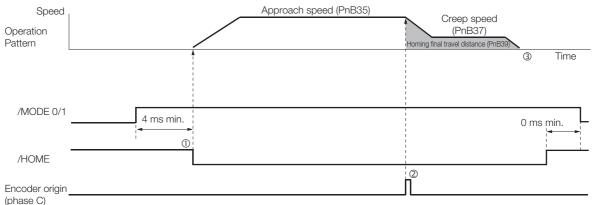
#### Using Only the /DEC Signal for Homing (PnB31 = 2)

- Turn ON the /HOME signal. Homing starts. The motor will rotate in the direction specified in PnB32 (Homing Direction) at the speed specified in PnB35 (Approach Speed).
- ② When the /DEC signal turns ON, the motor decelerates to the creep speed.
- ③ Homing is completed after the motor moves the final travel distance. Set PnB25 to the value of the current position where the motor is stopped.



# Using Only the Encoder Origin (Phase C) for the Homing (PnB31 = 3)

- Turn ON the /HOME signal. Homing starts. The motor will rotate in the direction specified in PnB32 (Homing Direction) at the speed specified in PnB35 (Approach Speed).
- ② When the encoder's origin signal (phase C) is detected, the motor decelerates to the creep speed.
- ③ Homing is completed after the motor moves the final travel distance. Set PnB25 to the value of the current position where the motor is stopped.



13.3.1 Types of Operation

# **13.3 Program Table Operation**

With program table operation, you can register (program) positioning patterns in a table in advance and then use commands from the host controller to specify the operation patterns to perform operation.

If you use program table operation, you do not need motion control programming in the host controller.

This section describes the types of operation that are possible, program table details, and SigmaWin+ operating procedures. It also provides examples of program table operation.

## 13.3.1 Types of Operation

Two types of program table operation are provided: positioning and registration.

Both types of operation are described in the rest of this section.



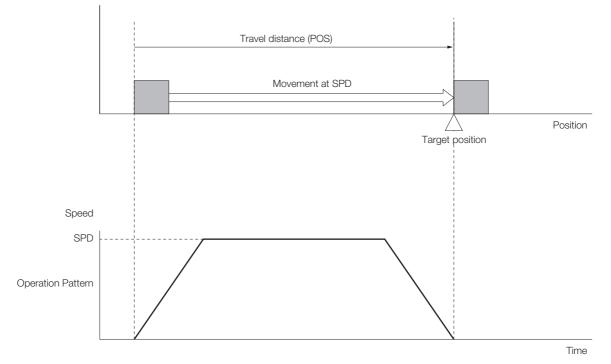
This section describes program table operation using the item names and symbols that are registered in the program table. Refer to the following section for detailed information on the names and symbols.

I 13.3.5 Settings in the Program Table on page 13-13

#### Positioning

For positioning, the target positions are specified as the target positions (POS) in the program table. The motor is moved to the current target position.

Positioning is illustrated conceptually in the following figure.

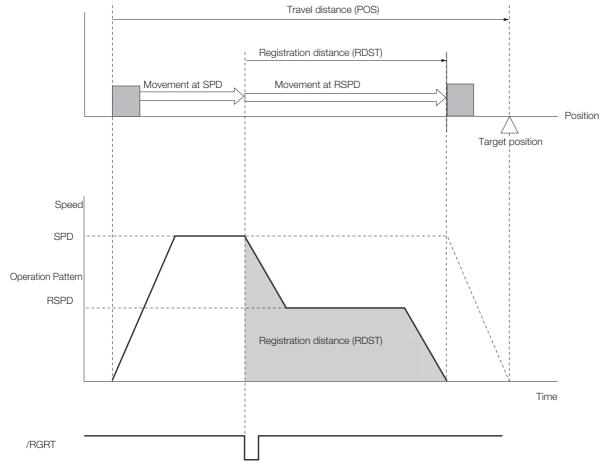


13.3.1 Types of Operation

## **Registration Operation**

If an external trigger signal (/RGRT) is input during travel (i.e., during positioning) toward a target position that is specified as the target position (POS) in the program table, the motor will move the registration distance (RDST) that is specified in the program table.

Registration operation is illustrated conceptually in the following figure.



13.3.2 I/O Signals Related to Program Table Operation

## 13.3.2 I/O Signals Related to Program Table Operation

| Input Signal      | Description                                                                                                                                                                                                                                    | Reference |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| /MODE 0/1         | ON: Mode 0 (program table operation)<br>OFF: Mode 1 (jog speed table operation or homing)                                                                                                                                                      | page 6-4  |
| /START-STOP       | Turn ON this signal to start operation for the program step that is specified<br>by the /SEL0 to /SEL4 (Program Step Selection Inputs) signals.<br>Turn OFF this signal to stop program table operation and decelerate the<br>motor to a stop. | page 6-4  |
| /PGMRES           | If this signal turns ON while a program table operation is stopped, the pro-<br>gram table operation will be reset and canceled. <sup>*1</sup>                                                                                                 | page 6-5  |
| /SEL0 to<br>/SEL7 | These signals specify the program step number at which to start program table operation.*2                                                                                                                                                     | page 6-7  |
| /RGRT             | Registration operation starts on the rising edge of this signal.                                                                                                                                                                               | page 6-4  |

The following I/O signals are related to program table operation.

#### Input Signals Related to Program Table Operation

\*1. "Canceled" is the state in which the mode is mode 0, execution is not in a stopped state, and no program step has been executed.

\*2. Use the eight selection signals (/SEL0 to /SEL7) to specify between 0 and 255 for PGMSTEP. A value of 1 means that the signal is ON (active), and a value of 0 means that the signal is OFF (inactive).

| PGMSTEP   |       | Selection Signals |       |       |       |       |       |       |
|-----------|-------|-------------------|-------|-------|-------|-------|-------|-------|
| FGINISTEF | /SEL7 | /SEL6             | /SEL5 | /SEL4 | /SEL3 | /SEL2 | /SEL1 | /SEL0 |
| 0         | 0     | 0                 | 0     | 0     | 0     | 0     | 0     | 0     |
| 1         | 0     | 0                 | 0     | 0     | 0     | 0     | 0     | 1     |
| 2         | 0     | 0                 | 0     | 0     | 0     | 0     | 1     | 0     |
| 3         | 0     | 0                 | 0     | 0     | 0     | 0     | 1     | 1     |
| 4         | 0     | 0                 | 0     | 0     | 0     | 1     | 0     | 0     |
| 5         | 0     | 0                 | 0     | 0     | 0     | 1     | 0     | 1     |
| 6         | 0     | 0                 | 0     | 0     | 0     | 1     | 1     | 0     |
| 7         | 0     | 0                 | 0     | 0     | 0     | 1     | 1     | 1     |
| 8         | 0     | 0                 | 0     | 0     | 1     | 0     | 0     | 0     |
|           |       |                   |       |       |       |       |       |       |
|           |       |                   |       | •     |       |       |       |       |
|           |       |                   |       | •     |       |       |       |       |
|           |       |                   |       | -     |       |       |       |       |
| 254       | 1     | 1                 | 1     | 1     | 1     | 1     | 1     | 0     |
| 255       | 1     | 1                 | 1     | 1     | 1     | 1     | 1     | 1     |

#### Output Signals Related to Program Table Operation

| Output Signal       | Description                                                                                                                                                                                                                             |  |  |  |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| /COIN               | This signal turns ON when the target position (final travel distance) is within the positioning completed width. It also turns ON when the Servomotor stops after positioning is canceled, even if the target position was not reached. |  |  |  |
| /POUT0 to<br>/POUT7 | You can set these signals as outputs. The output status is specified with POUT in the pro-<br>gram steps.                                                                                                                               |  |  |  |

Operation with Digital I/O

13.3.3 Parameter Related to Program Table Operation

Information The wiring for the signals, and the parameter settings, described in the table above are not necessary when program table operations are performed with serial commands. The following serial commands are used instead of the signals. Refer to the following section for details.

G Chapter 14 Operation with Serial Command Communications

| Signal         | Corresponding Serial Command                 |
|----------------|----------------------------------------------|
| /MODE 0/1      | None (Mode switching is not necessary.)      |
| /START-STOP    | Start: START SSS command (SSS = 000 to 255)  |
| /SEL0 to /SEL7 | Stop: STOP command<br>Restart: START command |
| /PGMRES        | PGMRES command                               |

#### 13.3.3 Parameter Related to Program Table Operation

Set the positioning completed width (INPOSITION width) and the near signal width (NEAR width) in the following parameters.

If you specify INPOSITION or NEAR as the end condition, the end condition is met when the difference between the target position specified for POS in the program table and the current position is less than or equal to the value set in one of the following parameters.

| PnB2D | INPOSITION Width |                     |                    |              |                     |  |  |  |  |
|-------|------------------|---------------------|--------------------|--------------|---------------------|--|--|--|--|
|       | Setting Range    | Setting Unit        | Default<br>Setting | When Enabled | Classifica-<br>tion |  |  |  |  |
|       | 0 to 9,9999      | 1 reference<br>unit | 1                  | Immediately  | Setup               |  |  |  |  |
| PnB2F | NEAR Width       |                     |                    |              |                     |  |  |  |  |
|       | Setting Range    | Setting Unit        | Default<br>Setting | When Enabled | Classifica-<br>tion |  |  |  |  |
|       | 0 to 9,9999      | 1 reference<br>unit | 1                  | Immediately  | Setup               |  |  |  |  |

#### 13.3.4 Program Table Configuration

The program table is a table that contains programming. You can enter up to 256 program steps.

The configuration of the program table is shown below. Each line in the table is called a program step. The steps are managed with program step numbers 0 to 255.

Refer to the following section for details on the items that are set.

13.3.5 Settings in the Program Table on page 13-13

| PGM-<br>STEP | POS | SPD | RDST | RSPD | ACC | DEC | POUT | EVENT | LOOP | NEXT |
|--------------|-----|-----|------|------|-----|-----|------|-------|------|------|
| 0            |     |     |      |      |     |     |      |       |      |      |
| 1            |     |     |      |      |     |     |      |       |      |      |
| 2            |     |     |      |      |     |     |      |       |      |      |
| :            | ••• | :   | :    | :    | :   | :   | :    | :     | :    | :    |
| 255          |     |     |      |      |     |     |      |       |      |      |



Note

After you edit the program table, save it to flash memory. Refer to the following section for the operating procedure.

I → Saving the Program Table to Flash Memory in the SERVOPACK on page 13-24

If you turn OFF the power supply before you save the program table in flash memory, the values that you set in the program table will be lost.

## 13.3.5 Settings in the Program Table

| Item        | Name                                                                  | Meaning                                                                                                                                                                                                                                                                                                                                                                               | Setting Procedure                                                                                        |
|-------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| PGM<br>STEP | Program step                                                          | Numbers are used to identify the program steps in the program table.                                                                                                                                                                                                                                                                                                                  | The /SEL0 to /SEL7 signals are used to specify the program step.                                         |
| POS         | Target position                                                       | Specifies the target position.                                                                                                                                                                                                                                                                                                                                                        | Refer to the following section.                                                                          |
| SPD         | Positioning speed                                                     | Specifies the target speed for positioning.                                                                                                                                                                                                                                                                                                                                           | Refer to the following section.                                                                          |
| RDST        | Registration dis-<br>tance                                            | Specifies the travel distance after the trigger signal (/RGRT) is input.                                                                                                                                                                                                                                                                                                              | Refer to the following section.                                                                          |
| RSPD        | Registration speed                                                    | Specifies the target speed for positioning after the trigger signal (/RGRT) is input.                                                                                                                                                                                                                                                                                                 | Refer to the following section.                                                                          |
| ACC         | Acceleration rate                                                     | Specifies the acceleration rate to use to reach the positioning speed.                                                                                                                                                                                                                                                                                                                | Refer to the following section.                                                                          |
| DEC         | Deceleration rate                                                     | Specifies the deceleration rate from the posi-<br>tioning speed.                                                                                                                                                                                                                                                                                                                      | ACC and DEC on page 13-19                                                                                |
| POUT        | Programmable<br>output specifica-<br>tion                             | Specifies the output status of<br>/POUT0 to /POUT7.<br>nnnnnnn<br>/POUT0<br>/POUT0<br>/POUT0<br>/POUT7<br>n = N, A, Z, or:<br>N: Not active (OFF)<br>A: Active (ON)<br>Z: ZONE signal<br>A colon (:) indicates using the specification<br>from the previous program step.<br>Refer to the following section for information<br>on the ZONE signals.<br><i>Image 13.5 ZONE Outputs</i> | Refer to the following section.<br>POUT (Output Signal) on page<br>13-20                                 |
| EVENT       | End condition                                                         | Specifies the condition to use to determine<br>when the program step is completed. When<br>the end condition is met and the number of<br>executions specified for LOOP is completed,<br>execution jumps to the program step speci-<br>fied by NEXT.                                                                                                                                   | Refer to the following section.                                                                          |
| LOOP        | Number of loops                                                       | Specifies the number of times to execute the program step.                                                                                                                                                                                                                                                                                                                            | Refer to the following section.                                                                          |
| NEXT        | Next program<br>step                                                  | Specify the program step to execute after completion of the current program step.                                                                                                                                                                                                                                                                                                     | Refer to the following section.                                                                          |
| Important   | error will occur<br>START-STOP s<br>If the target postion), you can c | ew positioning during positioning, an E53E (Mov<br>and program table operation will be stopped. To<br>ignal OFF and then ON again. Execution will be<br>sition (POS) is ±INFINITE and the registration dis<br>change the program step to change the speed.<br>e Servomotor will simply change to the new spe                                                                          | o start operation again, turn the<br>restarted from the next step.<br>stance (RDST) is "–" (no registra- |

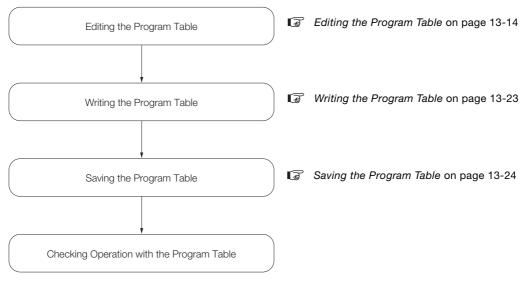
- In this case, the Servomotor will simply change the speed. In all other cases, you cannot change the program step to change the speed. An E53E (Movement Reference Duplication) error will occur.
- You can change the settings in the program table only when program table operation is canceled.

If program table operation is in progress or stopped, you cannot change the settings, even for program steps that are not currently being executed. An E5EE (Execution Not Possible during Program Table Operation) error will occur.

## 13.3.6 SigmaWin+ Procedures

You use the SigmaWin+ to edit, write, and save the program table.

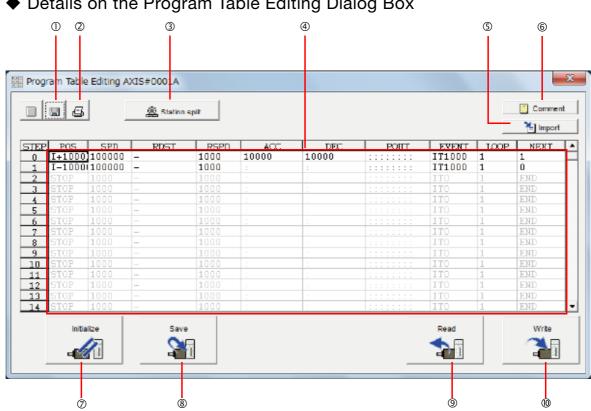
A flowchart is provided below.



## Editing the Program Table

Displaying the Program Table Editing Dialog Box.

Select Edit Program Table in the Menu Dialog Box of the SigmaWin+.



| No. | Item                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0   | Save Button                    | Saves the program table currently displayed on the SigmaWin+ in a file on the computer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 2   | Print Button                   | Used to print the program table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 3   | Station split<br>Button        | Splits the valid coordinate range (i.e., the range defined by PnB21 to PnB23) into equal intervals and sets the resulting positions in the program table.                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 4   | Program table<br>editing cells | <ul> <li>You edit the program table here. The colors of the cells will change as follows:</li> <li>White: The values in SERVOPACK RAM is the same as the value in the SigmaWin+ table cells.</li> <li>Green: If any changes are made, the rows that include the changes change to green. When you write the changes, the cells change to white.</li> <li>Red: If there is a setting error, the row is displayed in red. The Write Button will be disabled.</li> <li>Refer to the following section for the table cell editing procedures.</li> <li>Image I Activity Procedures on page 13-16</li> </ul> |
| 5   | Import Button                  | Imports a file on the computer to a program table in SigmaWin+.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 6   | Comment Button                 | Lets you enter a comment for the program table. The comment is also saved when you click the <b>Save</b> Button.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Ø   | Initialize Button              | Initializes the flash memory for the program table in the SERVOPACK and restores the default settings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 8   | Save Button                    | Saves the program table in RAM in the SERVOPACK to flash memory. If you save the program table to flash memory, it will not be lost even if you turn OFF the power supply. The next time you turn ON the power supply, the program table will be written to RAM.                                                                                                                                                                                                                                                                                                                                        |
| 9   | Read Button                    | Reads the program table in RAM in the SERVOPACK to the SigmaWin+.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 0   | Write Button                   | Writes the program table currently displayed on the SigmaWin+ to the SERVO-<br>PACK. The program table is written only to RAM. Writing the program table<br>enables program operation.                                                                                                                                                                                                                                                                                                                                                                                                                  |

## Details on the Program Table Editing Dialog Box

#### Editing Procedures

The following two ways are used to edit the program table.

Note: The method that is used depends on the item.

Items That Are Entered Directly

Click the cell to edit the item. Enter the setting directly.

| STEP | POS    | SPD    |
|------|--------|--------|
| 0    | I+1000 | 100000 |
| 1    | I-1000 | 100000 |
| 2    | CTOD   | 1000   |

#### • Items with Dialog Boxes

Double-click the cell to display the dialog box for editing. Make the settings in the dialog box.

|                                  | Target Postion Reservation | ×                      |
|----------------------------------|----------------------------|------------------------|
| Displays the<br>current setting. | +1000000                   | ]                      |
|                                  | Target Position            | Position / Distance    |
|                                  |                            | [renerence units]      |
|                                  |                            | (-99999999 - 99999999) |

Setting procedures are provided below for each item.

#### POS

Set the target positions.

1. Double-click the cell to edit. The Target Position Reservation Dialog Box will be displayed.

#### 2. Set the target position and the position/distance.

Information The *Position/Distance* setting is enabled when you set the target position to an absolute position or relative distance.

| Target Postion Reservation | ×                         |
|----------------------------|---------------------------|
| I+1000000                  |                           |
|                            |                           |
| Target Position            | Position / Distance       |
| Relative distance -        | 1000000 [reference units] |
|                            | (-99999999 - 99999999)    |
|                            |                           |
|                            | OK Cancel                 |
|                            | Cancel                    |

Target position

| Selected Item                                  | Description                                                                                                                   | Display in Program<br>Table |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Absolute position                              | Use this setting to specify the target position directly.                                                                     | A ± Position                |
| Relative distance                              | Use this setting to specify the relative position (travel dis-<br>tance) from the previous step.                              | I ± Distance                |
| Infinity<br>(Positive direction) <sup>*1</sup> | Constant-speed operation is performed in the forward direction.                                                               | +INFINITE                   |
| Infinity<br>(Negative direction) <sup>*1</sup> | Constant-speed operation is performed in the reverse direction.                                                               | -INFINITE                   |
| Stop<br>[default setting]                      | The axis is not moved. Use this setting to stop constant-<br>speed operation when the target position is set to<br>infinite.  | STOP                        |
| Consecutive stop*2                             | Specify the absolute target position within the rotational coordinates to perform positioning after constant-speed operation. | S + Position                |
| Without reference                              | The axis is not moved. This setting can be used only when POUT is specified.                                                  | _                           |

\*1. You can use the INFINITE settings for the target positions only for rotational coordinates (PnB20 = 1, 2, or 3) or when the software limits are not used (PnB21 and PnB23 = 0). An error will occur if you use an INFINITE setting for linear coordinates or when the software limits are enabled.

\*2. You can use consecutive stop settings for the target positions for rotational coordinates (PnB20 = 1, 2, or 3) or when the target position in the previous step is set to INFINITE. A consecutive stop setting will result in an error if linear coordinates are being used or if the target position for the previous step is not INFINITE. Also, you cannot use the consecutive stop setting in combination with a speed change for an infinite target position setting.

• Position/Distance

| Unit             | Setting Range                                                                                                                                                           | Default Setting |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1 reference unit | <ul> <li>PnB54 = 0 (Disable Expansion Mode):<br/>-99,999,999 to +99,999,999</li> <li>PnB54 = 1 (Enable Expansion Mode):<br/>-1,073,741,823 to +1,073,741,823</li> </ul> | STOP            |

#### 3. Click the OK Button.

This concludes the setting procedure.

#### SPD

Specify the target speeds for positioning.

Select the cells to edit and enter the values directly.

| Unit | Setting Range                                                                                                                        | Default Setting |
|------|--------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| ,    | <ul> <li>PnB54 = 0 (Disable Expansion Mode): 1 to 99,999,999</li> <li>PnB54 = 1 (Enable Expansion Mode): 1 to 199,999,999</li> </ul> | 1,000           |

#### RDST

Set the registration absolute distance.

- Note: 1. You cannot use registration in combination with a speed change with an infinite target position setting. 2. You cannot use registration in combination with consecutive stopping.
- **1.** Double-click the cell to edit.

The Registration Relative Position Dialog Box will be displayed.

#### **Using Registration**

2. Clear the selection of the No registration Check Box and enter the registration absolute distance.

| Registration Relative Position                         |   |
|--------------------------------------------------------|---|
| ☐ No registration                                      |   |
| Registration Relative Position 80000 [reference units] |   |
| (0 - 9999999)                                          |   |
| 0K Cancel                                              |   |
|                                                        | _ |

| Unit | Setting Range                                                                                                                        | Default Setting |
|------|--------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| ,    | <ul> <li>PnB54 = 0 (Disable Expansion Mode): 1 to 99,999,999</li> <li>PnB54 = 1 (Enable Expansion Mode): 1 to 199,999,999</li> </ul> | 1,000           |

#### **Not Using Registration**

2. Select the No registration Check Box.

| Registration Relative Position                     | x  |
|----------------------------------------------------|----|
| Registration<br>Registration Relative Position<br> |    |
| OK Canc                                            | el |

#### 3. Click the OK Button.

This concludes the setting procedure.

#### RSPD

Set the registration speed.

Select the cell to edit and set the value directly.

| Unit | Setting Range                                                                                                                        | Default Setting |
|------|--------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|      | <ul> <li>PnB54 = 0 (Disable Expansion Mode): 1 to 99,999,999</li> <li>PnB54 = 1 (Enable Expansion Mode): 1 to 199,999,999</li> </ul> | 1,000           |

#### ACC and DEC

Set the acceleration rate (ACC) and deceleration rate (DEC) for movement.

- 1. Double-click a cell under ACC or DEC. The Acceleration/Deceleration Dialog Box will be displayed.
- 2. Set the acceleration and deceleration rates. The Same as previous step Check Boxes are selected by default.

| Acceleration/Deceleration     | ×                             |
|-------------------------------|-------------------------------|
| Acceleration                  | Deceleration                  |
| Same as previous step         | Same as previous step         |
| Acceleration :                | Deceleration :                |
| (1 - 99999999)                | (1 - 99999999)                |
| [x1000reference units/min/ms] | [x1000reference units/min/ms] |
|                               | OK Cancel                     |

To use different values from the previous step, clear the selections of the **Same as previous step**. Check Boxes and enter the values directly.

| n                     |
|-----------------------|
|                       |
| e as previous step    |
| tion                  |
| 1 - 99999999)         |
| ference units/min/ms] |
| Cancel                |
|                       |

| Unit | Setting Range                                                                                                                        | Default Setting |
|------|--------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| , (  | <ul> <li>PnB54 = 0 (Disable Expansion Mode): 1 to 99,999,999</li> <li>PnB54 = 1 (Enable Expansion Mode): 1 to 199,999,999</li> </ul> | :               |

#### 3. Click the OK Button.

This concludes the setting procedure.



If you select the **Same as Previous Step** Check Box in the first program step, the acceleration rate that was valid before program table operation was started (PnB29 (Acceleration Rate), set with the ACC serial command) and the deceleration rate that was valid before program table operation was started (PnB2B (Deceleration Rate), set with the DEC serial command) will be used.

#### POUT (Output Signal)

Specify the signals to output immediately after program step execution is started.

Note: 1. If you want to output the signal at the end of the step, specify POUT as POS = "-" in the next step. 2. It is possible to set a ZONE signal for /POUT5 to /POUT7, but the output is always OFF.

#### 1. Double-click the cell to edit.

The Output Signal Dialog Box will be displayed.

| Output Signal   | ×                       |
|-----------------|-------------------------|
|                 |                         |
| Output signal 0 | Same as previous step 💌 |
| Output signal 1 | Same as previous step 💌 |
| Output signal 2 | Same as previous step 💌 |
| Output signal 3 | Same as previous step 💌 |
| Output aignal 4 | Same as previous step 💌 |
| Output algoal 5 | Same as previous step 💌 |
| Output signal 6 | Same as previous step 💌 |
| Output signal 7 | Same as previous step 💌 |
|                 | OK) Cancel              |

2. Select the settings for output signals 0 to 7 in the boxes.

The corresponding terminals are given below. Output signal 0: /POUT0 terminal Output signal 1: /POUT1 terminal Output signal 2: /POUT2 terminal Output signal 3: /POUT3 terminal Output signal 4: /POUT4 terminal Output signal 5: /POUT5 terminal Output signal 6: /POUT6 terminal Output signal 7: /POUT7 terminal

| Selection Items       | Description                                                       | Program Table Notation |
|-----------------------|-------------------------------------------------------------------|------------------------|
| Active                | Always ON                                                         | А                      |
| Not Active            | Always OFF                                                        | Ν                      |
| Same as previous step | Continues previous state.                                         | :                      |
| ZONE                  | Sets the ZONE signal (/Z0 to /Z4) that corresponds to that digit. | Z                      |

#### 3. Click the OK Button.

This concludes the setting procedure.

#### EVENT

Specify the conditions to complete execution of the program steps.

When the end condition is met and the number of executions specified for LOOP is completed, execution jumps to the program step specified by NEXT. If the number of executions specified for LOOP has not been completed, the step will be executed again.

- **1.** Double-click the cell to edit. The Event Dialog Box will be displayed.
- 2. Set the condition and the wait time.

| Ev  | ent                  |   |           | <b>x</b> |
|-----|----------------------|---|-----------|----------|
| l r | IT1000               |   |           |          |
|     |                      |   |           |          |
|     | Condition            |   | Wait time |          |
|     | Positioning complete | • | 1000      | [ms]     |
|     |                      |   | (0 - 9    | 9999)    |
|     |                      |   |           |          |
|     |                      |   | OK        | Cancel   |
|     |                      |   |           |          |

Condition

| Selected Item                             | Description                                                                                                        | Display in Pro-<br>gram Table |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Positioning complete<br>[default setting] | The step ends when the /INPOSITION (Positioning Completed Output) signal turns ON (closes).*                       | I                             |
| NEAR                                      | The step ends when the /NEAR signal width is entered.*                                                             | N                             |
| Command Issuance<br>Completion            | The step ends when position reference distribution is completed (DEN).*                                            | D                             |
| SEL0, SEL1,                               | The step ends when the /SELx input signal turns ON (closes).*<br>x = 0 to 7                                        | SELx                          |
|                                           | Execution waits for n milliseconds after the /INPOSITION (Positioning Completion Output) signal turns ON (closes). | ITn                           |
| Wait time                                 | Execution waits for n milliseconds after the /NEAR (Near Output) signal turns ON (closes).                         | NTn                           |
| Wait lime                                 | Execution waits for n milliseconds after position reference distribution is completed (DEN).                       | DTn                           |
|                                           | Execution waits for n milliseconds after the SELx input signal turns ON (closes).                                  | SELxTn                        |
| Same as previous step                     | The condition from the previous program step is used.                                                              | :                             |

\* The edge is not detected, the level is.

• Wait Time

| Unit for "n" | Setting Range of "n" | Default Setting |
|--------------|----------------------|-----------------|
| ms           | 0 to 99,999          | ITO             |

#### 3. Click the OK Button.

This concludes the setting procedure.

#### ■ LOOP

Specify the number of times to execute the step.

Note: NEXT is accessed after the number of executions specified with LOOP has been completed. You cannot specify LOOP across more than one program step.

Select the cell to edit and set the value directly.

| Unit  | Setting Range | Default Setting |
|-------|---------------|-----------------|
| Times | 1 to 99,999   | 1               |

#### NEXT

Specify the operation to perform after execution of the current program step is completed.

1. Double-click the cell to edit. The Next Step Dialog Box will be displayed.

#### **Executing a Next Step**

2. Clear the selection of the END Check Box and set a value between 0 and 255 for the next step number.

| Next Step                                 | x             |                 |
|-------------------------------------------|---------------|-----------------|
| Complete<br>Next step numi<br>3<br>(0 - 2 |               |                 |
| ОК                                        | Cancel        |                 |
| Unit                                      | Setting Range | Default Setting |
| _                                         | 0 to 255      | END*            |

\* Program table operation is ended and canceled.

#### Ending Program Execution at the Current Step

#### 2. Select the Complete Check Box.

When execution of the current program step is completed, program execution will be canceled.

| Next Step        |
|------------------|
| [☞ [Complete]    |
| Next step number |
| (0 - 255)        |
| 0K Cancel        |

#### 3. Click the OK Button.

This concludes the setting procedure.

### Writing the Program Table

You can write the edited program table to SERVOPACK RAM to operate the SERVOPACK according to the program table.

| ١ | 1. Make sure that the system is in SERVO OFF state when you write the program table.           |
|---|------------------------------------------------------------------------------------------------|
|   | 2. The program table that is written will be deleted when the power supply to the SERVOPACK is |
| J | turned OFF. Before you turn OFF the power supply to the SERVOPACK, save the program            |
|   | table from RAM to flash memory. Refer to the following section for the procedure.              |
|   | $\overline{\mathfrak{Z}}$ Saving the Program Table on page 13-24                               |

1. Click the Write Button in the Program Table Editing Dialog Box.

|      |       |        |      |      |       |       |           |        |      | 🔚 Import |
|------|-------|--------|------|------|-------|-------|-----------|--------|------|----------|
|      | FOS   | SPD    | RDST | RSPD | ÂCC   | DEC   | POUT      | EVENT  | LOOP | NEXT     |
|      |       | 150000 | -    | 1000 | 10000 | 10000 | 111111111 | IT1000 | 1    | 1        |
|      | -1000 | 100000 | -    | 1000 |       |       |           | IT1000 | 1    | 0        |
|      |       |        |      |      |       | :     |           |        |      |          |
|      |       |        |      |      |       |       |           | ITO    |      |          |
|      |       | 1000   |      | 1000 |       |       |           | ITO    | 1    | END      |
| 5 S1 |       | 1000   |      |      |       |       |           |        | 1    | END      |
|      |       |        |      |      |       | 1     |           |        |      |          |
| 7 ST |       | 1000   |      | 1000 |       |       |           | ITO    | 1    |          |
| 8 S1 |       | 1000   | -    | 1000 |       |       |           |        | 1    | END      |
| 9 ST |       |        |      |      |       |       |           |        |      |          |
| 0 S1 |       |        |      |      |       |       |           | ITO    | 1    |          |
| 1 S1 |       | 1000   |      |      |       |       |           | ITO    | 1    |          |
| 2 S1 |       | 1000   |      | 1000 |       |       |           |        | 1    | END      |
| 3 ST |       |        |      |      |       |       |           |        |      |          |
| 4 ST |       | 1000   |      | 1000 |       |       |           | ITO    | 1    |          |

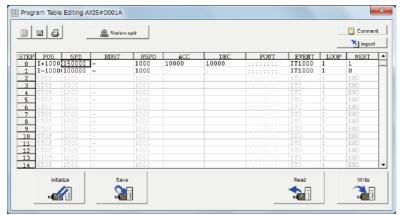
The Write Dialog Box will be displayed.

2. Click the OK Button.

Note

| Write                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                      |
| Writes the table data being edited into the Servopack.<br>When the power is turned OFF after this has been carried out,<br>the data is erased.<br>When saving is necessary, save to a file or implement this function.<br>Thereafter, implement saving of the table. |
| Cancel                                                                                                                                                                                                                                                               |

The program table edited on the SigmaWin+ will be written to the SERVOPACK and all edited cells will change to white.



This concludes the writing procedure.

## Saving the Program Table

### Saving the Program Table to Flash Memory in the SERVOPACK

To prevent the program table from being deleted when the power supply to the SERVOPACK is turned OFF, you must save it to flash memory in the SERVOPACK. The program table that is saved in the flash memory is automatically loaded each time the power supply is turned ON. We recommend that you save the program table that is normally used for operation in this flash memory.

There are the following three ways to save the program table to flash memory in the SERVO-PACK.

- Save it from the Edit Program Dialog Box.
- Save it with the PGMSTORE serial command.
- Save it with FnB03 (Edit/Save Program Table) on a Digital Operator.

Use the following procedure to save the program table from the Edit Program Dialog Box.

- Program Table Editing AXIS#0001A Comment . . . A Station split 🎦 Import EVENT LOOP NEXT \* IT1000 1 1 IT1000 1 0 POID 00150 3 4 6 7 8 9 10 11 12 13 Read Write Initialize 91 \$∎ 2 -1/1
- 1. Click the Save Button in the Program Table Editing Dialog Box.

The Save Table Dialog Box will be displayed.

2. Click the OK Button.



This concludes the saving procedure.

### ◆ Saving the Program Table to a Computer File

You can save the program table to a file on the computer. Use computer files to back up program tables.

1. Click the Save Button.

|    |      |        |      |      |       |       |      |        | _    | 🔚 Import |
|----|------|--------|------|------|-------|-------|------|--------|------|----------|
| ΈP |      | SPD    | RDST | RSPD | ACC   | DEC   | POUT | EVENT  | LOOP | NEXT     |
| 0  |      | 150000 | -    | 1000 | 10000 | 10000 |      | IT1000 | 1    | 1        |
| 1  |      | 100000 | -    | 1000 |       |       |      | IT1000 | 1    | 0        |
| 2  | STOP |        |      |      |       | 1     |      |        | 1    | END      |
| 3  | STOP |        |      |      |       | 1     |      | ITO    | 1    |          |
| 4  | STOP | 1000   |      | 1000 |       |       |      | ITO    | 1    |          |
| 5  | STOP |        |      | 1000 |       |       |      | ITO    | 1    | END      |
| 6  | STOP |        |      |      |       | 1     |      |        |      |          |
| 7  | STOP |        |      | 1000 |       |       |      | ITO    | 1    |          |
| 8  | STOP | 1000   | -    | 1000 |       |       |      | ITO    | 1    | END      |
| 9  | STOP |        |      |      |       |       |      |        | 1    | END      |
| 0  | STOP |        |      |      |       | 1     |      | ITO    |      |          |
| 1  | STOP | 1000   |      | 1000 |       |       |      | ITO    | 1    |          |
| 2  | STOP | 1000   | -    | 1000 |       |       |      | ITO    | 1    | END      |
| 3  | STOP |        |      |      |       |       |      |        |      |          |
| 4  | STOP | 1000   |      | 1000 |       | 1     |      | ITO    | 1    | END      |

The Open Dialog Box will be displayed.

2. Specify the save location and file name.

You can set any file name. However, you cannot change the file name extension.

Information You can also set a comment.

| Save As                                                          |                       |                           |       |       |          | ? ×          |
|------------------------------------------------------------------|-----------------------|---------------------------|-------|-------|----------|--------------|
| Savejn:                                                          | 🕒 My Documer          | nts                       | •     | ← 🖻 💣 | <b>.</b> |              |
| My Recent<br>Documents<br>Desktop<br>My Documents<br>My Computer |                       |                           |       |       |          |              |
| My Network<br>Places                                             | File <u>n</u> ame:    | 20140907090049            |       | •     |          | <u>S</u> ave |
| Flaces                                                           | Save as <u>t</u> ype: | Program table file(*.pgt) |       | •     |          | Cancel       |
|                                                                  | Product info          | SGD7S-***E0A/SGDV-C       | CA03A | 1     |          |              |
|                                                                  | <u>C</u> omment:      |                           |       |       |          |              |

#### 13.3.7 State Transitions

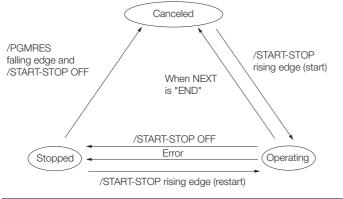
| Information | You can use the <b>Import</b> Button to load the program table saved in a file to the SERVO-<br>PACK. |
|-------------|-------------------------------------------------------------------------------------------------------|
|-------------|-------------------------------------------------------------------------------------------------------|

| STEP           | POS                  | SPD    | RDST | RSPD | ACC   | DEC   | FOUT      | EVENT                     | LOOP | NEXT |  |
|----------------|----------------------|--------|------|------|-------|-------|-----------|---------------------------|------|------|--|
| Û              | I+1000               |        | -    | 1000 | 10000 | 10000 |           | IT1000                    | 1    | 1    |  |
| 1              |                      | 100000 | -    | 1000 | :     |       |           | IT1000                    | 1    | 0    |  |
| 2              | STOP                 |        |      |      | 1.00  |       |           |                           |      |      |  |
| 3              | STOP                 |        |      |      | 1     | 1     |           |                           | 1    |      |  |
| 4              | STOP                 |        |      |      |       | 1     |           | ITO                       | 1    |      |  |
| 5              | STOP                 |        |      |      |       | 1     |           |                           |      |      |  |
| 6              | STOP                 |        |      |      | :     | 1     |           |                           |      |      |  |
| - 7            | STOP                 |        |      |      |       | 1     |           | ITO                       |      |      |  |
| 8              | STOP                 |        |      |      |       | 1     | 111111111 |                           |      |      |  |
| 9              | STOP                 |        |      |      | 1     | 1     |           |                           |      |      |  |
| 10             | STOP                 |        |      | 1000 |       | 1     |           | ITO                       | 1    |      |  |
| 11             | STOP                 |        |      |      |       | 1     | 111111111 |                           |      |      |  |
| 12             | STOP                 |        |      |      | 1     | 1.0   |           |                           | 1    |      |  |
| 13             |                      |        | -    |      |       | 1     |           |                           |      |      |  |
| 14             | STOP                 |        |      | 1000 | 1     | 1     |           |                           | 1    |      |  |
| 12<br>13<br>14 | STOP<br>STOP<br>STOP | 1000   | -    | 1000 |       |       |           | ITO<br>ITO<br>ITO<br>Read |      |      |  |

This concludes the saving procedure.

## 13.3.7 State Transitions

Program table operation can be in any of three states: Canceled, operating, or stopped.



|            |             | Transition Condition |          | State Transition  |         |
|------------|-------------|----------------------|----------|-------------------|---------|
|            | /START-STOP | /PRGRES              | Canceled | Operating         | Stopped |
|            |             | OR OFF               | •        | $\longrightarrow$ |         |
| sition     | OFF         | OR OFF               |          | •                 | >       |
| Transition | OFF         |                      | <        |                   | •       |
|            |             | OR OFF               |          | <                 | •       |

Note: 1. "Canceled state" means that the mode is mode 0, execution is not in a stopped state, and no program step is being executed.

2. The status will also change from operating to canceled in the following case: The next step is set to END in the program table.

The status will also change from operating to stopped in the following case: An error occurs during operation.



If the program table operation is restarted after it is stopped because of an error, the PGMSTEP in which the error occurred will be skipped and execution will be restarted from the PGMSTEP specified by NEXT. (If the operation has not been executed for the number of times specified in the LOOP, the next LOOP will be executed.)

This section provides the following 12 examples to show the timing of the I/O signals related to program table operation.

In the following examples, it is assumed that an homing has been completed to define the origin.

Refer to the following section for a timing chart from when the power supply to the equipment is turned ON until homing is completed when an incremental encoder is used.

#### (3.2 Homing on page 13-4

| No. | Item                                                                 | Reference  |
|-----|----------------------------------------------------------------------|------------|
| 1   | Specifying the Program Steps to Execute One at a Time                | page 13-27 |
| 2   | Specifying the Next Step to Execute in the NEXT Setting              | page 13-29 |
| 3   | Specifying the Number of Times to Execute a Program Step             | page 13-30 |
| 4   | Pausing Program Table Operation                                      | page 13-31 |
| 5   | Outputting POUT Signals for the Specified Time                       | page 13-33 |
| 6   | Specifying SEL Signals as Events                                     | page 13-34 |
| 7   | Combining Positioning with Constant-Speed Operation                  | page 13-35 |
| 8   | Performing Registration                                              | page 13-36 |
| 9   | Pausing Registration                                                 | page 13-37 |
| 10  | Turning ON the /RGRT Signal While Program Table Operation Is Stopped | page 13-38 |
| 11  | Using Consecutive Stops                                              | page 13-39 |
| 12  | Resetting Program Table Operation                                    | page 13-41 |

### Specifying the Program Steps to Execute One at a Time

In this example, the program table contains steps 0 to 5, but only program steps 3 and 5 are executed.

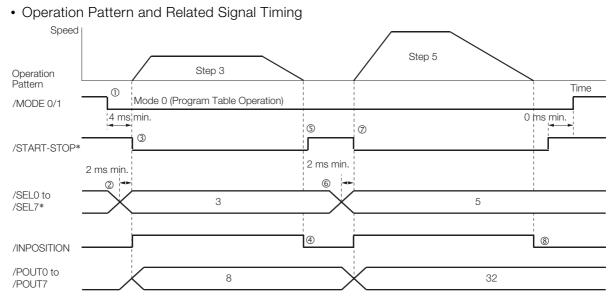
Step 3 performs relative positioning for 100,000 reference units at a speed of 15,000,000 references units/min. The acceleration/deceleration rates that are set in PnB29 and PnB2B are used.

Step 5 performs relative positioning for 300,000 reference units at a speed of 30,000,000 references units/min with the same acceleration/deceleration rates as step 3.

| PGMSTEP | POS      | SPD   | RDST | RSPD | ACC | DEC | POUT     | EVENT  | LOOP | NEXT |
|---------|----------|-------|------|------|-----|-----|----------|--------|------|------|
| 0       | l+100000 | 15000 | -    | 1000 | :   | :   | NNNNNNA  | IT2000 | 1    | END  |
| 1       | A+100000 | 15000 | -    | 1000 | :   | :   | NNNNNAN  | IT2000 | 1    | END  |
| 2       | l+300000 | 15000 | -    | 1000 | :   | :   | NNNNANN  | IT2000 | 1    | END  |
| 3       | l+100000 | 15000 | -    | 1000 | :   | :   | NNNNANNN | IT2000 | 1    | END  |
| 4       | I+200000 | 30000 | -    | 1000 | :   | :   | NNNANNNN | IT2000 | 1    | END  |
| 5       | I+300000 | 30000 | _    | 1000 | :   | :   | NNANNNN  | IT2000 | 1    | END  |

The program table for this positioning is shown below.

- Operating Procedure
  - ① Turn ON the /MODE 0/1 signal to change to mode 0.
  - ② Set the /SEL0 to /SEL7 signals to 3 (i.e., turn ON /SEL0 and /SEL1) to specify program step 3.
  - ③ Turn ON the /START-STOP signal to start program table operation.
    - The /INPOSITION signal turns OFF and the /POUT3 signal turns ON.
  - When positioning is completed to the target position, the /INPOSITION signal turns ON.
  - © Turn OFF the /START-STOP signal.
  - Set the /SEL0 to /SEL7 signals to 5 (i.e., turn ON /SEL0 and /SEL2) to specify program step 5.
  - Turn ON the /START-STOP signal to start program table operation. The /POUT5 signal turns ON.
  - When positioning is completed to the target position, the /INPOSITION signal turns ON.



\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

### Specifying the Next Step to Execute in the NEXT Setting

In this example, repeated positioning is performed using program steps 0 and 1.

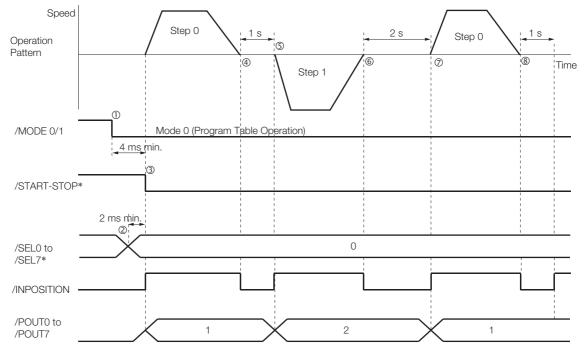
Step 0 performs relative positioning for 300,000 reference units at a speed of 15,000,000 references units/min. The acceleration rate is 400,000,000 reference units/min/ms and the deceleration rate is 200,000,000 reference units/min/ms.

Step 1 performs relative positioning for -400,000 reference units at a speed of 20,000,000 references units/min. The acceleration rate is 500,000,000 reference units/min/ms and the deceleration rate is 250,000,000 reference units/min/ms.

| PGM-<br>STEP | POS      | SPD   | RDST | RSPD | ACC    | DEC    | POUT    | EVENT  | LOOP | NEXT |
|--------------|----------|-------|------|------|--------|--------|---------|--------|------|------|
| 0            | l+300000 | 15000 | -    | 1000 | 400000 | 200000 | NNNNNNA | IT1000 | 1    | 1    |
| 1            | 1-400000 | 20000 | -    | 1000 | 500000 | 250000 | NNNNNAN | IT2000 | 1    | 0    |

The program table for this positioning is shown below.

- Operating Procedure
  - ① Turn ON the /MODE 0/1 signal to change to mode 0.
  - ② Set the /SEL0 to /SEL7 signals to 0 to specify program step 0.
  - ③ Turn ON the /START-STOP signal to start program table operation. The /INPOSITION signal turns OFF and the /POUT0 signal turns ON.
  - When positioning is completed to the target position, the /INPOSITION signal turns ON.
  - S After a wait time of 1 second, execution of the program step specified with the NEXT setting (program step 1) is executed.
    The (NEQCITION and POLITION areas of the conduction of the program step 2011 and the conduction of the program step 2011 and the conduction of the program step 30 and the conduction of the
    - The /INPOSITION and POUT0 signals turn OFF and the /POUT1 signal turns ON.
  - <sup>®</sup> When positioning is completed to the target position, the /INPOSITION signal turns ON.
  - After a wait time of 2 seconds, execution of the program step specified with the NEXT setting (program step 0) is executed.
  - Steps 4 to 7 are repeated.
- Operation Pattern and Related Signal Timing



\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

## Specifying the Number of Times to Execute a Program Step

In this example, program step 0 is executed and then step 1 is executed three times.

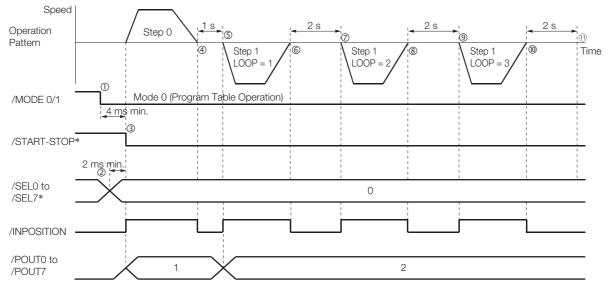
Step 0 performs relative positioning for 300,000 reference units at a speed of 15,000,000 references units/min. The acceleration rate is 400,000,000 reference units/min/ms and the deceleration rate is 200,000,000 reference units/min/ms.

Step 1 performs relative positioning for -400,000 reference units at a speed of 20,000,000 references units/min. The acceleration rate is 500,000,000 reference units/min/ms and the deceleration rate is 250,000,000 reference units/min/ms. The number of loops for step 1 is set to 2.

The program table for this positioning is shown below.

| PGM-<br>STEP | POS      | SPD   | RDST | RSPD | ACC    | DEC    | POUT    | EVENT  | LOOP | NEXT |
|--------------|----------|-------|------|------|--------|--------|---------|--------|------|------|
| 0            | I+300000 | 15000 | -    | 1000 | 400000 | 200000 | NNNNNNA | IT1000 | 1    | 1    |
| 1            | 1-400000 | 20000 | -    | 1000 | 500000 | 250000 | NNNNNAN | IT2000 | 3    | END  |

- Operating Procedure
  - ① Turn ON the /MODE 0/1 signal to change to mode 0.
  - ② Set the /SEL0 to /SEL7 signals to 0 to specify program step 0.
  - ③ Turn ON the /START-STOP signal to start program table operation. The /INPOSITION signal turns OFF and the /POUT0 signal turns ON.
  - When positioning is completed to the target position, the /INPOSITION signal turns ON.
  - S After a wait time of 1 second, execution of the program step specified with the NEXT setting (program step 1) is executed.
    - The /INPOSITION and /POUT0 signals turn OFF and the /POUT1 signal turns ON.
  - When positioning is completed to the target position, the /INPOSITION signal turns ON.
     After a wait time of 2 seconds, execution of program step 1 is started twice.
  - The /INPOSITION signal turns OFF.
  - When positioning is completed to the target position, the /INPOSITION signal turns ON.
  - After a wait time of 2 seconds, execution of program step 1 is started a third time. The /INPOSITION signal turns OFF.
     A started a third time.
     The /INPOSITION signal turns of the started a third time.
     The /INPOSITION signal turns of the started a third time.
     The started a thir
  - <sup>®</sup> When positioning is completed to the target position, the /INPOSITION signal turns ON.
  - ① After a wait time of 2 seconds, program table operation is ended and the /POUT1 signal turns OFF.



Operation Pattern and Related Signal Timing

\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

## Pausing Program Table Operation

This example shows how to turn OFF the /START-STOP signal to temporarily stop program table operation and then turn ON the /START-STOP signal to execute the remainder of the step.

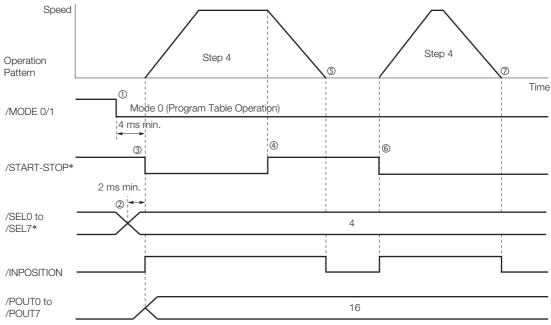
Execution is temporarily stopped and then restarted during execution of program step 4.

| PGM-<br>STEP | POS      | SPD   | RDST | RSPD | ACC    | DEC    | POUT     | EVENT  | LOOP | NEXT |
|--------------|----------|-------|------|------|--------|--------|----------|--------|------|------|
| 0            | l+100000 | 15000 | -    | 1000 | 400000 | 200000 | NNNNNNA  | IT1000 | 1    | END  |
| 1            | A+100000 | 15000 | —    | 1000 | :      | :      | NNNNNAN  | IT2000 | 1    | END  |
| 2            | l+300000 | 15000 | -    | 1000 | :      | :      | NNNNANN  | IT3000 | 1    | END  |
| 3            | l+100000 | 15000 | -    | 1000 | :      | :      | NNNNANNN | IT2000 | 1    | END  |
| 4            | I+200000 | 30000 | _    | 1000 | 200000 | 200000 | NNNANNNN | IT2000 | 1    | END  |

The program table for this positioning is shown below.

- Operating Procedure
  - ① Turn ON the /MODE 0/1 signal to change to mode 0.
  - ② Set the /SEL0 to /SEL7 signals to 4 (i.e., turn ON /SEL2) to specify program step 4.
  - ③ Turn ON the /START-STOP signal to start program table operation. The /INPOSITION signal turns OFF and the /POUT4 signal turns ON.
  - ④ Turn OFF the /START-STOP signal to stop program table operation.
  - ⑤ The Servomotor will decelerate to a stop.
  - © Turn ON the /START-STOP signal to restart program table operation. The /SEL0 to /SEL7 signals are not latched at this time.
  - ⑦ When positioning is completed to the target position, the /INPOSITION signal turns ON.

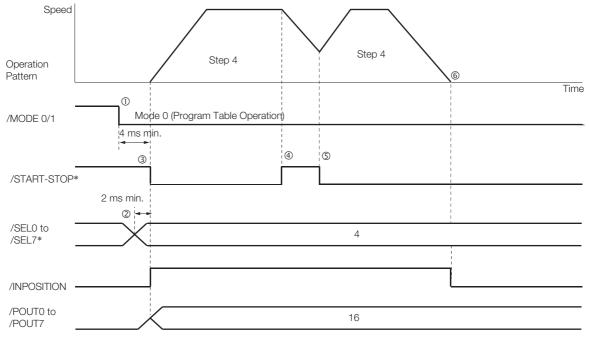
#### Operation Pattern and Related Signal Timing



\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

As described below, operation is restarted even when the /START-STOP signal is turned ON even during deceleration after the /START-STOP signal is turned OFF.

- Operating Procedure
  - ① Turn ON the /MODE 0/1 signal to change to mode 0.
  - ② Set the /SEL0 to /SEL7 signals to 4 (i.e., turn ON /SEL2) to specify program step 4.
  - ③ Turn ON the /START-STOP signal to start program table operation.
    The /INPOSITION signal turns OFF and the /DOUTA signal turns ON
  - The /INPOSITION signal turns OFF and the /POUT4 signal turns ON.
  - Turn OFF the /START-STOP signal to stop program table operation.
     Turn ON the (START-STOP signal while the Operational states in the operation of the o
  - ⑤ Turn ON the /START-STOP signal while the Servomotor is decelerating. Program table operation is restarted.
    - The remaining travel distance will be executed.
  - <sup>®</sup> When positioning is completed to the target position, the /INPOSITION signal turns ON.
- Operation Pattern and Related Signal Timing



\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

## **Outputting POUT Signals for the Specified Time**

This example shows how to output the POUT signals in the next step for the specified length of time after completing positioning for a program step.

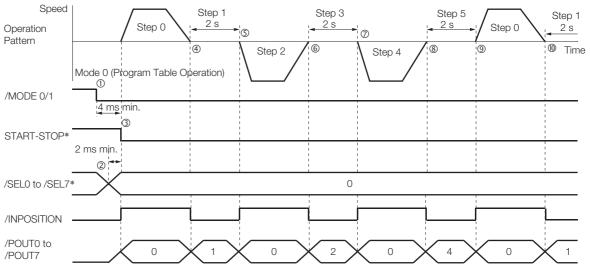
Positioning is registered for steps 0, 2, and 4. POUT signal outputs are specified for steps 1, 3, and 5.

| PGM-<br>STEP | POS      | SPD   | RDST | RSPD | ACC    | DEC    | POUT    | EVENT | LOOP | NEXT |
|--------------|----------|-------|------|------|--------|--------|---------|-------|------|------|
| 0            | I+200000 | 15000 | -    | 1000 | 400000 | 200000 | NNNNNNN | IT0   | 1    | 1    |
| 1            | -        | 15000 | -    | 1000 | :      | :      | :::::A  | T2000 | 1    | 2    |
| 2            | I-200000 | 30000 | -    | 1000 | :      | :      | NNNNNNN | IT0   | 1    | 3    |
| 3            | -        | 30000 | -    | 1000 | :      | :      | :::::A: | T2000 | 1    | 4    |
| 4            | I-200000 | 30000 | -    | 1000 | :      | :      | NNNNNNN | IT0   | 1    | 5    |
| 5            | -        | 30000 | -    | 1000 | :      | :      | ::::A:: | T2000 | 1    | 0    |

The program table for this positioning is shown below.

- Operating Procedure
  - ① Turn ON the /MODE 0/1 signal to change to mode 0.
  - ② Set the /SEL0 to /SEL7 signals to 0 to specify program step 0.
  - ③ Turn ON the /START-STOP signal to start program table operation. The /INPOSITION signal turns OFF.
  - When positioning is completed to the target position, the /INPOSITION signal turns ON. Execution moves to program step 1 and the /POUT0 signal turns ON.
  - S After a wait time of 2 seconds, execution of the program step specified with the NEXT setting (program step 2) is executed.
  - The /INPOSITION signal turns OFF.
  - When positioning is completed to the target position, the /INPOSITION signal turns ON. Execution moves to program step 3 and the /POUT1 signal turns ON.
  - After a wait time of 2 seconds, execution of the program step specified with the NEXT setting (program step 4) is executed.
    - The /INPOSITION signal turns OFF.
  - When positioning is completed to the target position, the /INPOSITION signal turns ON. Execution moves to program step 5 and the /POUT2 signal turns ON.
  - Image: Image:
    - The /INPOSITION signal turns OFF.
  - Steps 4 to 9 are repeated.

#### • Operation Pattern and Related Signal Timing



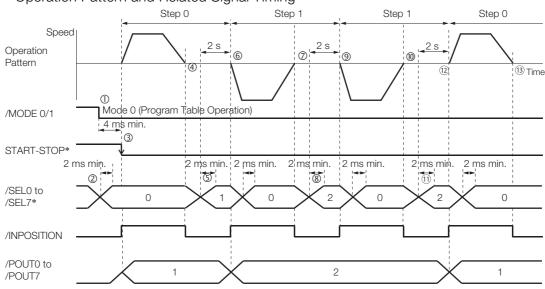
\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

### Specifying SEL Signals as Events

In this example, SEL signals are specified as the end conditions for the program steps. Step 0 ends 2 seconds after the /SEL0 signal turns ON after positioning is completed. Step 1 ends 2 seconds after the /SEL1 signal turns ON after positioning is completed. The program table for this positioning is shown below.

| PGM-<br>STEP | POS      | SPD   | RDST | RSPD | ACC    | DEC    | POUT    | EVENT     | LOOP | NEXT |
|--------------|----------|-------|------|------|--------|--------|---------|-----------|------|------|
| 0            | l+200000 | 15000 | -    | 1000 | 400000 | 200000 | NNNNNNA | SEL0T2000 | 1    | 1    |
| 1            | I-200000 | 30000 | _    | 1000 | 400000 | 200000 | NNNNNAN | SEL1T2000 | 2    | 0    |

- Operating Procedure
  - ① Turn ON the /MODE 0/1 signal to change to mode 0.
  - ② Set the /SEL0 to /SEL7 signals to 0 to specify program step 0.
  - ③ Turn ON the /START-STOP signal to start program table operation.
    - The /INPOSITION signal turns OFF and the /POUT0 signal turns ON.
  - When positioning is completed to the target position, the /INPOSITION signal turns ON.
  - S The /SEL0 signal turns ON.
  - After a wait time of 2 seconds, execution of the program step specified with the NEXT set- ting (program step 1) is executed.
    - The /INPOSITION signal turns OFF and the /POUT1 signal turns ON.
  - ⑦ When positioning is completed to the target position, the /INPOSITION signal turns ON.
  - The /SEL1 signal turns ON.
  - After a wait time of 2 seconds, program step 1 is executed again. The /INPOSITION signal turns OFF.
  - <sup>®</sup> When positioning is completed to the target position, the /INPOSITION signal turns ON.
  - 1) The /SEL1 signal turns ON.
  - After a wait time of 2 seconds, execution of the program step specified with the NEXT set- ting (program step 0) is executed.
    - The /INPOSITION and /POUT1 signals turn OFF and the /POUT0 signal turns ON.
  - (3) Steps 4 to 12 are repeated.



· Operation Pattern and Related Signal Timing

\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

### **Combining Positioning with Constant-Speed Operation**

This example shows how to perform operation that combines constant-speed operation and positioning when the target position (POS) is set to INFINITE.

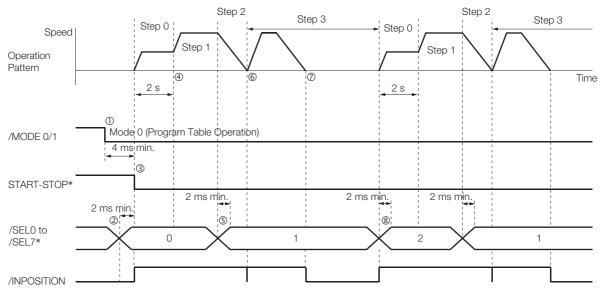
Step 0 performs operation for 2 seconds with no target position (infinite length = INFINITE) at a speed of 15,000,000 reference units/min.

Step 1 performs operation with no target position (infinite length = INFINITE) and changes the speed from 15,000,000 reference units/min to 30,000,000 reference units/min. Operation continues until the /SEL0 signal turns ON.

Step 2 decelerates the motor to a stop and step 3 performs relative positioning from the stop position to a target position of 200,000 reference units.

| PGM-<br>STEP | POS       | SPD   | RDST | RSPD | ACC    | DEC    | POUT    | EVENT  | LOOP | NEXT |
|--------------|-----------|-------|------|------|--------|--------|---------|--------|------|------|
| 0            | +INFINITE | 15000 | -    | 1000 | 400000 | 200000 | NNNNNNN | T2000  | 1    | 1    |
| 1            | +INFINITE | 30000 | _    | 1000 | :      | :      | :       | SEL0T0 | 1    | 2    |
| 2            | STOP      | 30000 | _    | 1000 | :      | :      | :       | IT0    | 1    | 3    |
| 3            | I+200000  | 30000 | -    | 1000 |        | :      |         | SEL1T0 | 1    | 0    |

- Operating Procedure
  - ① Turn ON the /MODE 0/1 signal to change to mode 0.
  - ② Set the /SEL0 to /SEL7 signals to 0 to specify program step 0.
  - ③ Turn ON the /START-STOP signal to start program table operation. The /INPOSITION signal turns OFF.
  - ④ After 2 seconds elapse, step 1 is executed.
  - <sup>⑤</sup> When the /SEL0 signal turns ON, step 2 is executed.
  - 6 After the motor decelerates to a stop, the /INPOSITION signal turns ON and step 3 is executed. At the start of execution, the /INPOSITION signal turns OFF.
  - ⑦ When positioning is completed to the target position, the /INPOSITION signal turns ON.
  - When the /SEL1 signal turns ON, program step 3 is ended and program step 0 is executed.
- Operation Pattern and Related Signal Timing



\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

Operation with Digital I/O

### **Performing Registration**

This example shows how to use the /RGRT signal during execution of a program step to change to the specified speed and perform positioning for the specified distance.

When the /RGRT signal turns ON during step 0, positioning is performed for a travel distance (RDST) of 100,000 reference units.

The speed changes to 15,000,000 reference units/min (RSPD).

When the /RGRT signal turns ON during step 1, positioning is performed for a travel distance (RDST) of 100,000 reference units.

The speed changes to 15,000,000 reference units/min (RSPD).

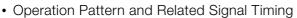
The program table for this positioning is shown below.

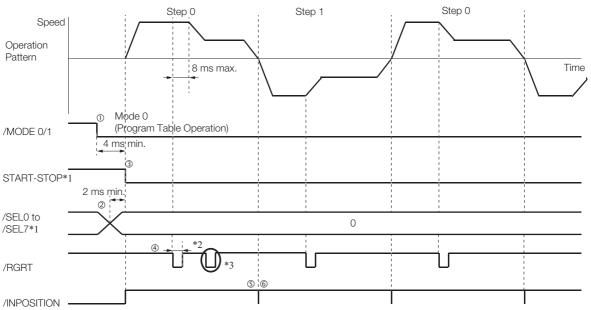
| PGM-<br>STEP | POS      | SPD   | RDST   | RSPD  | ACC    | DEC    | POUT    | EVENT | LOOP | NEXT |
|--------------|----------|-------|--------|-------|--------|--------|---------|-------|------|------|
| 0            | I+200000 | 30000 | 100000 | 15000 | 400000 | 200000 | NNNNNNN | IT0   | 1    | 1    |
| 1            | 1-200000 | 30000 | 100000 | 15000 | :      | :      | ::::::: | IT0   | 1    | 0    |

• Operating Procedure

- ① Turn ON the /MODE 0/1 signal to change to mode 0.
- ② Set the /SEL0 to /SEL7 signals to 0 to specify program step 0.
- ③ Turn ON the /START-STOP signal to start program table operation. The /INPOSITION signal turns OFF.
- The /RGRT signal turns ON to perform registration operation. The speed changes to the registration speed.
- <sup>®</sup> The /INPOSITION turns ON when positioning is completed for the registration distance.
- © When execution of program step 1 starts, the /INPOSITION signal turns OFF.

Information If the remaining distance to the target position is shorter than the registration distance (RDST) when the /RGRT signal turns ON, an E23A serial command not acknowledged response (A.AEF (Insufficient Registration Distance Alarm)) occurs, the servo is turned OFF, and program execution is stopped.





- \*1. Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.
- \*2. PnB12 = 0 (Registration is started by changing the /RGRT signal from OFF (open) to ON (closed)): 20 us min.
- PnB12 = 1 (Registration is started by changing the /RGRT signal from ON (closed) to OFF (open)): 200  $\mu$ s min.
- \*3. The /RGRT signal is ignored during registration operation.

### Pausing Registration

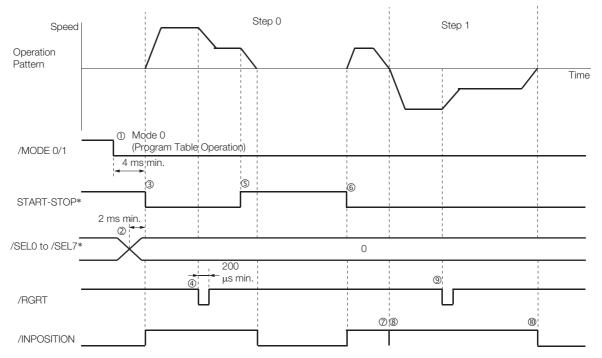
This example shows how to turn OFF the /START-STOP signal to temporarily stop registration operation and then turn ON the /START-STOP signal to restart registration operation.

The program table for this positioning is shown below.

| PGM-<br>STEP | POS      | SPD   | RDST   | RSPD  | ACC    | DEC    | POUT    | EVENT | LOOP | NEXT |
|--------------|----------|-------|--------|-------|--------|--------|---------|-------|------|------|
| 0            | I+200000 | 30000 | 100000 | 15000 | 400000 | 200000 | NNNNNNN | IT0   | 1    | 1    |
| 1            | I-200000 | 30000 | 100000 | 15000 | :      | :      | ::::::: | IT0   | 1    | END  |

Operating Procedure

- <sup>①</sup> Turn ON the /MODE 0/1 signal to change to mode 0.
- ② Set the /SEL0 to /SEL7 signals to 0 to specify program step 0.
- ③ Turn ON the /START-STOP signal to start program table operation. The /INPOSITION signal turns OFF.
- The /RGRT signal turns ON to perform registration operation. The speed changes to the registration speed.
- ⑤ Turn OFF the /START-STOP signal to stop operation.
- © Turn ON the /START-STOP signal to restart program table operation.
- The /INPOSITION turns ON when positioning is completed for the remaining registration distance.
- When execution of program step 1 starts, the /INPOSITION signal turns OFF.
- The /RGRT signal turns ON to perform registration operation. The speed changes to the registration speed.
- The /INPOSITION turns ON when positioning is completed for the registration distance.
- Operation Pattern and Related Signal Timing



\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

Operation with Digital I/O

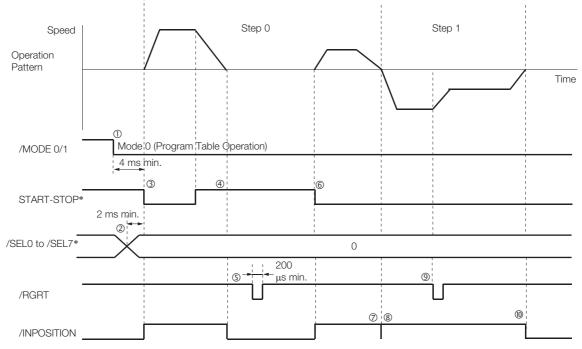
### Turning ON the /RGRT Signal While Program Table Operation Is Stopped

This example shows what happens when the /RGRT signal is turned ON while program table operation is stopped after turning OFF the /START-STOP signal. In this case, registration operation is performed when the /START-STOP signal is turned ON.

The program table for this positioning is shown below.

| PGM<br>STE | DAG      | SPD   | RDST   | RSPD  | ACC    | DEC    | POUT    | EVENT | LOOP | NEXT |
|------------|----------|-------|--------|-------|--------|--------|---------|-------|------|------|
| 0          | I+200000 | 30000 | 100000 | 15000 | 400000 | 200000 | NNNNNNN | IT0   | 1    | 1    |
| 1          | I-200000 | 30000 | 100000 | 15000 |        | :      | ::::::: | ITO   | 1    | END  |

- Operating Procedure
  - $\odot\;$  Turn ON the /MODE 0/1 signal to change to mode 0.
  - ② Set the /SEL0 to /SEL7 signals to 0 to specify program step 0.
  - ③ Turn ON the /START-STOP signal to start program table operation. The /INPOSITION signal turns OFF.
  - Turn OFF the /START-STOP signal to stop operation.
  - ⑤ The /RGRT signal turns ON to specify registration operation.
  - Turn ON the /START-STOP signal to restart program table operation. In this case, registration operation is performed.
  - ⑦ The /INPOSITION turns ON when positioning is completed for the registration distance.
  - ® When execution of program step 1 starts, the /INPOSITION signal turns OFF.
  - The /RGRT signal turns ON to perform registration operation. The speed changes to the registration speed.
  - The /INPOSITION turns ON when positioning is completed for the registration distance.
- Operation Pattern and Related Signal Timing



\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

### Using Consecutive Stops



You can use consecutive stops to set the target position to infinite (+/-INFINITE) and then perform positioning from constant-speed operation to a specified absolute position within the rotational coordinates without stopping.

During positioning, the positioning speed (SPD) that is set for the previous program step is continued until the point where deceleration is started to position to the target position within the rotational coordinates without rotating in the reverse direction.

Note: Conditions for Using a Consecutive Stop

All of the following conditions must be met to use a consecutive stop.

If execution is attempted when any of the conditions is not met, an E53E (Movement Reference Duplication) or E63E (Consecutive Stop Execution Failure) error will occur.

Conditions:

- Rotational coordinates must be used (PnB20 = 1, 2, or 3).
  The target position (POS) in the previous program step must be infinite (±INFINITE).
- The target positions (POS) in the previous two program steps must not both be set to infinite (±INFINITE). • Registration cannot be used in the previous program step.

A consecutive stop is used with a program step that is set for an infinite length and constantspeed operation.

In the following example, step 0 operates the motor for 2 seconds at a speed of 1,080,000,000 reference units/min and then execution moves to step 1. If the reference unit is set to 0.001 deg, then the speed would be 1,080 deg/min.

Step 1 continues operation at the positioning speed (SPD) specified for step 0 and performs positioning to a target position of 45,000 reference units (45 deg). The rotation direction is not reversed.

The program table for this positioning is shown below.

| PGMSTEP | POS       | SPD     | RDST | RSPD | ACC  | DEC  | POUT    | EVENT | LOOP | NEXT |
|---------|-----------|---------|------|------|------|------|---------|-------|------|------|
| 0       | +INFINITE | 1080000 | -    | 1000 | 1080 | 1080 | NNNNNNA | T2000 | 1    | 1    |
| 1       | S+45000   | 1000    | -    | 1000 | 1080 | 1080 | NNNNNAN | IT0   | 1    | END  |

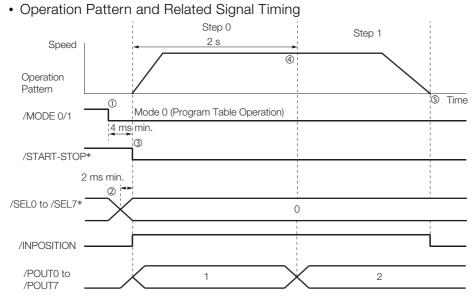
Note: 1. If a consecutive stop is specified for the target position (POS), the setting of the deceleration rate (DEC) in the previous program step is disabled.

2. If INFINITE is specified for the target position (POS), always set the number of loops setting (LOOP) to 1.

3. If a consecutive stop is specified for the target position (POS), always set the number of loops setting (LOOP) to 1.

4. If a consecutive stop is specified for the target position (POS), the settings of the positioning speed (SPD) and acceleration rate (ACC) are ignored. The values that were specified in the previous program step are used.

- Operating Procedure
  - <sup>①</sup> Turn ON the /MODE 0/1 signal to change to mode 0.
  - ② Set the /SEL0 to /SEL7 signals to 0 to specify program step 0.
  - ③ Turn ON the /START-STOP signal to start program table operation. The /INPOSITION signal turns OFF and the /POUT0 signal turns ON.
  - ④ After 2 seconds elapse, step 1 is executed.
  - The /POUT0 signal turns OFF and the /POUT1 signal turns ON.
  - S When positioning is completed to the target position (45 deg = 45,000 reference units), the /INPOSITION signal turns ON.



\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

## **Resetting Program Table Operation**

In this example, program operation is reset during repeated operation of program steps 0 and 1 and then the program step is specified and operation is restarted from the canceled state.

Note: "Canceled" is the state in which the mode is mode 0, execution is not in a stopped state, and no program step has been executed.

Step 0 performs relative positioning for 100,000 reference units at a speed of 15,000,000 references units/min. The acceleration rate is 400,000,000 reference units/min/ms and the deceleration rate is 200,000,000 reference units/min/ms.

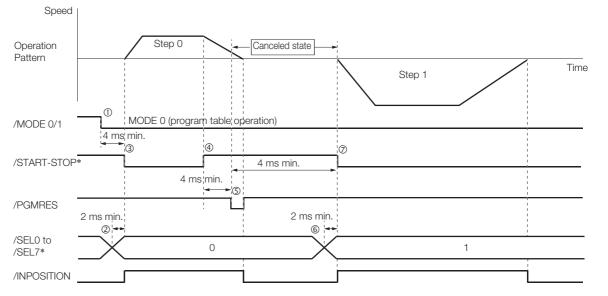
Step 1 performs relative positioning for 100,000 reference units at a speed of 30,000,000 references units/min. The acceleration rate is 400,000,000 reference units/min/ms and the deceleration rate is 200,000,000 reference units/min/ms.

| PGM-<br>STEP | POS      | SPD   | RDST | RSPD | ACC    | DEC    | POUT          | EVENT  | LOOP | NEXT |
|--------------|----------|-------|------|------|--------|--------|---------------|--------|------|------|
| 0            | l+100000 | 15000 | -    | 1000 | 400000 | 200000 | NNNNN-<br>NNN | IT1000 | 1    | 1    |
| 1            | I-100000 | 30000 | _    | 1000 | 400000 | 200000 | NNNNN-<br>NNN | IT1000 | 1    | 0    |

The program table for this positioning is shown below.

#### Operating Procedure

- ① Turn ON the /MODE 0/1 signal to change to mode 0.
- ② Set the /SEL0 to /SEL7 signals to 0 to specify program step 0.
- ③ Turn ON the /START-STOP signal to start program table operation.
- Turn OFF the /START-STOP signal to stop program table operation.
- ⑤ Turn ON the /PGMRES signal to cancel program table operation.
- © Set the /SEL0 to /SEL7 signals to 1 (i.e., turn ON /SEL0) to specify program step 1.
- ⑦ Turn ON the /START-STOP signal to start program table operation.
- When positioning is completed to the target position, the /INPOSITION signal turns ON.
- Operation Pattern and Related Signal Timing



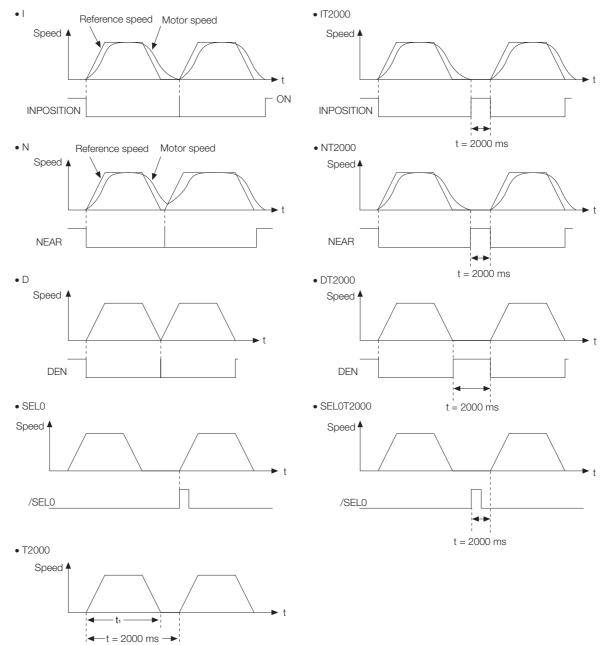
\* Do not change /SEL0 to /SEL7 for 4 ms after turning ON the /START-STOP signal.

Operation with Digital I/O

13.3.9 EVENT Examples

## 13.3.9 EVENT Examples

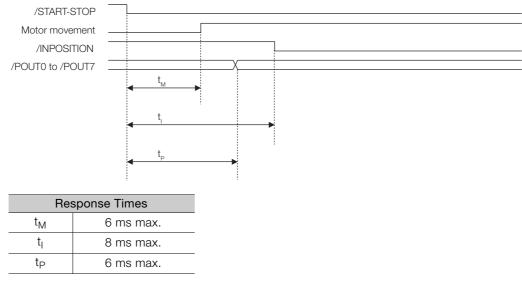
This section provides examples of the settings and operations for the EVENT end conditions for program steps.



Note: If t <  $t_1$ , an error (E53E) will occur and program table operation will be stopped.

## 13.3.10 Output Response Times after /START-STOP Turns ON

The response times for starting the Servomotor, the /INPOSITION signal, and the /POUT0 to / POUT7 signals when the /START-STOP signal is turned ON to start program table operation are shown below.



Note: In the following cases, the response times can be as long as 16 ms max.
When program table operation is stopped (including when it is stopped for an error)
When the motor stops due to overtravel

13.4.1 Input Signals Related to Jog Operation

# **13.4 Jog Speed Table Operation**

You can perform jog operation from the SigmaWin+, or you can use the /JOGP and /JOGN input signals to perform jog operation. Jog operation is performed at the specified jog speed.

## 13.4.1 Input Signals Related to Jog Operation

The following signals are used for jog operation: /MODE 0/1, /JOGP, /JOGN, and /JOG0 to / JOG3.

Turn OFF the/MODE 0/1 signal to change to mode 1. Use the /JOGP signal as the command for forward jog operation and the /JOGN signal as the command for reverse jog operation.

| Input Signal                                                                                                                                                                                 | Description                                                                                                                                                                                                                                                             | Reference |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--|--|--|--|
| /MODE 0/1                                                                                                                                                                                    | ON: Mode 0 (program table operation)<br>OFF: Mode 1 (jog speed table operation or homing)                                                                                                                                                                               | page 6-4  |  |  |  |  |
| /JOGP                                                                                                                                                                                        | Turn this signal ON to jog forward at the jog speed registered in the jog speed table.<br>The motor is accelerated according to PnB29 (Acceleration Rate).<br>When this signal turns OFF, the motor is decelerated to a stop according to PnB2B (Deceleration Rate).    | page 6-6  |  |  |  |  |
| /JOGN                                                                                                                                                                                        | Turn this signal ON to jog in reverse at the jog speed registered in the jog speed table.<br>The motor is accelerated according to PnB29 (Acceleration Rate).<br>When this signal turns OFF, the motor is decelerated to a stop according to PnB2B (Deceleration Rate). | page 6-6  |  |  |  |  |
| /JOG0 to /JOG3                                                                                                                                                                               | Use these signals to specify a jog speed that is registered in the jog speed table.                                                                                                                                                                                     | page 6-6  |  |  |  |  |
| Turn ON only one of the following signals at the same time: /HOME, /JOGP, and /JOGN. Other-<br>wise, the command will be disabled and no operation will be performed. To jog the motor, turn |                                                                                                                                                                                                                                                                         |           |  |  |  |  |

ON either the /JOGP or /JOGN signal.

## 13.4.2 Jog Speeds

Note

You set the jog speeds in the Jog Speed Table Editing Dialog Box on the SigmaWin+. You can register up to 16 jog speeds in JSPD0 to JSPD15 in the jog speed table.

The specifications for the jog speeds are given in the following table.

| Jog Speed | Setting Range    | 0                         | Default Setting | When Enabled |
|-----------|------------------|---------------------------|-----------------|--------------|
| obg opeed | 1 to 99,999,999* | 1,000 reference units/min | 1,000           | Immediately  |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be 1 to 199,999,999. Refer to the following section for details.

I 12.4 Speed/Position Expansion Function Setting on page 12-8

Note: Edit the jog speed table only when the Servomotor is stopped.

13.4.3 Jog Speed Table and Speed Selection Signals

## 13.4.3 Jog Speed Table and Speed Selection Signals

You can register up to 16 jog speeds in the jog speed table.

The /JOG0 to /JOG3 (Jog Speed Selection) signals are used to specify the jog speeds that are registered in the jog speed table.

| J    | og Speed Table                            | L     | log Speed Se | lection Signal | S     |
|------|-------------------------------------------|-------|--------------|----------------|-------|
| JSPD | Jog Speed*<br>(1,000 reference units/min) | /JOG3 | /JOG2        | /JOG1          | /JOG0 |
| 0    | ±nnnnnnn                                  | 0     | 0            | 0              | 0     |
| 1    | ±nnnnnnn                                  | 0     | 0            | 0              | 1     |
| 2    | ±nnnnnnn                                  | 0     | 0            | 1              | 0     |
| 3    | ±nnnnnnn                                  | 0     | 0            | 1              | 1     |
| 4    | ±nnnnnnn                                  | 0     | 1            | 0              | 0     |
| 5    | ±nnnnnnn                                  | 0     | 1            | 0              | 1     |
| 6    | ±nnnnnnn                                  | 0     | 1            | 1              | 0     |
| 7    | ±nnnnnnn                                  | 0     | 1            | 1              | 1     |
| 8    | ±nnnnnnn                                  | 1     | 0            | 0              | 0     |
| 9    | ±nnnnnnn                                  | 1     | 0            | 0              | 1     |
| 10   | ±nnnnnnn                                  | 1     | 0            | 1              | 0     |
| 11   | ±nnnnnnn                                  | 1     | 0            | 1              | 1     |
| 12   | ±nnnnnnn                                  | 1     | 1            | 0              | 0     |
| 13   | ±nnnnnnn                                  | 1     | 1            | 0              | 1     |
| 14   | ±nnnnnnn                                  | 1     | 1            | 1              | 0     |
| 15   | ±nnnnnnn                                  | 1     | 1            | 1              | 1     |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be ±nnnnnnnn. Refer to the following section for details.

12.4 Speed/Position Expansion Function Setting on page 12-8Note: 1: Signal is ON (active), 0: Signal is OFF (inactive).

# 13.4.4 SigmaWin+ Procedures

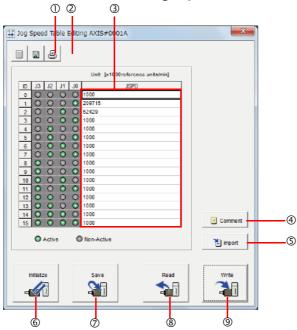
You use the SigmaWin+ to edit, write, and save the jog speed table. Use the following flow.

| Editing the Jog Speed Table                   | S Editing the Jog Speed Table on page 13-46 |
|-----------------------------------------------|---------------------------------------------|
| Writing the Jog Speed Table                   | B Writing the Jog Speed Table on page 13-47 |
| Saving the Jog Speed Table                    | Saving the Jog Speed Table on page 13-48    |
| Checking the Operation of the Jog Speed Table |                                             |

## Editing the Jog Speed Table

• Displaying the Jog Speed Table Editing Dialog Box Select *Edit Jog Speed Table* in the Menu Dialog Box of the SigmaWin+.

### Details on the Jog Speed Table Editing Dialog Box



| No. | Item              | Description                                                                   |
|-----|-------------------|-------------------------------------------------------------------------------|
| 1   | Save Button       | Saves the currently displayed settings to a computer file.                    |
| 2   | Print Button      | Prints the currently displayed settings.                                      |
| 3   | Setting Area      | Set the jog speeds.<br>Select the cell and enter the value directly.          |
| 4   | Comment Button    | Lets you add a comment.                                                       |
| 5   | Import Button     | Imports a jog speed table from a file saved on the computer to the SigmaWin+. |
| 6   | Initialize Button | Initializes the flash memory in the SERVOPACK.                                |
| Ø   | Save Button       | Saves the settings in the SERVOPACK to flash memory.                          |
| 8   | Read Button       | Reads the settings in the SERVOPACK to the SigmaWin+.                         |
| 9   | Write Button      | Writes the currently displayed settings to the SERVOPACK.                     |

### Writing the Jog Speed Table

You can write the edited jog speed table to SERVOPACK RAM to operate the SERVOPACK according to the program.

 Make sure that the system is in SERVO OFF state when you write the jog speed table.
 The jog speed table that is written will be deleted when the power supply to the SERVOPACK is turned OFF. Before you turn OFF the power supply to the SERVOPACK, save the jog speed table from RAM to flash memory. Refer to the following section for the operating procedure.
 Saving the Jog Speed Table on page 13-48

1. Click the Write Button on the Jog Speed Table Editing Dialog Box.

| 😩 Jog  | Spee       | d Ta    | ble B   | Editir  | ng AXIS#0001A                    | ×        |
|--------|------------|---------|---------|---------|----------------------------------|----------|
|        |            | g       |         |         |                                  |          |
|        |            |         |         |         | Unit: [x1000reference units/min] |          |
| D      | <b>J</b> 3 | J2      | J1      | JO      | JSPD                             |          |
| 0      | 0          | 0       | D       | 0       | 1000                             |          |
| 1      | 0          | 0       | 0       | 0       | 209715                           |          |
| 2      | 0          | $\odot$ | $\odot$ | $\odot$ | 52429                            |          |
| 3      | 0          | $\odot$ | 0       |         | 1000                             |          |
| 4      | $\odot$    | ۲       |         | $\odot$ | 1000                             |          |
| 5      | 0          | ٥       | 0       |         | 1000                             |          |
| 6      | 0          | ٢       | ٥       | 0       | 1000                             |          |
| 7      | 0          | ۲       | ٥       | ~       | 1000                             |          |
| 8      | •          | 0       | D       | 0       | 1000                             |          |
| 9      | 0          | 0       | 0       | 0       | 1000                             |          |
| 10     | 0          | 0       | 0       | ~       | 1000                             |          |
| 11     | 0          | 0       | 0       |         | 1000                             |          |
| 12     | 0          |         | 0       |         | 1000                             |          |
| 13     | 0          | 0       | 0       | 0       | 1000                             |          |
| 14     | 0          | ٥       | 0       | 0       | 1000                             | Comment  |
| 15     | 0          | ٢       | 0       | 0       | 1000                             | Comment  |
|        | 0          | Activ   | •       | C       | Non-Active                       | 🛅 Import |
| ।<br>व | nitieliz   | e       |         |         | Save Read                        | Write    |

The Write Dialog Box will be displayed.

2. Click the OK Button.



The jog speed table edited on the SigmaWin+ will be written to the SERVOPACK and the edited cells will change to white.

| Dog Speed Table Editing AXIS#0001A | ×        |
|------------------------------------|----------|
|                                    |          |
|                                    |          |
| Unit: (x1000reference units/min)   |          |
| ID J3 J2 J1 J0 JSPD                |          |
| 0 0 0 0 0 1000                     |          |
| 1 0 0 0 209715                     |          |
| 2 0 0 9 0 52429                    |          |
| 3 💿 💿 💿 💿 1000                     |          |
| 4 0 0 0 0 1000                     |          |
| 5 0 0 0 1000                       |          |
| 6 0 0 0 1000                       |          |
| 7 🖸 🕘 💿 💿 1000                     |          |
| 8 8 8 8 1000                       |          |
| 9 0 0 0 1000                       |          |
| 10 0 0 0 1000                      |          |
| 11 O O O 1000                      |          |
| 12 0 0 0 0 1000                    |          |
| 13 0 0 0 0 1000                    |          |
| 14 0 0 0 0 1000                    | Comment  |
| 15 💿 💿 💿 1000                      | Comment  |
| Active Non-Active                  | 🐮 Import |
|                                    |          |
|                                    | [        |
| Initialize Save Read               | Write    |
|                                    |          |
|                                    | -        |
|                                    | <u></u>  |

This concludes the writing procedure.

### Saving the Jog Speed Table

#### • Saving the Jog Speed Table to Flash Memory in the SERVOPACK

To prevent the jog speed table from being deleted when the power supply to the SERVOPACK is turned OFF, you must save it to flash memory in the SERVOPACK. The jog speed table that is saved in the flash memory is automatically loaded each time the power supply is turned ON.

There are the following three ways to save the jog speed table to flash memory in the SERVO-PACK.

- Save it from the Jog Speed Table Editing Dialog Box.
- Save it with the JSPDSTORE serial command.
- Save it with FnB05 (Edit/Save Jog Speed Table) on a Digital Operator.

Use the following procedure to save the jog speed table from the Jog Speed Editing Dialog Box.

#### 1. Click the Save Button on the Jog Speed Table Editing Dialog Box.

| Unit:         [x1000reference unitshin]           D         33         J2         J1         J0         JSPD           0         0         0         0         2006           1         0         0         200715           2         0         0         52429           3         0         0         1000           4         0         1000           5         0         0         1000           6         0         0         1000           7         0         0         1000           8         0         0         1000           10         0         0         1000           11         0         0         1000 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unit:         [x1000reference units/min]           0         0         0         1000           1         0         0         239715         2           2         0         0         229715         2           3         0         0         1000         4           4         0         0         1000         6           5         0         0         1000         6           7         0         0         1000         7           9         0         0         1000         1000           10         0         0         1000         1000                                                                         |
| D     J3     J2     J1     J0     JSPD       0     O     O     O     1000       1     O     O     O     209715       2     O     O     O     219715       3     O     O     O     1000       4     O     O     O     1000       5     O     O     O     1000       6     O     O     O     1000       7     O     O     O     1000       9     O     O     O     1000       10     O     O     O     1000                                                                                                                                                                                                                        |
| 0       0       0       1000         1       0       0       209715         2       0       0       652429         3       0       0       1000         4       0       0       1000         5       0       0       1000         6       0       0       1000         7       0       0       1000         8       0       0       1000         9       0       0       0         10       0       0       1000                                                                                                                                                                                                                 |
| 1       0       0       299715         2       0       0       62429         3       0       0       1000         4       0       0       1000         5       0       0       1000         6       0       0       1000         7       0       0       1000         8       0       0       1000         9       0       0       0         10       0       0       1000                                                                                                                                                                                                                                                       |
| 2       0       0       5 2429         3       0       0       1000         4       0       0       1000         5       0       0       0         7       0       0       1000         8       0       0       1000         9       0       0       0         100       0       1000         10       0       0       1000                                                                                                                                                                                                                                                                                                      |
| 3       0       0       0100         4       0       0       1000         5       0       0       1000         6       0       0       1000         7       0       0       1000         8       0       0       1000         9       0       0       0         10       0       0       1000                                                                                                                                                                                                                                                                                                                                    |
| 4       0       0       1000         5       0       0       1000         7       0       0       1000         8       0       0       1000         9       0       0       0       1000         10       0       0       1000         11       0       0       1000                                                                                                                                                                                                                                                                                                                                                             |
| 5       0       0       1000         6       0       0       1000         7       0       0       1000         8       0       0       1000         9       0       0       1000         10       0       0       1000         11       0       0       1000                                                                                                                                                                                                                                                                                                                                                                     |
| 6       O       O       O       1000         7       O       O       O       1000         8       O       O       1000         9       O       O       0       1000         10       O       O       0       1000         11       O       O       0       1000                                                                                                                                                                                                                                                                                                                                                                  |
| 7       0       0       1000         8       0       0       1000         9       0       0       0         10       0       0       0         11       0       0       1000                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 8         0         0         1000           9         0         0         1000           10         0         0         0         1000           11         0         0         0         1000                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 9 ○ ○ ○ ○ 1000<br>10 ○ ○ ○ ○ ○ 1000<br>11 ○ ○ ○ ○ ○ 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 11 💿 🖸 💿 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 12 0 0 0 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 13 O O O 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 14 0 0 0 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 15 O O 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Active Non-Active                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Initialize Save Read Write                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

The Save Table Dialog Box will be displayed.

2. Click the OK Button.

| Sa | ve x                                                              |  |  |  |  |  |  |  |
|----|-------------------------------------------------------------------|--|--|--|--|--|--|--|
|    |                                                                   |  |  |  |  |  |  |  |
|    | Saves the table data into flash memory.<br>Continue this process? |  |  |  |  |  |  |  |
|    | Cancel                                                            |  |  |  |  |  |  |  |

This concludes the saving procedure.

### ◆ Saving the Jog Speed Table to a Computer File

You can save the jog speed table to a file on the computer. Use computer files to back up jog speed tables.

1. Click the Save Button.

| Jog Speed Table Editing AXIS#0001A | ×          |
|------------------------------------|------------|
| 8                                  |            |
| Unit: [x1000rafaranaa              | unitə/min] |
| ID J3 J2 J1 J0 JSPD                |            |
| 0 0 0 0 1000                       |            |
| 1 0 0 0 0 209715                   |            |
| 2 0 0 0 52429                      |            |
| 3 0 0 0 0 1000                     |            |
| 4 0 0 0 0 1000                     |            |
| 5 0 0 0 0 1000                     |            |
| 6 0 0 0 1000<br>7 0 0 0 0 1000     |            |
| 7 O O O 1000<br>8 O O O 1000       |            |
| 9 0 0 0 0 1000                     |            |
|                                    |            |
|                                    |            |
| 12 • • • • 1000                    |            |
| 13 🔘 🔘 🕒 🔘 1000                    |            |
| 14 🔘 🔘 🔘 🔘 1000                    |            |
| 15 💿 💿 💿 💿 1000                    | Comment    |
| Active In Non-Active               | 造 import   |
| Initisize Save                     | Read Write |

The Open Dialog Box will be displayed.

2. Specify the save location and file name.

You can set any file name. However, you cannot change the file name extension.

Information You can also set a comment.

| Save As  |                                                         |                                                                      |       |         | ? ×                    |
|----------|---------------------------------------------------------|----------------------------------------------------------------------|-------|---------|------------------------|
| Save in: | My Document                                             | \$                                                                   | • + E | ) 💣 🎟 - |                        |
|          | File pame:<br>Save as type:<br>Product info<br>Comment: | SO140507050045<br>Program table file(*.pgt)<br>SG075=****E0A/SGDV=00 | AGGA  | × [     | <u>S</u> ave<br>Cancel |

13.4.5 Jog Speed Table Operation Example

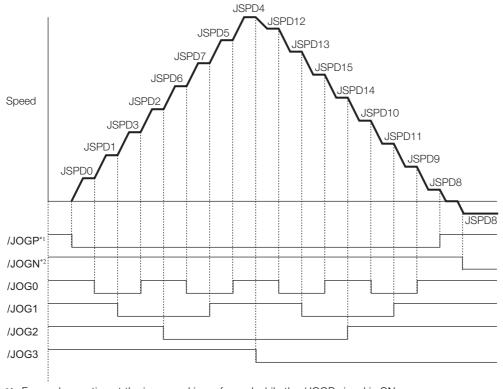
Information You can use the Import Button to load the jog speed table saved in a file to the SERVO-PACK.

|    |         |         |         |    | Unit: [x1000reference units/min] |          |
|----|---------|---------|---------|----|----------------------------------|----------|
| ID | J3      | J2      | J1      | JO | JSPD                             |          |
| 0  | 0       | 0       | D       |    | 1000                             |          |
| 1  | 0       | Ō       | Ô       | 0  | 209715                           |          |
| 2  | 0       | Ō       | Ō       | Õ  | 52429                            |          |
| 3  | 0       | 0       | 0       | 0  | 1000                             |          |
| 4  | 0       | ٢       |         |    | 1000                             |          |
| 5  | 0       | 0       | 0       | 0  | 1000                             |          |
| 6  | 0       | 0       | 0       |    | 1000                             |          |
| 7  | 0       | $\odot$ | 0       | 0  | 1000                             |          |
| 8  | 0       | 0       | Ð       | 0  | 1000                             |          |
| 9  | 0       | 0       | 0       |    | 1000                             |          |
| 10 | 0       | 0       | 0       | 0  | 1000                             |          |
| 11 | 0       | $\odot$ | $\odot$ | 0  | 1000                             |          |
| 12 | $\circ$ | $\odot$ | O       | 0  | 1000                             |          |
| 13 | 0       | 0       |         | 0  | 1000                             |          |
| 14 | $\circ$ | 0       | 0       | 0  | 1000                             | -        |
| 15 | 0       | $\odot$ | 0       | 0  | 1000                             | Comment  |
|    | 0,      | Activ   | •       | C  | Non-Active                       | 🗄 Import |

This concludes the saving procedure.

## 13.4.5 Jog Speed Table Operation Example

This example shows how to perform operation by using the /JOG0 to /JOG3 (Jog Speed Selection) signals to specify the jog speeds that are registered in the jog speed table.



\*1. Forward operation at the jog speed is performed while the /JOGP signal is ON.\*2. Reverse operation at the jog speed is performed while the /JOGN signal is ON.

13.4.6 Timing of Signal Changes

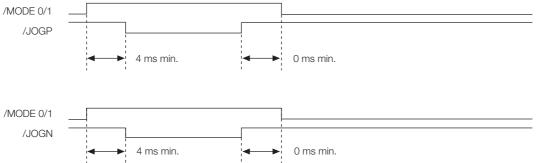
# 13.4.6 Timing of Signal Changes

The timing of the /MODE 0/1 and /JOGP signals, the /MODE 0/1 and /JOGN signals, and the /HOME, /JOGP, and /JOGN signals is shown below.

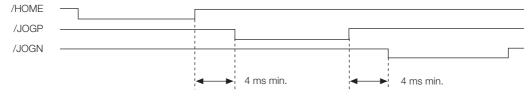
To start jog operation, turn OFF the /MODE 0/1 signal, wait for at least 4 ms, and then turn ON the

/JOGP or /JOGN signal.

To change to mode 0, turn OFF the /JOGP or /JOGN signal and then turn OFF the /MODE 0/1 signal. The timing is shown below.



If you have performed homing, turn OFF the /HOME signal, wait for at least 4 ms, and then turn ON the /JOGP or /JOGN signal. When jog operation in both directions, allow at least 4 ms between the /JOGP and /JOGN signals. The timing is shown below.



13.5.1 ZONE Table and ZONE Signals

# 13.5 ZONE Outputs

You can use ZONE signals to output a ZONE number to indicate when the current value is within a registered zone.

The ZONE signals (/Z0 to /Z4) are assigned to output signals /POUT0 to /POUT4 on CN11.

# 13.5.1 ZONE Table and ZONE Signals

You can register the desired zones in the ZONE table. The ZONE table consists of settings for the ZONE numbers (ZONE), ZONE N values (ZONE N), and ZONE P values (ZONE P). You can register up to 32 zones.

The ZONE numbers identify the registered zones.

ZONE N is the lower limit of the ZONE and ZONE P is the upper limit of the ZONE. The setting conditions for ZONE N and ZONE P are given in the following table.

| Setting Range              | Setting Unit     | Default Setting | When Enabled |
|----------------------------|------------------|-----------------|--------------|
| -99,999,999 to 99,999,999* | 1 reference unit | 0               | Immediately  |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be -1,073,741,823 to +1,073,741,823. Refer to the following section for details.

12.4 Speed/Position Expansion Function Setting on page 12-8

The ZONE signals indicate the ZONE number. If the current value is within a zone registered in the ZONE table, the corresponding ZONE number is output on the ZONE signals.

You can use the ZONE numbers as required, e.g., to trigger operations related to positioning.

|                     | ZONE Table                      |                                 |                 | Z               | ONE Signa       | ls              |                 |
|---------------------|---------------------------------|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| ZONE Number<br>(ID) | ZONE N*<br>[Reference<br>Units] | ZONE P*<br>[Reference<br>Units] | /Z4<br>(/POUT4) | /Z3<br>(/POUT3) | /Z2<br>(/POUT2) | /Z1<br>(/POUT1) | /Z0<br>(/POUT0) |
| 0                   | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 0               | 0               | 0               | 0               |
| 1                   | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 0               | 0               | 0               | 1               |
| 2                   | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 0               | 0               | 1               | 0               |
| 3                   | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 0               | 0               | 1               | 1               |
| 4                   | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 0               | 1               | 0               | 0               |
| 5                   | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 0               | 1               | 0               | 1               |
| 6                   | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 0               | 1               | 1               | 0               |
| 7                   | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 0               | 1               | 1               | 1               |
| 8                   | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 1               | 0               | 0               | 0               |
| 9                   | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 1               | 0               | 0               | 1               |
| 10                  | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 1               | 0               | 1               | 0               |
| 11                  | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 1               | 0               | 1               | 1               |
| 12                  | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 1               | 1               | 0               | 0               |
| 13                  | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 1               | 1               | 0               | 1               |
| 14                  | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 1               | 1               | 1               | 0               |
| 15                  | ±nnnnnnn                        | ±nnnnnnn                        | 0               | 1               | 1               | 1               | 1               |
| 16                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 0               | 0               | 0               | 0               |
| 17                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 0               | 0               | 0               | 1               |
| 18                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 0               | 0               | 1               | 0               |
| 19                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 0               | 0               | 1               | 1               |
| 20                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 0               | 1               | 0               | 0               |
| 21                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 0               | 1               | 0               | 1               |
| 22                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 0               | 1               | 1               | 0               |
| 23                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 0               | 1               | 1               | 1               |

Continued on next page.

13.5.1 ZONE Table and ZONE Signals

Continued from previous page.

|                     | ZONE Table                      |                                 |                 |                 | ZONE Signals    |                 |                 |  |  |
|---------------------|---------------------------------|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|--|
| ZONE Number<br>(ID) | ZONE N*<br>[Reference<br>Units] | ZONE P*<br>[Reference<br>Units] | /Z4<br>(/POUT4) | /Z3<br>(/POUT3) | /Z2<br>(/POUT2) | /Z1<br>(/POUT1) | /Z0<br>(/POUT0) |  |  |
| 24                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 1               | 0               | 0               | 0               |  |  |
| 25                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 1               | 0               | 0               | 1               |  |  |
| 26                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 1               | 0               | 1               | 0               |  |  |
| 27                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 1               | 0               | 1               | 1               |  |  |
| 28                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 1               | 1               | 0               | 0               |  |  |
| 29                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 1               | 1               | 0               | 1               |  |  |
| 30                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 1               | 1               | 1               | 0               |  |  |
| 31                  | ±nnnnnnn                        | ±nnnnnnn                        | 1               | 1               | 1               | 1               | 1               |  |  |

\* If you set PnB54 to 1 (Enable Expansion Mode), the range will be ±nnnnnnnn. Refer to the following section for details.

12.4 Speed/Position Expansion Function Setting on page 12-8

Note: 1: Signal is ON (active), 0: Signal is OFF (inactive).



Always save the ZONE table to flash memory after you edit it. Refer to the following section for the procedure.

*G* ♦ Saving the Program Table to Flash Memory in the SERVOPACK on page 13-24

If you turn OFF the power supply before you save changes to flash memory, the changes to the ZONE table will be lost.

### **ZONE Table Settings and ZONE Numbers**

The relationship between the ZONE table settings and the ZONE numbers is shown below.

• ZONE N  $\leq$  ZONE P

The ZONE signals for the corresponding ZONE number is output if the current value is between ZONE N and ZONE P, inclusive (the shaded part in the following figure).



The ZONE signals for the corresponding ZONE number is output if the current value is less than or equal to ZONE P or greater than or equal to ZONE N (the shaded parts in the following figure).



- Duplicated Settings in the ZONE Table The smaller ZONE number is output.
- ZONE N and ZONE P = 0 The ZONE number is disabled.
- When the Current Value Is Not In Any ZONE All of the ZONE signals will be OFF (0).

13.5.2 Parameters Related to ZONE Signals

# 13.5.2 Parameters Related to ZONE Signals

With the following parameter, the initial status\* of the programmable output signals (/POUT0 to /POUT7) can be set to ZONE signals.

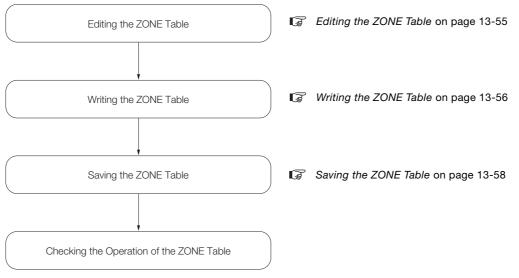
The initial status is the status that exists after the control power supply is turned ON or after resetting the SERVOPACK.

| Parameter |                               | Meaning                                                                                                            | When Enabled  | Classification |
|-----------|-------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------|----------------|
| PnB4F     | 0000h<br>(default<br>setting) | When the control power supply is turned ON or the SERVOPACK is reset, the /POUT0 to /POUT7 signals are turned OFF. | After restart | Setup          |
|           | 0001h                         | When control power is turned ON or SERVOPACK is reset, signals /POUT0 to 7 are ZONE signals.                       |               |                |

Note: You can set the ZONE signals for /POUT5 to /POUT7, but the outputs will always be OFF.

## 13.5.3 SigmaWin+ Procedures

You use the SigmaWin+ to edit, write, and save the ZONE table. Use the following flow.

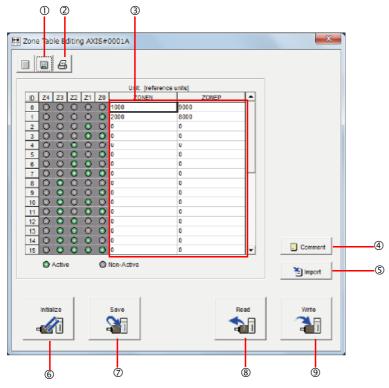


## Editing the ZONE Table

Displaying the Zone Table Editing.

Select *Zone Table Editing* in the Menu Dialog Box of the SigmaWin+.

### Details on the Zone Table Editing



| No. | Name              | Description                                                                        |
|-----|-------------------|------------------------------------------------------------------------------------|
| 1   | Save Button       | Saves the currently displayed settings to a computer file.                         |
| 2   | Print Button      | Prints the currently displayed settings.                                           |
| 3   | Setting Area      | Sets the ranges for ZONE outputs.<br>Select the cell and enter the value directly. |
| 4   | Comment Button    | Lets you add a comment.                                                            |
| 5   | Import Button     | Imports a ZONE table from a file saved on the computer to the SigmaWin+.           |
| 6   | Initialize Button | Initializes the flash memory in the SERVOPACK.                                     |
| 0   | Save Button       | Saves the settings in the SERVOPACK to flash memory.                               |
| 8   | Read Button       | Reads the settings in the SERVOPACK to the SigmaWin+.                              |
| 9   | Write Button      | Writes the currently displayed settings to the SERVOPACK.                          |

Note

## Writing the ZONE Table

You can write the edited ZONE table to SERVOPACK RAM to operate the SERVOPACK according to the program.

1. Make sure that the system is in SERVO OFF state when you write the ZONE table.

2. The ZONE table that is written will be deleted when the power supply to the SERVOPACK is turned OFF.

Before you turn OFF the power supply to the SERVOPACK, save the ZONE table from RAM to flash memory. Refer to the following section for the operating procedure.

### 1. Click the Write Button on the Zone Table Editing.

| 🔛 Zone Table Editing A | Zone Table Editing AXIS#0001A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |          |          |  |  |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------|----------|--|--|
| 8                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |          |          |  |  |
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|                        | Unit: (reference                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1     | -        |          |  |  |
| D Z4 Z3 Z2 Z1          | Z0 ZONEN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ZONEP | -        |          |  |  |
| 00000                  | 0 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 9000  |          |          |  |  |
|                        | 2000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 8000  |          |          |  |  |
| 30000                  | 00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0     |          |          |  |  |
| 300000                 | Č.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | v     |          |          |  |  |
| 4 0 0 0 0<br>5 0 0 0 0 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0     |          |          |  |  |
| 6 8 8 9 9 9            | Image: | 0     |          |          |  |  |
| 7 0 0 0 0              | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0     |          |          |  |  |
| 80000                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0     |          |          |  |  |
| 90000                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0     |          |          |  |  |
| 10 0 0 0 0             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0     |          |          |  |  |
| 11 0 0 0 0             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0     |          |          |  |  |
| 12 🖸 🖸 🙆 🙆             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0     |          |          |  |  |
| 13 🖸 🖸 🙆 🚇             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0     |          |          |  |  |
| 14 0 0 0 0             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0     |          | Comment  |  |  |
| 15 🖸 🖸 🗿 🔘             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0     | <b>T</b> |          |  |  |
| Active                 | Non-Active                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |          |          |  |  |
|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |          | 🔁 import |  |  |
|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |          |          |  |  |
|                        | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |       | -        |          |  |  |
| Initialize             | Save                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | R     | ead      | Wrtte    |  |  |
| 199                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |          | <b>2</b> |  |  |
|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | व     |          | -        |  |  |
|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |          |          |  |  |
|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |          |          |  |  |

The Write Dialog Box will be displayed.

2. Click the OK Button.

| - | Write                                                                                                                                                                                                                                                                |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                                                                                                                                                                                                                                                                      |
|   | Writes the table data being edited into the Servopack.<br>When the power is turned OFF after this has been carried out,<br>the data is erseed.<br>When saving is necessary, save to a file or implement this function.<br>Thereafter, implement saving of the table. |
|   | OK Cancel                                                                                                                                                                                                                                                            |

The ZONE table edited on the SigmaWin+ will be written to the SERVOPACK and the edited cells will change to white.

| III Zone Table Editing AXIS#0001A |            |  |  |  |  |
|-----------------------------------|------------|--|--|--|--|
|                                   |            |  |  |  |  |
|                                   |            |  |  |  |  |
| Unit: [reference ur               | its]       |  |  |  |  |
| D Z4 Z3 Z2 Z1 Z0 ZONEN            | ZONEP      |  |  |  |  |
|                                   | 9000       |  |  |  |  |
|                                   | 3000       |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   | 1          |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   | 1          |  |  |  |  |
|                                   | 0          |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   | Comment    |  |  |  |  |
| 13 0 0 0 0 0                      |            |  |  |  |  |
| Active Non-Active                 | 1 import   |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   |            |  |  |  |  |
| initialize Save                   | Read Write |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   |            |  |  |  |  |
|                                   |            |  |  |  |  |

This concludes the writing procedure.

### Saving the ZONE Table

### Saving the ZONE Table to Flash Memory in the SERVOPACK

To prevent the ZONE table from being deleted when the power supply to the SERVOPACK is turned OFF, you must save it to flash memory in the SERVOPACK. The ZONE table that is saved in the flash memory is automatically loaded each time the power supply is turned ON.

There are the following three ways to save the ZONE table to flash memory in the SERVO-PACK.

- Save it on the Zone Table Editing.
- Save it with the ZONESTORE serial command.
- Save it with FnB04 (Edit/Save ZONE Table) on a Digital Operator.

Use the following procedure to save the ZONE table from the Zone Table Editing.

### 1. Click the Save Button on the Zone Table Editing.

| 🖽 Zoni | e Tab   | le E  | ditin | g AX       | IS# | 0001A            |          |      |    | ×        |
|--------|---------|-------|-------|------------|-----|------------------|----------|------|----|----------|
|        |         | Ø     |       |            |     |                  |          |      |    |          |
|        | -       |       |       |            |     |                  |          |      |    | _        |
|        |         |       |       |            |     | Unit: (reference | e units] |      |    |          |
| D      |         |       |       | <b>Z</b> 1 |     | ZONEN            |          | ONEP |    |          |
| 0      |         | 0     | 0     | 0          | D   |                  | 9000     |      |    |          |
| 1      |         | 0     | 0     | $\circ$    |     | 2000             | 8000     |      |    |          |
| 2      | D       | 0     | 0     |            | D   | 0                | 0        |      |    |          |
| 3      | 0       | 0     | 0     | 0          | ٥   | 0                | 0        |      |    |          |
| 4      |         | 0     | 0     | 0          | 0   | U                | U        |      |    |          |
| 5      |         | 0     | 0     | 0          |     | 0                | 0        |      |    |          |
| 6      |         | 0     |       |            |     | 0                | 0        |      |    |          |
| 7      | õ       |       |       | 0          | _   | 0                | 0        |      |    |          |
| 8      |         | 0     |       | 0          |     | 0                | 0        |      | -  |          |
| 9      |         | 0     |       | 0          |     | 0                | 0        |      |    |          |
| 10     | 8       | 0     | 8     | 0          | ~   | 0                | 0        |      |    |          |
| 11     | ď       | ŏ     | ŏ     | ð          | ŏ   | 0                | 0        |      |    |          |
|        | ŏ       | ŏ     | ŏ     | ŏ          |     | 0                | 0        |      |    |          |
| 13     | ŏ       | ŏ     | ŏ     | ŏ          | ŏ   | 0                | 0        |      |    |          |
| 14     |         | ŏ     | ŏ     | ŏ          | ŏ   | 0                | 0        |      | -  | Comment  |
|        | 0/      | Activ | 0     |            | 0   | Non-Active       |          |      |    |          |
|        |         |       |       |            |     |                  |          |      |    | 🛅 Import |
|        |         |       |       |            |     |                  |          |      |    |          |
|        |         |       | -     |            | - Г | 1                |          |      |    | - I      |
|        | Initial | ze    |       |            |     | Save             |          | Re   | ad | Write    |
|        |         |       |       |            |     |                  |          | -    |    |          |
|        | -4      | 11    |       |            |     |                  |          |      |    |          |
|        |         | _     |       |            |     |                  |          |      |    |          |
|        |         |       |       |            |     |                  |          |      |    |          |

The Save Table Dialog Box will be displayed.

2. Click the OK Button.

| 5 | 5ave X                                                            |
|---|-------------------------------------------------------------------|
|   |                                                                   |
|   | Saves the table data into flash memory.<br>Continue this process? |
|   | Cancel                                                            |

This concludes the saving procedure.

◆ Saving the ZONE Table to a Computer File

You can save the ZONE table to a file on the computer. Use computer files to back up ZONE tables.

1. Click the Save Button.

| 🖽 Zo | one | Tab    | le E  | ditin      | g AX    | IS# | 0001A             |        |              | ×          |
|------|-----|--------|-------|------------|---------|-----|-------------------|--------|--------------|------------|
|      |     |        | Ø     |            |         |     |                   |        |              |            |
|      |     | _      |       |            |         |     |                   |        |              |            |
|      |     |        | _     |            |         |     | Unit: (reference) | units] | _            |            |
|      | D   |        |       | <b>Z</b> 2 |         | Z0  | ZONEN             | ZONEP  | 1 <u>-</u> 1 |            |
|      | 0   | 0      | 0     | 0          | 0       | _   | 1                 | 9000   |              |            |
|      | 1   | 0      | 0     | 0          | 0       |     | 2000              | 8000   |              |            |
|      | 2   | 0      | 0     | 0          | 0       |     | 0                 | 0      |              |            |
|      | 3   |        | 00    | 0          | 0       | 0   | 0                 | 0      |              |            |
|      | 4   | ő      | ŏ     | ŏ          | 00      | ŏ   | 0                 | 0      |              |            |
|      | 6   | ŏ      | ŏ     | ŏ          | ŏ       |     | 0                 | 0      |              |            |
|      | 7   | ŏ      | ŏ     | ŏ          | ŏ       |     | 0                 | 0      |              |            |
|      | 8   | ŏ      | ŏ     | ŏ          | ŏ       |     | 0                 | 0      |              |            |
|      | š   | ŏ      | ŏ     | ŏ          | ŏ       |     | 0                 | 0      |              |            |
|      | 10  |        | ŏ     | ŏ          | ŏ       |     | 0                 | 0      |              |            |
|      | 11  | õ      | ŏ     | ŏ          | ŏ       |     | 0                 | 0      |              |            |
|      | 12  | õ      | ŏ     | ŏ          | õ       |     | 0                 | 0      |              |            |
|      | 13  | D      | 0     | 0          | $\odot$ |     | 0                 | 0      |              |            |
|      | 14  | D      | 0     | 0          | 0       | Ð   | 0                 | 0      |              |            |
|      | 15  | D      | 0     | 0          | ٢       | 0   | 0                 | 0      | -            | Comment    |
|      |     | 0      | Activ |            |         | ~   | Non-Active        |        |              |            |
|      |     |        | - CUV |            |         | 9   | NUIL-AUDYO        |        |              | 1 import   |
|      |     |        |       |            |         |     |                   |        |              |            |
|      |     |        |       |            |         |     |                   |        |              |            |
|      |     |        |       |            |         |     |                   |        |              |            |
|      |     | initia | IZ8   |            |         |     | Save              | R      | ead          | Write      |
|      |     | _      | Я     |            |         |     |                   |        |              | - <b>A</b> |
|      |     | ~0     |       |            |         |     |                   | 4      | 1            | -          |
| -    |     | _      | _     |            | _       | _   |                   |        |              |            |
|      |     |        |       |            |         |     |                   |        |              |            |

The Open Dialog Box will be displayed.

**2.** Specify the save location and file name.

You can set any file name. However, you cannot change the file name extension.

Information You can also set a comment.

| Save As                                                          |                          |                           |                  |       | ? ×    |
|------------------------------------------------------------------|--------------------------|---------------------------|------------------|-------|--------|
| Savejn:                                                          | Hy Document              | 5                         | • <del>•</del> • | - 📸 🖬 |        |
| My Recent<br>Documents<br>Desktop<br>My Documents<br>My Computer | File pame:               | 20140907090045            |                  | -     | Save   |
| Places                                                           | Save as <u>t</u> ype:    | Program table file(*.pgt) |                  |       | Cancel |
|                                                                  | Product info<br>Comment: | SGD7S-****EDA/SGDV-OC     | A03A             |       |        |

| Information | You can use the <b>Import</b> Button to load the program table saved in a file to the SERVO-<br>PACK. |
|-------------|-------------------------------------------------------------------------------------------------------|
|-------------|-------------------------------------------------------------------------------------------------------|

| 0       0       0       0       1       9000         1       0       0       0       2000       6000         2       0       0       0       0       0         3       0       0       0       0       0         4       0       0       0       0       0         5       0       0       0       0       0         6       0       0       0       0       0         7       0       0       0       0       0         8       0       0       0       0       0         10       0       0       0       0       0         11       0       0       0       0       0         15       0       0       0       0       0         15       0       0       0       0       0         15       0       0       0       0       0                                                                                                                                                                                                                                                                                                                                                                      | D Z4 | 73    | 72 | 71      | Z0 | Unit: (referen<br>ZONEN | ce units]<br>ZONEP | - |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|----|---------|----|-------------------------|--------------------|---|----------|
| 1       0       0       0       0       0       0       0         2       0       0       0       0       0       0       0       0         3       0       0       0       0       0       0       0       0         4       0       0       0       0       0       0       0       0         5       0       0       0       0       0       0       0       0         6       0       0       0       0       0       0       0       0         7       0       0       0       0       0       0       0       0       0         9       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0                                                                                                                                                                        |      |       |    |         |    |                         |                    |   |          |
| 2       0       0       0       0       0         3       0       0       0       0       0         4       0       0       0       0       0         5       0       0       0       0       0         5       0       0       0       0       0         7       0       0       0       0       0         9       0       0       0       0       0         10       0       0       0       0       0         12       0       0       0       0       0         15       0       0       0       0       0         15       0       0       0       0       0         15       0       0       0       0       0         15       0       0       0       0       0       0                                                                                                                                                                                                                                                                                                                                                                                                                        |      |       | _  | _       | _  | 2000                    |                    |   |          |
| 3       0       0       0       0       0         4       0       0       0       0       0         5       0       0       0       0       0         6       0       0       0       0       0         6       0       0       0       0       0         8       0       0       0       0       0         9       0       0       0       0       0         10       0       0       0       0       0         11       0       0       0       0       0         15       0       0       0       0       0         15       0       0       0       0       0         15       0       0       0       0       0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       |    |         |    | 0                       | 0                  |   |          |
| 4       0       0       0       0       0         5       0       0       0       0       0         6       0       0       0       0       0         7       0       0       0       0       0         8       0       0       0       0       0         9       0       0       0       0       0         10       0       0       0       0       0         12       0       0       0       0       0         15       0       0       0       0       0         15       0       0       0       0       0         15       0       0       0       0       0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       |    |         |    | 0                       | 0                  |   |          |
| 6       0       0       0       0         7       0       0       0       0       0         8       0       0       0       0       0         9       0       0       0       0       0         10       0       0       0       0       0         11       0       0       0       0       0         15       0       0       0       0       0         15       0       0       0       0       0         15       0       0       0       0       0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      | 0     |    | $\odot$ | Ó  | U                       | U                  |   |          |
| 7       0       0       0       0         8       0       0       0       0         9       0       0       0       0         10       0       0       0       0         11       0       0       0       0         12       0       0       0       0         13       0       0       0       0         15       0       0       0       0       •         15       0       0       0       0       •                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5 🔘  | 0     | 0  |         | ۲  | 0                       | 0                  |   |          |
| 8       0       0       0       0         9       0       0       0       0         10       0       0       0       0         11       0       0       0       0         12       0       0       0       0         15       0       0       0       0         15       0       0       0       0         15       0       0       0       0         15       0       0       0       0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |       |    |         |    |                         | 0                  |   |          |
| 9         0         0         0         0           10         0         0         0         0           11         0         0         0         0           12         0         0         0         0           15         0         0         0         0           15         0         0         0         0           15         0         0         0         0           15         0         0         0         0           15         0         0         0         0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       |    |         |    |                         | -                  |   |          |
| 10       0       0       0       0         11       0       0       0       0         12       0       0       0       0         13       0       0       0       0         14       0       0       0       0         15       0       0       0       0         15       0       0       0       0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | _    |       |    |         |    | -                       | -                  |   |          |
| 11         0         0         0         0           12         0         0         0         0           13         0         0         0         0           14         0         0         0         0           15         0         0         0         0           15         0         0         0         0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       |    |         |    | -                       | -                  |   |          |
| 12 0 0 0 0 0 0 0<br>15 0 0 0 0 0 0<br>14 0 0 0 0 0 0<br>15 0 0 0 0 0 0 0<br>15 0 0 0 0 0 0 0 0<br>0 Active @ Non-Active                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |       |    |         |    |                         | -                  | _ |          |
| 13 0 0 0 0 0 0<br>14 0 0 0 0 0 0<br>15 0 0 0 0 0 0<br>Active O Non-Active                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |       |    |         |    |                         | -                  | _ |          |
| 14         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0 |      | _     |    |         |    |                         | -                  | _ |          |
| 15 0 0 0 0 0 0 V Comme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |       |    |         |    |                         | -                  | _ |          |
| Active Non-Active                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | _     |    | _       | _  |                         |                    | - | Commer   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ٥    | Activ | •  |         | 0  | Non-Active              | 1                  |   | 1 import |

This concludes the saving procedure.

## 13.5.4 ZONE Output Application Example

### Using the ZONE Outputs as Zone Signals

In this example, the motor is moved with program step operation and ZONE numbers are output when the current value enters a registered zone. You can use the ZONE numbers as zone signals for each zone, e.g., to trigger operations related to positioning.

Assume that the program table consists of the following five steps.

| PGMSTEP | POS      | SPD   | RDST | RSPD | ACC        | DEC    | POUT     | EVENT | LOOP | NEXT |
|---------|----------|-------|------|------|------------|--------|----------|-------|------|------|
| 0       | A+000000 | 30000 | -    | 1000 | 40000<br>0 | 200000 | NNNZZZZZ | ITO   | 1    | END  |
| 1       | A+100000 | 30000 | -    | 1000 | :          | :      | NNNZZZZZ | IT0   | 1    | END  |
| 2       | A+200000 | 30000 | -    | 1000 | :          | :      | NNNZZZZZ | IT0   | 1    | END  |
| 3       | A+300000 | 30000 | -    | 1000 | :          | :      | NNNZZZZZ | IT0   | 1    | END  |
| 4       | A+400000 | 30000 | -    | 1000 | :          | :      | NNNZZZZZ | IT0   | 1    | END  |

The ZONE table is shown below.

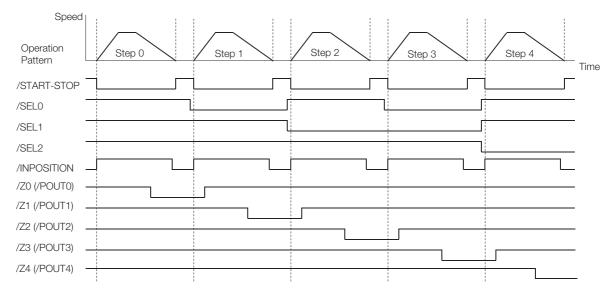
| ZONE Number<br>(ID) | ZONE N  | ZONE P  |
|---------------------|---------|---------|
| 0                   | 0       | 0       |
| 1                   | -1000   | +1000   |
| 2                   | +99000  | +101000 |
| 3                   | 0       | 0       |
| 4                   | +199000 | +201000 |
| 5                   | 0       | 0       |
| 6                   | 0       | 0       |
| 7                   | 0       | 0       |
| 8                   | +299000 | +301000 |
| 9                   | 0       | 0       |
| 10                  | 0       | 0       |
| 11                  | 0       | 0       |
| 12                  | 0       | 0       |
| 13                  | 0       | 0       |
| 14                  | 0       | 0       |
| 15                  | 0       | 0       |
| 16                  | +399000 | +401000 |
| 17                  | 0       | 0       |
| 18                  | 0       | 0       |
| 19                  | 0       | 0       |
| 20                  | 0       | 0       |
| 21                  | 0       | 0       |
| 22                  | 0       | 0       |
| 23                  | 0       | 0       |
| 24                  | 0       | 0       |
| 25                  | 0       | 0       |
| 26                  | 0       | 0       |
| 27                  | 0       | 0       |
| 28                  | 0       | 0       |
| 29                  | 0       | 0       |
| 30                  | 0       | 0       |
| 31                  | 0       | 0       |

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### 13.5.4 ZONE Output Application Example

The relationship between the operation pattern, ZONE signals, and /POUT signal is shown in the following figure.



## Using the ZONE Outputs as Passing Signals

In this example, the ZONE numbers are output at passing signals as the motor passed through the registered zones. You can use the passing signals as required, e.g., to trigger operations related to positioning.

Assume that the program table consists of the following two steps.

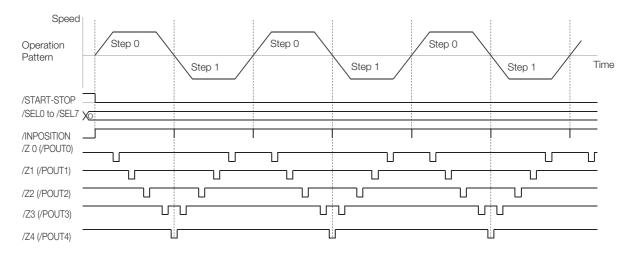
| PGMSTEP | POS      | SPD   | RDST | RSPD | ACC | DEC | POUT     | EVENT | LOOP | NEXT |
|---------|----------|-------|------|------|-----|-----|----------|-------|------|------|
| 0       | A+500000 | 30000 | -    | 1000 | :   |     | NNNZZZZZ | IT0   | 1    | 1    |
| 1       | A+000000 | 30000 | -    | 1000 | :   | :   | NNNZZZZZ | IT0   | 1    | 0    |

The ZONE table is shown below.

| ZONE Number<br>(ID) | ZONE N  | ZONE P  |
|---------------------|---------|---------|
| 0                   | 0       | 0       |
| 1                   | +99995  | +100004 |
| 2                   | +199995 | +200004 |
| 3                   | 0       | 0       |
| 4                   | +299995 | +300004 |
| 5                   | 0       | 0       |
| 6                   | 0       | 0       |
| 7                   | 0       | 0       |
| 8                   | +399995 | +400004 |
| 9                   | 0       | 0       |
| 10                  | 0       | 0       |
| 11                  | 0       | 0       |
| 12                  | 0       | 0       |
| 13                  | 0       | 0       |
| 14                  | 0       | 0       |
| 15                  | 0       | 0       |
| 16                  | +499995 | +500004 |
| 17                  | 0       | 0       |
| 18                  | 0       | 0       |
| 19                  | 0       | 0       |
| 20                  | 0       | 0       |
| 21                  | 0       | 0       |
| 22                  | 0       | 0       |
| 23                  | 0       | 0       |
| 24                  | 0       | 0       |
| 25                  | 0       | 0       |
| 26                  | 0       | 0       |
| 27                  | 0       | 0       |
| 28                  | 0       | 0       |
| 29                  | 0       | 0       |
| 30                  | 0       | 0       |
| 31                  | 0       | 0       |

### 13.5.4 ZONE Output Application Example

The relationship between the operation pattern and the ZONE numbers for this example is shown in the following figure.



# Operation with Serial Command Communications

14

This chapter provides information on using serial commands to operate the INDEXER Module.

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## 14.8

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# **14.1 Introduction to Serial Command Communications**

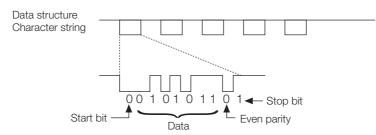
You can use serial command communications to perform the following functions.

- Homing
- · Positioning, jog operation, and registration with serial commands
- Positioning with a program table
- Editing a jog speed table
- Editing a ZONE table
- Editing parameters, monitoring, and utility functions

# **14.2** Communications Specifications for Serial Command Communications

The communications specifications for serial command communications are given in the following table.

| Item               | Specifications                                                                                                   |
|--------------------|------------------------------------------------------------------------------------------------------------------|
| Interface          | Full duplex (RS-422 or RS-485) or half duplex (RS-485) (Set the appropriate wiring method with parameter PnB00.) |
| Synchronization    | Start-stop synchronization (ASYNC)                                                                               |
| Bit Rate           | 9600, 19200, or 38400 bps<br>(Selectable with parameter PnB01.)                                                  |
| Start Bits         | 1 bit                                                                                                            |
| Data Bits          | 7 bits, ASCII code                                                                                               |
| Parity Bits        | 1 bit, even parity                                                                                               |
| Stop Bits          | 1 bit                                                                                                            |
| X-ON/X-OFF Control | No                                                                                                               |
| DTR/DSR Control    | No                                                                                                               |
| RTS/CTS Control    | No                                                                                                               |
| Echoback           | Each character, Each command, or None<br>Select the specification with the PnB00 parameter.                      |

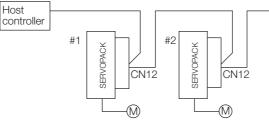


### **Settings** 14.3

This section explains the settings for the INDEXER Module's serial commands.

#### Simplified Configuration Diagram 14.3.1

The following diagram shows the basic connections for multi-axis control.



Up to 16 axes can be connected.

Refer to the following section for information on wiring. 4.6 Serial Command Communications Connector (CN12) on page 4-45

#### 14.3.2 Setting the Axis Address

Host

Axis addresses can be set with parameter Pn010 (axis address selection). Set an axis address in the range 1 to F. If an address outside this range is set, serial command communications will not be performed. Refer to the following section for information on the parameter setting methods.

[ 5.1 Manipulating Parameters (Pn□□□) on page 5-3

Note: With the INDEXER Module (NS600) for SGDH SERVOPACKs, axis addresses were set with rotary switches, but with INDEXER Modules (SGDV-OCA03A) for SGDV SERVOPACKs, axis addresses are set in the parameters.

14.3.3 Parameters Related to Serial Communications

## 14.3.3 Parameters Related to Serial Communications

The following table shows the parameters that set the communications protocol, bit rate, and "OK" response.

| I     | Parameter              | Meaning                                                                                                                              | When Enabled  |
|-------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------|---------------|
|       | 0                      | Full-duplex wiring is used for communications method.                                                                                |               |
|       | 1<br>(default setting) | Full-duplex wiring is used for communications method.<br>Echoback is performed for each character.                                   |               |
|       | 2                      | Half-duplex wiring is used for communications method.<br>CR is used as the delimiter.                                                |               |
|       | 3                      | Half-duplex wiring is used for communications method.<br>CR is used as the delimiter.<br>Echoback is performed for each character.   |               |
| PnB00 | 4                      | Half-duplex wiring is used for communications method.<br>CR is used as the delimiter.<br>Echoback is performed for each command.     | After restart |
|       | 5                      | Half-duplex wiring is used for communications method.<br>CRLF is used as the delimiter.                                              |               |
|       | 6                      | Half-duplex wiring is used for communications method.<br>CRLF is used as the delimiter.<br>Echoback is performed for each character. |               |
|       | 7                      | Half-duplex wiring is used for communications method.<br>CRLF is used as the delimiter.<br>Echoback is performed for each command.   |               |
|       | 8, 9                   | Reserved parameter                                                                                                                   |               |
| PnB01 | 0<br>(default setting) | Sets bit rate at 9600 bps.                                                                                                           | After restert |
| PNBUI | 1                      | Sets bit rate at 19200 bps.                                                                                                          | After restart |
|       | 2                      | Sets bit rate at 38400 bps.                                                                                                          |               |
|       | 0                      | Does not return OK response.                                                                                                         |               |
| PnB02 | 1<br>(default setting) | Returns OK response.                                                                                                                 | Immediately   |

# 14.4 Command/Response Format

| Command (Host controlle                                                                        | r  ightarrow INDEXER Module)   | Response (Host controller $\leftarrow$ INDEXER Module) |               |               |                |                           |
|------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------------------------------|---------------|---------------|----------------|---------------------------|
| Axis no. Command charac                                                                        | ter string Delimiter           | Axis no. Resi                                          | nonse         | e charact     | er string      | Delimiter                 |
|                                                                                                | Dominio                        |                                                        | pono          |               | orounig        | Dominitor                 |
| Example:<br>1SVON [CR]                                                                         |                                |                                                        | $\rightarrow$ | Exampl<br>10K | e:<br>[CR] [LF | ]                         |
| 2SVON [CR]                                                                                     |                                |                                                        | $\rightarrow$ | 20K           | [CR] [LF       | -]                        |
| 1POS10000 [CR]                                                                                 |                                |                                                        | $\rightarrow$ | 10K           | [CR] [LF       | ]                         |
| 2POS10000 [CR]                                                                                 |                                |                                                        | $\rightarrow$ | 20K           | [CR] [LF       | -]                        |
| 1ST [CR]                                                                                       |                                |                                                        | $\rightarrow$ | 10K           | [CR] [LF       | -]                        |
| 2ST [CR]                                                                                       |                                |                                                        | $\rightarrow$ | 20K           | [CR] [LF       | -]                        |
| 1PUN [CR]                                                                                      |                                |                                                        | $\rightarrow$ | 1PUN =        | = +000045      | 67 [CR] [LF]              |
| 2PUN [CR]                                                                                      |                                |                                                        | $\rightarrow$ | 2PUN =        | = -0000234     | 45 [CR] [LF]              |
| iter to either [CR] or [CŘ]<br>In both cases, [CR] [LF] w<br>back.<br>Upper-case and lower-cas |                                | Note: The respor<br>Alphabetic<br>upper-case           | al cha        |               |                | R] [LF].<br>se are always |
| Note: In ASCII, the [CR] character                                                             | r is 0Dh and the [LF] characte | er is 0Ah.                                             |               |               |                |                           |

The following diagram shows the command/response format.



To maximize communications reliability, confirm the echoback and responses to each command while communicating with the INDEXER Module. When the echoback and responses are not being confirmed, improve the communications reliability by reading the status when appropriate.

# 14.5 Global Commands

Global commands are commands that are sent to all axes at the same time.

| Com      | imand (Host controller $ ightarrow$ INDE)                                                       | KER Module) | Response (Host controller $\leftarrow$ INDEXER Module) |
|----------|-------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------|
|          |                                                                                                 |             |                                                        |
| "*"      | Command character string                                                                        | Delimiter   |                                                        |
|          | Example: *SVON [CR]<br>*ST [CR]<br>*PUN [CR]                                                    |             | No response returned.                                  |
| addresse | number setting "*" is the global<br>as all axes.<br>back or response is returned wh<br>is used. |             |                                                        |
|          |                                                                                                 |             |                                                        |



When global commands are used, improve the communications reliability by reading the status when appropriate.

# 14.6 Echoback Response Time

The following diagram shows the response time from the command transmission until the echoback.

| Command                                                                                                                                            | top bit                                                             |                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------|
| Echoback — High impedance                                                                                                                          | Start bit                                                           | High impedance                                         |
| PnB00 (Protocol) Settings                                                                                                                          | t <sub>F</sub> Min.                                                 | t⊨ Max.                                                |
| 1:<br>Full-duplex wiring is used for communica-<br>tions method.<br>Echoback is performed for each character.                                      | - <u>1</u><br>Bit rate × 2<br>(Centered at the command<br>stop bit) | $100 \mu\text{s} + \frac{1}{\text{Bit rate} \times 2}$ |
| 3:<br>Half-duplex wiring is used for communica-<br>tions method.<br>CR is used as the delimiter.<br>Echoback is performed for each character.      |                                                                     |                                                        |
| 4:<br>Half-duplex wiring is used for communica-<br>tions method.<br>CR is used as the delimiter.<br>Echoback is performed for each com-<br>mand.   | 250 μs – <u>1</u><br>Bit rate × 2                                   | $600 \mu\text{s} + \frac{1}{\text{Bit rate} \times 2}$ |
| 6:<br>Half-duplex wiring is used for communica-<br>tions method.<br>CRLF is used as the delimiter.<br>Echoback is performed for each character.    | Bit rate × 2                                                        | Bit rate × 2                                           |
| 7:<br>Half-duplex wiring is used for communica-<br>tions method.<br>CRLF is used as the delimiter.<br>Echoback is performed for each com-<br>mand. |                                                                     |                                                        |
| Example For PnB00 = 1 and PnB01 =<br>$t_E min = -\frac{1}{Bit rate \times 2}$                                                                      |                                                                     |                                                        |



When using half-duplex wiring, the host controller must set the line driver to high impedance within the  ${\rm t}_{\rm E}$  min. response time.

14.7.1 Positive Responses

# 14.7 Response Data Details

There are positive responses and negative responses. The positive response indicates normal operation and the negative response indicates an error.

### 14.7.1 Positive Responses

There two kinds of positive responses, responses that return data (for commands such as PRM) and responses that do not return data (for commands such as SVON).

For commands that require data to be returned, refer to the description of the individual command for details on the structure of the response's character string.

For commands that do not require data to be returned, the positive response is "OK" unless parameter PnB02 is set to 0. If PnB02 = 0, there is no response.

### Structure of the Response "OK"

Note: In ASCII, the [SP] character is 20h, the [CR] character is 0Dh, and the [LF] character is 0Ah.

### 14.7.2 Negative Responses

There will be no response if one of the following errors is detected: a parity error (E48E), framing error (E49E), or overrun error (E4AE). There will be no response to a global command or a command with an incorrect axis number.

In all other cases, a negative response will be returned if an error is detected.

### Structure of the Negative Response

| Undefined Command Error    | E56E [SP] ERR [SP] SN [CR] [LF]                                                  |
|----------------------------|----------------------------------------------------------------------------------|
| Address Out-of-range Error | E57E [SP] ERR [SP] PN [CR] [LF]                                                  |
| Data Out-of-range Error    | E58E [SP] ERR [SP] OV [CR] [LF]                                                  |
| Other Errors               | ExxE [SP] [SP] [SP] [SP] [SP] [SP] [SP] [CR] [LF]<br>The xx is the error number. |

Note: In ASCII, the [SP] character is 20h, the [CR] character is 0Dh, and the [LF] character is 0Ah.

14.8.1 Basic Operation Commands

# 14.8 Serial Commands

The axis number and delimiter are attached to actual serial commands, but are omitted here.

Some data in responses (such as parameters, table numbers, and monitored data) is expressed numerically. The presence/absence of the sign and the number of digits are correct in the numerical data shown in these examples, but the sign and numerical value will vary in actual applications.

# 14.8.1 Basic Operation Commands

| Serial Command | Function/Description                                                                                                       | Positive Response (Normal Response)                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SVON           | Servo ON:<br>Supplies power to the Servo-<br>motor.<br>This command is the same as<br>turning ON the /S-ON signal.         | ОК                                                                                                                                                                                                                                                                                                                                                                                                                        |
| SVOFF          | Servo OFF:<br>Stops the power supply to the<br>Servomotor.<br>This command is the same as<br>turning OFF the /S-ON signal. | ОК                                                                                                                                                                                                                                                                                                                                                                                                                        |
| ARES           | Alarm Reset:<br>Clears the alarm.                                                                                          | The response "OK" will be returned when the alarm<br>has been cleared. The alarm code will be returned if<br>the alarm remains uncleared.<br>ALM [SP] A. xxx [SP] [CR] [LF]<br>(The xxx is the SERVOPACK alarm code.)<br>ALM [SP] E xxA [SP] [CR] [LF]<br>(The xx is the INDEXER Module alarm code.)                                                                                                                      |
| RES            | Reset:<br>This command is the same as<br>turning OFF/ON the control<br>power supply.                                       | None (No response)<br>Note: If the RES command has been successfully exe-<br>cuted, no response will be returned. Because the<br>execution of the RES command resets all status in<br>the same way that restarting the control power sup-<br>ply will, serial communications will be unstable for a<br>maximum of 5 seconds after the RES command is<br>used. Wait at least 5 seconds before sending the<br>next command. |

The following table shows the basic operation commands.

14.8.2 Homing

# 14.8.2 Homing

| Serial Command |                                                                                                     | Function                                       | n/Description                                                                                                                                                                                                                                                    | Positive<br>Response |
|----------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
|                |                                                                                                     |                                                | vith the HOLD command, homing will be<br>when the ZRN command is executed                                                                                                                                                                                        |                      |
|                | The parameters                                                                                      | for homing are sp                              | ecified in parameters PnB31 to PnB39.                                                                                                                                                                                                                            |                      |
|                | PnB31<br>Homing<br>Method                                                                           | PnB32<br>Homing<br>Direction                   | PnB33 to PnB39                                                                                                                                                                                                                                                   |                      |
|                | PnB31 = 0:<br>No homing.<br>Homing ends<br>when the con-<br>trol power sup-<br>ply is turned<br>ON. | _                                              | _                                                                                                                                                                                                                                                                |                      |
| ZRN            | PnB31 = 1:<br>Uses the /DEC<br>signal and the<br>encoder's<br>phase C.                              |                                                | ZEN<br>Moving<br>Speed<br>(PnB33) Approach<br>(PnB33) Speed<br>(PnB35)<br>(PnB37)<br>Final Move Distance<br>(PnB39)<br>When PnB11<br>is 0<br>Encoder's<br>phase C<br>/DEC*<br>/DEC*<br>When PnB11<br>is 1<br>* To change the polarity, use parame-<br>ter PnB11. | ОК                   |
|                | PnB31 = 2:<br>Uses the /DEC<br>signal only.                                                         | PnB32 = 0:<br>Forward<br>PnB32 = 1:<br>Reverse | ZRN<br>Approach<br>speed<br>(PnB35)<br>Final Move Distance<br>(PnB39)<br>When PnB11<br>is 0<br>When PnB11<br>is 1<br>* To change the polarity, use parame-                                                                                                       |                      |
|                | PnB31 = 3:<br>Uses the<br>encoder's<br>phase C only.                                                |                                                | Encoder phase C                                                                                                                                                                                                                                                  |                      |
|                | When the contro                                                                                     | l power supply is                              | is completed is specified in PnB25.<br>turned ON and homing is completed,<br>replaced with the value in PnB25.<br>Continued or                                                                                                                                   |                      |

The following commands are used for homing.

Continued on next page.

### 14.8 Serial Commands

14.8.2 Homing

Continued from previous page.

| Serial Command |                                                                                                                                                                                                                                                         |                                                                               | Function/Des                                                                                                    | orintion                                                   |                           |                                                       |                   |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------|-------------------------------------------------------|-------------------|
|                |                                                                                                                                                                                                                                                         | Function/Description                                                          |                                                                                                                 |                                                            |                           |                                                       | Positiv<br>Respon |
|                | When using an incremental encoder: Origin     When using an absolute encoder: Absolute Encoder Offset                                                                                                                                                   |                                                                               |                                                                                                                 |                                                            |                           |                                                       |                   |
|                | PnB25                                                                                                                                                                                                                                                   | Setting<br>Range                                                              | Setting Unit                                                                                                    | Default<br>Setting                                         | Whe                       | en Enabled                                            |                   |
|                |                                                                                                                                                                                                                                                         | -999999999 to<br>+999999999*                                                  | 1 reference<br>unit                                                                                             | 0                                                          | Af                        | ter restart                                           |                   |
|                | Pa                                                                                                                                                                                                                                                      | arameter                                                                      | M                                                                                                               | eaning                                                     |                           | When<br>Enabled                                       |                   |
|                |                                                                                                                                                                                                                                                         | 0<br>(default<br>setting)                                                     | Homing is not executed.                                                                                         |                                                            |                           |                                                       |                   |
|                | PnB31                                                                                                                                                                                                                                                   | 1                                                                             | /DEC and phase<br>homing.                                                                                       | se C are used f                                            | or                        | After restart                                         |                   |
|                |                                                                                                                                                                                                                                                         | 2                                                                             | Only /DEC is u                                                                                                  |                                                            |                           | -                                                     |                   |
|                |                                                                                                                                                                                                                                                         | 3                                                                             | Only phase C i                                                                                                  | s used for hom                                             | ning.                     |                                                       |                   |
|                | PnB32                                                                                                                                                                                                                                                   | 0<br>(default<br>setting)                                                     | /HOME or ZRN command is used for homing in forward direction.                                                   |                                                            | n.                        | Immediately                                           |                   |
|                |                                                                                                                                                                                                                                                         | 1                                                                             | /HOME or ZRN command is used for homing in reverse direction.                                                   |                                                            |                           |                                                       |                   |
|                |                                                                                                                                                                                                                                                         | Homing Moving Speed                                                           |                                                                                                                 |                                                            |                           |                                                       |                   |
|                | PnB33                                                                                                                                                                                                                                                   | Setting Range                                                                 | _                                                                                                               | Default<br>Setting                                         | W                         | hen Enabled                                           |                   |
| ZRN            |                                                                                                                                                                                                                                                         | 1 to<br>999999999*                                                            | 1000<br>Reference<br>units/min                                                                                  | 1000                                                       | 1                         | Immediately                                           | ОК                |
|                | PnB35                                                                                                                                                                                                                                                   | Homing Approach Speed                                                         |                                                                                                                 |                                                            |                           |                                                       |                   |
|                |                                                                                                                                                                                                                                                         | Setting Range                                                                 | -                                                                                                               | Default<br>Setting                                         | W                         | hen Enabled                                           |                   |
|                |                                                                                                                                                                                                                                                         | 1 to<br>999999999*                                                            | 1000<br>Reference<br>units/min                                                                                  | 1000                                                       | 1                         | Immediately                                           |                   |
|                |                                                                                                                                                                                                                                                         | Homing Creep Speed                                                            |                                                                                                                 |                                                            |                           |                                                       |                   |
|                | Setting Ran                                                                                                                                                                                                                                             |                                                                               | e Setting Unit                                                                                                  | Default<br>Setting                                         | W                         | hen Enabled                                           |                   |
|                |                                                                                                                                                                                                                                                         | 1 to<br>999999999*                                                            | 1000<br>Reference<br>units/min                                                                                  | 1000                                                       | I                         | Immediately                                           |                   |
|                |                                                                                                                                                                                                                                                         | Homing Final                                                                  | Move Distance                                                                                                   |                                                            |                           |                                                       |                   |
|                | PnB39                                                                                                                                                                                                                                                   | Setting Range                                                                 | e Setting Unit                                                                                                  | Default<br>Setting                                         | W                         | hen Enabled                                           |                   |
|                |                                                                                                                                                                                                                                                         | -999999999 to<br>+999999999*                                                  |                                                                                                                 | 0                                                          |                           | Immediately                                           |                   |
|                | Note: 1. The software limits (PnB21 and PnB23) are disabled until homing is com-<br>pleted. They are enabled after homing is completed. On the other hand, the<br>overtravel signals (P-OT and N-OT signals) are enabled before homing is<br>completed. |                                                                               |                                                                                                                 |                                                            |                           |                                                       |                   |
|                | 2. V<br>tł<br>3. E<br>4. H                                                                                                                                                                                                                              | /hen an incremen<br>ne ZSET comman<br>rror E5DE will occ<br>loming can be per | tal encoder is bei<br>d (coordinates se<br>cur if the ZRN con<br>formed only wher<br>cur if the ZRN con<br>sed. | tting) is executed<br>nmand is execute<br>n an incremental | l inste<br>ed wh<br>encod | ad of homing.<br>ile PnB31 = 0.<br>ler is being used. |                   |

Continued on next page.

### 14-13

14.8.2 Homing

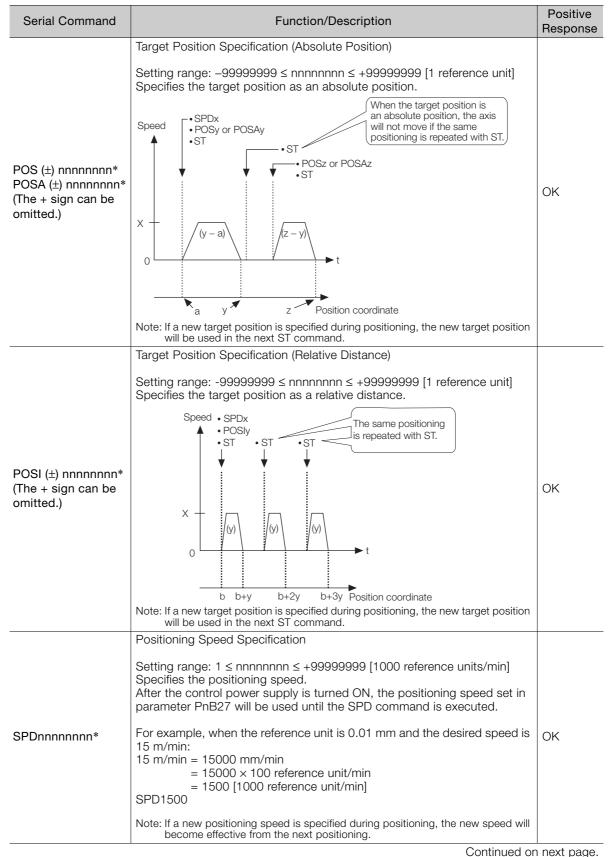
Positive Serial Command Function/Description Response Coordinates Setting Note: It can be dangerous to execute this command carelessly to switch the coordinates of the reference position. After executing this command, confirm that the reference position and the new coordinates are in agreement before starting operation. Setting range:  $-999999999 \le nnnnnnn \le +999999999$  [Reference units] · With an Incremental Encoder Replaces the current position with nnnnnnn. Homing will be completed and the software limits (PnB21 and PnB23) will be enabled. This coordinates setting will be cleared when the control power supply is turned OFF. ZSET (±) nnnnnnn\* OK Note: Parameter PnB25 will not be refreshed. PnB25 will be used as the current position when the control power supply is turned ON and homing is completed. · With an Absolute Encoder Switches the current position to nnnnnnn and refreshes PnB25 with the absolute position offset so that the current position becomes nnnnnnn. The coordinates setting will remain effective after the control power supply is turned OFF. Normally, this command is executed once during system setup and it is not necessary to execute it again. Each time that the command is executed, the content of PnB25 is refreshed and stored in EEPROM, so this command must not be executed repeatedly or too frequently. Note: When one of the Pn20E to Pn210, Pn205, or PnB20 to PnB25 parameters has been changed, enable the new setting by turning the control power supply OFF and then ON again before executing the command.

Continued from previous page.

\* If you set PnB54 to 1 (Enable Expansion Mode), the parameter setting range, the command name, and the command setting range will change. Refer to the following section for details.

12.4 Speed/Position Expansion Function Setting on page 12-8

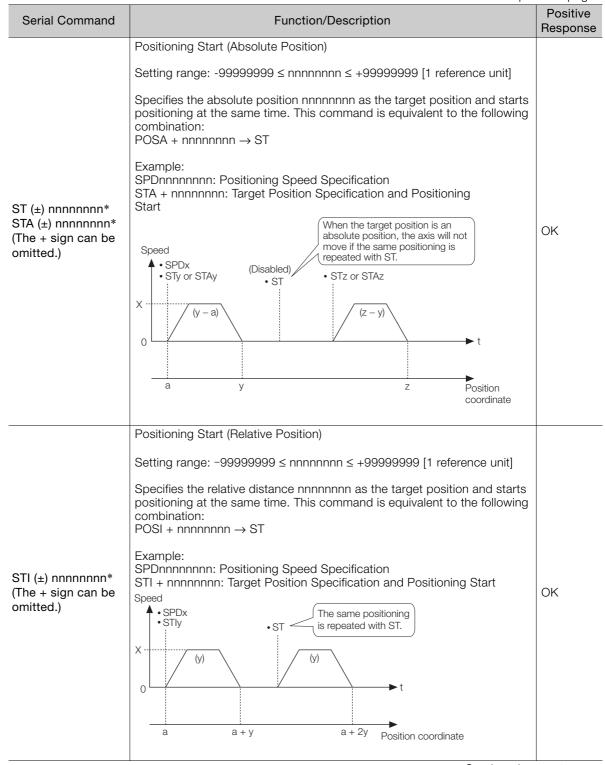
The following commands are used for positioning, jog operation, and registration with serial commands.



|                | Continued from pre                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | evious page.         |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Serial Command | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Positive<br>Response |
| ACCnnnnnnn*    | Acceleration Specification<br>Setting range: $1 \le nnnnnnn \le +999999999 [1000 (reference units/min)/ms]$<br>reference<br>V $\frac{1}{t_1}$ $\frac{1}{t_2}$ $\frac{1}{t_3}$ $\frac{1}{t_4}$ Time<br>V [ × 1000 reference units/min]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | OK                   |
|                | $\label{eq:Acceleration} \begin{split} \text{Acceleration} &= \frac{\text{V} \left[ \times 1000 \text{ reference units/min} \right]}{\text{t}_2 - \text{t}_1 \left[ \text{ms} \right]} \\ \text{Deceleration} &= \frac{\text{V} \left[ \times 1000 \text{ reference units/min} \right]}{\text{t}_4 - \text{t}_3 \left[ \text{ms} \right]} \\ \text{Note: The acceleration setting in parameter PnB29 can also be used. Executing the command ACCnnnnnnn is the same as executing TRMB29 = nnnnnnn.} \end{split}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                      |
| DECnnnnnnn*    | Deceleration Specification<br>Setting range: 1 ≤ nnnnnnnn ≤ +99999999 [1000 (reference units/min)/<br>ms]<br>Note: The deceleration setting in parameter PnB2B can also be used. Executing the<br>command DECnnnnnnn is the same as executing TRMB2B = nnnnnnn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ОК                   |
| ST             | Positioning Start<br>Starts positioning with the speed specified by the SPD command and the<br>target position specification and speed specification can be omitted.<br>In this case, the previous positioning will be repeated.<br>Error E51E will occur if the ST command is executed but the target posi-<br>tion hasn't been specified even once. If the ST command is executed but<br>the speed hasn't been specified even once, the speed specified in param-<br>eter PnB27 will be used.<br>When positioning has been stopped with the HOLD command, the posi-<br>tioning will be restarted (the hold will be cleared) if the ST command is<br>executed.<br>Example 1:<br>POSI + nnnnnnn: Target Position Specification<br>SPDnnnnnnnn: Positioning Speed Specification<br>ST: Positioning Start<br>ST: Repeat<br>Example 2:<br>POSI + nnnnnnn: Target Position Specification<br>ST: Positioning Start (using the speed specified in PnB27)<br>Example 3:<br>POSI + nnnnnnn: Target Position Specification<br>ST: Positioning Start<br>HOLD: Positioning Interruption<br>ST: Positioning Restart (Clear Hold)<br>Note: An E53E error will occur if a new move command such as the ST command is<br>received while the motor is already moving (positioning or other moving oper-<br>ation). Execute a move command such as the ST command is<br>previous moving operation has been completed. | OK                   |

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|                | Continued from pre                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | evious page.         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Serial Command | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Positive<br>Response |
|                | Registration Distance Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |
|                | Setting range: $0 \le nnnnnnn \le 999999999$ [1 reference unit]                                                                                                                                                                                                                                                                                                                                                                                                                                             |                      |
|                | Specifies the registration distance that is used in the RS, RSnnnnnnn, RSAnnnnnnn, and RSInnnnnnn commands.                                                                                                                                                                                                                                                                                                                                                                                                 |                      |
| RDSTnnnnnnn*   | POSa<br>RDSTb<br>Speed SPDx<br>x<br>y<br>/RGRT<br>Note: Alarm E23A will occur (the Servomotor will become servo OFF state) if the /<br>RGRT signal is latched but the deceleration distance is longer than the regis-                                                                                                                                                                                                                                                                                       | ОК                   |
|                | tration distance (if the registration distance would be exceeded even if decel-<br>eration were started immediately).                                                                                                                                                                                                                                                                                                                                                                                       |                      |
| RSPDnnnnnnn*   | <ul> <li>Registration Speed Specification</li> <li>Setting range: 1 ≤ nnnnnnn ≤ 99999999 [1000 reference units/min]</li> <li>Specifies the registration speed.</li> <li>After the control power supply is turned ON, the registration speed set in parameter PnB27 will be used until the speed is specified with this command.</li> <li>Note: If a new registration speed is specified during registration operation, the new speed will become effective from the next registration operation.</li> </ul> | ОК                   |
|                | Continued or                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | n next page.         |

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|                                                                        | Continued from pre                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                      |
|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Serial Command                                                         | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Positive<br>Response |
|                                                                        | Positioning Start with Registration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |
|                                                                        | Starts positioning with the speed specified by the SPD command and the target position specified by the POS, POSA, or POSI command.<br>If the /RGRT signal goes ON during positioning, that position is latched and the motor will move the specified relative distance from the latched position. The registration operation uses the registration distance specified by the RDST command and the registration speed specified by the RSPD command.<br>The target position specification, positioning speed specification, registration distance specification, and registration speed specification can be omitted. In this case, the positioning performed in the previous registration operation will be repeated. |                      |
|                                                                        | Error E51E will occur if the RS command is executed but the target posi-<br>tion hasn't been specified even once. Error E52E will occur if the RS com-<br>mand is executed but the registration distance hasn't been specified even<br>once. If the RS command is executed but the positioning speed and regis-<br>tration speed haven't been specified even once, the speed specified in<br>parameter PnB27 will be used either as the positioning speed or the regis-<br>tration speed.<br>When registration positioning has been stopped with the HOLD com-<br>mand, the registration positioning will be restarted (the hold will be<br>cleared) if the RS command is executed.                                    |                      |
| RS                                                                     | Example 1:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | OK                   |
|                                                                        | POSI + nnnnnnn: Target Position Specification<br>SPDnnnnnnn: Positioning Speed Specification<br>RDSTnnnnnnn: Registration Distance Specification<br>RSPDnnnnnnn: Registration Speed Specification<br>RS: Positioning Start with Registration<br>RS: Repeat                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                      |
|                                                                        | Example 2:<br>POSI + nnnnnnn:Target Position Specification<br>RDSTnnnnnnn: Registration Distance Specification<br>RS: Positioning Start with Registration (using the speed specified in<br>PnB27<br>for both the positioning and registration speeds)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |
|                                                                        | Example 3:<br>POSI + nnnnnnn: Target Position Specification<br>RDSTnnnnnnn: Registration Distance Specification<br>RS: Positioning Start with Registration<br>HOLD: Positioning Interruption<br>PO. De officient Position                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |
|                                                                        | RS: Positioning Restart (Clear Hold)<br>Note: Error E53E will occur if a new move command such as the RS command is<br>received while the motor is already moving (positioning or other moving oper-<br>ation). Execute a move command such as the RS command only after the<br>previous moving operation has been completed.                                                                                                                                                                                                                                                                                                                                                                                          |                      |
|                                                                        | Positioning Start with Registration (Absolute Position)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                      |
|                                                                        | Setting range: $-99999999 \le nnnnnnn \le +999999999$ [1 reference unit]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |
| RS (±) nnnnnnn*<br>RSA (±) nnnnnnn*<br>(The + sign can be<br>omitted.) | Specifies the absolute position nnnnnnn as the target position and starts registration positioning at the same time. This command is equivalent to the following combination:<br>POSA + nnnnnnn $\rightarrow$ RS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ОК                   |
|                                                                        | Example:<br>SPDnnnnnnn: Positioning Speed Specification<br>RDSTnnnnnnn: Registration Distance Specification<br>RSPDnnnnnnn: Registration Speed Specification<br>RSA +nnnnnnn: Target Position Specification and Positioning Start with<br>Registration                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |
|                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |

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| Serial Command       Function/Description       Positive Response         RSI (±) nnnnnn*       Positioning Start with Registration (Relative Distance)       Setting range: -999999999 ≤ nnnnnnn ≤ +999999999 [1 reference unit]       Specifies the relative distance nnnnnnn ≤ +999999999 [1 reference unit]       Specifies the relative distance nnnnnnn ≤ +999999999 [1 reference unit]       Specifies the relative distance nnnnnnn ≤ +99999999 [1 reference unit]       OK         Specifies the relative distance nnnnnnn as the target position and starts registration positioning at the same time. This command is equivalent to the following combination:<br>POSI + nnnnnnnn → RS       OK         Example:<br>SPDnnnnnnnn: Registration Distance<br>RSPDnnnnnnn: Registration Distance<br>RSPDnnnnnnn: Registration Speed Specification<br>RSP Innnnnnn: Target Position Speed Specification and Positioning Start with<br>Registration<br>JOG Forward/Reverse       JOG Forward/Reverse         Setting range: 1 ≤ nnnnnnn ≤ 99999999 [1000 reference units/min]       Starts JOG forward or JOG reverse operation at the speed specified in<br>nnnnnn.<br>JOGNnnnnnnn: Reverse<br>The specified speed and JOG direction can be changed while jog opera-<br>tion is in progress.       OK         JOGPNnnnnnn*       *SkIP<br>• JOGNy       •JOGNz       •JOGPx<br>• JOGNz       •OK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                    | Continued from previous page.                                                                                                                                                                                                                                                                                                                                                                                                       |    |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--|
| RSI (±) nnnnnn*       Setting range: -099999999 ≤ nnnnnnn ≤ +99999999 [1 reference unit]       Specifies the relative distance nnnnnnn as the target position and starts registration positioning at the same time. This command is equivalent to the following combination:       OK         POSI + nnnnnnn*       POSI + nnnnnnn → RS       OK         Example:       SPDnnnnnnn: Positioning Speed Specification       RSDTnnnnnn: Registration Distance       OK         SPDINNNNNN:       RSI + nnnnnnn: Registration Speed Specification       RSD + nnnnnnn: Registration Speed Specification       OK         JOG Forward/Reverse       Setting range: 1 ≤ nnnnnnn ≤ 99999999 [1000 reference units/min]       Starts JOG forward or JOG reverse operation at the speed specified in nnnnnnn.       JOGPnnnnnnn: Reverse       OK         JOGPNNNNNN*       Specified speed and JOG direction can be changed while jog operation is in progress.       OK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Serial Command     | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                |    |  |
| RSI (±) nnnnnnn*<br>(The + sign can be<br>omitted.)       Specifies the relative distance nnnnnnn as the target position and starts<br>registration positioning at the same time. This command is equivalent to<br>the following combination:<br>POSI + nnnnnnn → RS       OK         Example:<br>SPDnnnnnnn: Positioning Speed Specification<br>RDSTnnnnnnn: Registration Distance<br>RSPDnnnnnnn: Registration Speed Specification<br>RSI + nnnnnnn: Registration Speed Specification and Positioning Start with<br>Registration       OK         JOG Forward/Reverse<br>Setting range: 1 ≤ nnnnnnn ≤ 99999999 [1000 reference units/min]<br>Starts JOG forward or JOG reverse operation at the speed specified in<br>nnnnnn.<br>JOGPnnnnnnn: Reverse<br>The specified speed and JOG direction can be changed while jog opera-<br>tion is in progress.       OK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (The + sign can be | Positioning Start with Registration (Relative Distance)                                                                                                                                                                                                                                                                                                                                                                             |    |  |
| RSI (±) nnnnnn*<br>(The + sign can be<br>omitted.)       registration positioning at the same time. This command is equivalent to<br>the following combination:<br>POSI + nnnnnnn → RS       OK         Example:<br>SPDnnnnnnn: Registration Distance<br>RSPDnnnnnnn: Registration Distance<br>RSPDnnnnnnn: Target Position Speed Specification<br>RSI + nnnnnnn: Target Position Specification and Positioning Start with<br>Registration       OK         JOG Forward/Reverse<br>Setting range: 1 ≤ nnnnnnn ≤ 99999999 [1000 reference units/min]<br>Starts JOG forward or JOG reverse operation at the speed specified in<br>nnnnnnn.<br>JOGPnnnnnnn: Reverse<br>The specified speed and JOG direction can be changed while jog opera-<br>tion is in progress.       OK         JOGPNnnnnnn*       *SKIP<br>• JOGNy<br>• JOGNz • JOGNz • JOGNz<br>• JOGNz • JOGNz<br>• JOGNz • JOGNz • JOGNz<br>• JOGNz • JOGNz • JOGNz • JOGNz • JOGNz<br>• JOGNz • JO |                    | Setting range: $-99999999 \le nnnnnnn \le +999999999$ [1 reference unit]                                                                                                                                                                                                                                                                                                                                                            |    |  |
| JOGPnnnnnnn*       JOGPnnnnnnn: Positioning Speed Specification         JOGPnnnnnnn:       Registration Distance         RSI + nnnnnnn:       Target Position Specification and Positioning Start with Registration         JOG Forward/Reverse       Setting range: 1 ≤ nnnnnnn ≤ 99999999 [1000 reference units/min]         Starts JOG forward or JOG reverse operation at the speed specified in nnnnnnn.       JOGPnnnnnnn: Forward         JOGNnnnnnn*       Speed and JOG direction can be changed while jog operation is in progress.         Speed       • SKIP         • JOGPx       • JOGNx       • JOGPx         • JOGPx       • JOGNy       • JOGPx         • JOGPx       • JOGNy       • JOGPx         • JOGPx       • JOGNy       • JOGPx                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    | registration positioning at the same time. This command is equivalent to the following combination:                                                                                                                                                                                                                                                                                                                                 | ОК |  |
| JOGPnnnnnnn*       Setting range: 1 ≤ nnnnnnn ≤ 99999999 [1000 reference units/min]         JOGPnnnnnnn*       Starts JOG forward or JOG reverse operation at the speed specified in nnnnnnn         JOGPnnnnnnn*       JOGNnnnnnnn: Forward JOG direction can be changed while jog operation is in progress.         Speed       • SKIP         V JOGNz       • JOGPx                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    | SPDnnnnnnn: Positioning Speed Specification<br>RDSTnnnnnnn: Registration Distance<br>RSPDnnnnnnn: Registration Speed Specification<br>RSI +nnnnnnn: Target Position Specification and Positioning Start with                                                                                                                                                                                                                        |    |  |
| y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    | Setting range: 1 ≤ nnnnnnn ≤ 99999999 [1000 reference units/min]<br>Starts JOG forward or JOG reverse operation at the speed specified in<br>nnnnnnn.<br>JOGPnnnnnnn: Forward<br>JOGNnnnnnnn: Reverse<br>The specified speed and JOG direction can be changed while jog opera-<br>tion is in progress.<br>Speed • SKIP<br>• JOGNy • JOGNz • JOGPx<br>* • JOGPx • • JOGNy • JOGNz • JOGPx<br>* • • • • • • • • • • • • • • • • • • • | OK |  |

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### 14.8.3 Positioning, Jog Operation, and Registration with Serial Commands

| JOG Forward/Reverse with Registration         Setting range: 1 ≤ nnnnnnn ≤ 99999999 [1000 reference units/min]         Starts JOG forward or JOG reverse operation at the speed specified in nnnnnnn.         RJOGPnnnnnnn:Forward         RJOGNnnnnnnn:Reverse         If the /RGRT signal goes ON during forward/reverse jog operation, that position is latched and the motor will move the specified relative distance from the latched position. The registration operation uses the registration distance specified by the RDST command and the registration speed specified by the RSPD command.         Error E52E will occur if the RJOGP/RJOGNnnnnnnn command is executed but the registration distance hasn't been specified even once. If the RJOGP/RJOGNnnnnnnn command is executed by the RDST will be used for the registration speed.         When registration jog operation has been stopped with the HOLD command, forward registration jog operation will be restarted (the hold will be cleared) when the RJOGPnnnnnnn command is executed again. Reverse registration jog operation will be restarted when the RJOGNnnnnnn command is executed again.         RJOGPNnnnnnn*       The specified speed and direction cannot be changed while jog operation is in progress. Error E53E will occur if the speed or direction is changed during operation. | Setting range: $1 \le nnnnnnn \le 999999999$ [1000 reference units/min]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Command                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 0 → a → t<br>-b → ···································                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | RJOGPnnnnnnn: Forward<br>RJOGNnnnnnn: Reverse<br>If the /RGRT signal goes ON during forward/reverse jog operation, that<br>position is latched and the motor will move the specified relative distance<br>from the latched position. The registration operation uses the registration<br>distance specified by the RDST command and the registration speed<br>specified by the RSPD command.<br>Error ES2E will occur if the RJOGP/RJOGNnnnnnnn command is exe-<br>cuted but the registration distance hasn't been specified even once. If the<br>RJOGPNnnnnnn*<br>RJOGNnnnnnnn*<br>RJOGNnnnnnnn*<br>RJOGNnnnnnnn*<br>Speed hasn't been specified even once, the speed but the registration<br>is peed hasn't been specified even once, the speed specified in parameter<br>PnB27 will be used for the registration speed.<br>When registration jog operation has been stopped with the HOLD com-<br>mand, forward registration jog operation will be restarted (the hold will be<br>cleared) when the RJOGPnnnnnnn command is executed again. Reverse<br>registration jog operation will be restarted when the RJOGNnnnnnnn<br>command is executed again.<br>The specified speed and direction cannot be changed while jog operation<br>is in progress. Error E53E will occur if the speed or direction is changed<br>during operation. | nnnnnnn*<br>nnnnnnn*<br>nnnnnnn*<br>Ti<br>sp<br>cu<br>cu<br>cu<br>cu<br>cu<br>cu<br>cu<br>cu<br>cu<br>cu<br>cu<br>cu<br>cu |

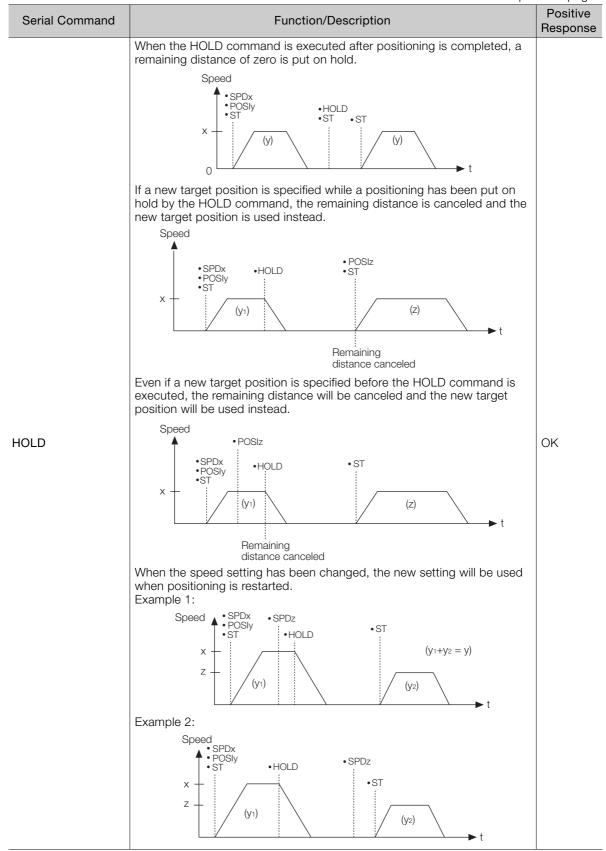
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14.8.3 Positioning, Jog Operation, and Registration with Serial Commands

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|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Serial Command               | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Positive<br>Response |
| HOLD                         | Positioning Interruption<br>Interrupts the current positioning.<br>The remainder of the positioning is put on hold.<br>When the HOLD command has interrupted a positioning initiated by an<br>ST, STINNINNINN, STANNINNINN, or STININNINNIN command, the position-<br>ing can be restarted by executing the ST command.<br>When the HOLD command has interrupted registration positioning initi-<br>ated by an RS, RSININNINNI, RSANINNINNI, or RSININNINNIN command,<br>the registration positioning can be restarted by executing the RS com-<br>mand.<br>When the HOLD command has interrupted a "forward jog operation with<br>registration" operation that was initiated by the RJOGPNINNINNIN com-<br>mand, the operation can be restarted by executing the RJOGPNINNINNIN<br>command again.<br>When the HOLD command has interrupted a "reverse jog operation with<br>registration" operation that was initiated by the RJOGNINNINNINNIN<br>command again.<br>When the HOLD command has interrupted a "reverse jog operation with<br>registration" operation can be restarted by executing the RJOGNINNINNINNI<br>command, the operation can be restarted by executing the RJOGNINNINNINNI<br>command, the operation can be restarted by executing the ZRN command.<br>When the HOLD command has interrupted homing initiated by the ZRN<br>command, homing can be restarted by executing the ZRN command.<br>When the HOLD command is executed during a JOG forward operation<br>initiated by JOGPINININNIN or a JOG reverse operation initiated by JOGNIN<br>nnnnnnn, the JOG operation will be stopped.<br>Speed<br>* OSIV<br>* OVER * | OK                   |
|                              | Continued or                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |

#### 14.8.3 Positioning, Jog Operation, and Registration with Serial Commands

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Operation with Serial Command Communications

|                | Continued from previous page.                                                                                                                                                                                                                                              |                      |  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--|
| Serial Command | Function/Description                                                                                                                                                                                                                                                       | Positive<br>Response |  |
| SKIP           | Positioning Stop<br>Stops the current positioning.<br>The remaining distance will be canceled.<br>• SPDx<br>• POSIV<br>• ST<br>Speed • • SKIP<br>speed • • JOGPx<br>• SKIP<br>canceled • • JOGPx<br>• SKIP<br>canceled • • SKIP                                            | OK                   |  |
| POUTnnnnnnn    | POUT Specification<br>Specifies the operation of programmable output signals /POUT0 to<br>/POUT7.<br>Settings:<br>N: Inactive<br>A: Active<br>Z: ZONE table<br>":": Continue<br>POUT n n n n n n n<br>POUT n n n n n n n<br>/POUT0<br>/POUT1<br>/POUT4<br>/POUT6<br>/POUT7 | OK                   |  |

\* If you set PnB54 to 1 (Enable Expansion Mode), the command name and the command setting range will change. Refer to the following section for details.

12.4 Speed/Position Expansion Function Setting on page 12-8

## 14.8.4 Positioning with a Program Table

## **Program Table Setup Commands**

The following table shows the Program Table Setup Commands.

| Serial Command | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Positive Response |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| PGMSTORE       | Program Table Save<br>Saves the program table in flash memory.<br>Once PGMSTORE is executed, the program<br>table will be retained after the control power<br>supply is turned OFF. Because the program<br>table is stored in flash memory, this command<br>must not be executed frequently.<br>Note: Do not turn OFF the control power supply while<br>PGMSTORE is being executed.<br>Execution can take a few seconds to slightly<br>longer than 10 seconds. The green LED will<br>flash during execution. | ок                |

Continued from previous page.

| Serial Command         | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Continued from previous page. Positive Response                                                                                                                                                                                                                               |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | Program Table Initialization                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                               |
| PGMINIT                | Resets all values in the program table to their<br>default settings.<br>Note: Do not turn OFF the control power supply while<br>PGMINIT is being executed.<br>Execution can take a few seconds to slightly<br>longer than 10 seconds. The green LED will                                                                                                                                                                                                                                  | ок                                                                                                                                                                                                                                                                            |
| POSTsss*               | flash during execution.  Program Table POS Read  Reads the POS value (positioning target position). sss: Program step (PGMSTEP)  Program Table POS Write                                                                                                                                                                                                                                                                                                                                  | POST123 = A+12345678 [CR] [LF]<br>POST123 = I+12345678 [CR] [LF]<br>POST123 = S+12345678 [CR] [LF]<br>POST123 = +INFINITE [SP] [CR] [LF]<br>POST123 = STOP [SP] [SP] [SP]<br>[SP] [SP] [SP] [CR] [LF]<br>POST123 = -[SP] [SP] [SP] [SP] [SP]<br>[SP] [SP] [SP] [SP] [CR] [LF] |
| POSTsss =<br>nnnnnnn*  | Program Table POS Write<br>Sets the POS value (positioning target position).<br>sss: Program step (PGMSTEP)<br>Settings:<br>Annnnnnn: Absolute position [1 reference unit]<br>(–99999999 ≤ nnnnnnn ≤ +99999999)<br>Innnnnnn: Relative distance [1 reference unit]<br>(–99999999 ≤ nnnnnnn ≤ +99999999)<br>Snnnnnnn: Continuous stop [1 reference unit]<br>(–99999999 ≤ nnnnnnn ≤ +99999999)<br>+INFINITE or -INFINITE:<br>JOG forward or JOG reverse<br>STOP: Stop<br>–: No specification | ОК                                                                                                                                                                                                                                                                            |
| SPDTsss*               | Program Table SPD Read<br>Reads the SPD value (positioning speed).<br>sss: Program step (PGMSTEP)                                                                                                                                                                                                                                                                                                                                                                                         | SPDT123 = 12345678 [CR] [LF]                                                                                                                                                                                                                                                  |
| SPDTsss =<br>nnnnnnn*  | Program Table SPD Write         Sets the SPD value (positioning speed).         sss: Program step (PGMSTEP)         Settings:         1 ≤ nnnnnnnn ≤ +999999999 [1000 reference units/min]                                                                                                                                                                                                                                                                                                | ОК                                                                                                                                                                                                                                                                            |
| RDSTTsss*              | Program Table RDST Read<br>Reads the RDST value (registration distance).<br>sss: Program step (PGMSTEP)                                                                                                                                                                                                                                                                                                                                                                                   | RDSTT123 = 12345678 [CR] [LF]<br>RDSTT123 = -[SP] [SP] [SP] [SP]<br>[SP] [SP] [SP] [CR] [LF]                                                                                                                                                                                  |
| RDSTTsss =<br>nnnnnnn* | Program Table RDST Write<br>Sets the RDST value (registration distance).<br>sss: Program step (PGMSTEP)<br>Settings:<br>0 ≤ nnnnnnn ≤ 999999999:<br>Registration distance [1 reference unit]<br>-: No registration                                                                                                                                                                                                                                                                        | OK                                                                                                                                                                                                                                                                            |
| RSPDTsss*              | Program Table RSPD Read<br>Reads the RSPD value (registration speed).<br>sss: Program step (PGMSTEP)                                                                                                                                                                                                                                                                                                                                                                                      | RSPDT123 = 12345678 [CR] [LF]                                                                                                                                                                                                                                                 |

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|                        |                                                                                                                                                                                                                                                                                                                                                                        | Continued from previous page.                                                              |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Serial Command         | Function/Description                                                                                                                                                                                                                                                                                                                                                   | Positive Response                                                                          |
| RSPDTsss =<br>nnnnnnn* | Program Table RSPD Write<br>Sets the RSPD value (registration speed).<br>sss: Program step (PGMSTEP)<br>Settings:<br>1 ≤ nnnnnnnn ≤ +999999999 [1000 reference<br>units/min]                                                                                                                                                                                           | ОК                                                                                         |
| ACCTsss*               | Program Table ACC Read<br>Reads the ACC value (acceleration).<br>sss: Program step (PGMSTEP)                                                                                                                                                                                                                                                                           | ACCT123 = 12345678 [CR] [LF]<br>ACCT123 = :[SP] [SP] [SP] [SP] [SP]<br>[SP] [SP] [CR] [LF] |
| ACCTsss =<br>nnnnnnn*  | Program Table ACC Write<br>Sets the ACC value (acceleration).<br>sss: Program step (PGMSTEP)<br>Settings:<br>1 ≤ nnnnnnn ≤ +99999999: Acceleration [1000<br>(reference units/min)/ms]<br>":": Continues the previously executed program<br>step's specification.                                                                                                       | ОК                                                                                         |
| DECTsss*               | Program Table DEC Read<br>Reads the DEC value (deceleration).<br>sss: Program step (PGMSTEP)                                                                                                                                                                                                                                                                           | DECT123 = 12345678 [CR] [LF]<br>DECT123 = :[SP] [SP] [SP] [SP] [SP]<br>[SP] [SP] [CR] [LF] |
| DECTsss =<br>nnnnnnn*  | Program Table DEC Write         Sets the DEC value (deceleration).         sss: Program step (PGMSTEP)         Settings:         1 ≤ nnnnnnnn ≤ +999999999: Deceleration [1000 (reference units/min)/ms]         ":": Continues the previously executed program step's specification.         Program Table POUT Read                                                  | ОК                                                                                         |
| POUTTsss*              | Reads the POUT value (programmable output<br>signal).<br>sss: Program step (PGMSTEP)                                                                                                                                                                                                                                                                                   | POUTT123 = NANANANZ [CR] [LF]                                                              |
| POUTTsss =<br>nnnnnnn* | Program Table POUT Write<br>Sets the POUT value (programmable output sig-<br>nal).<br>sss: Program step (PGMSTEP)<br>Settings:<br>N: Not active<br>A: Active<br>Z: ZONE table<br>":": Continues the previously executed program<br>step's specification.<br>POUT n n n n n n<br>POUT n n n n n n<br>POUT 1<br>/POUT2<br>/POUT2<br>/POUT4<br>/POUT5<br>/POUT6<br>/POUT7 | ОК                                                                                         |

Continued from previous page.

| 0.110                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Continued from previous page.         |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Serial Command            | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Positive Response                     |
| EVENTTsss                 | Program Table EVENT Read<br>Reads the EVENT value (pass condition).<br>sss: Program step (PGMSTEP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                       |
|                           | Program Table EVENT Write                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                       |
|                           | Sets the EVENT value (pass condition).<br>sss: Program step (PGMSTEP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                       |
| EVENTTsss = nnnn-<br>nnnn | <ul> <li>Settings:</li> <li>I: INPOSITION (positioning completed) active</li> <li>N: NEAR (near position) active</li> <li>D: DEN (positioning reference distribution completed) active</li> <li>SELx: SEL input signal active (x = 0 to 7)</li> <li>Tnnnnn: Time elapsed (ms) since the program step started.</li> <li>(0 ≤ nnnnn ≤ 99999)</li> <li>ITnnnnn: Time elapsed (ms) after the INPOSI-TION signal became active. (0 ≤ nnnnn ≤ 99999)</li> <li>NTnnnnn: Time elapsed (ms) after the NEAR signal became active. (0 ≤ nnnnn ≤ 99999)</li> <li>DTnnnnn: Time elapsed (ms) after the DEN signal became active. (0 ≤ nnnnn ≤ 99999)</li> <li>DTnnnnn: Time elapsed (ms) after the DEN signal became active. (0 ≤ nnnnn ≤ 99999)</li> <li>SELxnnnnn: Time elapsed (ms) after the SEL input signal became active.</li> <li>(x = 0 to 7, 0 ≤ nnnnn ≤ 99999)</li> <li>":": Continues the previously executed program step's specification.</li> </ul> | ОК                                    |
| LOOPTsss                  | Program Table LOOP Read<br>Reads the LOOP value (number of repetitions).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | LOOPT123 = 12345 [CR] [LF]            |
|                           | sss: Program step (PGMSTEP)<br>Program Table LOOP Write                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                       |
| LOOPTsss = nnnnn          | Sets the LOOP value (number of repetitions).<br>sss: Program step (PGMSTEP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ОК                                    |
|                           | Setting:<br>1 ≤ nnnnn ≤ 99999                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                       |
|                           | Program Table NEXT Read                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | NEXTT123 = 12345 [CR] [LF]            |
| NEXTTsss                  | Reads the NEXT value (link destination).<br>sss: Program step (PGMSTEP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | NEXTT123 = END [SP] [SP] [CR]<br>[LF] |
| NEXTTsss = nnn            | Program Table NEXT Write<br>Sets the NEXT value (link destination).<br>sss: Program step (PGMSTEP)<br>Settings:<br>$0 \le nnn \le 255$ :Program step (PGMSTEP)<br>END: End                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ОК                                    |

\* If you set PnB54 to 1 (Enable Expansion Mode), the command name, the command setting range, and the acknowledgment will change. Refer to the following section for details.

12.4 Speed/Position Expansion Function Setting on page 12-8

## **Program Table Operation Commands**

The following table shows the Program Table Operation Commands

| Serial Command | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                    | Positive Response |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| STARTsss       | <ul> <li>Program Table Operation Start</li> <li>Starts program table operation from pro-<br/>gram step sss.</li> <li>sss: Program step (PGMSTEP)</li> <li>When program table operation has been<br/>interrupted by the STOP command or<br/>other method, the STARTsss command<br/>can be executed to cancel that operation<br/>and simultaneously start a new program<br/>table operation from program step sss.</li> </ul>             | ОК                |
| START          | Program Table Operation Restart<br>When program table operation has been<br>interrupted by the STOP command or<br>other method, the START command can<br>be executed to restart that operation<br>(clearing the hold state).<br>If program table operation was canceled or<br>ended, the START command will start a<br>new program table operation from the pro-<br>gram step (sss) that was specified in the<br>last STARTsss command. | ОК                |
| STOP           | Program Table Operation Interruption<br>Interrupts a program table operation.<br>When a positioning is in progress, the<br>remainder of the operation (remaining dis-<br>tance) is put on hold.                                                                                                                                                                                                                                         | ОК                |
| PGMRES         | Program Table Operation Reset<br>When program table operation has been<br>interrupted by the STOP command or<br>other method, the PGMRES command can<br>be executed to cancel that operation (reset<br>program table operation.)                                                                                                                                                                                                        | ОК                |

14.8.5 Editing a Jog Speed Table

#### Editing a Jog Speed Table 14.8.5

The following commands are used to edit a jog speed table.

| Serial Command     | Function/Description                                                                                                                                                                                                                                                                                       | Positive Response             |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| JSPDSTORE          | JOG Speed Table Save<br>Saves the JOG speed table in flash memory.<br>Once JSPDSTORE is executed, the jog<br>speed table will be retained after the control<br>power supply is turned OFF. Because the<br>JOG speed table is stored in flash memory,<br>this command must not be executed fre-<br>quently. | ОК                            |
| JSPDINIT           | JOG Speed Table Initialization<br>Resets all values in the JOG speed table to<br>their default settings.                                                                                                                                                                                                   | ОК                            |
| JSPDTdd*           | JOG Speed Table Read<br>Reads the JOG speed table setting for the<br>specified number.<br>dd: JOG speed number                                                                                                                                                                                             | JSPDT123 = 12345678 [CR] [LF] |
| JSPDTdd = nnnnnnn* | JOG Speed Table Write<br>Sets the JOG speed table setting for the<br>specified number.<br>dd: JOG speed number<br>Settings: 1 ≤ nnnnnnn ≤ 99999999<br>[1,000 reference units/min]                                                                                                                          | ОК                            |

\* If you set PnB54 to 1 (Enable Expansion Mode), the command name, the command setting range, and the acknowledgment will change. Refer to the following section for details.
 I 12.4 Speed/Position Expansion Function Setting on page 12-8

#### Editing a ZONE Table 14.8.6

The following commands are used to edit a ZONE table.

| zone boundary position.)                                                                                                                                                                                                          | Serial Command | Function/Description                                                                                                                                                                                                                                    | Positive Response               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| ZONEINIT     Resets all values in the ZONE table to their default settings.     OK       ZONE Table ZONEP Read     ZONEPTzz*     Reads the ZONEP value (positive side zone boundary position.)     ZONEPT123 = +12345678 [CR] [LI | ZONESTORE      | Saves the ZONE table in flash memory.<br>Once ZONESTORE is executed, the ZONE<br>table will be retained after the control<br>power supply is turned OFF. Because the<br>ZONE table is stored in flash memory, this<br>command must not be executed fre- | ОК                              |
| <b>ZONEPTzz*</b> Reads the ZONEP value (positive side zone boundary position.) ZONEPT123 = +12345678 [CR] [LI                                                                                                                     | ZONEINIT       | Resets all values in the ZONE table to their                                                                                                                                                                                                            | ОК                              |
|                                                                                                                                                                                                                                   | ZONEPTzz*      | Reads the ZONEP value (positive side                                                                                                                                                                                                                    | ZONEPT123 = +12345678 [CR] [LF] |

Continued on next page.

|                        |                                                                                                                                                                         | Continued from previous page.   |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| Serial Command         | Function/Description                                                                                                                                                    | Positive Response               |
| ZONEPTzz = nnnnnnn*    | ZONE Table ZONEP Write<br>Sets the ZONEP value (positive side zone<br>boundary position).<br>zz: ZONE number (ZONE ID)<br>Settings: –99999999 ≤ nnnnnnnn ≤<br>+99999999 | ОК                              |
| ZONENTzz*              | ZONE Table ZONEN Read<br>Reads the ZONEN value (negative side<br>zone boundary position.)<br>zz: ZONE number (ZONE ID)                                                  | ZONENT123 = +12345678 [CR] [LF] |
| ZONENTzz =<br>nnnnnnn* | ZONE Table ZONEN Write<br>Sets the ZONEN value (negative side zone<br>boundary position).<br>zz: ZONE number (ZONE ID)<br>Settings: –99999999 ≤ nnnnnnn ≤<br>+99999999  | ОК                              |

\* If you set PnB54 to 1 (Enable Expansion Mode), the command name, the command setting range, and the acknowledgment will change. Refer to the following section for details.

3 12.4 Speed/Position Expansion Function Setting on page 12-8

## 14.8.7 Editing Parameters, Monitoring, and Utility Functions

## **Parameter Editing Commands**

The following commands are used to edit parameters.

| Serial Command | Function/Description                                                                                                                                                   | Positive Response                                                                                                                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| РВМррр         |                                                                                                                                                                        | An 8-digit signed decimal value is<br>returned for commands PRM124,<br>PRM164, PRM165, PRM550 to<br>PRM553, PRMB21, PRMB23,<br>PRMB25, PRMB39, and PRMB50.<br>Example: PRMB21 = +12345678<br>[CR] [LF]<br>Eight-digit hexadecimal for PRM000<br>to PRM002, PRM006 to PRM009, |
|                | Parameter Read<br>Reads a parameter.<br>ppp: Parameter number (Pn number)<br>Example: Reading PnB00<br>Command: 1PRMB00 [CR]<br>Response: 1PRMB00 = 00000001 [CR] [LF] | PRM00A, PRM00B to PRM00D,<br>PRM00F, PRM010, PRM040,<br>PRM080, PRM081, PRM10B,<br>PRM139, PRM140, PRM160,<br>RPM170, PRM310, PRM408,<br>PRM416, PRM423, PRM460,<br>PRM530, PRM587, PRMB53, and<br>PRMB54, and PRM000 = 00001234<br>[CR] [LF] is returned.                   |
|                |                                                                                                                                                                        | A 10-digit unsigned decimal value is<br>returned for commands PRM20E,<br>PRM210, PRM212, PRM520,<br>PRM526, and PRM531.<br>Example: PRM20E=1234567890<br>[CR] [LF]                                                                                                           |
|                |                                                                                                                                                                        | An 8-digit unsigned decimal value is<br>returned for all other parameters.<br>Example: PRMB00 = 12345678<br>[CR] [LF]                                                                                                                                                        |

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| Carriel Commence         | Continued from previous page.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |  |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--|
| Serial Command           | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Positive Response |  |
| PRMppp =<br>(±) nnnnnn*  | Parameter Write<br>Sets a parameter.<br>ppp: Parameter number (Pn number)<br>Parameters are stored in EEPROM, so the<br>settings will be retained after the control<br>power supply is turned OFF. Because the<br>value is stored in EEPROM, this command<br>must not be used if the setting needs to be<br>changed frequently. In such a case, use the<br>TRMppp = (±) nnnnnnn command.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ОК                |  |
|                          | <ul> <li>Note: The settings of parameters are updated at one of the following two times. Immediately: The setting of the parameter is enabled immediately. After restart: The setting of the parameter is enabled the next time the control power supply is turned OFF and ON again.</li> <li>Refer to the following section for the timing of enabling parameter settings.</li> <li>16.2.2 List of Parameters on page 16-4</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                   |  |
| TRMppp =<br>(±) nnnnnnn* | <ul> <li>Temporary Parameter Write</li> <li>Sets a parameter.</li> <li>ppp: Parameter number (Pn number)</li> <li>The PRMppp = (±) nnnnnnn command stores the parameter setting in EEPROM, but the TRMppp = (±) nnnnnnn command does not. Because this command does not write the setting in EEPROM, it can be used to change settings frequently.</li> <li>Note: The settings of parameters are updated at one of the following two times. Immediately: The setting of the parameter is enabled immediately.</li> <li>After restart: The setting of the parameter is enabled the next time the control power supply is turned OFF and ON again. You cannot use the TRMppp = (±) nnnnnnn command to edit parameters that are enabled after turning the control power supply OFF and ON again. Use the PRMppp = (±) nnnnnnn command.</li> <li>Refer to the following section for the timing of enabling parameter settings.</li> <li>Image 16.2.2 List of Parameters on page 16-4</li> </ul> | OK                |  |
| PRMINIT                  | Parameter Initialization<br>Resets all parameters to their default set-<br>tings.<br>After executing PRMINIT, turn the control<br>power supply OFF and ON.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | OK                |  |

\* If you set PnB54 to 1 (Enable Expansion Mode), the command name will change. Refer to the following section for details.

312.4 Speed/Position Expansion Function Setting on page 12-8

## **Monitor and Utility Function Commands**

The following table shows the Monitor and Utility Function Commands.

| Serial Command | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Positive Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ALM            | Alarm or Warning Read                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <ul> <li>One of the following responses is returned depending on the status.</li> <li>ALM [SP] A.xxx [SP] [CR] [LF] (The "xxx" is the SERVOPACK's alarm/warning code.)</li> <li>ALM [SP] ExxA [SP] [CR] [LF] (ExxA is the INDEXER Module's alarm code.)</li> <li>ALM [SP] HBB [SP] [CR] [LF]</li> <li>ALM [SP] N-OT [SP] [CR] [LF]</li> <li>ALM [SP] N-OT [SP] [CR] [LF]</li> <li>ALM [SP] N-LS [SP] [CR] [LF]</li> <li>ALM [SP] BB [SP] [SP] [CR] [LF]</li> <li>ALM [SP] BB [SP] [CR] [LF]</li> </ul> |
|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <ul> <li>ALM [SP] HOLD [SP] [CR] [LF]</li> <li>ALM [SP] INPOS [CR] [LF]</li> <li>ALM [SP] NEAR [SP] [CR] [LF]</li> <li>ALM [SP] RUN [SP] [SP] [CR] [LF]</li> <li>ALM [SP] . [SP] [SP] [SP] [SP] [CR] [LF]</li> </ul>                                                                                                                                                                                                                                                                                   |
| ALMn           | Alarm History Read<br>(0 ≤ n ≤ 9)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | One of the following responses is<br>returned depending on the status:<br>No alarm, SERVOPACK alarm, or<br>INDEXER Module alarm.<br>• ALM1 = NONE [CR] [LF]<br>• ALM1 = A.xxx [CR] [LF]<br>• ALM1 = ExxA [CR] [LF]                                                                                                                                                                                                                                                                                     |
| ERR            | Most Recent Error Read<br>Most R |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| IN1            | SERVOPACK Input Signal Monitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | IN1 = 01010101 [CR] [LF]<br>0: Photocoupler OFF<br>1: Photocoupler ON<br>Bit 0: /S-ON<br>Bit 1: /ALM-RST<br>Bit 2: P-OT<br>Bit 3: N-OT<br>Bit 4: /DEC<br>Bit 5: Not used (Invalid)<br>Bit 6: /RGRT<br>Bit 7: Not used (Always 0)                                                                                                                                                                                                                                                                       |
| IN2            | INDEXER Module Input Signal Monitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | IN2 = 10101010101 [CR] [LF]<br>0: Photocoupler OFF<br>1: Photocoupler ON<br>Bit 0: /MODE 0/1<br>Bit 1: /START-STOP; /HOME<br>Bit 2: /PGMRES; /JOGP<br>Bit 3: /SEL0; /JOGN<br>Bit 4: /SEL1; /JOG0<br>Bit 5: /SEL2; /JOG1<br>Bit 6: /SEL3; /JOG2<br>Bit 7: /SEL4; /JOG3<br>Bit 8: /SEL5<br>Bit 9: /SEL6<br>Bit 10: /SEL7                                                                                                                                                                                 |

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| Serial Command     | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Positive Response                                                                                                                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | INDEXER Module Input Signal Specification<br>The actual signal is ignored and the input<br>signal is forcibly set to the specified status.<br>This command is used to test operation<br>when the actual signal line is not connected.                                                                                                                                                                                                                                              |                                                                                                                                                                                                                  |
| IN2TESTbbbbbbbbbbb | b = 0: Photocoupler OFF<br>b = 1: Photocoupler ON<br>Bit 0: /MODE 0/1<br>Bit 1: /START-STOP; /HOME<br>Bit 2: /PGMRES; /JOGP<br>Bit 3: /SEL0; /JOGN<br>Bit 4: /SEL1; /JOG0<br>Bit 5: /SEL2; /JOG1<br>Bit 6: /SEL2; /JOG1<br>Bit 6: /SEL3; /JOG2<br>Bit 7: /SEL4; /JOG3<br>Bit 8: /SEL5<br>Bit 9: /SEL6<br>Bit 10: /SEL7<br>IN2TESTEND: Return to actual signal sta-                                                                                                                 | ОК                                                                                                                                                                                                               |
|                    | <ul> <li>INZ FESTEND. Return to actual signal status.</li> <li>Note: Error E56E will occur if fewer than 11 digits (bbbbbbbbbbbb) are specified in the command.</li> <li>If operation is being performed in Mode 0 (program table operation mode), /MODE0/1 must be set to 1 before /START-STOP is set to 1. If operation is being performed in Mode 1 (homing or JOG speed table operation mode), /MODE0/1 must be set to 0 before /HOME, /JOGP, or /JOGN is set to 1.</li> </ul> |                                                                                                                                                                                                                  |
| IN3                | Safety Input Signal Monitor                                                                                                                                                                                                                                                                                                                                                                                                                                                        | IN3 = 01010101 [CR] [LF]<br>0: Photocoupler OFF<br>1: Photocoupler ON<br>Bit 0: /HWBB1<br>Bit 1: /HWBB2<br>Bit 2 to Bit 7: Not used (indefinite)                                                                 |
| OUT1               | SERVOPACK Output Signal Monitor                                                                                                                                                                                                                                                                                                                                                                                                                                                    | OUT1 = 01010101 [CR] [LF]<br>0: Photocoupler OFF<br>1: Photocoupler ON<br>Bit 0: ALM<br>Bit 1: /WRN<br>Bit 2: /BK<br>Bit 3: /S-RDY<br>Bit 4: /ALO1<br>Bit 5: /ALO2<br>Bit 6: /ALO3<br>Bit 7: Not used (Always 0) |

| <b>∍</b> _F]             |  |
|--------------------------|--|
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| ignal<br>e digits<br>om- |  |
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| Continued from previous page. |                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Serial Command                | Function/Description                                                                                                                                 | Positive Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
|                               |                                                                                                                                                      | STS = 1010101 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| STS or MON6                   | Status Flag Monitor                                                                                                                                  | <ul> <li>Bit 0: ON (1) when the /INPOSITION (positioning completed) signal is active.</li> <li>Bit 1: ON (1) when the NEAR (near position) signal is active.</li> <li>Bit 2: ON (1) when the DEN (positioning reference distribution completed) signal is active.</li> <li>Bit 3: ON (1) when positioning or program operation is interrupted (on hold).</li> <li>Bit 4: ON (1) during program operation.</li> <li>Bit 5: ON (1) when the current (torque) is being limited.</li> <li>Bit 6: ON (1) when the main power supply is ON.</li> </ul> |  |
| PUN or MON1*                  | Position Reference Current Position                                                                                                                  | PUN = +12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| PFB or MON7*                  | Current (Actual) Motor Position Monitor                                                                                                              | PFB = +12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| POS or MON8*                  | Target Position Monitor                                                                                                                              | POS = +12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| DST or MON9*                  | Target Distance Monitor                                                                                                                              | DST = +12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| RPOS or MON10*                | Registration Target Position Monitor                                                                                                                 | RPOS = +12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| RDST or MON11*                | Registration Target Distance Monitor                                                                                                                 | RDST = 12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| NFB or MON3<br>TREF or MON5   | Motor Speed Monitor [min <sup>-1</sup> ] (rotational<br>motor)<br>Motor Speed Monitor [mm/s] (linear motor)<br>Internal Torque Reference Monitor [%] | NFB = +12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
|                               |                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| NREF or MON4                  | Speed Reference Monitor [min <sup>-1</sup> ] (rotational<br>motor)<br>Speed Reference Monitor [mm/s] (linear<br>motor)                               | NREF = 12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| PER or MON2*                  | Position Error Monitor [Reference units]                                                                                                             | PER = +12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| TRMS                          | Cumulative Load Ratio Monitor [%]                                                                                                                    | TRMS = 12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| RGRMS                         | Regeneration Load Ratio Monitor [%]                                                                                                                  | TGRMS = 12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| DBRMS                         | Dynamic-Brake Load Ratio Monitor [%]                                                                                                                 | DBRMS = 12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| HALLSENS                      | Hall Sensor Monitor for Linear Servomotor                                                                                                            | HALLSENS=1[SP]LLH[CR][LF]<br>A number<br>between<br>0 and 7<br>V [H or L]<br>Status of phase<br>V [H or L]<br>Status of phase<br>U [H or L]                                                                                                                                                                                                                                                                                                                                                                                                      |  |
| ТҮРЕ                          | INDEXER Module Model Code Display<br>INDEXER Module Model Code = 0A03                                                                                | TYPE = 00000A03 [CR] [LF]<br>(Displayed in hexadecimal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| YSPEC                         | INDEXER Module Special Specification No.<br>Display                                                                                                  | YSPEC = 12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| VER                           | INDEXER Module Firmware Version Display                                                                                                              | VER = 00001234 [CR] [LF]<br>(Displayed in hexadecimal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| SVTYPE                        | SERVOPACK Model Code Display<br>SGD7S-DDDDE0A = 73                                                                                                   | SVTYPE = 00000073 [CR] [LF]<br>(Displayed in hexadecimal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| SVYSPEC                       | SERVOPACK Special Specification No. Display                                                                                                          | SVYSPEC = 12345678 [CR] [LF]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
| SVVER                         | SERVOPACK Firmware Version Display                                                                                                                   | SVVER = 12345678 [CR] [LF]<br>(Displayed in hexadecimal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Continued from previous page.                             |  |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|--|
| Serial Command | Function/Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Positive Response                                         |  |
| MTTYPE         | $ \begin{array}{c} \mbox{Motor Model Code Display} \\ & \underbrace{\begin{array}{c} 0 \ 1 \ 1 \ 1} \\ \mbox{Voltage} \\ 00 = 100 \ VAC \\ 01 = 200 \ VAC \\ 02 = 400 \ VAC \\ 02 = 400 \ VAC \\ 02 = 3 \ GMAV \\ 62 = 3 \ GMAV \\ 62 = 3 \ GMSV \\ 63 = 3 \ GMGV \\ 6D = 3 \ GMV \\ 6D = 3 \ GMV \\ 6E = 3 \ GMEV \\ 72 \ to \ 79 = 3 \ GMCV \\ A0 = 3 \ GMTA \\ A1 = 3 \ GMTA$ | MTTYPE = 00001234 [CR] [LF]<br>(Displayed in hexadecimal) |  |
| MTSIZE         | Motor Capacity Display [10 W]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | MTSIZE = 12345678 [CR] [LF]                               |  |
| PGTYPE         | Encoder Model Code Display<br>000D: 3-bit incremental encoder<br>0011:17-bit incremental encoder<br>0014:20-bit incremental encoder<br>0018:24-bit incremental encoder<br>0110:16-bit absolute encoder<br>0111:17-bit absolute encoder (multi-turn)<br>0116:22-bit absolute encoder (multi-turn)<br>0118:24-bit absolute encoder (multi-turn)<br>0214:20-bit absolute encoder (within one<br>rotation)<br>0216:22-bit absolute encoder (within one<br>rotation)<br>When fully-closed loop control is selected<br>and linear motor is used:<br>0008:8-bit serial converter unit<br>0006:12-bit serial converter unit<br>0008:8-bit incremental scale<br>0009:9-bit incremental scale<br>0000:13-bit incremental scale<br>0109:9-bit absolute scale<br>010A:10-bit absolute scale<br>Note: When fully-closed loop control is selected,<br>the external encoder's information is dis-<br>played.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | PGTYPE = 00001234 [CR] [LF]<br>(Displayed in hexadecimal) |  |
| PGVER          | Encoder Firmware Version Display<br>Note: When fully-closed loop control is selected,<br>the external encoder's information is dis-<br>played.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | PGVER = 00001234 [CR] [LF]<br>(Displayed in hexadecimal)  |  |
| ABSPGRES       | Absolute Encoder Reset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ОК                                                        |  |
| MLTLIMSET      | Multi-turn Limit Setting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ОК                                                        |  |
| ALMTRCCLR      | Alarm Trace Clear                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ОК                                                        |  |
| CURZERO        | Motor Current Zero Adjustment OK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                           |  |

\* If you set PnB54 to 1 (Enable Expansion Mode), the acknowledgement will change. Refer to the following section for details.
 *12.4 Speed/Position Expansion Function Setting* on page 12-8

# Maintenance

This chapter provides information on the meaning of, causes of, and corrections for alarms and warnings.

(15)

| 15.1 | Inspec                                                                       | ctions and Part Replacement 15-2                                            |
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| 15.2 | Alarm                                                                        | Displays15-5                                                                |
|      | 15.2.1<br>15.2.2<br>15.2.3<br>15.2.4<br>15.2.5<br>15.2.6<br>15.2.7<br>15.2.8 | List of Alarms                                                              |
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15.1.1 Inspections

## **15.1 Inspections and Part Replacement**

This section describes inspections and part replacement for SERVOPACKs.

## 15.1.1 Inspections

Perform the inspections given in the following table at least once every year for the SERVO-PACK. Daily inspections are not required.

| Item         | Frequency               | Inspection                                                                           | Correction                                     |
|--------------|-------------------------|--------------------------------------------------------------------------------------|------------------------------------------------|
| Exterior     |                         | Check for dust, dirt, and oil on the surfaces.                                       | Clean with compressed air or a cloth.          |
| Loose Screws | At least once a<br>year | Check for loose terminal block<br>and connector screws and for<br>other loose parts. | Tighten any loose screws or other loose parts. |

## 15.1.2 Guidelines for Part Replacement

The following electric or electronic parts are subject to mechanical wear or deterioration over time. Use one of the following methods to check the standard replacement period.

- Use the service life prediction function of the SERVOPACK.
   Refer to the following section for information on service life predictions.
   *I* 9.4 Monitoring Product Life on page 9-14
- Use the following table.

| Part                   | Standard Replace-<br>ment Period | Remarks                                                                                                                                                                                        |
|------------------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling Fan            | 4 years to 5 years               | The standard replacement periods given on the left are for                                                                                                                                     |
| Electrolytic Capacitor | 10 years                         | <ul> <li>the following operating conditions.</li> <li>Surrounding air temperature: Annual average of 30°C</li> <li>Load factor: 80% max.</li> <li>Operation rate: 20 hours/day max.</li> </ul> |
| Relays                 | 100,000 power ON operations      | Power ON frequency: Once an hour                                                                                                                                                               |
| Battery                | 3 years without power supplied   | Surrounding temperature without power supplied: 20°C                                                                                                                                           |

When any standard replacement period is close to expiring, contact your Yaskawa representative. After an examination of the part in question, we will determine whether the part should be replaced.



The parameters of any SERVOPACKs that are sent to Yaskawa for part replacement are reset to the default settings before they are returned to you. Always keep a record of the parameter settings. And, always confirm that the parameters are properly set before starting operation.

## 15.1.3 Replacing the Battery

If the battery voltage drops to approximately 2.7 V or less, an A.830 alarm (Encoder Battery Alarm) or an A.930 warning (Encoder Battery Warning) will be displayed.

If this alarm or warning is displayed, the battery must be replaced. Refer to the following section for the battery replacement procedure.

## **Battery Alarm/Warning Selection**

Whether to display an alarm or a warning is determined by the setting of  $Pn008 = n.\Box\Box\BoxX$  (Low Battery Voltage Alarm/Warning Selection).

| F     | Parameter                   | Meaning                                         | When Enabled  | Classification |
|-------|-----------------------------|-------------------------------------------------|---------------|----------------|
| Pn008 | n.□□□0<br>(default setting) | Output alarm (A.830) for low battery voltage.   | After restart | Setup          |
|       | n.0001                      | Output warning (A.930) for low battery voltage. |               |                |

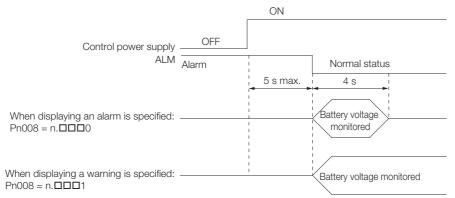
• Pn008 = n.□□□0

The ALM (Servo Alarm) signal is output for up to five seconds when the control power supply is turned ON, and then the battery voltage is monitored for four seconds.

No alarm will be displayed even if the battery voltage drops below the specified value after these four seconds.

• Pn008 = n.□□□1

The ALM (Servo Alarm) signal is output for up to five seconds when the control power supply is turned ON, and then the battery voltage is monitored continuously.



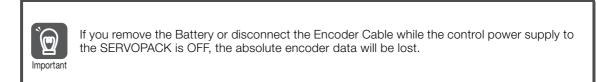
## **Battery Replacement Procedure**

- When Installing a Battery on the Host Controller
- 1. Turn ON only the control power supply to the SERVOPACK.
- 2. Remove the old battery and mount a new battery.
- **3.** Turn OFF the control power supply to the SERVOPACK to clear the A.830 alarm (Absolute Encoder Battery Error).
- 4. Turn ON the control power supply to the SERVOPACK again.
- 5. Make sure that the alarm has been cleared and that the SERVOPACK operates normally.

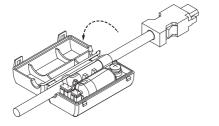
#### 15.1.3 Replacing the Battery

## When Using an Encoder Cable with a Battery Case

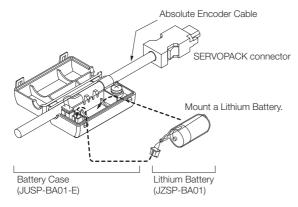
1. Turn ON only the control power supply to the SERVOPACK.



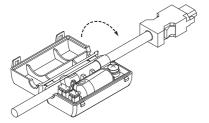
2. Open the cover of the Battery Case.



3. Remove the old Battery and mount a new Battery.



4. Close the cover of the Battery Case.



- **5.** Turn OFF the power supply to the SERVOPACK to clear the A.830 alarm (Absolute Encoder Battery Error).
- 6. Turn ON the power supply to the SERVOPACK.
- 7. Make sure that the alarm has been cleared and that the SERVOPACK operates normally.

## 15.2 Alarm Displays

If an error occurs in the SERVOPACK, the status is displayed as described below.

## ♦ Status Display

| SERVOPACK Panel Display                                 | The alarm number will be displayed.<br>Refer to the following section for details.<br>The section for details.                                        |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Indicators                                              | Green indicator: Remains unlit<br>Red indicator: Remains lit<br>Refer to the following section for details.<br>3 <i>1.5.2 Indicators</i> on page 1-11 |
| Digital Operator                                        | The alarm code is displayed at the top left of the screen.                                                                                            |
| Response to the Alarm or Warning Read<br>Command (ALM)  | Alarm code                                                                                                                                            |
| Response to the Most Recent Error Read<br>Command (ERR) | No change                                                                                                                                             |
| ALM Signal                                              | The alarm signal turns ON. (The photocoupler turns OFF.)                                                                                              |
| /WARN Signal                                            | No change                                                                                                                                             |

A list of the alarms that may occur and the causes of and corrections for those alarms are given below.

## 15.2.1 List of Alarms

This section gives the alarm names, alarm meanings, alarm stopping methods, alarm reset possibilities, and alarm code outputs in order of the alarm numbers.

## Servomotor Stopping Method for Alarms

Refer to the following section for information on the stopping method for alarms. 5.12.2 Servomotor Stopping Method for Alarms on page 5-36

## Alarm Reset Possibility

Yes: You can use an alarm reset to clear the alarm. However, this assumes that the cause of the alarm has been removed. No: You cannot clear the alarm. 15.2.1 List of Alarms

## List of Alarms

|                 |                                                                         |                                                                                                                                                                          | Servo-                           | Alarm                   | Alarm Code Output |       |       |
|-----------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------------------|-------------------|-------|-------|
| Alarm<br>Number | Alarm Name                                                              | Alarm Meaning                                                                                                                                                            | motor<br>Stop-<br>ping<br>Method | Reset<br>Possi-<br>ble? | /ALO1             | /ALO2 | /ALO3 |
| A.020           | Parameter Checksum<br>Error                                             | There is an error in the parameter data in the SERVOPACK.                                                                                                                | Gr.1                             | No                      |                   |       |       |
| A.021           | Parameter Format<br>Error                                               | There is an error in the parameter data format in the SERVOPACK.                                                                                                         | Gr.1                             | No                      | -                 |       |       |
| A.022           | System Checksum<br>Error                                                | There is an error in the parameter data in the SERVOPACK.                                                                                                                | Gr.1                             | No                      |                   |       |       |
| A.024           | System Alarm                                                            | An internal program error occurred in the SERVOPACK.                                                                                                                     | Gr.1                             | No                      | -                 |       |       |
| A.025           | System Alarm                                                            | An internal program error occurred in the SERVOPACK.                                                                                                                     | Gr.1                             | No                      |                   |       |       |
| A.030           | Main Circuit Detector<br>Error                                          | There is an error in the detection data for the main circuit.                                                                                                            | Gr.1                             | Yes                     |                   |       |       |
| A.040           | Parameter Setting<br>Error                                              | A parameter setting is outside of the set-<br>ting range.                                                                                                                | Gr.1                             | No                      |                   |       |       |
| A.041           | Encoder Output Pulse<br>Setting Error                                   | The setting of Pn212 (Encoder Output<br>Pulses) or Pn281 (Encoder Output Reso-<br>lution) is outside of the setting range or<br>does not satisfy the setting conditions. | Gr.1                             | No                      |                   |       |       |
| A.042           | Parameter Combina-<br>tion Error                                        | The combination of some parameters exceeds the setting range.                                                                                                            | Gr.1                             | No                      | Н                 | Н     | Н     |
| A.044           | Semi-Closed/Fully-<br>Closed Loop Control<br>Parameter Setting<br>Error | The settings of the Option Module and<br>Pn002 = n.X□□□ (External Encoder<br>Usage) do not match.                                                                        | Gr.1                             | No                      |                   |       |       |
| A.04A           | Parameter Setting<br>Error 2                                            | There is an error in setting of parameters reserved by the system.                                                                                                       | Gr.1                             | No                      |                   |       |       |
| A.050           | Combination Error                                                       | The capacities of the SERVOPACK and Servomotor do not match.                                                                                                             | Gr.1                             | Yes                     | -                 |       |       |
| A.051           | Unsupported Device<br>Alarm                                             | An unsupported device was connected.                                                                                                                                     | Gr.1                             | No                      |                   |       |       |
| A.070           | Motor Type Change<br>Detected                                           | The connected motor is a different type of motor from the previously connected motor.                                                                                    | Gr.1                             | No                      |                   |       |       |
| A.080           | Linear Encoder Pitch<br>Setting Error                                   | The setting of Pn282 (Linear Encoder Pitch) has not been changed from the default setting.                                                                               | Gr.1                             | No                      |                   |       |       |
| A.0b0           | Invalid Servo ON<br>Command Alarm                                       | The /S-ON (Servo ON) signal was input<br>from the host controller after a utility func-<br>tion that turns ON the Servomotor was<br>executed.                            | Gr.1                             | Yes                     |                   |       |       |
| A.100           | Overcurrent Detected                                                    | An overcurrent flowed through the power transformer or the heat sink overheated.                                                                                         | Gr.1                             | No                      | L                 | Н     | Н     |
| A.101           | Motor Overcurrent<br>Detected                                           | The current to the motor exceeded the allowable current.                                                                                                                 | Gr.1                             | No                      |                   |       |       |
| A.300           | Regeneration Error                                                      | There is an error related to regeneration.                                                                                                                               | Gr.1                             | Yes                     |                   |       |       |
| A.320           | Regenerative Over-<br>load                                              | A regenerative overload occurred.                                                                                                                                        | Gr.2                             | Yes                     |                   |       |       |
| A.330           | Main Circuit Power<br>Supply Wiring Error                               | <ul> <li>The AC power supply input setting or<br/>DC power supply input setting is not<br/>correct.</li> <li>The power supply wiring is not correct.</li> </ul>          | Gr.1                             | Yes                     |                   | L     | Н     |

15.2.1 List of Alarms

| Continued from previous p | page. |
|---------------------------|-------|
|---------------------------|-------|

|                 |                                                                      |                                                                                                                                                                                                                                                                             | Servo-                           |                                  | Alarm Code Output |   |   |
|-----------------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|-------------------|---|---|
| Alarm<br>Number | Alarm Name                                                           | Alarm Meaning                                                                                                                                                                                                                                                               | motor<br>Stop-<br>ping<br>Method | Alarm<br>Reset<br>Possi-<br>ble? | /ALO1             |   |   |
| A.400           | Overvoltage                                                          | The main circuit DC voltage is too high.                                                                                                                                                                                                                                    | Gr.1                             | Yes                              | - н               | н | L |
| A.410           | Undervoltage                                                         | The main circuit DC voltage is too low.                                                                                                                                                                                                                                     | Gr.2                             | Yes                              |                   |   |   |
| A.510           | Overspeed                                                            | The motor exceeded the maximum speed.                                                                                                                                                                                                                                       | Gr.1                             | Yes                              |                   |   |   |
| A.511           | Encoder Output Pulse<br>Overspeed                                    | <ul> <li>Rotary Servomotor: The pulse output<br/>speed for the setting of Pn212 (Encoder<br/>Output Pulses) was exceeded.</li> <li>Linear Servomotor: The motor speed<br/>upper limit for the setting of Pn281<br/>(Encoder Output Resolution) was<br/>exceeded.</li> </ul> | Gr.1                             | Yes                              | L                 | н | L |
| A.520           | Vibration Alarm                                                      | Abnormal oscillation was detected in the motor speed.                                                                                                                                                                                                                       | Gr.1                             | Yes                              |                   |   |   |
| A.521           | Autotuning Alarm                                                     | Vibration was detected during autotuning for the tuning-less function.                                                                                                                                                                                                      | Gr.1                             | Yes                              |                   |   |   |
| A.550           | Maximum Speed Set-<br>ting Error                                     | The setting of Pn385 (Maximum Motor Speed) is greater than the maximum motor speed.                                                                                                                                                                                         | Gr.1                             | Yes                              |                   |   |   |
| A.710           | Instantaneous Over-<br>load                                          | The Servomotor was operating for several seconds to several tens of seconds under a torque that largely exceeded the rating.                                                                                                                                                | Gr.2                             | Yes                              |                   |   |   |
| A.720           | Continuous Overload                                                  | The Servomotor was operating continu-<br>ously under a torque that exceeded the<br>rating.                                                                                                                                                                                  | Gr.1                             | Yes                              |                   |   |   |
| A.730<br>A.731  | Dynamic Brake Over-<br>load                                          | When the dynamic brake was applied,<br>the rotational or linear kinetic energy<br>exceeded the capacity of the dynamic<br>brake resistor.                                                                                                                                   | Gr.1                             | Yes                              |                   |   |   |
| A.740           | Inrush Current Limit-<br>ing Resistor Overload                       | The main circuit power supply was fre-<br>quently turned ON and OFF.                                                                                                                                                                                                        | Gr.1                             | Yes                              | L                 | L | L |
| A.7A1           | Internal Temperature<br>Error 1 (Control Board<br>Temperature Error) | The surrounding temperature of the con-<br>trol PCB is abnormal.                                                                                                                                                                                                            | Gr.2                             | Yes                              |                   |   |   |
| A.7A2           | Internal Temperature<br>Error 2 (Power Board<br>Temperature Error)   | The surrounding temperature of the power PCB is abnormal.                                                                                                                                                                                                                   | Gr.2                             | Yes                              |                   |   |   |
| A.7A3           | Internal Temperature<br>Sensor Error                                 | An error occurred in the temperature sensor circuit.                                                                                                                                                                                                                        | Gr.2                             | No                               |                   |   |   |
| A.7Ab           | SERVOPACK Built-in<br>Fan Stopped                                    | The fan inside the SERVOPACK stopped.                                                                                                                                                                                                                                       | Gr.1                             | Yes                              | Ī                 |   |   |
| A.810           | Encoder Backup<br>Alarm                                              | The power supplies to the encoder all failed and the position data was lost.                                                                                                                                                                                                | Gr.1                             | No                               |                   |   |   |
| A.820           | Encoder Checksum<br>Alarm                                            | There is an error in the checksum results for encoder memory.                                                                                                                                                                                                               | Gr.1                             | No                               |                   |   |   |
| A.830           | Encoder Battery<br>Alarm                                             | The battery voltage was lower than the specified level after the control power supply was turned ON.                                                                                                                                                                        | Gr.1                             | Yes                              | H                 | Н | Н |
| A.840           | Encoder Data Alarm                                                   | There is an internal data error in the encoder.                                                                                                                                                                                                                             | Gr.1                             | No                               |                   |   |   |
| A.850           | Encoder Overspeed                                                    | The encoder was operating at high speed when the power was turned ON.                                                                                                                                                                                                       | Gr.1                             | No                               |                   |   |   |
| A.860           | Encoder Overheated                                                   | The internal temperature of encoder is too high.                                                                                                                                                                                                                            | Gr.1                             | No                               |                   |   |   |

Continued on next page.

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#### 15.2 Alarm Displays

15.2.1 List of Alarms

Continued from previous page.

|                 |                                                |                                                                                                                                     | Servo-                           | - Alarm                                            | Alarm Code Output |       |       |
|-----------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------------------|-------------------|-------|-------|
| Alarm<br>Number | Alarm Name                                     | Alarm Meaning                                                                                                                       | motor<br>Stop-<br>ping<br>Method | Reset<br>Possi-<br>ble?                            | /ALO1             | /ALO2 | /ALO3 |
| A.861           | Motor Overheated                               | The internal temperature of motor is too high.                                                                                      | Gr.1                             | No                                                 |                   |       |       |
| A.862           | Overheat Alarm                                 | The input voltage (temperature) for the overheat protection input (TH) signal exceeded the setting of Pn61B (Overheat Alarm Level). | Gr.1                             | Yes                                                |                   |       |       |
| A.890           | Encoder Scale Error                            | A failure occurred in the linear encoder.                                                                                           | Gr.1                             | No                                                 |                   |       |       |
| A.891           | Encoder Module Error                           | An error occurred in the linear encoder.                                                                                            | Gr.1                             | No                                                 |                   |       |       |
| A.8A0           | External Encoder<br>Error                      | An error occurred in the external encoder.                                                                                          | Gr.1                             | Yes                                                |                   |       |       |
| A.8A1           | External Encoder<br>Module Error               | An error occurred in the Serial Converter Unit.                                                                                     | Gr.1                             | Yes                                                | Н                 | Н     | Н     |
| A.8A2           | External Incremental<br>Encoder Sensor Error   | An error occurred in the external encoder.                                                                                          | Gr.1                             | Yes                                                |                   |       |       |
| A.8A3           | External Absolute<br>Encoder Position<br>Error | An error occurred in the position data of the external encoder.                                                                     | Gr.1                             | Yes                                                |                   |       |       |
| A.8A5           | External Encoder<br>Overspeed                  | An overspeed error occurred in the exter-<br>nal encoder.                                                                           | Gr.1                             | Yes                                                |                   |       |       |
| A.8A6           | External Encoder<br>Overheated                 | An overheating error occurred in the external encoder.                                                                              | Gr.1                             | Yes                                                |                   |       |       |
| A.AEF           | INDEXER Module<br>Alarm                        | Some kind of alarm has occurred at the INDEXER Module.                                                                              | Gr.1                             | Depends<br>on the<br>Module<br>alarm <sup>*1</sup> | Н                 | L     | L     |
| A.b33           | Current Detection<br>Error 3                   | An error occurred in the current detection circuit.                                                                                 | Gr.1                             | No                                                 |                   |       |       |
| A.bC0           | System Alarm 10                                | Internal program error 10 occurred in the SERVOPACK.                                                                                | Gr.1                             | No                                                 |                   |       |       |
| A.bF0           | System Alarm 0                                 | Internal program error 0 occurred in the SERVOPACK.                                                                                 | Gr.1                             | No                                                 |                   |       |       |
| A.bF1           | System Alarm 1                                 | Internal program error 1 occurred in the SERVOPACK.                                                                                 | Gr.1                             | No                                                 |                   |       |       |
| A.bF2           | System Alarm 2                                 | Internal program error 2 occurred in the SERVOPACK.                                                                                 | Gr.1                             | No                                                 |                   |       |       |
| A.bF3           | System Alarm 3                                 | Internal program error 3 occurred in the SERVOPACK.                                                                                 | Gr.1                             | No                                                 | Н                 | Н     | Н     |
| A.bF4           | System Alarm 4                                 | Internal program error 4 occurred in the SERVOPACK.                                                                                 | Gr.1                             | No                                                 |                   |       |       |
| A.bF5           | System Alarm 5                                 | Internal program error 5 occurred in the SERVOPACK.                                                                                 | Gr.1                             | No                                                 |                   |       |       |
| A.bF6           | System Alarm 6                                 | Internal program error 6 occurred in the SERVOPACK.                                                                                 | Gr.1                             | No                                                 |                   |       |       |
| A.bF7           | System Alarm 7                                 | Internal program error 7 occurred in the SERVOPACK.                                                                                 | Gr.1                             | No                                                 |                   |       |       |
| A.bF8           | System Alarm 8                                 | Internal program error 8 occurred in the SERVOPACK.                                                                                 | Gr.1                             | No                                                 |                   |       |       |

15.2.1 List of Alarms

| Continued from pre | evious page. |
|--------------------|--------------|
|--------------------|--------------|

|                 |                                                                            | Carrie                                                                                       | Contin                                     | · .                              | ous page. |       |   |
|-----------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------|-----------|-------|---|
| Alarm<br>Number | Alarm Name                                                                 | Alarm Meaning                                                                                | Servo-<br>motor<br>Stop-<br>ping<br>Method | Alarm<br>Reset<br>Possi-<br>ble? | /Alarm    | /ALO2 |   |
| A.C10           | Servomotor Out of<br>Control                                               | The Servomotor ran out of control.                                                           | Gr.1                                       | Yes                              |           |       |   |
| A.C20           | Phase Detection Error                                                      | The detection of the phase is not correct.                                                   | Gr.1                                       | No                               | L         | Н     | L |
| A.C21           | Polarity Sensor Error                                                      | An error occurred in the polarity sensor.                                                    | Gr.1                                       | No                               |           |       | L |
| A.C22           | Phase Information<br>Disagreement                                          | The phase information does not match.                                                        | Gr.1                                       | No                               |           |       |   |
| A.C50           | Polarity Detection<br>Failure                                              | The polarity detection failed.                                                               | Gr.1                                       | No                               |           |       |   |
| A.C51           | Overtravel Detected<br>during Polarity Detec-<br>tion                      | The overtravel signal was detected during polarity detection.                                | Gr.1                                       | Yes                              |           |       |   |
| A.C52           | Polarity Detection Not<br>Completed                                        | The servo was turned ON before the polarity was detected.                                    | Gr.1                                       | Yes                              |           |       |   |
| A.C53           | Out of Range of<br>Motion for Polarity<br>Detection                        | The travel distance exceeded the setting of Pn48E (Polarity Detection Range).                | Gr.1                                       | No                               |           |       |   |
| A.C54           | Polarity Detection<br>Failure 2                                            | The polarity detection failed.                                                               | Gr.1                                       | No                               |           |       |   |
| A.C80           | Encoder Clear Error or<br>Multiturn Limit Set-<br>ting Error               | The multiturn data for the absolute encoder was not correctly cleared or set.                | Gr.1                                       | No                               | -         |       |   |
| A.C90           | Encoder Communica-<br>tions Error                                          | Communications between the encoder and SERVOPACK is not possible.                            | Gr.1                                       | No                               |           |       |   |
| A.C91           | Encoder Communica-<br>tions Position Data<br>Acceleration Rate<br>Error    | An error occurred in calculating the posi-<br>tion data of the encoder.                      | Gr.1                                       | No                               | L         | Н     | L |
| A.C92           | Encoder Communica-<br>tions Timer Error                                    | An error occurred in the communications timer between the encoder and SERVO-PACK.            | Gr.1                                       | No                               | -         |       |   |
| A.CA0           | Encoder Parameter<br>Error                                                 | The parameters in the encoder are cor-<br>rupted.                                            | Gr.1                                       | No                               |           |       |   |
| A.Cb0           | Encoder Echoback<br>Error                                                  | The contents of communications with the encoder are incorrect.                               | Gr.1                                       | No                               |           |       |   |
| A.CC0           | Multiturn Limit Dis-<br>agreement                                          | Different multiturn limits have been set in the encoder and the SERVOPACK.                   | Gr.1                                       | No                               |           |       |   |
| A.CF1           | Reception Failed Error<br>in Feedback Option<br>Module Communica-<br>tions | Receiving data from the Feedback Option<br>Module failed.                                    | Gr.1                                       | No                               |           |       |   |
| A.CF2           | Timer Stopped Error<br>in Feedback Option<br>Module Communica-<br>tions    | An error occurred in the timer for commu-<br>nications with the Feedback Option Mod-<br>ule. | Gr.1                                       | No                               |           |       |   |

Continued on next page.

#### 15.2 Alarm Displays

15.2.1 List of Alarms

|                 |                                                                        |                                                                                                                                                                                                                                                                                                                                                              | Servo-                           | Contin                           |       | Code C | 1 0 |
|-----------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|-------|--------|-----|
| Alarm<br>Number | Alarm Name                                                             | Alarm Meaning                                                                                                                                                                                                                                                                                                                                                | motor<br>Stop-<br>ping<br>Method | Alarm<br>Reset<br>Possi-<br>ble? | /ALO1 | /ALO2  |     |
| A.d00           | Position Deviation<br>Overflow                                         | The setting of Pn520 (Excessive Position Deviation Alarm Level) was exceeded by the position deviation.                                                                                                                                                                                                                                                      | Gr.1                             | Yes                              |       |        |     |
| A.d01           | Position Deviation<br>Overflow Alarm at<br>Servo ON                    | The servo was turned ON after the posi-<br>tion deviation exceeded the setting of<br>Pn526 (Excessive Position Deviation<br>Alarm Level at Servo ON) while the servo<br>was OFF.                                                                                                                                                                             | Gr.1                             | Yes                              | I     |        | Н   |
| A.d02           | Position Deviation<br>Overflow Alarm for<br>Speed Limit at Servo<br>ON | If position deviation remains in the devia-<br>tion counter, the setting of Pn529 or<br>Pn584 (Speed Limit Level at Servo ON)<br>limits the speed when the servo is turned<br>ON. This alarm occurs if a position refer-<br>ence is input and the setting of Pn520<br>(Excessive Position Deviation Alarm Level)<br>is exceeded before the limit is cleared. | Gr.2                             | Yes                              |       | L      |     |
| A.d10           | Motor-Load Position<br>Deviation Overflow                              | There was too much position deviation<br>between the motor and load during fully-<br>closed loop control.                                                                                                                                                                                                                                                    | Gr.2                             | Yes                              | L     | L      | Н   |
| A.d30           | Position Data Over-<br>flow                                            | The position feedback data exceeded ±1,879,048,192.                                                                                                                                                                                                                                                                                                          | Gr.1                             | No                               |       |        |     |

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|                 |                                                                                          |                                                                                                              | Servo-                  | Contin                           | Alorm | 1 0   |   |
|-----------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------|----------------------------------|-------|-------|---|
| Alarm<br>Number | Alarm Name                                                                               | Alarm Meaning                                                                                                | Stop-<br>ping<br>Method | Alarm<br>Reset<br>Possi-<br>ble? | /ALO1 | /ALO2 |   |
| A.E00           | Command Option<br>Module IF Initializa-<br>tion Timeout Error                            | Communications initialization failed between the SERVOPACK and the Command Option Module.                    | Gr.2                    | Yes                              |       |       |   |
| A.E02           | Command Option<br>Module IF Synchroni-<br>zation Error 1                                 | An synchronization error occurred between the SERVOPACK and the Command Option Module.                       | Gr.1                    | Yes                              |       |       |   |
| A.E03           | Command Option<br>Module IF Communi-<br>cations Data Error                               | An error occurred in the data of commu-<br>nications between the SERVOPACK and<br>the Command Option Module. | Gr.1                    | Yes                              |       |       |   |
| A.E70           | Command Option<br>Module Detection<br>Failure                                            | Detection of the Command Option Mod-<br>ule failed.                                                          | Gr.1                    | No                               |       |       |   |
| A.E71           | Safety Option Module<br>Detection Failure                                                | Detection of the safety option module failed.                                                                | Gr.1                    | No                               |       |       |   |
| A.E72           | Feedback Option<br>Module Detection<br>Failure                                           | Detection of the Feedback Option Mod-<br>ule failed.                                                         | Gr.1                    | No                               |       |       |   |
| A.E73           | Unsupported Com-<br>mand Option Module                                                   | An unsupported command option mod-<br>ule was connected.                                                     | Gr.1                    | No                               |       |       |   |
| A.E74           | Unsupported Safety<br>Option Module                                                      | An unsupported safety option module was connected.                                                           | Gr.1                    | No                               | _     |       |   |
| A.E75           | Unsupported Feed-<br>back Option Module                                                  | An unsupported feedback option module was connected.                                                         | Gr.1                    | No                               | Н     | L     | L |
| A.E80           | Command Option<br>Module Unmatched<br>Error                                              | The command option module was replaced with a different model.                                               | Gr.1                    | No                               |       |       |   |
| A.EA2           | Alarm in Current<br>Communications<br>between the INDEXER<br>Module and SERVO-<br>PACK 1 | An error occurred in communications<br>between the INDEXER Module and SER-<br>VOPACK during operation.       | Gr.1                    | Yes                              |       |       |   |
| A.EA3           | Alarm in Current<br>Communications<br>between the INDEXER<br>Module and SERVO-<br>PACK 2 | An error occurred in communications<br>between the INDEXER Module and SER-<br>VOPACK during operation.       | Gr.1                    | Yes                              | -     |       |   |
| A.Eb1           | Safety Function Sig-<br>nal Input Timing Error                                           | An error occurred in the input timing of the safety function signal.                                         | Gr.1                    | No                               |       |       |   |
| A.EC8           | Gate Drive Error 1                                                                       | An error occurred in the gate drive circuit.                                                                 | Gr.1                    | No                               | Ţ     |       |   |
| A.EC9           | Gate Drive Error 2                                                                       | An error occurred in the gate drive circuit.                                                                 | Gr.1                    | No                               | ]     |       |   |
| A.Ed1           | Command Option<br>Module IF Command<br>Timeout Error                                     | Processing of command from the com-<br>mand option module was not completed.                                 | Gr.2                    | Yes                              |       |       |   |
| A.F10           | Power Supply Line<br>Open Phase                                                          | The voltage was low for more than one second for phase R, S, or T when the main power supply was ON.         | Gr.2                    | Yes                              | н     | L     | н |

Continued on next page.

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#### 15.2 Alarm Displays

15.2.1 List of Alarms

| Continued from previous page |                                              |                                                                       |                                            |                         |         |        |        |  |
|------------------------------|----------------------------------------------|-----------------------------------------------------------------------|--------------------------------------------|-------------------------|---------|--------|--------|--|
| Alarm<br>Number              |                                              | Alarm Meaning                                                         | Servo-<br>motor<br>Stop-<br>ping<br>Method | Alarm                   | Alarm   | Code C | Output |  |
|                              | Alarm Name                                   |                                                                       |                                            | Reset<br>Possi-<br>ble? | /ALO1   | /ALO2  | /ALO3  |  |
| FL-1*2                       |                                              |                                                                       |                                            |                         |         |        |        |  |
| FL-2*2                       |                                              | An internal program error occurred in the SERVOPACK.                  | _                                          | No                      |         |        |        |  |
| FL-3*2                       |                                              |                                                                       |                                            |                         | Invalid |        |        |  |
| FL-4 <sup>*2</sup>           | System Alarm                                 |                                                                       |                                            |                         |         |        |        |  |
| FL-5 <sup>*2</sup>           |                                              |                                                                       |                                            |                         |         |        |        |  |
| FL-6 <sup>*2</sup>           |                                              |                                                                       |                                            |                         |         |        |        |  |
| FL-7 <sup>*2</sup>           |                                              |                                                                       |                                            |                         | -       |        |        |  |
| CPF00                        | Digital Operator Com-<br>munications Error 1 | Communications were not possible between the Digital Operator (model: |                                            | No                      |         |        |        |  |
| CPF01                        | Digital Operator Com-<br>munications Error 2 | JSP-OP05A-1-E) and the SÈRVOPACK<br>.g., a CPU error occurred).       | _                                          | INO                     |         |        |        |  |

\*1. Refer to the following section for details. 15.2.3 INDEXER Module Alarm Displays and Troubleshooting on page 15-45

\*2. These alarms are not stored in the alarm history. They are only displayed on the panel display.

The causes of and corrections for the alarms are given in the following table. Contact your Yaskawa representative if you cannot solve a problem with the correction given in the table.

| Alarm Number:<br>Alarm Name                                                                           | Possible Cause                                                                                                                                           | Confirmation                                                                                                                                               | Correction                                                                                                                                              | Reference |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                                                                       | The power supply voltage suddenly dropped.                                                                                                               | Measure the power supply voltage.                                                                                                                          | Set the power supply volt-<br>age within the specified<br>range, and initialize the<br>parameter settings.                                              | page 5-10 |
|                                                                                                       | The power supply<br>was shut OFF while<br>writing parameter set-<br>tings.                                                                               | Check the timing of shutting OFF the power supply.                                                                                                         | Initialize the parameter settings and then set the parameters again.                                                                                    |           |
| <b>A.020:</b><br>Parameter                                                                            | The number of times<br>that parameters were<br>written exceeded the<br>limit.                                                                            | Check to see if the<br>parameters were fre-<br>quently changed from<br>the host controller.                                                                | The SERVOPACK may be<br>faulty. Replace the SER-<br>VOPACK.<br>Reconsider the method<br>for writing the parame-<br>ters.                                | _         |
| Checksum Error<br>(There is an error<br>in the parameter<br>data in the SER-<br>VOPACK.)              | A malfunction was<br>caused by noise from<br>the AC power supply,<br>ground, static elec-<br>tricity, or other source.                                   | Turn the power supply<br>to the SERVOPACK<br>OFF and ON again. If<br>the alarm still occurs,<br>noise may be the<br>cause.                                 | Implement countermea-<br>sures against noise.                                                                                                           | page 4-6  |
|                                                                                                       | Gas, water drops, or<br>cutting oil entered the<br>SERVOPACK and<br>caused failure of the<br>internal components.                                        | Check the installation conditions.                                                                                                                         | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                | _         |
|                                                                                                       | A failure occurred in the SERVOPACK.                                                                                                                     | Turn the power supply<br>to the SERVOPACK<br>OFF and ON again. If<br>the alarm still occurs,<br>the SERVOPACK may<br>have failed.                          | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                | _         |
| A.021:<br>Parameter For-<br>mat Error<br>(There is an error<br>in the parameter<br>data format in the | The software version<br>of the SERVOPACK<br>that caused the alarm<br>is older than the soft-<br>ware version of the<br>parameters specified<br>to write. | Read the product infor-<br>mation to see if the soft-<br>ware versions are the<br>same. If they are differ-<br>ent, it could be the<br>cause of the alarm. | Write the parameters from<br>another SERVOPACK with<br>the same model and the<br>same software version,<br>and then turn the power<br>OFF and ON again. | page 9-2  |
| data format in the SERVOPACK.)                                                                        | A failure occurred in the SERVOPACK.                                                                                                                     | -                                                                                                                                                          | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                | -         |
|                                                                                                       | The power supply voltage suddenly dropped.                                                                                                               | Measure the power supply voltage.                                                                                                                          | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                | -         |
| A.022:<br>System Check-<br>sum Error<br>(There is an error                                            | The power supply<br>was shut OFF while<br>setting a utility func-<br>tion.                                                                               | Check the timing of shutting OFF the power supply.                                                                                                         | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                | _         |
| in the parameter<br>data in the SER-<br>VOPACK.)                                                      | A failure occurred in the SERVOPACK.                                                                                                                     | Turn the power supply<br>to the SERVOPACK<br>OFF and ON again. If<br>the alarm still occurs,<br>the SERVOPACK may<br>have failed.                          | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                | -         |

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| Alarm Number:                                                                               | Possible Cause                                                                                                                                                                       | Confirmation                                                                                                                    | Continued from pro                                                                              | Reference |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------|
| Alarm Name                                                                                  |                                                                                                                                                                                      | Commation                                                                                                                       | Correction                                                                                      | nererence |
| A.024:<br>System Alarm<br>(An internal pro-<br>gram error<br>occurred in the<br>SERVOPACK.) | A failure occurred in the SERVOPACK.                                                                                                                                                 | _                                                                                                                               | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                        | _         |
| A.025:<br>System Alarm<br>(An internal pro-<br>gram error<br>occurred in the<br>SERVOPACK.) | A failure occurred in the SERVOPACK.                                                                                                                                                 | -                                                                                                                               | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                        | _         |
|                                                                                             | A failure occurred in the SERVOPACK.                                                                                                                                                 | -                                                                                                                               | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                        | -         |
| <b>A.030:</b><br>Main Circuit<br>Detector Error                                             | The jumper between<br>the DC Reactor termi-<br>nals ( $\ominus$ 1 and $\ominus$ 2)<br>was removed or there<br>is faulty contact.                                                     |                                                                                                                                 | Correct the wiring between the DC Reactor                                                       |           |
|                                                                                             | The cable between<br>the DC Reactor and<br>SERVOPACK is not<br>wired correctly or<br>there is a faulty con-<br>tact.                                                                 |                                                                                                                                 | terminals.                                                                                      | _         |
|                                                                                             | The SERVOPACK and<br>Servomotor capaci-<br>ties do not match<br>each other.                                                                                                          | Check the combination<br>of the SERVOPACK and<br>Servomotor capacities.                                                         | Select a proper combina-<br>tion of SERVOPACK and<br>Servomotor capacities.                     | page 1-16 |
| A.040:<br>Parameter Set-                                                                    | The motor parameter<br>file was not written to<br>the linear encoder.<br>(This applies only<br>when not using a<br>Serial Converter Unit.)                                           | Check to see if the<br>motor parameter file<br>was written to the lin-<br>ear encoder.                                          | Write the motor parame-<br>ter file to the linear<br>encoder.                                   | page 5-17 |
| ting Error<br>(A parameter set-<br>ting is outside of                                       | A failure occurred in the SERVOPACK.                                                                                                                                                 | _                                                                                                                               | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                        | _         |
| the setting<br>range.)                                                                      | A parameter setting is outside of the setting range.                                                                                                                                 | Check the setting<br>ranges of the parame-<br>ters that have been<br>changed.                                                   | Set the parameters to values within the setting ranges.                                         | _         |
|                                                                                             | The electronic gear ratio is outside of the setting range.                                                                                                                           | Check the electronic<br>gear ratio. The ratio<br>must be within the fol-<br>lowing range: 0.001 <<br>(Pn20E/Pn210) <<br>64,000. | Set the electronic gear<br>ratio in the following<br>range: 0.001 < (Pn20E/<br>Pn210) < 64,000. | page 5-42 |
| A.041:<br>Encoder Output<br>Pulse Setting<br>Error                                          | The setting of Pn212<br>(Encoder Output<br>Pulses) or Pn281<br>(Encoder Output Res-<br>olution) is outside of<br>the setting range or<br>does not satisfy the<br>setting conditions. | Check the setting of Pn212 or Pn281.                                                                                            | Set Pn212 or Pn281 to an appropriate value.                                                     | page 6-15 |

Continued from previous page.

| Alarm Number:                                                                                             |                                                                                                                                                                            |                                                                                                                       |                                                                                                                                               |           |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Alarm Name                                                                                                | Possible Cause                                                                                                                                                             | Confirmation                                                                                                          | Correction                                                                                                                                    | Reference |
| <b>A.042:</b><br>Parameter Com-<br>bination Error                                                         | The speed of program<br>jog operation went<br>below the setting<br>range when the elec-<br>tronic gear ratio<br>(Pn20E/Pn210) or the<br>Servomotor was<br>changed.         | Check to see if the detection conditions <sup>*1</sup> are satisfied.                                                 | Decrease the setting of<br>the electronic gear ratio<br>(Pn20E/Pn210).                                                                        | page 5-42 |
|                                                                                                           | The speed of program<br>jog operation went<br>below the setting<br>range when Pn533 or<br>Pn585 (Program Jog<br>Operation Speed) was<br>changed.                           | Check to see if the detection conditions <sup>*1</sup> are satisfied.                                                 | Increase the setting of Pn533 or Pn585.                                                                                                       | page 7-13 |
|                                                                                                           | The movement speed<br>of advanced autotun-<br>ing went below the<br>setting range when<br>the electronic gear<br>ratio (Pn20E/ Pn210)<br>or the Servomotor<br>was changed. | Check to see if the detection conditions <sup>*2</sup> are satisfied.                                                 | Decrease the setting of<br>the electronic gear ratio<br>(Pn20E/Pn210).                                                                        | page 5-42 |
| A.044:<br>Semi-Closed/<br>Fully-Closed<br>Loop Control<br>Parameter<br>Setting Error                      | The setting of the<br>Fully-closed Module<br>does not match the<br>setting of Pn002 =<br>n.X□□□ (External<br>Encoder Usage).                                               | Check the setting of Pn002 = $n.X\square\square\square$ .                                                             | Make sure that the setting<br>of the Fully-closed Mod-<br>ule agrees with the setting<br>of Pn002 = $n.X\square\square\square$ .              | page 10-5 |
| A.04A:<br>Parameter Set-<br>ting Error 2                                                                  | A parameter reserved<br>by the system was<br>changed.                                                                                                                      | _                                                                                                                     | Set the following reserved<br>parameters to the default<br>settings.<br>Pn200.2<br>Pn207.1<br>Pn50A.0<br>Pn50A.1<br>Pn50A.2<br>Pn50C<br>Pn50D | _         |
| A.050:<br>Combination<br>Error<br>(The capacities of<br>the SERVOPACK<br>and Servomotor<br>do not match.) | The SERVOPACK and<br>Servomotor capaci-<br>ties do not match<br>each other.                                                                                                | Confirm that the follow-<br>ing condition is met:<br>$1/4 \le$ (Servomotor<br>capacity/SERVOPACK<br>capacity) $\le 4$ | Select a proper combina-<br>tion of the SERVOPACK<br>and Servomotor capaci-<br>ties.                                                          | page 1-16 |
|                                                                                                           | A failure occurred in the encoder.                                                                                                                                         | Replace the encoder<br>and check to see if the<br>alarm still occurs.                                                 | Replace the Servomotor or encoder.                                                                                                            | _         |
|                                                                                                           | A failure occurred in the SERVOPACK.                                                                                                                                       | _                                                                                                                     | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                      | _         |
| <b>A.051:</b><br>Unsupported<br>Device Alarm                                                              | The motor parameter<br>file was not written to<br>the linear encoder.<br>(This applies only<br>when not using a<br>Serial Converter Unit.)                                 | Check to see if the<br>motor parameter file<br>was written to the lin-<br>ear encoder.                                | Write the motor parame-<br>ter file to the linear<br>encoder.                                                                                 | page 5-17 |
|                                                                                                           | An unsupported Serial<br>Converter Unit or<br>encoder (e.g., an<br>external encoder) is<br>connected to the<br>SERVOPACK.                                                  | Check the product combination specifica-tions.                                                                        | Change to a correct com-<br>bination of models.                                                                                               | -         |

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| Alarm Number:<br>Alarm Name                                                                                                                           | Possible Cause                                                                                                                                           | Confirmation                | Correction                                                                                                                                                    | Reference  |
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| A.070:<br>Motor Type<br>Change Detected<br>(The connected<br>motor is a differ-<br>ent type of motor<br>from the previ-<br>ously connected<br>motor.) | A Rotary Servomotor<br>was removed and a<br>Linear Servomotor<br>was connected.                                                                          | _                           | Set the parameters for a<br>Linear Servomotor and<br>reset the motor type<br>alarm. Then, turn the<br>power supply to the SER-<br>VOPACK OFF and ON<br>again. | page 15-54 |
|                                                                                                                                                       | A Linear Servomotor<br>was removed and a<br>Rotary Servomotor<br>was connected.                                                                          | _                           | Set the parameters for a<br>Rotary Servomotor and<br>reset the motor type<br>alarm. Then, turn the<br>power supply to the SER-<br>VOPACK OFF and ON<br>again. | page 15-54 |
| A.080:<br>Linear Encoder<br>Pitch Setting<br>Error                                                                                                    | The setting of Pn282<br>(Linear Encoder Pitch)<br>has not been changed<br>from the default set-<br>ting.                                                 | Check the setting of Pn282. | Correct the setting of Pn282.                                                                                                                                 | page 5-16  |
| <b>A.0b0:</b><br>Invalid Servo ON<br>Command Alarm                                                                                                    | The /S-ON (Servo ON)<br>signal was input from<br>the host controller<br>after a utility function<br>that turns ON the Ser-<br>vomotor was exe-<br>cuted. | -                           | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. Or, execute a<br>software reset.                                                               | page 6-30  |

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| Alarm Number:<br>Alarm Name                                       | Possible Cause                                                                                                                                  | Confirmation                                                                                                                                                                                                 | Correction                                                                                                                                          | Reference |  |
| A.100:<br>Overcurrent                                             | The Main Circuit<br>Cable is not wired<br>correctly or there is<br>faulty contact.                                                              | Check the wiring.                                                                                                                                                                                            | Correct the wiring.                                                                                                                                 | page 4-26 |  |
|                                                                   | There is a short-circuit<br>or ground fault in a<br>Main Circuit Cable.                                                                         | Check for short-circuits<br>across Servomotor<br>phases U, V, and W, or<br>between the ground<br>and Servomotor phases<br>U, V, and W.                                                                       | The cable may be short-<br>circuited. Replace the<br>cable.                                                                                         |           |  |
|                                                                   | There is a short-circuit<br>or ground fault inside<br>the Servomotor.                                                                           | Check for short-circuits<br>across Servomotor<br>phases U, V, and W, or<br>between the ground<br>and Servomotor phases<br>U, V, or W.                                                                        | The Servomotor may be faulty. Replace the Servo-<br>motor.                                                                                          |           |  |
|                                                                   | There is a short-circuit<br>or ground fault inside<br>the SERVOPACK.                                                                            | Check for short-circuits<br>across the Servomotor<br>connection terminals U,<br>V, and W on the SER-<br>VOPACK, or between<br>the ground and termi-<br>nals U, V, or W.                                      | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                            |           |  |
| Detected<br>(An overcurrent<br>flowed through<br>the power trans- | The regenerative<br>resistor is not wired<br>correctly or there is<br>faulty contact.                                                           | Check the wiring.                                                                                                                                                                                            | Correct the wiring.                                                                                                                                 | page 4-23 |  |
| former or the heat<br>sink overheated.)                           | The dynamic brake<br>(DB, emergency stop<br>executed from the<br>SERVOPACK) was<br>frequently activated,<br>or a DB overload<br>alarm occurred. | Check the power con-<br>sumed by the DB resis-<br>tor to see how<br>frequently the DB is<br>being used. Or, check<br>the alarm display to see<br>if a DB overload alarm<br>(A.730 or A.731) has<br>occurred. | Change the SERVOPACK<br>model, operating meth-<br>ods, or the mechanisms<br>so that the dynamic brake<br>does not need to be used<br>so frequently. | -         |  |
|                                                                   | The regenerative pro-<br>cessing capacity was<br>exceeded.                                                                                      | Check the regenerative<br>load ratio in the Sig-<br>maWin+ Motion Monitor<br>Tab Page to see how<br>frequently the regenera-<br>tive resistor is being<br>used.                                              | Recheck the operating conditions and load.                                                                                                          | *3        |  |
|                                                                   | The SERVOPACK regenerative resis-<br>tance is too small.                                                                                        | Check the regenerative<br>load ratio in the Sig-<br>maWin+ Motion Monitor<br>Tab Page to see how<br>frequently the regenera-<br>tive resistor is being<br>used.                                              | Change the regenerative<br>resistance to a value<br>larger than the SERVO-<br>PACK minimum allowable<br>resistance.                                 |           |  |

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| Alarm Number:<br>Alarm Name                                                                                                           | Possible Cause                                                                                     | Confirmation                                                                                                                                                            | Correction                                                                                                                                                                 | Reference |
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| A.100:<br>Overcurrent<br>Detected<br>(An overcurrent<br>flowed through<br>the power trans-<br>former or the heat<br>sink overheated.) | A heavy load was<br>applied while the Ser-<br>vomotor was stopped<br>or running at a low<br>speed. | Check to see if the operating conditions exceed Servo Drive specifications.                                                                                             | Reduce the load applied<br>to the Servomotor. Or,<br>increase the operating<br>speed.                                                                                      | _         |
|                                                                                                                                       | A malfunction was caused by noise.                                                                 | Improve the noise envi-<br>ronment, e.g. by<br>improving the wiring or<br>installation conditions,<br>and check to see if the<br>alarm still occurs.                    | Implement countermea-<br>sures against noise, such<br>as correct wiring of the<br>FG. Use an FG wire size<br>equivalent to the SERVO-<br>PACK's main circuit wire<br>size. | -         |
|                                                                                                                                       | A failure occurred in the SERVOPACK.                                                               | _                                                                                                                                                                       | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                      | _         |
| A.101:<br>Motor Overcur-<br>rent Detected<br>(The current to<br>the motor<br>exceeded the<br>allowable cur-<br>rent.)                 | The Main Circuit<br>Cable is not wired<br>correctly or there is<br>faulty contact.                 | Check the wiring.                                                                                                                                                       | Correct the wiring.                                                                                                                                                        |           |
|                                                                                                                                       | There is a short-circuit<br>or ground fault in a<br>Main Circuit Cable.                            | Check for short-circuits<br>across cable phases U,<br>V, and W, or between<br>the ground and cable<br>phases U, V, and W.                                               | The cable may be short-<br>circuited. Replace the<br>cable.                                                                                                                | page 4-26 |
|                                                                                                                                       | There is a short-circuit<br>or ground fault inside<br>the Servomotor.                              | Check for short-circuits<br>across Servomotor<br>phases U, V, and W, or<br>between the ground<br>and Servomotor phases<br>U, V, or W.                                   | The Servomotor may be faulty. Replace the Servo-motor.                                                                                                                     |           |
|                                                                                                                                       | There is a short-circuit<br>or ground fault inside<br>the SERVOPACK.                               | Check for short-circuits<br>across the Servomotor<br>connection terminals U,<br>V, and W on the SER-<br>VOPACK, or between<br>the ground and termi-<br>nals U, V, or W. | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                                   |           |
|                                                                                                                                       | A heavy load was<br>applied while the Ser-<br>vomotor was stopped<br>or running at a low<br>speed. | Check to see if the<br>operating conditions<br>exceed Servo Drive<br>specifications.                                                                                    | Reduce the load applied<br>to the Servomotor. Or,<br>increase the operating<br>speed.                                                                                      | _         |
|                                                                                                                                       | A malfunction was caused by noise.                                                                 | Improve the noise envi-<br>ronment, e.g. by<br>improving the wiring or<br>installation conditions,<br>and check to see if the<br>alarm still occurs.                    | Implement countermea-<br>sures against noise, such<br>as correct wiring of the<br>FG. Use an FG wire size<br>equivalent to the SERVO-<br>PACK's main circuit wire<br>size. | -         |
|                                                                                                                                       | A failure occurred in the SERVOPACK.                                                               | -                                                                                                                                                                       | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                      | -         |

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| Alarm Number:<br>Alarm Name     | Possible Cause                                                                                                                                                                                                                                                        | Confirmation                                                                                                                                      | Correction                                                                                                                                                                                                             | Reference |
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| A.300:<br>Regeneration<br>Error | When using the built-<br>in regenerative resis-<br>tor, the jumper<br>between the regener-<br>ative resistor terminals<br>(B2 and B3) was<br>removed from one of<br>the following SERVO-<br>PACKs: SGD7S-<br>3R8A, -5R5A, -7R6A,<br>-120A, -180A, -200A,<br>or -330A. | Check to see if the<br>jumper is connected<br>between power supply<br>terminals B2 and B3. <sup>*4</sup>                                          | Correctly connect a jumper.                                                                                                                                                                                            | page 4-23 |
|                                 | The External Regener-<br>ative Resistor or<br>Regenerative Resis-<br>tor Unit is not wired<br>correctly, or was<br>removed or discon-<br>nected.                                                                                                                      | Check the wiring of the<br>External Regenerative<br>Resistor or Regenera-<br>tive Resistor Unit. <sup>*4</sup>                                    | Correct the wiring of the<br>External Regenerative<br>Resistor or Regenerative<br>Resistor Unit.                                                                                                                       |           |
|                                 | Pn600 (Regenerative<br>Resistor Capacity) is<br>not set to 0 and an<br>External Regenerative<br>Resistor is not con-<br>nected to one of the<br>following SERVO-<br>PACKs:<br>SGD7S-R70A, -R90A,<br>-1R6A, -2R8A, -R70F,<br>-R90F, -2R1F, or<br>-2R8F.                | Check to see if an<br>External Regenerative<br>Resistor is connected<br>and check the setting of<br>Pn600.                                        | Connect an External<br>Regenerative Resistor, or<br>set Pn600 (Regenerative<br>Resistor Capacity) to 0<br>(setting unit: ×10 W) if no<br>Regenerative Resistor is<br>required.                                         | page 5-54 |
|                                 | A Regenerative Resis-<br>tor is not connected<br>to one of the following<br>SERVOPACKs:<br>SGD7S-470A, -550A,<br>-590A, or -780A.                                                                                                                                     | Check to see if an<br>External Regenerative<br>Resistor or a Regenera-<br>tive Resistor Unit is con-<br>nected and check the<br>setting of Pn600. | Connect an External<br>Regenerative Resistor and<br>set Pn600 to an appropri-<br>ate value, or connect a<br>Regenerative Resistor<br>Unit and set Pn600 to 0.                                                          |           |
|                                 | A failure occurred in the SERVOPACK.                                                                                                                                                                                                                                  | _                                                                                                                                                 | While the main circuit<br>power supply is OFF, turn<br>the control power supply<br>to the SERVOPACK OFF<br>and ON again. If an alarm<br>still occurs, the SERVO-<br>PACK may be faulty.<br>Replace the SERVO-<br>PACK. | _         |

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| Alarm Number:<br>Alarm Name        | Possible Cause                                                                                                                                                      | Confirmation                                                                                                                            | Correction                                                                                                                                                                               | Reference |
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| A.320:<br>Regenerative<br>Overload | The power supply voltage exceeded the specified range.                                                                                                              | Measure the power supply voltage.                                                                                                       | Set the power supply volt-<br>age within the specified range.                                                                                                                            | _         |
|                                    | The external regener-<br>ative resistance value<br>or regenerative resis-<br>tor capacity is too<br>small, or there has<br>been a continuous<br>regeneration state. | Check the operating<br>conditions or the<br>capacity using the Sig-<br>maJunmaSize+ Capac-<br>ity Selection Software or<br>other means. | Change the regenerative<br>resistance value or capac-<br>ity.<br>Reconsider the operating<br>conditions using the Sig-<br>maJunmaSize+ Capacity<br>Selection Software or<br>other means. | *3        |
|                                    | There was a continu-<br>ous regeneration state<br>because a negative<br>load was continu-<br>ously applied.                                                         | Check the load applied<br>to the Servomotor<br>during operation.                                                                        | Reconsider the system<br>including the servo,<br>machine, and operating<br>conditions.                                                                                                   | _         |
|                                    | The setting of Pn600<br>(Regenerative Resis-<br>tor Capacity) is<br>smaller than the<br>capacity of the Exter-<br>nal Regenerative<br>Resistor.                     | Check to see if a<br>Regenerative Resistor is<br>connected and check<br>the setting of Pn600.                                           | Correct the setting of Pn600.                                                                                                                                                            | page 5-54 |
|                                    | The setting of Pn603<br>(Regenerative Resis-<br>tor Capacity) is<br>smaller than the<br>capacity of the Exter-<br>nal Regenerative<br>Resistor.                     | Check to see if a<br>Regenerative Resistor is<br>connected and check<br>the setting of Pn603.                                           | Correct the setting of Pn603.                                                                                                                                                            | page 5-54 |
|                                    | The external regener-<br>ative resistance is too<br>high.                                                                                                           | Check the regenerative resistance.                                                                                                      | Change the regenerative<br>resistance to a correct<br>value or use an External<br>Regenerative Resistor of<br>an appropriate capacity.                                                   | *3        |
|                                    | A failure occurred in the SERVOPACK.                                                                                                                                | -                                                                                                                                       | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                                                 | -         |

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| Alarm Number:<br>Alarm Name                                                                                                    | Possible Cause                                                                                                                                                                                                                                       | Confirmation                                                                                               | Correction                                                                                                                                                                                                             | Reference               |
|                                                                                                                                | The regenerative<br>resistor was discon-<br>nected when the<br>SERVOPACK power<br>supply voltage was<br>high.                                                                                                                                        | Measure the resistance<br>of the regenerative<br>resistor using a measur-<br>ing instrument.               | If you are using the regen-<br>erative resistor built into<br>the SERVOPACK, replace<br>the SERVOPACK.<br>If you are using an Exter-<br>nal Regenerative Resis-<br>tor, replace the External<br>Regenerative Resistor. | -                       |
| 4 220.                                                                                                                         | DC power was sup-<br>plied when an AC<br>power supply input<br>was specified in the<br>settings.                                                                                                                                                     | Check the power sup-<br>ply to see if it is a DC<br>power supply.                                          | Correct the power supply setting to match the actual power supply.                                                                                                                                                     | page 5-12               |
| A.330:<br>Main Circuit<br>Power Supply<br>Wiring Error<br>(Detected when<br>the main circuit<br>power supply is<br>turned ON.) | AC power was sup-<br>plied when a DC<br>power supply input<br>was specified in the<br>settings.                                                                                                                                                      | Check the power sup-<br>ply to see if it is an AC<br>power supply.                                         | Correct the power supply setting to match the actual power supply.                                                                                                                                                     | page 5-12               |
|                                                                                                                                | Pn600 (Regenerative<br>Resistor Capacity) is<br>not set to 0 and an<br>External Regenerative<br>Resistor is not con-<br>nected to one of the<br>following<br>SERVOPACKs:<br>SGD7S-R70A, -R90A,<br>-1R6A, -2R8A, -R70F,<br>-R90F, -2R1F, or<br>-2R8F. | Check to see if an<br>External Regenerative<br>Resistor is connected<br>and check the setting of<br>Pn600. | Connect an External<br>Regenerative Resistor, or<br>if an External Regenera-<br>tive Resistor is not<br>required, set Pn600 to 0.                                                                                      | page 4-23,<br>page 5-54 |
|                                                                                                                                | A failure occurred in the SERVOPACK.                                                                                                                                                                                                                 | -                                                                                                          | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                                                                               | -                       |

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| Alarm Number:<br>Alarm Name                                   | Possible Cause                                                                               | Confirmation                                                                                      | Correction                                                                                                                                                                                                                | Reference |
|---------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                               | The power supply voltage exceeded the specified range.                                       | Measure the power supply voltage.                                                                 | Set the AC/DC power supply voltage within the specified range.                                                                                                                                                            | _         |
|                                                               | The power supply is<br>not stable or was<br>influenced by a light-<br>ning surge.            | Measure the power supply voltage.                                                                 | Improve the power sup-<br>ply conditions, install a<br>surge absorber, and then<br>turn the power supply<br>OFF and ON again. If an<br>alarm still occurs, the<br>SERVOPACK may be<br>faulty. Replace the SER-<br>VOPACK. | _         |
| A.400:<br>Overvoltage<br>(Detected in the                     | The voltage for AC<br>power supply was too<br>high during accelera-<br>tion or deceleration. | Check the power sup-<br>ply voltage and the<br>speed and torque<br>during operation.              | Set the AC power supply voltage within the speci-<br>fied range.                                                                                                                                                          | -         |
| main circuit<br>power supply<br>section of the<br>SERVOPACK.) | The external regener-<br>ative resistance is too<br>high for the operating<br>conditions.    | Check the operating conditions and the regenerative resistance.                                   | Select a regenerative<br>resistance value that is<br>appropriate for the oper-<br>ating conditions and load.                                                                                                              | *3        |
|                                                               | The moment of inertia ratio or mass ratio exceeded the allow-able value.                     | Check to see if the<br>moment of inertia ratio<br>or mass ratio is within<br>the allowable range. | Increase the deceleration time, or reduce the load.                                                                                                                                                                       | _         |
|                                                               | A failure occurred in the SERVOPACK.                                                         | -                                                                                                 | While the main circuit<br>power supply is OFF, turn<br>the control power supply<br>to the SERVOPACK OFF<br>and ON again. If an alarm<br>still occurs, the SERVO-<br>PACK may be faulty.<br>Replace the SERVO-<br>PACK.    | -         |

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| Alarm Number:<br>Alarm Name                                                | Possible Cause                                                                                                                                                                                                                                           | Confirmation                                                        | Correction                                                                                                                             | Reference    |
|                                                                            | The power supply voltage went below the specified range.                                                                                                                                                                                                 | Measure the power supply voltage.                                   | Set the power supply volt-<br>age within the specified range.                                                                          | _            |
|                                                                            | The power supply voltage dropped during operation.                                                                                                                                                                                                       | Measure the power supply voltage.                                   | Increase the power supply capacity.                                                                                                    | _            |
|                                                                            | A momentary power interruption occurred.                                                                                                                                                                                                                 | Measure the power supply voltage.                                   | If you have changed the<br>setting of Pn509 (Momen-<br>tary Power Interruption<br>Hold Time), decrease the<br>setting.                 | page 6-11    |
| A.410:<br>Undervoltage<br>(Detected in the<br>main circuit<br>power supply | The SERVOPACK fuse is blown out.                                                                                                                                                                                                                         | _                                                                   | Replace the SERVO-<br>PACK and connect a<br>reactor to the DC reactor<br>terminals ( $\ominus$ 1 and $\ominus$ 2) on<br>the SERVOPACK. | -            |
| section of the<br>SERVOPACK.)                                              | A failure occurred in the SERVOPACK.                                                                                                                                                                                                                     | -                                                                   | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                               | _            |
|                                                                            | The jumper between<br>the DC Reactor termi-<br>nals ( $\ominus$ 1 and $\ominus$ 2)<br>was removed or there<br>is faulty contact.<br>The cable between<br>the DC Reactor and<br>SERVOPACK is not<br>wired correctly or<br>there is a faulty con-<br>tact. |                                                                     | Correct the wiring<br>between the DC Reactor<br>terminals.                                                                             | _            |
|                                                                            | The order of phases<br>U, V, and W in the<br>motor wiring is not<br>correct.                                                                                                                                                                             | Check the wiring of the Servomotor.                                 | Make sure that the Servo-<br>motor is correctly wired.                                                                                 | _            |
| A.510:<br>Overspeed<br>(The motor                                          | A reference value that<br>exceeded the over-<br>speed detection level<br>was input.                                                                                                                                                                      | Check the input refer-<br>ence.                                     | Reduce the reference value. Or, adjust the gain.                                                                                       | _            |
| exceeded the maximum speed.)                                               | The motor exceeded the maximum speed.                                                                                                                                                                                                                    | Check the waveform of the motor speed.                              | Adjust the servo gains. Or, reconsider the operating conditions.                                                                       | _            |
|                                                                            | A failure occurred in the SERVOPACK.                                                                                                                                                                                                                     | -                                                                   | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                               | -            |
| A.511:                                                                     | The encoder output<br>pulse frequency<br>exceeded the limit.                                                                                                                                                                                             | Check the encoder out-<br>put pulse setting.                        | Decrease the setting of<br>Pn212 (Encoder Output<br>Pulses) or Pn281<br>(Encoder Output Resolu-<br>tion).                              | page 6-20    |
| Encoder Output<br>Pulse Overspeed                                          | The encoder output<br>pulse frequency<br>exceeded the limit<br>because the motor<br>speed was too high.                                                                                                                                                  | Check the encoder out-<br>put pulse setting and<br>the motor speed. | Reduce the motor speed.                                                                                                                | -            |

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| Alarm Number:<br>Alarm Name                                                                     | Possible Cause                                                                                                                     | Confirmation                                                                                                                                  | Correction                                                                                                                                                                                       | Reference               |
|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
|                                                                                                 | Abnormal oscillation<br>was detected in the<br>motor speed.                                                                        | Check for abnormal<br>motor noise, and check<br>the speed and torque<br>waveforms during oper-<br>ation.                                      | Reduce the motor speed.<br>Or, reduce the setting of<br>Pn100 (Speed Loop<br>Gain).                                                                                                              | page 8-73               |
| A.520:<br>Vibration Alarm                                                                       | The setting of Pn103<br>(Moment of Inertia<br>Ratio) is greater than<br>the actual moment of<br>inertia or was greatly<br>changed. | Check the moment of inertia ratio or mass ratio.                                                                                              | Set Pn103 (Moment of<br>Inertia Ratio) to an appro-<br>priate value.                                                                                                                             | page 8-15               |
|                                                                                                 | The vibration detec-<br>tion level (Pn312 or<br>Pn384) is not suitable.                                                            | Check that the vibra-<br>tion detection level<br>(Pn312 or Pn384) is<br>suitable.                                                             | Set a suitable vibration<br>detection level (Pn312 or<br>Pn384).                                                                                                                                 | page 6-32               |
| A.521:<br>Autotuning Alarm<br>(Vibration was<br>detected while<br>executing the<br>output uning | The Servomotor<br>vibrated considerably<br>while performing the<br>tuning-less function.                                           | Check the waveform of the motor speed.                                                                                                        | Reduce the load so that<br>the moment of inertia ratio<br>is within the allowable<br>value. Or increase the<br>load level or reduce the<br>rigidity level in the tuning-<br>less level settings. | page 8-12               |
| custom tuning,<br>Easy FFT, or the<br>tuning-less func-<br>tion.)                               | The Servomotor<br>vibrated considerably<br>while performing cus-<br>tom tuning or Easy<br>FFT.                                     | Check the waveform of the motor speed.                                                                                                        | Check the operating pro-<br>cedure of corresponding<br>function and implement<br>corrections.                                                                                                    | page 8-41,<br>page 8-89 |
| A.550:<br>Maximum Speed<br>Setting Error                                                        | The setting of Pn385<br>(Maximum Motor<br>Speed) is greater than<br>the maximum speed.                                             | Check the setting of<br>Pn385, and the upper<br>limits of the maximum<br>motor speed setting<br>and the encoder output<br>resolution setting. | Set Pn385 to a value that does not exceed the max-<br>imum motor speed.                                                                                                                          | page 6-14               |
|                                                                                                 | The wiring is not cor-<br>rect or there is a faulty<br>connection in the<br>motor or encoder wir-<br>ing.                          | Check the wiring.                                                                                                                             | Make sure that the Servo-<br>motor and encoder are<br>correctly wired.                                                                                                                           | page 4-26               |
|                                                                                                 | Operation was per-<br>formed that exceeded<br>the overload protec-<br>tion characteristics.                                        | Check the motor over-<br>load characteristics and<br>Run command.                                                                             | Reconsider the load and operating conditions. Or, increase the motor capacity.                                                                                                                   | -                       |
| A.710:<br>Instantaneous<br>Overload<br>A.720:<br>Continuous<br>Overload                         | An excessive load<br>was applied during<br>operation because the<br>Servomotor was not<br>driven due to<br>mechanical problems.    | Check the operation reference and motor speed.                                                                                                | Correct the mechanical problem.                                                                                                                                                                  | -                       |
|                                                                                                 | There is an error in the setting of Pn282 (Lin-<br>ear Encoder Pitch).                                                             | Check the setting of Pn282.                                                                                                                   | Correct the setting of Pn282.                                                                                                                                                                    | page 5-16               |
|                                                                                                 | There is an error in the<br>setting of Pn080 =<br>n.□□X□ (Motor<br>Phase Selection).                                               | Check the setting of Pn080 = $n.\Box\Box X\Box$ .                                                                                             | Set Pn080 = $n.\Box\Box X\Box$ to an appropriate value.                                                                                                                                          | page 5-21               |
|                                                                                                 | A failure occurred in the SERVOPACK.                                                                                               | -                                                                                                                                             | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                                                         | -                       |

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| Continued from previous page                                                                                             |                                                                                                                                                                               |                                                                                                                                                                             |                                                                                                                                                                                                                            | evious page.          |
|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Alarm Number:<br>Alarm Name                                                                                              | Possible Cause                                                                                                                                                                | Confirmation                                                                                                                                                                | Correction                                                                                                                                                                                                                 | Reference             |
| A.730 and                                                                                                                | The Servomotor was rotated by an external force.                                                                                                                              | Check the operation status.                                                                                                                                                 | Implement measures to<br>ensure that the motor will<br>not be rotated by an<br>external force.                                                                                                                             | _                     |
| A.731:<br>Dynamic Brake<br>Overload<br>(An excessive<br>power consump-<br>tion by the<br>dynamic brake<br>was detected.) | When the Servomo-<br>tor was stopped with<br>the dynamic brake,<br>the rotational or linear<br>kinetic energy<br>exceeded the capac-<br>ity of the dynamic<br>brake resistor. | Check the power con-<br>sumed by the DB resis-<br>tor to see how<br>frequently the DB is<br>being used.                                                                     | <ul> <li>Reconsider the following:</li> <li>Reduce the Servomotor command speed.</li> <li>Decrease the moment of inertia ratio or mass ratio.</li> <li>Reduce the frequency of stopping with the dynamic brake.</li> </ul> | _                     |
|                                                                                                                          | A failure occurred in the SERVOPACK.                                                                                                                                          | -                                                                                                                                                                           | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                                                                                   | _                     |
| A.740:<br>Inrush Current<br>Limiting Resistor<br>Overload<br>(The main circuit<br>power supply                           | The allowable fre-<br>quency of the inrush<br>current limiting resis-<br>tor was exceeded<br>when the main circuit<br>power supply was<br>turned ON and OFF.                  | _                                                                                                                                                                           | Reduce the frequency of<br>turning the main circuit<br>power supply ON and<br>OFF.                                                                                                                                         | _                     |
| was frequently<br>turned ON and<br>OFF.)                                                                                 | A failure occurred in the SERVOPACK.                                                                                                                                          | _                                                                                                                                                                           | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                                                                                   | _                     |
|                                                                                                                          | The surrounding tem-<br>perature is too high.                                                                                                                                 | Check the surrounding<br>temperature using a<br>thermometer. Or, check<br>the operating status<br>with the SERVOPACK<br>installation environment<br>monitor.                | Decrease the surround-<br>ing temperature by<br>improving the SERVO-<br>PACK installation condi-<br>tions.                                                                                                                 | page 3-8              |
| A 7A1.                                                                                                                   | An overload alarm<br>was reset by turning<br>OFF the power sup-<br>ply too many times.                                                                                        | Check the alarm display<br>to see if there is an<br>overload alarm.                                                                                                         | Change the method for resetting the alarm.                                                                                                                                                                                 | _                     |
| A.7A1:<br>Internal Tempera-<br>ture Error 1<br>(Control Board<br>Temperature<br>Error)                                   | There was an exces-<br>sive load or operation<br>was performed that<br>exceeded the regen-<br>erative processing<br>capacity.                                                 | Use the accumulated<br>load ratio to check the<br>load during operation,<br>and use the regenera-<br>tive load ratio to check<br>the regenerative pro-<br>cessing capacity. | Reconsider the load and operating conditions.                                                                                                                                                                              | _                     |
|                                                                                                                          | The SERVOPACK<br>installation orientation<br>is not correct or there<br>is insufficient space<br>around the SERVO-<br>PACK.                                                   | Check the SERVOPACK installation conditions.                                                                                                                                | Install the SERVOPACK according to specifica-<br>tions.                                                                                                                                                                    | page 3-4,<br>page 3-7 |
|                                                                                                                          | A failure occurred in the SERVOPACK.                                                                                                                                          | -                                                                                                                                                                           | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.<br>Continued o                                                                                                                                                    | -                     |

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| Alarm Number:<br>Alarm Name                                                                                              | Possible Cause                                                                                                                                | Confirmation                                                                                                                                                                | Correction                                                                                                                               | Reference             |
|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
|                                                                                                                          | The surrounding tem-<br>perature is too high.                                                                                                 | Check the surrounding<br>temperature using a<br>thermometer. Or, check<br>the operating status<br>with the SERVOPACK<br>installation environment<br>monitor.                | Decrease the surround-<br>ing temperature by<br>improving the SERVO-<br>PACK installation condi-<br>tions.                               | page 3-8              |
|                                                                                                                          | An overload alarm<br>was reset by turning<br>OFF the power sup-<br>ply too many times.                                                        | Check the alarm display to see if there is an overload alarm.                                                                                                               | Change the method for resetting the alarm.                                                                                               | -                     |
| A.7A2:<br>Internal Tempera-<br>ture Error 2<br>(Power Board<br>Temperature<br>Error)                                     | There was an exces-<br>sive load or operation<br>was performed that<br>exceeded the regen-<br>erative processing<br>capacity.                 | Use the accumulated<br>load ratio to check the<br>load during operation,<br>and use the regenera-<br>tive load ratio to check<br>the regenerative pro-<br>cessing capacity. | Reconsider the load and operating conditions.                                                                                            | -                     |
|                                                                                                                          | The SERVOPACK<br>installation orientation<br>is not correct or there<br>is insufficient space<br>around the SERVO-<br>PACK.                   | Check the SERVOPACK installation conditions.                                                                                                                                | Install the SERVOPACK according to specifica-<br>tions.                                                                                  | page 3-4,<br>page 3-7 |
|                                                                                                                          | A failure occurred in the SERVOPACK.                                                                                                          | -                                                                                                                                                                           | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                 | -                     |
| A.7A3:<br>Internal Tempera-<br>ture Sensor Error<br>(An error<br>occurred in the<br>temperature sen-<br>sor circuit.)    | A failure occurred in the SERVOPACK.                                                                                                          | _                                                                                                                                                                           | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                 | _                     |
| A.7Ab:<br>SERVOPACK<br>Built-in Fan<br>Stopped                                                                           | The fan inside the<br>SERVOPACK<br>stopped.                                                                                                   | Check for foreign matter inside the SERVOPACK.                                                                                                                              | Remove foreign matter<br>from the SERVOPACK. If<br>an alarm still occurs, the<br>SERVOPACK may be<br>faulty. Replace the SER-<br>VOPACK. | -                     |
|                                                                                                                          | The power to the absolute encoder was turned ON for the first time.                                                                           | Check to see if the<br>power supply was<br>turned ON for the first<br>time.                                                                                                 | Set up the encoder.                                                                                                                      | page 5-48             |
| A.810:<br>Encoder Backup<br>Alarm<br>(Detected at the<br>encoder, but only<br>when an abso-<br>lute encoder is<br>used.) | The Encoder Cable<br>was disconnected<br>and then connected<br>again.                                                                         | Check to see if the<br>power supply was<br>turned ON for the first<br>time.                                                                                                 | Check the encoder con-<br>nection and set up the<br>encoder.                                                                             |                       |
|                                                                                                                          | Power is not being<br>supplied both from<br>the control power<br>supply (+5 V) from the<br>SERVOPACK and<br>from the battery<br>power supply. | Check the encoder<br>connector battery and<br>the connector status.                                                                                                         | Replace the battery or<br>implement similar mea-<br>sures to supply power to<br>the encoder, and set up<br>the encoder.                  |                       |
|                                                                                                                          | A failure occurred in the absolute encoder.                                                                                                   | _                                                                                                                                                                           | If the alarm still occurs<br>after setting up the<br>encoder again, replace<br>the Servomotor.                                           | -                     |
|                                                                                                                          | A failure occurred in the SERVOPACK.                                                                                                          | -                                                                                                                                                                           | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                 | -                     |

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|-------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Alarm Number:<br>Alarm Name                                                   | Possible Cause                                                            | Confirmation                             | Correction                                                                                                                                                                                                                                                                                                                                                                                     | Reference |
| <b>A.820:</b><br>Encoder Check-<br>sum Alarm<br>(Detected at the<br>encoder.) | A failure occurred in the encoder.                                        | _                                        | <ul> <li>When Using an Absolute Encoder</li> <li>Set up the encoder again.</li> <li>If the alarm still occurs, the Servomotor may be faulty. Replace the Servomotor.</li> <li>When Using a Singleturn Absolute Encoder or Incremental Encoder</li> <li>The Servomotor may be faulty. Replace the Servomotor.</li> <li>The linear encoder may be faulty. Replace the linear encoder.</li> </ul> | page 5-48 |
|                                                                               | A failure occurred in the SERVOPACK.                                      | -                                        | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                                                                                                                                                                                                                                                       | -         |
| A.830:<br>Encoder Battery                                                     | The battery connec-<br>tion is faulty or a bat-<br>tery is not connected. | Check the battery con-<br>nection.       | Correct the battery con-<br>nection.                                                                                                                                                                                                                                                                                                                                                           | page 4-27 |
| Alarm<br>(The absolute<br>encoder battery                                     | The battery voltage is lower than the specified value (2.7 V).            | Measure the battery voltage.             | Replace the battery.                                                                                                                                                                                                                                                                                                                                                                           | page 15-3 |
| voltage was lower<br>than the speci-<br>fied level.)                          | A failure occurred in the SERVOPACK.                                      | _                                        | The SERVOPACK may be faulty. Replace the SER-<br>VOPACK.                                                                                                                                                                                                                                                                                                                                       | -         |
|                                                                               | The encoder malfunc-<br>tioned.                                           | _                                        | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the Servomotor or<br>linear encoder may be<br>faulty. Replace the Servo-<br>motor or linear encoder.                                                                                                                                                                                               | -         |
|                                                                               | An error occurred in reading data from the linear encoder.                | _                                        | The linear encoder is not<br>mounted within an appro-<br>priate tolerance. Correct<br>the mounting of the linear<br>encoder.                                                                                                                                                                                                                                                                   | -         |
| A.840:<br>Encoder Data<br>Alarm<br>(Detected at the<br>encoder.)              | Excessive speed<br>occurred in the linear<br>encoder.                     | _                                        | Control the motor speed<br>within the range specified<br>by the linear encoder<br>manufacturer and then<br>turn ON the control power<br>supply.                                                                                                                                                                                                                                                | _         |
|                                                                               | The encoder malfunc-<br>tioned due to noise.                              | _                                        | Correct the wiring around<br>the encoder by separating<br>the Encoder Cable from<br>the Servomotor Main Cir-<br>cuit Cable or by ground-<br>ing the encoder.                                                                                                                                                                                                                                   | _         |
|                                                                               | The polarity sensor is not wired correctly.                               | Check the wiring of the polarity sensor. | Correct the wiring of the polarity sensor.                                                                                                                                                                                                                                                                                                                                                     | -         |
|                                                                               | The polarity sensor failed.                                               | _                                        | Replace the polarity sen-<br>sor.                                                                                                                                                                                                                                                                                                                                                              | -         |
|                                                                               |                                                                           |                                          |                                                                                                                                                                                                                                                                                                                                                                                                |           |

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| Alarm Number:                                                                                                                                                                                       |                                                                                                                                         |                                                                        | Continued from pro                                                                                                                                                                                                  |           |
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| Alarm Name                                                                                                                                                                                          | Possible Cause                                                                                                                          | Confirmation                                                           | Correction                                                                                                                                                                                                          | Reference |
|                                                                                                                                                                                                     | Rotary Servomotor:<br>The Servomotor<br>speed was 200 min <sup>-1</sup><br>or higher when the<br>control power supply<br>was turned ON. | Check the motor speed<br>when the power supply<br>is turned ON.        | Reduce the Servomotor<br>speed to a value less than<br>200 min <sup>-1</sup> , and turn ON<br>the control power supply.                                                                                             | _         |
| A.850:<br>Encoder Over-<br>speed<br>(Detected at the                                                                                                                                                | Linear Servomotor:<br>The Servomotor<br>exceeded the speci-<br>fied speed when the<br>control power supply<br>was turned ON.            | Check the motor speed<br>when the power supply<br>is turned ON.        | Control the motor speed<br>within the range specified<br>by the linear encoder<br>manufacturer and then<br>turn ON the control power<br>supply.                                                                     | -         |
| encoder when<br>the control power<br>supply is turned<br>ON.)                                                                                                                                       | A failure occurred in the encoder.                                                                                                      | _                                                                      | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the Servomotor or<br>linear encoder may be<br>faulty. Replace the Servo-<br>motor or linear encoder.                    | _         |
|                                                                                                                                                                                                     | A failure occurred in the SERVOPACK.                                                                                                    | _                                                                      | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                                                               | _         |
| A.860:                                                                                                                                                                                              | The surrounding air temperature around the Servomotor is too high.                                                                      | Measure the surround-<br>ing air temperature<br>around the Servomotor. | Reduce the surrounding<br>air temperature of the<br>Servomotor to 40°C or<br>less.                                                                                                                                  | _         |
| Encoder Over-<br>heated<br>(Detected when a<br>Rotary Servomo-                                                                                                                                      | The Servomotor load is greater than the rated load.                                                                                     | Use the accumulated load ratio to check the load.                      | Operate the Servo Drive<br>so that the motor load<br>remains within the speci-<br>fied range.                                                                                                                       | page 9-3  |
| tor, Absolute Lin-<br>ear Encoder, or<br>Direct Drive Ser-<br>vomotor is con-<br>nected. However,<br>this alarm is not<br>detected for<br>SGMCS Servo-<br>motors.)<br>(Detected at the<br>encoder.) | A failure occurred in the encoder.                                                                                                      | _                                                                      | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the Servomotor or<br>absolute linear encoder<br>may be faulty. Replace the<br>Servomotor or absolute<br>linear encoder. | -         |
|                                                                                                                                                                                                     | A failure occurred in the SERVOPACK.                                                                                                    | -                                                                      | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                                                               | -         |

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| Alarm Number:                            |                                                                                                                                      | 0                                                                                                                                        | Continued from pro                                                                                                                                                                                                                  |           |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Alarm Name                               | Possible Cause                                                                                                                       | Confirmation                                                                                                                             | Correction                                                                                                                                                                                                                          | Reference |
|                                          | The surrounding tem-<br>perature around the<br>Servomotor is too<br>high.                                                            | Measure the surround-<br>ing temperature around<br>the Servomotor.                                                                       | Reduce the surrounding<br>air temperature of the<br>Servomotor to 40° or less.                                                                                                                                                      | _         |
|                                          | The motor load is greater than the rated load.                                                                                       | Check the load with the<br>accumulated load ratio<br>on the Motion Monitor<br>Tab Page on the Sig-<br>maWin+.                            | Operate the Servo Drive<br>so that the motor load<br>remains within the speci-<br>fied range.                                                                                                                                       | page 9-3  |
| A.861:<br>Motor Over-<br>heated          | A failure occurred in<br>the Serial Converter<br>Unit.                                                                               | _                                                                                                                                        | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the Serial Con-<br>verter Unit may be faulty.<br>Replace the Serial Con-<br>verter Unit.                                                | -         |
|                                          | A failure occurred in the SERVOPACK.                                                                                                 | _                                                                                                                                        | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                                                                               | _         |
|                                          | The surrounding tem-<br>perature is too high.                                                                                        | Check the surrounding temperature using a thermometer.                                                                                   | Lower the surrounding<br>temperature by improving<br>the installation conditions<br>of the Linear Servomotor<br>or the machine.                                                                                                     | _         |
|                                          | The overheat protec-<br>tion input signal line is<br>disconnected or<br>short-circuited.                                             | Check the input voltage<br>with the overheat pro-<br>tection input information<br>on the Motion Monitor<br>Tab Page on the<br>SigmaWin+. | Repair the line for the overheat protection input signal.                                                                                                                                                                           | _         |
| A.862:                                   | An overload alarm<br>was reset by turning<br>OFF the power sup-<br>ply too many times.                                               | Check the alarm display<br>to see if there is an<br>overload alarm.                                                                      | Change the method for resetting the alarm.                                                                                                                                                                                          | _         |
| Overheat Alarm                           | Operation was per-<br>formed under an<br>excessive load.                                                                             | Use the accumulated load ratio to check the load during operation.                                                                       | Reconsider the load and operating conditions.                                                                                                                                                                                       | _         |
|                                          | A failure occurred in the SERVOPACK.                                                                                                 | _                                                                                                                                        | The SERVOPACK may be faulty. Replace the SERVOPACK.                                                                                                                                                                                 | -         |
|                                          | The temperature<br>detection circuit in the<br>Linear Servomotor is<br>faulty or the sensor<br>attached to the<br>machine is faulty. | _                                                                                                                                        | The temperature detec-<br>tion circuit in the Linear<br>Servomotor may be faulty<br>or the sensor attached to<br>the machine may be<br>faulty. Replace the Linear<br>Servomotor or repair the<br>sensor attached to the<br>machine. | -         |
| <b>A.890:</b><br>Encoder Scale<br>Error  | A failure occurred in the linear encoder.                                                                                            | -                                                                                                                                        | The linear encoder may be faulty. Replace the linear encoder.                                                                                                                                                                       | _         |
| <b>A.891:</b><br>Encoder Module<br>Error | A failure occurred in the linear encoder.                                                                                            | _                                                                                                                                        | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the linear encoder<br>may be faulty. Replace the<br>linear encoder.                                                                     | _         |

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Maintenance

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| Alarm Number:                                               |                                                                                               | 0                                                                                                                             | Continued from pr                                                                                                                                     |            |
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| Alarm Name                                                  | Possible Cause                                                                                | Confirmation                                                                                                                  | Correction                                                                                                                                            | Reference  |
| A.8A0:<br>External Encoder<br>Error                         | Setting the origin of<br>the absolute linear<br>encoder failed<br>because the motor<br>moved. | Before you set the ori-<br>gin, use the fully-closed<br>feedback pulse counter<br>to confirm that the<br>motor is not moving. | The motor must be stopped while setting the origin position.                                                                                          | page 5-51  |
|                                                             | A failure occurred in the external encoder.                                                   | -                                                                                                                             | Replace the external encoder.                                                                                                                         | -          |
| A.8A1:                                                      | A failure occurred in the external encoder.                                                   | _                                                                                                                             | Replace the external encoder.                                                                                                                         | -          |
| External Encoder<br>Module Error                            | A failure occurred in the Serial Converter Unit.                                              | -                                                                                                                             | Replace the Serial Con-<br>verter Unit.                                                                                                               | -          |
| A.8A2:<br>External Incre-<br>mental Encoder<br>Sensor Error | A failure occurred in the external encoder.                                                   | _                                                                                                                             | Replace the external encoder.                                                                                                                         | -          |
| A.8A3:<br>External Abso-<br>lute Encoder<br>Position Error  | A failure occurred in the external absolute encoder.                                          | _                                                                                                                             | The external absolute<br>encoder may be faulty.<br>Refer to the encoder<br>manufacturer's instruc-<br>tion manual for correc-<br>tions.               | -          |
| A.8A5:<br>External Encoder<br>Overspeed                     | An overspeed error<br>was detected in the<br>external encoder.                                | Check the maximum speed of the external encoder.                                                                              | Keep the external<br>encoder below its maxi-<br>mum speed.                                                                                            | -          |
| A.8A6:<br>External Encoder<br>Overheated                    | An overheating error was detected in the external encoder.                                    | -                                                                                                                             | Replace the external encoder.                                                                                                                         | -          |
| A.AEF:<br>INDEXER<br>Module Alarm                           | Some kind of alarm<br>has occurred at the<br>INDEXER Module.                                  | Use the SigmaWin+ to<br>check the serial com-<br>mand negative<br>response of the<br>INDEXER Module.                          | Follow the correction for a serial command negative response from the INDEXER Module.                                                                 | page 15-45 |
| A.b33:<br>Current Detec-<br>tion Error 3                    | A failure occurred in the current detection circuit.                                          | _                                                                                                                             | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | -          |
| A.bC0:<br>System Alarm 10                                   | A failure occurred in the SERVOPACK.                                                          |                                                                                                                               | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | -          |
| A.bF0:<br>System Alarm 0                                    | A failure occurred in the SERVOPACK.                                                          | _                                                                                                                             | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | -          |
| A.bF1:<br>System Alarm 1                                    | A failure occurred in the SERVOPACK.                                                          | -                                                                                                                             | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | -          |

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| Alarm Number:                   |                                      |              | Continued from pre                                                                                                                                    | lineae page. |
|---------------------------------|--------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Alarm Name                      | Possible Cause                       | Confirmation | Correction                                                                                                                                            | Reference    |
| A.bF2:<br>System Alarm 2        | A failure occurred in the SERVOPACK. | _            | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | _            |
| A.bF3:<br>System Alarm 3        | A failure occurred in the SERVOPACK. | _            | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | -            |
| <b>A.bF4:</b><br>System Alarm 4 | A failure occurred in the SERVOPACK. | -            | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | -            |
| <b>A.bF5:</b><br>System Alarm 5 | A failure occurred in the SERVOPACK. | _            | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | _            |
| <b>A.bF6:</b><br>System Alarm 6 | A failure occurred in the SERVOPACK. | _            | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | -            |
| A.bF7:<br>System Alarm 7        | A failure occurred in the SERVOPACK. | -            | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | -            |
| A.bF8:<br>System Alarm 8        | A failure occurred in the SERVOPACK. | _            | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | -            |

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|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Alarm Number:<br>Alarm Name                                                             | Possible Cause                                                                                                                        | Confirmation                                                                                                                                                              | Correction                                                                                                                                                                                                                   | Reference |
|                                                                                         | The order of phases<br>U, V, and W in the<br>motor wiring is not<br>correct.                                                          | Check the Servomotor wiring.                                                                                                                                              | Make sure that the Servo-<br>motor is correctly wired.                                                                                                                                                                       | _         |
|                                                                                         | There is an error in the setting of $Pn080 =$<br>n. $\Box\BoxX\Box$ (Motor Phase Selection).                                          | Check the setting of Pn080 = $n.\Box\BoxX\Box$ .                                                                                                                          | Set Pn080 = $n.\Box\Box X\Box$ to an appropriate value.                                                                                                                                                                      | page 5-21 |
| A.C10:<br>Servomotor Out<br>of Control<br>(Detected when<br>the servo is<br>turned ON.) | A failure occurred in the encoder.                                                                                                    | _                                                                                                                                                                         | If the motor wiring is cor-<br>rect and an alarm still<br>occurs after turning the<br>power supply OFF and<br>ON again, the Servomotor<br>or linear encoder may be<br>faulty. Replace the Servo-<br>motor or linear encoder. | _         |
|                                                                                         | A failure occurred in the SERVOPACK.                                                                                                  | _                                                                                                                                                                         | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                                                                        | _         |
|                                                                                         | The linear encoder signal level is too low.                                                                                           | Check the voltage of the linear encoder signal.                                                                                                                           | Fine-tune the mounting of<br>the scale head. Or,<br>replace the linear<br>encoder.                                                                                                                                           | _         |
| A.C20:<br>Phase Detection<br>Error                                                      | The count-up direc-<br>tion of the linear<br>encoder does not<br>match the forward<br>direction of the Mov-<br>ing Coil in the motor. | Check the setting of<br>Pn080 = $n.\Box\Box X\Box$<br>(Motor Phase Selec-<br>tion). Check the installa-<br>tion orientation for the<br>linear encoder and<br>Moving Coil. | Change the setting of<br>Pn080 = $n.\Box\Box X\Box$ .<br>Correctly reinstall the lin-<br>ear encoder or Moving<br>Coil.                                                                                                      | page 5-21 |
|                                                                                         | The polarity sensor<br>signal is being<br>affected by noise.                                                                          | _                                                                                                                                                                         | Correct the FG wiring.<br>Implement countermea-<br>sures against noise for the<br>polarity sensor wiring.                                                                                                                    | -         |
|                                                                                         | The setting of Pn282<br>(Linear Encoder Scale<br>Pitch) is not correct.                                                               | Check the setting of<br>Pn282 (Linear Encoder<br>Scale Pitch).                                                                                                            | Check the specifications of the linear encoder and set a correct value.                                                                                                                                                      | page 5-16 |
| A.C21:                                                                                  | The polarity sensor is protruding from the Magnetic Way of the motor.                                                                 | Check the polarity sen-<br>sor.                                                                                                                                           | Correctly reinstall the<br>Moving Coil or Magnetic<br>Way of the motor.                                                                                                                                                      | _         |
| Polarity Sensor<br>Error                                                                | The polarity sensor is not wired correctly.                                                                                           | Check the wiring of the polarity sensor.                                                                                                                                  | Correct the wiring of the polarity sensor.                                                                                                                                                                                   | -         |
|                                                                                         | The polarity sensor failed.                                                                                                           | -                                                                                                                                                                         | Replace the polarity sen-<br>sor.                                                                                                                                                                                            | -         |
| A.C22:<br>Phase Informa-<br>tion Disagree-<br>ment                                      | The SERVOPACK<br>phase information is<br>different from the lin-<br>ear encoder phase<br>information.                                 | -                                                                                                                                                                         | Perform polarity detec-<br>tion.                                                                                                                                                                                             | page 5-26 |

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| Alarm Number:<br>Alarm Name                                   | Possible Cause                                                       | Confirmation                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Correction                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Reference               |
|---------------------------------------------------------------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| A.C50:<br>Polarity Detec-<br>tion Failure                     | The parameter set-<br>tings are not correct.                         | Check the linear<br>encoder specifications<br>and feedback signal<br>status.                                                                                                                                                                                                                                                                                                                                                                                    | The settings of Pn282<br>(Linear Encoder Pitch)<br>and Pn080 = n. $\Box$ X $\Box$<br>(Motor Phase Selection)<br>may not match the instal-<br>lation. Set the parame-<br>ters to correct values.                                                                                                                                                                                                                                                                                    | page 5-16,<br>page 5-21 |
|                                                               | There is noise on the scale signal.                                  | Check to make sure<br>that the frame grounds<br>of the Serial Converter<br>Unit and Servomotor<br>are connected to the<br>FG terminal on the SER-<br>VOPACK and that the<br>FG terminal on the SER-<br>VOPACK is connected<br>to the frame ground on<br>the power supply.<br>And, confirm that the<br>shield is properly pro-<br>cessed on the Linear<br>Encoder Cable. Check<br>to see if the detection<br>reference is repeatedly<br>output in one direction. | Implement appropriate<br>countermeasures against<br>noise for the Linear<br>Encoder Cable.                                                                                                                                                                                                                                                                                                                                                                                         | -                       |
|                                                               | An external force was<br>applied to the Moving<br>Coil of the motor. | _                                                                                                                                                                                                                                                                                                                                                                                                                                                               | The polarity cannot be<br>properly detected if the<br>detection reference is 0<br>and the speed feedback<br>is not 0 because of an<br>external force, such as<br>cable tension, applied to<br>the Moving Coil. Imple-<br>ment measures to reduce<br>the external force so that<br>the speed feedback goes<br>to 0. If the external force<br>cannot be reduced,<br>increase the setting of<br>Pn481 (Polarity Detection<br>Speed Loop Gain).                                        | _                       |
|                                                               | The linear encoder resolution is too low.                            | Check the linear<br>encoder scale pitch to<br>see if it is within 100<br>μm.                                                                                                                                                                                                                                                                                                                                                                                    | If the linear encoder scale<br>pitch is 100 $\mu$ m or higher,<br>the SERVOPACK cannot<br>detect the correct speed<br>feedback. Use a linear<br>encoder scale pitch with<br>higher resolution. (We rec-<br>ommend a pitch of 40 $\mu$ m<br>or less.) Or, increase the<br>setting of Pn485 (Polarity<br>Detection Reference<br>Speed). However,<br>increasing the setting of<br>Pn485 will increase the<br>Servomotor movement<br>range that is required for<br>polarity detection. | _                       |
| A.C51:<br>Overtravel<br>Detected during<br>Polarity Detection | The overtravel signal was detected during polarity detection.        | Check the overtravel position.                                                                                                                                                                                                                                                                                                                                                                                                                                  | Wire the overtravel sig-<br>nals. Execute polarity<br>detection at a position<br>where an overtravel sig-<br>nal would not be<br>detected.                                                                                                                                                                                                                                                                                                                                         | page 4-38               |

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| Alarm Number:<br>Alarm Name                                     | Possible Cause                                                                                                                                                                                          | ause Confirmation Correction |                                                                                                                                                                                                                                                                      | Reference |
|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| A.C52:<br>Polarity Detec-<br>tion Not Com-<br>pleted            | <ul> <li>The servo was turned</li> <li>ON under the follow-<br/>ing circumstances.</li> <li>When an absolute<br/>scale was in use</li> <li>When polarity<br/>detection was not<br/>completed</li> </ul> | _                            | Execute polarity detec-<br>tion (with the SigmaWin+<br>or Digital Operator,<br>Fn080).                                                                                                                                                                               | -         |
| A.C53:<br>Out of Range of<br>Motion for Polar-<br>ity Detection | The travel distance<br>exceeded the setting<br>of Pn48E (Polarity<br>Detection Range) in<br>the middle of detec-<br>tion.                                                                               | _                            | Increase the setting of<br>Pn48E (Polarity Detection<br>Range). Or, increase the<br>setting of Pn481 (Polarity<br>Detection Speed Loop<br>Gain).                                                                                                                     | -         |
| A.C54:<br>Polarity Detec-<br>tion Failure 2                     | An external force was<br>applied to the Servo-<br>motor.                                                                                                                                                | _                            | Increase the setting of<br>Pn495 (Polarity Detection<br>Confirmation Force Refer-<br>ence). Increase the setting<br>of Pn498 (Polarity Detec-<br>tion Allowable Error<br>Range). Increasing the<br>allowable error will also<br>increase the motor tem-<br>perature. | _         |
| A.C80:<br>Encoder Clear                                         | A failure occurred in the encoder.                                                                                                                                                                      | _                            | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the Servomotor or<br>linear encoder may be<br>faulty. Replace the Servo-<br>motor or linear encoder.                                                                     | -         |
| Error or Multiturn<br>Limit Setting Error                       | A failure occurred in the SERVOPACK.                                                                                                                                                                    | -                            | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                                                                                                                | -         |

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| Alarm Number:                                                                          |                                                                                                                                                                                                                                                       |                                                                |                                                                                                                                                                                 | evious page |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Alarm Name                                                                             | Possible Cause                                                                                                                                                                                                                                        | Confirmation                                                   | Correction                                                                                                                                                                      | Reference   |
|                                                                                        | There is a faulty con-<br>tact in the connector<br>or the connector is<br>not wired correctly for<br>the encoder.                                                                                                                                     | Check the condition of the encoder connector.                  | Reconnect the encoder connector and check the encoder wiring.                                                                                                                   | page 4-26   |
|                                                                                        | There is a cable dis-<br>connection or short-<br>circuit in the encoder.<br>Or, the cable imped-<br>ance is outside the<br>specified values.                                                                                                          | Check the condition of the Encoder Cable.                      | Use the Encoder Cable within the specified specifications.                                                                                                                      | _           |
| A.C90:<br>Encoder Commu-                                                               | One of the following<br>has occurred: corro-<br>sion caused by<br>improper tempera-<br>ture, humidity, or gas,<br>a short-circuit caused<br>by entry of water<br>drops or cutting oil, or<br>faulty contact in con-<br>nector caused by<br>vibration. | Check the operating environment.                               | Improve the operating<br>environment, and replace<br>the cable. If the alarm still<br>occurs, replace the SER-<br>VOPACK.                                                       | page 3-2    |
| nications Error                                                                        | A malfunction was caused by noise.                                                                                                                                                                                                                    | _                                                              | Correct the wiring around<br>the encoder by separating<br>the Encoder Cable from<br>the Servomotor Main Cir-<br>cuit Cable or by ground-<br>ing the encoder.                    | page 4-6    |
|                                                                                        | A failure occurred in the SERVOPACK.                                                                                                                                                                                                                  | _                                                              | Connect the Servomotor<br>to another SERVOPACK,<br>and turn ON the control<br>power supply. If no alarm<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.    | -           |
|                                                                                        | A failure occurred in the encoder.                                                                                                                                                                                                                    | _                                                              | Connect the Servomotor<br>to another SERVOPACK,<br>and turn ON the control<br>power supply. If the alarm<br>occurs, the Servomotor<br>may be faulty. Replace the<br>Servomotor. | -           |
| A.C91:<br>Encoder Commu-<br>nications Posi-<br>tion Data<br>Acceleration Rate<br>Error | Noise entered on the signal lines because the Encoder Cable is bent or the sheath is damaged.                                                                                                                                                         | Check the condition of<br>the Encoder Cable and<br>connectors. | Check the Encoder Cable to see if it is installed correctly.                                                                                                                    | page 4-9    |
|                                                                                        | The Encoder Cable is<br>bundled with a high-<br>current line or<br>installed near a high-<br>current line.                                                                                                                                            | Check the installation<br>condition of the<br>Encoder Cable.   | Confirm that there is no surge voltage on the Encoder Cable.                                                                                                                    | _           |
|                                                                                        | There is variation in<br>the FG potential<br>because of the influ-<br>ence of machines on<br>the Servomotor side,<br>such as a welder.                                                                                                                | Check the installation<br>condition of the<br>Encoder Cable.   | Properly ground the machine to separate it from the FG of the encoder.                                                                                                          | _           |

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Alarm Number: **Possible Cause** Confirmation Correction Reference Alarm Name Noise entered on the Implement countermeasignal line from the sures against noise for the page 4-6 encoder. encoder wiring. Reduce machine vibra-Excessive vibration or Check the operating tion. shock was applied to conditions. Correctly install the Serthe encoder. vomotor or linear encoder. Turn the power supply to A.C92: the SERVOPACK OFF and Encoder Commu-ON again. If an alarm still A failure occurred in nications Timer occurs, the Servomotor or \_ the encoder. Error linear encoder may be faulty. Replace the Servomotor or linear encoder. Turn the power supply to the SERVOPACK OFF and A failure occurred in ON again. If an alarm still the SERVOPACK. occurs, the SERVOPACK may be faulty. Replace the SERVOPACK. Turn the power supply to the SERVOPACK OFF and ON again. If an alarm still A failure occurred in occurs, the Servomotor or the encoder. linear encoder may be faulty. Replace the Servo-A.CA0: Encoder Paramemotor or linear encoder. ter Error Turn the power supply to the SERVOPACK OFF and A failure occurred in ON again. If an alarm still the SERVOPACK. occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

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| Alarm Number:<br>Alarm Name                      | Possible Cause                                                                                                                                             | Confirmation                                                   | Correction                                                                                                                                                                                               | Reference |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                  | The encoder is wired incorrectly or there is faulty contact.                                                                                               | Check the wiring of the encoder.                               | Make sure that the encoder is correctly wired.                                                                                                                                                           | page 4-26 |
|                                                  | The specifications of<br>the Encoder Cable are<br>not correct and noise<br>entered on it.                                                                  | _                                                              | Use a shielded twisted-<br>pair wire cable or a<br>screened twisted-pair<br>cable with conductors of<br>at least 0.12 mm <sup>2</sup> .                                                                  | _         |
|                                                  | The Encoder Cable is too long and noise entered on it.                                                                                                     | _                                                              | <ul> <li>Rotary Servomotors:<br/>The Encoder Cable wir-<br/>ing distance must be 50<br/>m max.</li> <li>Linear Servomotors:<br/>The Encoder Cable wir-<br/>ing distance must be 20<br/>m max.</li> </ul> | -         |
| <b>A.Cb0:</b><br>Encoder Echo-<br>back Error     | There is variation in<br>the FG potential<br>because of the influ-<br>ence of machines on<br>the Servomotor side,<br>such as a welder.                     | Check the condition of<br>the Encoder Cable and<br>connectors. | Properly ground the machine to separate it from the FG of the encoder.                                                                                                                                   | _         |
|                                                  | Excessive vibration or shock was applied to the encoder.                                                                                                   | Check the operating conditions.                                | Reduce machine vibra-<br>tion.<br>Correctly install the Ser-<br>vomotor or linear encoder.                                                                                                               | _         |
|                                                  | A failure occurred in the encoder.                                                                                                                         | -                                                              | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the Servomotor or<br>linear encoder may be<br>faulty. Replace the Servo-<br>motor or linear encoder.         | -         |
|                                                  | A failure occurred in the SERVOPACK.                                                                                                                       | _                                                              | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                                                    | -         |
| <b>A.CC0:</b><br>Multiturn Limit<br>Disagreement | When using a Direct<br>Drive Servomotor, the<br>setting of Pn205 (Mul-<br>titurn Limit Setting)<br>does not agree with<br>the encoder.                     | Check the setting of Pn205.                                    | Correct the setting of Pn205 (0 to 65,535).                                                                                                                                                              | page 6-26 |
|                                                  | The multiturn limit of<br>the encoder is differ-<br>ent from that of the<br>SERVOPACK. Or, the<br>multiturn limit of the<br>SERVOPACK has<br>been changed. | Check the setting of<br>Pn205 in the SERVO-<br>PACK.           | Change the setting if the alarm occurs.                                                                                                                                                                  | page 6-26 |
|                                                  | A failure occurred in the SERVOPACK.                                                                                                                       | -                                                              | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.<br>Continued o                                     | -         |

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| Alarm Number:<br>Alarm Name                                                            | Possible Cause                                                                                                                | Confirmation                                                                      | Correction                                                                                                                               | Reference |
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|                                                                                        | The cable between<br>the Serial Converter<br>Unit and SERVOPACK<br>is not wired correctly<br>or there is a faulty<br>contact. | Check the wiring of the external encoder.                                         | Correctly wire the cable<br>between the Serial Con-<br>verter Unit and SERVO-<br>PACK.                                                   | page 4-28 |
| A.CF1:<br>Reception Failed<br>Error in Feed-<br>back Option                            | A specified cable is<br>not being used<br>between Serial Con-<br>verter Unit and SER-<br>VOPACK.                              | Check the wiring speci-<br>fications of the external encoder.                     | Use a specified cable.                                                                                                                   | -         |
| back Option<br>Module Commu-<br>nications                                              | The cable between<br>the Serial Converter<br>Unit and SERVOPACK<br>is too long.                                               | Measure the length of<br>the cable that connects<br>the Serial Converter<br>Unit. | The length of the cable<br>between the Serial Con-<br>verter Unit and SERVO-<br>PACK must be 20 m or<br>less.                            | -         |
|                                                                                        | The sheath on cable<br>between the Serial<br>Converter Unit and<br>SERVOPACK is bro-<br>ken.                                  | Check the cable that<br>connects the Serial<br>Converter Unit.                    | Replace the cable<br>between the Serial Con-<br>verter Unit and SERVO-<br>PACK.                                                          | _         |
| A.CF2:<br>Timer Stopped<br>Error in Feed-<br>back Option<br>Module Commu-<br>nications | Noise entered the cable between the Serial Converter Unit and SERVOPACK.                                                      | _                                                                                 | Correct the wiring around<br>the Serial Converter Unit,<br>e.g., separate I/O signal<br>lines from the Main Circuit<br>Cables or ground. | -         |
|                                                                                        | A failure occurred in<br>the Serial Converter<br>Unit.                                                                        | _                                                                                 | Replace the Serial Con-<br>verter Unit.                                                                                                  | -         |
|                                                                                        | A failure occurred in the SERVOPACK.                                                                                          | -                                                                                 | Replace the SERVO-<br>PACK.                                                                                                              | -         |

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| Alarm Number:<br>Alarm Name                                                                                                                                                                                                                                                                                                                         | Possible Cause                                                                                                                                                                          | Confirmation                                                                                                      | Correction                                                                                                                                                                                                                                                                                                                            | Reference |
|                                                                                                                                                                                                                                                                                                                                                     | The Servomotor U, V,<br>and W wiring is not<br>correct.                                                                                                                                 | Check the wiring of the Servomotor's Main Cir-<br>cuit Cables.                                                    | Make sure that there are<br>no faulty contacts in the<br>wiring for the Servomotor<br>and encoder.                                                                                                                                                                                                                                    | _         |
|                                                                                                                                                                                                                                                                                                                                                     | The position com-<br>mand speed is too<br>fast.                                                                                                                                         | Reduce the position<br>command speed and<br>try operating the SER-<br>VOPACK.                                     | Reduce the position refer-<br>ence speed or the refer-<br>ence acceleration rate, or<br>reconsider the electronic<br>gear ratio.                                                                                                                                                                                                      | page 5-42 |
| A.d00:<br>Position Devia-<br>tion Overflow<br>(The setting of<br>Pn520 (Exces-<br>sive Position<br>Deviation Alarm<br>Level) was<br>exceeded by the<br>position deviation.)                                                                                                                                                                         | The acceleration of<br>the position reference<br>is too high.                                                                                                                           | Reduce the reference<br>acceleration and try<br>operating the SERVO-<br>PACK.                                     | <ul> <li>Reduce the acceleration<br/>of the position reference<br/>with one of the following<br/>methods.</li> <li>Reduce the accelera-<br/>tion rate (ACC) and<br/>deceleration rate (DEC)<br/>in the program table.</li> <li>Reduce the settings of<br/>PnB29 (Acceleration<br/>Rate) and PnB2B<br/>(Deceleration Rate).</li> </ul> | _         |
|                                                                                                                                                                                                                                                                                                                                                     | The setting of Pn520<br>(Excessive Position<br>Deviation Alarm Level)<br>is too low for the<br>operating conditions.                                                                    | Check Pn520 (Exces-<br>sive Position Deviation<br>Alarm Level) to see if it<br>is set to an appropriate<br>value. | Optimize the setting of Pn520.                                                                                                                                                                                                                                                                                                        | page 8-7  |
|                                                                                                                                                                                                                                                                                                                                                     | A failure occurred in the SERVOPACK.                                                                                                                                                    | _                                                                                                                 | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                                                                                                                                                                                 | -         |
| A.d01:<br>Position Devia-<br>tion Overflow<br>Alarm at Servo<br>ON                                                                                                                                                                                                                                                                                  | The servo was turned<br>ON after the position<br>deviation exceeded<br>the setting of Pn526<br>(Excessive Position<br>Deviation Alarm Level<br>at Servo ON) while the<br>servo was OFF. | Check the position<br>deviation while the<br>servo is OFF.                                                        | Optimize the setting of<br>Pn526 (Excessive Position<br>Deviation Alarm Level at<br>Servo ON).                                                                                                                                                                                                                                        |           |
| A.d02:<br>Position Devia-<br>tion Counter, the set-<br>ting of Pn529 or<br>Pn584 (Speed Limit<br>Level at Servo ON)<br>limits the speed when<br>the servo is turned<br>Alarm for Speed<br>Limit at Servo ON<br>if a position reference<br>is input and the set-<br>ting of Pn520 (Exces-<br>sive Position Deviation<br>Alarm Level) is<br>exceeded. |                                                                                                                                                                                         | _                                                                                                                 | Optimize the setting of<br>Pn520 (Excessive Position<br>Deviation Alarm Level). Or,<br>adjust the setting of<br>Pn529 or Pn584 (Speed<br>Limit Level at Servo ON).                                                                                                                                                                    | page 8-7  |

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| Alarm Number:<br>Alarm Name                                         | Possible Cause                                                                                                                                                                                                                      | Confirmation                                                                              | Correction                                                                                                                                                           | Reference |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| A.d10:<br>Motor-Load Posi-<br>tion Deviation                        | The motor direction<br>and external encoder<br>installation orientation<br>are backward.                                                                                                                                            | Check the motor direc-<br>tion and the external<br>encoder installation ori-<br>entation. | Install the external<br>encoder in the opposite<br>direction, or change the<br>setting of Pn002 =<br>n.X□□□ (External<br>Encoder Usage) to<br>reverse the direction. | page 10-5 |
| Overflow                                                            | There is an error in the connection between the load (e.g., stage) and external encoder coupling.                                                                                                                                   | Check the coupling of the external encoder.                                               | Check the mechanical coupling.                                                                                                                                       | -         |
| A.d30:<br>Position Data<br>Overflow                                 | The position data<br>exceeded<br>±1,879,048,192.                                                                                                                                                                                    | Check the input refer-<br>ence pulse counter.                                             | Reconsider the operating specifications.                                                                                                                             | -         |
| A.E00:<br>Command Option                                            | The connection<br>between the SERVO-<br>PACK and the com-<br>mand option module<br>is faulty.                                                                                                                                       | Check the connection<br>between the SERVO-<br>PACK and the com-<br>mand option module.    | Correctly connect the command option module.                                                                                                                         | -         |
| Module IF Initial-<br>ization Timeout<br>Error                      | A command option<br>module fault<br>occurred.                                                                                                                                                                                       | _                                                                                         | Replace the command option module.                                                                                                                                   | -         |
|                                                                     | A SERVOPACK fault occurred.                                                                                                                                                                                                         | _                                                                                         | Replace the SERVO-<br>PACK.                                                                                                                                          | _         |
| A.E02:<br>Command Option<br>Module IF<br>Synchronization<br>Error 1 | The timing of synchro-<br>nization between the<br>servomotor and com-<br>mand option module<br>changed due to<br>change in the com-<br>munications cycle of<br>the host controller<br>connected to the<br>command option<br>module. | -                                                                                         | Turn the power supply<br>OFF and then ON again. If<br>the alarm occurs again,<br>restart communications<br>processing from the host<br>controller.                   | _         |
|                                                                     | The connection<br>between the SERVO-<br>PACK and the com-<br>mand option module<br>is faulty.                                                                                                                                       | Check the connection<br>between the SERVO-<br>PACK and the com-<br>mand option module.    | Correctly connect the command option module.                                                                                                                         | _         |
|                                                                     | A command option<br>module fault<br>occurred.                                                                                                                                                                                       | -                                                                                         | Replace the command option module.                                                                                                                                   | -         |
|                                                                     | A SERVOPACK fault occurred.                                                                                                                                                                                                         | _                                                                                         | Replace the SERVO-<br>PACK.                                                                                                                                          |           |

Continued from previous page.

| Alarm Number:                                                     | Possible Cause                                                                                                             | Confirmation                                                                            | Correction                                                                                                                                                                    | Reference  |
|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Alarm Name                                                        |                                                                                                                            | Committation                                                                            | Conscion                                                                                                                                                                      | nererence  |
| A.E03:                                                            | An error occurred due<br>to noise in the com-<br>munications between<br>the SERVOPACK and<br>the command option<br>module. | _                                                                                       | Take measures against<br>noise.                                                                                                                                               | -          |
| Command Option<br>Module IF Com-<br>munications Data<br>Error     | The connection<br>between the SERVO-<br>PACK and the com-<br>mand option module<br>is faulty.                              | Check the connection<br>between the SERVO-<br>PACK and the com-<br>mand option module.  | Correctly connect the command option module.                                                                                                                                  | _          |
|                                                                   | A command option module fault occurred.                                                                                    | -                                                                                       | Replace the command option module.                                                                                                                                            | _          |
|                                                                   | A SERVOPACK fault occurred.                                                                                                | _                                                                                       | Replace the SERVO-<br>PACK.                                                                                                                                                   | _          |
|                                                                   | The connection<br>between the SERVO-<br>PACK and the com-<br>mand option module<br>is faulty.                              | Check the connection<br>between the SERVO-<br>PACK and the com-<br>mand option module.  | Correctly connect the command option module.                                                                                                                                  | _          |
| A.E70:<br>Command Option<br>Module Detec-<br>tion Failure         | The command option module is not con-<br>nected.                                                                           | -                                                                                       | Correctly connect the command option module.                                                                                                                                  | -          |
| tion Failure                                                      | A command option<br>module fault<br>occurred.                                                                              | -                                                                                       | Replace the command option module.                                                                                                                                            | _          |
|                                                                   | A SERVOPACK fault occurred.                                                                                                | -                                                                                       | Replace the SERVO-<br>PACK.                                                                                                                                                   | _          |
| A.E71:<br>Safety Option<br>Module Detec-<br>tion Failure          | The connection<br>between the SERVO-<br>PACK and the safety<br>option module is<br>faulty.                                 | Check the connection<br>between the SERVO-<br>PACK and the safety<br>option module.     | Correctly connect the safety option module.                                                                                                                                   | -          |
|                                                                   | The safety option<br>module was discon-<br>nected.                                                                         | _                                                                                       | Execute Fn014 (Reset-<br>ting configuration error of<br>option module) using the<br>digital operator or Sig-<br>maWin+ and turn the<br>power supply OFF and<br>then ON again. | page 15-52 |
|                                                                   | A safety option mod-<br>ule fault occurred.                                                                                | _                                                                                       | Replace the safety option module.                                                                                                                                             | _          |
|                                                                   | A SERVOPACK fault occurred.                                                                                                | -                                                                                       | Replace the SERVO-<br>PACK.                                                                                                                                                   | -          |
| <b>A.E72:</b><br>Feedback Option<br>Module Detec-<br>tion Failure | There is a faulty con-<br>nection between the<br>SERVOPACK and the<br>Feedback Option<br>Module.                           | Check the connection<br>between the SERVO-<br>PACK and the Feed-<br>back Option Module. | Correctly connect the<br>Feedback Option Module.                                                                                                                              | _          |
|                                                                   | The Feedback Option<br>Module was discon-<br>nected.                                                                       | -                                                                                       | Reset the Option Module<br>configuration error and<br>turn the power supply to<br>the SERVOPACK OFF and<br>ON again.                                                          | page 15-52 |
|                                                                   | A failure occurred in<br>the Feedback Option<br>Module.                                                                    | -                                                                                       | Replace the Feedback<br>Option Module.                                                                                                                                        | _          |
|                                                                   | A failure occurred in the SERVOPACK.                                                                                       | _                                                                                       | Replace the SERVO-<br>PACK.                                                                                                                                                   | _          |

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| Alarm Number:<br>Alarm Name                                                                           | Possible Cause                                                                                                                 | Confirmation                                                                                                 | Correction                                                                                                                                                                                                                                                                                     | Reference  |
|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| A.E73:<br>Unsupported                                                                                 | A command option<br>module fault<br>occurred.                                                                                  | -                                                                                                            | Replace the command option module.                                                                                                                                                                                                                                                             | _          |
| Command Option<br>Module                                                                              | A unsupported com-<br>mand option module<br>was connected.                                                                     | -                                                                                                            | Connect a compatible command option module.                                                                                                                                                                                                                                                    | _          |
| A.E74:<br>Unsupported                                                                                 | A safety option mod-<br>ule fault occurred.                                                                                    | _                                                                                                            | Replace the safety option module.                                                                                                                                                                                                                                                              | _          |
| Safety Option<br>Module                                                                               | A unsupported safety option module was connected.                                                                              | _                                                                                                            | Connect a compatible safety option module.                                                                                                                                                                                                                                                     | _          |
| A.E75 <sup>*2</sup> :                                                                                 | A feedback option<br>module fault<br>occurred.                                                                                 | _                                                                                                            | Replace the feedback option module.                                                                                                                                                                                                                                                            | _          |
| Unsupported<br>Feedback Option<br>Module                                                              | A unsupported feed-<br>back option module<br>was connected.                                                                    | Refer to the catalog of<br>the connected feed-<br>back option module or<br>the manual of the SER-<br>VOPACK. | Connect a compatible feedback option module.                                                                                                                                                                                                                                                   | _          |
| A.E80:<br>Command Option<br>Module<br>Unmatched Error                                                 | The command option<br>module was replaced<br>with a different model.                                                           | _                                                                                                            | Execute Fn014 (Reset-<br>ting configuration error of<br>option module) using the<br>digital operator or Sig-<br>maWin+ and turn the<br>power supply OFF and<br>then ON again.                                                                                                                  | _          |
| A.EA2:<br>Alarm in Current<br>Communications<br>between the<br>INDEXER Module<br>and SERVO-<br>PACK 1 | An error occurred in<br>communications<br>between the INDEXER<br>Module and SERVO-<br>PACK during opera-<br>tion.              | _                                                                                                            | Take steps to reduce<br>noise in the system such<br>as improving frame<br>ground.                                                                                                                                                                                                              | page 15-45 |
| A.EA3:<br>Alarm in Current<br>Communications<br>between the<br>INDEXER Module<br>and SERVO-<br>PACK 2 | An error occurred in<br>communications<br>between the INDEXER<br>Module and SERVO-<br>PACK during opera-<br>tion.              | _                                                                                                            | Take steps to reduce<br>noise in the system such<br>as improving frame<br>ground.                                                                                                                                                                                                              | page 15-45 |
| A.Eb1:<br>Safety Function<br>Signal Input Tim-<br>ing Error                                           | The delay between<br>activation of the<br>/HWBB1 and<br>/HWBB2 input sig-<br>nals for the HWBB<br>was ten second or<br>longer. | Measure the time delay<br>between the /HWBB1<br>and /HWBB2 signals.                                          | The output signal circuits<br>or devices for /HWBB1<br>and /HWBB2 or the SER-<br>VOPACK input signal cir-<br>cuits may be faulty.<br>Alternatively, the input sig-<br>nal cables may be discon-<br>nected. Check to see if<br>any of these items are<br>faulty or have been dis-<br>connected. | -          |
|                                                                                                       | A failure occurred in the SERVOPACK.                                                                                           | _                                                                                                            | Replace the SERVO-<br>PACK.                                                                                                                                                                                                                                                                    | -          |

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| Continued from previous page.                                                                                |                                                                                                                                                |                                                                                |                                                                                                                                                       |           |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Alarm Number:<br>Alarm Name                                                                                  | Possible Cause                                                                                                                                 | Confirmation                                                                   | Correction                                                                                                                                            | Reference |
| A.EC8:<br>Gate Drive Error 1<br>(An error<br>occurred in the<br>gate drive circuit.)                         | A failure occurred in                                                                                                                          | -                                                                              | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still                                                                      | -         |
| A.EC9:<br>Gate Drive Error 2<br>(An error<br>occurred in the<br>gate drive circuit.)                         | the SERVOPACK.                                                                                                                                 | -                                                                              | occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                                                                                     | -         |
| A.Ed1:<br>Command Option<br>Module IF Com-                                                                   | Processing of the<br>servo ON command<br>from the command<br>option module is not<br>completed.                                                | -                                                                              | Input a servo ON com-<br>mand when the motor is<br>stopped.                                                                                           | -         |
| mand Timeout<br>Error                                                                                        | Processing of the<br>sensor ON command<br>from the command<br>option module is not<br>completed.                                               | -                                                                              | Check that the encoder is connected properly.                                                                                                         | _         |
|                                                                                                              | The three-phase<br>power supply wiring is<br>not correct.                                                                                      | Check the power sup-<br>ply wiring.                                            | Make sure that the power supply is correctly wired.                                                                                                   | page 4-12 |
| <b>A.F10:</b><br>Power Supply<br>Line Open Phase                                                             | The three-phase<br>power supply is<br>unbalanced.                                                                                              | Measure the voltage for<br>each phase of the<br>three-phase power sup-<br>ply. | Balance the power supply by changing phases.                                                                                                          | -         |
| (The voltage was<br>low for more than<br>one second for<br>phase R, S, or T<br>when the main<br>power supply | A single-phase power<br>supply was input with-<br>out specifying a sin-<br>gle-phase AC power<br>supply input (Pn00B =<br>$n.\Box1\Box\Box$ ). | Check the power sup-<br>ply and the parameter<br>setting.                      | Match the parameter set-<br>ting to the power supply.                                                                                                 | page 4-12 |
| was ON.)                                                                                                     | A failure occurred in the SERVOPACK.                                                                                                           | _                                                                              | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK. | _         |
| FL-1 <sup>*5</sup> :<br>System Alarm                                                                         |                                                                                                                                                |                                                                                |                                                                                                                                                       | -         |
| FL-2 <sup>*5</sup> :<br>System Alarm                                                                         | -                                                                                                                                              |                                                                                |                                                                                                                                                       | _         |
| FL-3 <sup>*5</sup> :<br>System Alarm                                                                         | -                                                                                                                                              |                                                                                | Turn the power supply to the SERVOPACK OFF and                                                                                                        | -         |
| FL-4 <sup>*5</sup> :<br>System Alarm                                                                         | A failure occurred in the SERVOPACK.                                                                                                           | -                                                                              | ON again. If an alarm still occurs, the SERVOPACK may be faulty. Replace the                                                                          | -         |
| FL-5 <sup>*5</sup> :<br>System Alarm<br>FL-6 <sup>*5</sup> :                                                 | -                                                                                                                                              |                                                                                | SERVOPACK.                                                                                                                                            | -         |
| System Alarm<br>FL-7 <sup>*5</sup> :                                                                         | -                                                                                                                                              |                                                                                |                                                                                                                                                       | -         |
| System Alarm                                                                                                 |                                                                                                                                                |                                                                                | Continued o                                                                                                                                           |           |

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| Alarm Number:<br>Alarm Name                                    | Possible Cause                                                                          | Confirmation                 | Correction                                                                                                                                                                   | Reference |
|----------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>CPF00:</b><br>Digital Operator<br>Communications<br>Error 1 | There is a faulty con-<br>nection between the<br>Digital Operator and<br>the SERVOPACK. | Check the connector contact. | Disconnect the connec-<br>tor and insert it again. Or,<br>replace the cable.                                                                                                 | _         |
|                                                                | A malfunction was caused by noise.                                                      | -                            | Keep the Digital Operator<br>or the cable away from<br>sources of noise.                                                                                                     | -         |
| <b>CPF01:</b><br>Digital Operator<br>Communications<br>Error 2 | A failure occurred in the Digital Operator.                                             | _                            | Disconnect the Digital<br>Operator and then con-<br>nect it again. If an alarm<br>still occurs, the Digital<br>Operator may be faulty.<br>Replace the Digital Oper-<br>ator. | _         |
|                                                                | A failure occurred in the SERVOPACK.                                                    | -                            | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                        | _         |

If either of the following conditions is detected, an alarm will occur.

| <ul> <li>Pn533 [min<sup>-1</sup>] × –</li> </ul>      | Encoder resolu  | ution                           | Pn20E     |     |       |
|-------------------------------------------------------|-----------------|---------------------------------|-----------|-----|-------|
| 1 1000 [11111 ] × =                                   | $6 \times 10^5$ | 2                               | Pn210     |     |       |
| • Maximum motor speed [min <sup>-1</sup> ] $\times$ – |                 | Encoder re                      | esolution |     | Pn20E |
|                                                       |                 | Approx. 3.66 × 10 <sup>12</sup> |           | ~ 2 | Pn210 |

Linear Servomotor

If either of the following conditions is detected, an alarm will occur.

| Pn585 [mm/s]              |   | Resolution of Serial Converter Unit | / | Pn20E |
|---------------------------|---|-------------------------------------|---|-------|
| Linear encoder pitch [µm] | × | 10                                  | - | Pn210 |
| Pn385 [100 mm/s]          |   | Resolution of Serial Converter Unit | > | Pn20E |
| Linear encoder pitch [µm] | ~ | Approx. 6.10 ×10 <sup>5</sup>       | ~ | Pn210 |

#### \*2. Detection Conditions

Rotary Servomotor

If either of the following conditions is detected, an alarm will occur.

• Rated motor speed [min<sup>-1</sup>]  $\times 1/3 \times \frac{\text{Encoder resolution}}{6 \times 10^5} \le \frac{\text{Pn20E}}{\text{Pn210}}$ 

• Maximum motor speed [min<sup>-1</sup>]  $\times \frac{\text{Encoder resolution}}{\text{Approx. 3.66} \times 10^{12}} \ge \frac{\text{Pn20E}}{\text{Pn210}}$ 

Linear Servomotor

If either of the following conditions is detected, an alarm will occur.

| • • | Rated motor speed [mm/s] $\times$ 1/3<br>Linear encoder pitch [ $\mu$ m] | × | Resolution of Serial Converter Unit<br>10                            | $\leq$ | Pn20E<br>Pn210 |
|-----|--------------------------------------------------------------------------|---|----------------------------------------------------------------------|--------|----------------|
| • . | Pn385 [100 mm/s]<br>Linear encoder pitch [μm]                            | × | Resolution of Serial Converter Unit<br>Approx. 6.10 ×10 <sup>5</sup> | $\geq$ | Pn20E<br>Pn210 |

\*3. Refer to the relevant manual in the following list for details.

Ω Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)

\*4. The SERVOPACK will fail if the External Regenerative Resistor or Regenerative Resistor Unit is connected while the jumper is connected between the B2 and B3 terminals.

\*5. These alarms are not stored in the alarm history. They are only displayed on the panel display.

# 15.2.3 INDEXER Module Alarm Displays and Troubleshooting

The INDEXER Module alarm list and the corresponding corrective actions are shown below.

| Serial<br>Command<br>Negative<br>Response | Alarm<br>Number | Alarm Name                                                                                                | Meaning                                                                                                                                                                                                      | Corrective Action                                                                                                                                                                                             | Servo-<br>motor<br>Stop<br>Method | Alarm<br>Reset |
|-------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------|
| E12A                                      | A.AEF           | Firmware<br>Execution Alarm                                                                               | The firmware pro-<br>cessing time was too<br>long.                                                                                                                                                           | <ul> <li>Upgrade the firm-<br/>ware version.</li> <li>Reduce the number<br/>of functions being<br/>used.</li> </ul>                                                                                           | Gr.1                              | N/A            |
| E13A                                      | A.AEF           | Firmware<br>Version<br>Unmatched                                                                          | The SERVOPACK<br>does not supported<br>this function,<br>because the soft-<br>ware version do not<br>match.                                                                                                  | <ul> <li>Upgrade the SERVO-<br/>PACK software version.</li> <li>Use the SERVO-<br/>PACK that supports the corresponding function.</li> <li>Use the SERVO-<br/>PACK with the function set disabled.</li> </ul> | Gr.1                              | N/A            |
| E14A                                      | A.AEF           | Parameter<br>Checksum Alarm<br>(Detected only<br>when control<br>power supply is<br>turned ON.)           | Incorrect or cor-<br>rupted parameters<br>are stored in<br>EEPROM.<br>(This alarm can occur<br>if the control power<br>supply is turned OFF<br>while the parameters<br>are being initialized or<br>changed.) | <ul> <li>Initialize the parameters with the PRMINIT command or FnB0B.</li> <li>If the problem is not solved, correct the parameters.</li> </ul>                                                               | Gr.1                              | N/A            |
| E15A                                      | A.AEF           | Parameter<br>Version<br>Unmatched<br>(Detected only<br>when the control<br>power supply is<br>turned ON.) | The combination of<br>the firmware version<br>number and the<br>parameter version<br>number is wrong.                                                                                                        | <ul> <li>Change the firmware version.</li> <li>Change the parameter version to match the firmware version.</li> </ul>                                                                                         | Gr.1                              | N/A            |
| E16A                                      | A.AEF           | Parameter Out-<br>of-range Alarm<br>(Detected only<br>when control<br>power supply is<br>turned ON.)      | The moving method<br>is set to a rotary<br>method (PnB20 = 1,<br>2, or 3), but the origin<br>set in PnB25 exceeds<br>the software limits set<br>in PnB21 and PnB23.                                          | Correct the origin set-<br>ting (PnB25) or the<br>software limits (PnB21<br>and PnB23).                                                                                                                       | Gr.1                              | N/A            |

Continued on next page.

15.2.3 INDEXER Module Alarm Displays and Troubleshooting

Continued from previous page. Serial Servo-Command Alarm motor Alarm Alarm Name Meaning **Corrective Action** Number Negative Stop Reset Method Response The INDEXER Module failed in initialization Take steps to reduce of communications noise in the system with the SERVOPACK A.E00 such as improving when the control frame ground. power was turned ÔN. · Upgrade the SERVO-PACK's software ver-The SERVOPACK is sion. not compatible with Replace the SERVO-A.AEF the INDEXER Mod-PACK with a SERVO-PACK that is ule. Initial Communicompatible with the cation Alarm INDEXER Module. between • The INDEXER Mod-**INDEXER** Module ule failed in paramand SERVOeter calculation N/A E17A Gr.1 PACK during initial com-(Detected only munications with · Connect the encoder when control the SERVOPACK and then change the power supply is when the control parameter. turned ON.) power was turned Cancel the A.040 ON. alarm and then This can happen in A.C90 or change the paramethe following cases: A.040 ter. • When a parame-(If the alarm display is ter has been other than A.E00, it changed while the can be reset by turnencoder is not ing the power OFF connected and back ON.) • When a parameter has been changed during occurrence of A.040 alarm An error occurred in Communication communications Take steps to reduce Alarm between A.EA2, between the noise in the system E18A **INDEXER** Module Gr.1 Available A.EA3 **INDEXER Module and** such as improving and SERVO-SERVOPACK during frame ground. PACK operation. The program table stored in flash mem- Initialize the program **Program Table** ory was not recorded table with the PGMI-Checksum Alarm properly. NIT command or (Detected only (This alarm can occur E19A A.AEF Available\*1 FnB06. Gr.1 if the control power when control If the problem is not supply is turned OFF power supply is solved, correct the while the program turned ON.) program table. table is being saved or initialized.) Program Table · Change the firmware The combination of Version version. the firmware version Unmatched Change the program E1AA A.AEF and the program Gr.1 Available\*1 table version to (Detected only table version is match the firmware when the control wrong. power is ON.) version.

#### 15.2.3 INDEXER Module Alarm Displays and Troubleshooting

Continued from previous page.

| • • •                                     |                 |                                                                                                                 |                                                                                                                                                                                                                              | Continued                                                                                                                                                                      |                                   | ous paye.               |
|-------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------|
| Serial<br>Command<br>Negative<br>Response | Alarm<br>Number | Alarm Name                                                                                                      | Meaning                                                                                                                                                                                                                      | Corrective Action                                                                                                                                                              | Servo-<br>motor<br>Stop<br>Method | Alarm<br>Reset          |
| E1BA                                      | A.AEF           | Program Out-of-<br>range Alarm<br>(Detected only<br>when control<br>power supply is<br>turned ON.)              | A value set in the pro-<br>gram table is not<br>within the allowed<br>setting range.                                                                                                                                         | <ul> <li>Change the firmware version.</li> <li>Change the program table version to match the firmware version.</li> </ul>                                                      | Gr.1                              | Available <sup>*1</sup> |
| E1CA                                      | A.AEF           | ZONE Table<br>Checksum Alarm<br>(Detected only<br>when control<br>power supply is<br>turned ON.)                | The ZONE table<br>stored in flash mem-<br>ory was not recorded<br>properly.<br>(This alarm can occur<br>if the control power<br>supply is turned OFF<br>while the ZONE table<br>is being saved or ini-<br>tialized.)         | <ul> <li>Initialize the ZONE table with the ZONEINIT command or FnB07.*2</li> <li>If the problem is not solved, correct the ZONE table.</li> </ul>                             | Gr.1                              | Available <sup>*2</sup> |
| E1DA                                      | A.AEF           | ZONE Table Ver-<br>sion Unmatched<br>(Detected only<br>when the control<br>power supply is<br>turned ON.)       | The combination of<br>the firmware version<br>and the ZONE table<br>version is wrong.                                                                                                                                        | <ul> <li>Change the firmware version.</li> <li>Change the ZONE table version to match the firmware version.</li> </ul>                                                         | Gr.1                              | Available <sup>*2</sup> |
| E1EA                                      | A.AEF           | ZONE Table Out-<br>of-range Alarm<br>(Detected only<br>when control<br>power supply is<br>turned ON.)           | A value set in the<br>ZONE table is not<br>within the allowed<br>setting range.                                                                                                                                              | <ul> <li>Change the firmware version.</li> <li>Change the ZONE table version to match the firmware version.</li> </ul>                                                         | Gr.1                              | Available <sup>*2</sup> |
| E1FA                                      | A.AEF           | JOG Speed<br>Table Checksum<br>Alarm<br>(Detected only<br>when control<br>power supply is<br>turned ON.)        | The JOG speed table<br>stored in flash mem-<br>ory was not recorded<br>properly.<br>(This alarm can occur<br>if the control power<br>supply is turned OFF<br>while the JOG speed<br>table is being saved<br>or initialized.) | <ul> <li>Initialize the JOG<br/>speed table with the<br/>JSPDINIT command<br/>or FnB08.</li> <li>If the problem is not<br/>solved, correct the<br/>JOG speed table.</li> </ul> | Gr.1                              | Available*3             |
| E21A                                      | A.AEF           | JOG Speed<br>Table Version<br>Unmatched<br>(Detected only<br>when the control<br>power supply is<br>turned ON.) | The combination of<br>the firmware version<br>and the JOG speed<br>table version is<br>wrong.                                                                                                                                | <ul> <li>Change the firmware version.</li> <li>Change the JOG speed table version to match the firmware version.</li> </ul>                                                    | Gr.1                              | Available*3             |
| E22A                                      | A.AEF           | JOG Speed<br>Table Out-of-<br>range Alarm<br>(Detected only<br>when control<br>power supply is<br>turned ON.)   | A value set in the<br>JOG speed table is<br>not within the allowed<br>setting range.                                                                                                                                         | <ul> <li>Change the firmware version.</li> <li>Change the JOG speed table version to match the firmware version.</li> </ul>                                                    | Gr.1                              | Available*3             |

Continued on next page.

Maintenance

#### 15.2.4 Resetting INDEXER Alarms

Continued from previous page.

| Serial<br>Command<br>Negative<br>Response | Alarm<br>Number | Alarm Name                                         | Meaning                                                                                                                                                                                                                                             | Corrective Action                                                                                                                                                                                                                                                                                                                                                                         | Servo-<br>motor<br>Stop<br>Method | Alarm<br>Reset |
|-------------------------------------------|-----------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------|
| E23A                                      | A.AEF           | Insufficient Reg-<br>istration Dis-<br>tance Alarm | The registration dis-<br>tance was shorter<br>than the deceleration<br>distance when the /<br>RGRT signal went<br>ON to start registra-<br>tion operation. (The<br>current position will<br>exceed the position<br>specified by registra-<br>tion.) | Either increase the reg-<br>istration distance or<br>reduce the decelera-<br>tion distance (increase<br>the deceleration rate).<br>The registration dis-<br>tance can be set by<br>executing the RDST<br>command or changing<br>the RDST parameter in<br>the program table.<br>The deceleration rate<br>can be changed by<br>executing the DEC<br>command or changing<br>parameter PnB2B. | Gr.1                              | Available      |

\*1. These alarms can be reset, but a Canceled Program Table Error (E44E) will occur the next time you attempt to start program table operation, so program table operation will not be possible.

\*2. These alarms can be reset, but it is possible that the ZONE signals (POUT0 to POUT7) will be output incorrectly. When using the ZONE table, correct the ZONE table without resetting.

\*3. These alarms can be reset, but a Canceled JOG Speed Table Error (E46E) will occur the next time you attempt to start JOG speed table operation, so JOG speed table operation will not be possible.

# 15.2.4 Resetting INDEXER Alarms

If there is an ALM (Servo Alarm) signal, use one of the following methods to reset the alarm after eliminating the cause of the alarm.



Be sure to eliminate the cause of an alarm before you reset the alarm. If you reset the alarm and continue operation without eliminating the cause of the alarm, it may result in damage to the equipment or fire.

#### Resetting Alarms with the SigmaWin+

Use the following procedure to reset alarms with the SigmaWin+.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Display Alarm in the Menu Dialog Box. The Alarm Display Dialog Box will be displayed.

15.2.4 Resetting INDEXER Alarms

3. Click the Reset axes Button.

| Axis<br>AXIS#0001A : SGD7S-2                                                                                                                                                                             |                |                             |                  |                                                                                                  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------|------------------|--------------------------------------------------------------------------------------------------|--|--|
|                                                                                                                                                                                                          | R8A20A         | A.C.90 : Encoder Com        | munications Erro | Ala                                                                                              |  |  |
|                                                                                                                                                                                                          |                |                             |                  |                                                                                                  |  |  |
|                                                                                                                                                                                                          |                |                             |                  |                                                                                                  |  |  |
|                                                                                                                                                                                                          |                |                             |                  |                                                                                                  |  |  |
| rm diagnosis Alarm History                                                                                                                                                                               |                |                             |                  |                                                                                                  |  |  |
|                                                                                                                                                                                                          |                |                             | Cause            | 1/5 ∢ ▶                                                                                          |  |  |
| Cause                                                                                                                                                                                                    |                |                             |                  |                                                                                                  |  |  |
| Contact fault of encoder connect                                                                                                                                                                         | ctor or incorr | ect encoder wiring.         |                  | *                                                                                                |  |  |
|                                                                                                                                                                                                          |                |                             |                  |                                                                                                  |  |  |
| 1                                                                                                                                                                                                        |                | Ψ                           |                  |                                                                                                  |  |  |
|                                                                                                                                                                                                          |                |                             |                  |                                                                                                  |  |  |
| Investigated actions                                                                                                                                                                                     |                |                             |                  |                                                                                                  |  |  |
| Investigated actions<br>Check the encoder connector con                                                                                                                                                  | ontact status  | 4.                          |                  | ~                                                                                                |  |  |
| -                                                                                                                                                                                                        | ontact status  | 4.                          |                  | Â                                                                                                |  |  |
| Check the encoder connector co                                                                                                                                                                           | ontact status  | i.                          |                  | Å                                                                                                |  |  |
| Check the encoder connector connector connector connective actions                                                                                                                                       |                |                             |                  | A<br>T                                                                                           |  |  |
| Check the encoder connector co                                                                                                                                                                           |                |                             | rrectly wired.   | *<br>*                                                                                           |  |  |
| Check the encoder connector connector connector connective actions                                                                                                                                       |                |                             | rrectly wired.   | 4<br>7<br>4                                                                                      |  |  |
| Check the encoder connector connector connector connective actions                                                                                                                                       |                |                             | rrectly wired.   | 4<br>7<br>4                                                                                      |  |  |
| Check the encoder connector of<br>Corrective actions<br>Re-insert the encoder connecto                                                                                                                   |                |                             | rrectly wired.   | 4<br>7<br>7                                                                                      |  |  |
| Check the encoder connector of<br>Corrective actions<br>Re-insert the encoder connecto<br>Monitor at occurrence of alarm                                                                                 | r and confirr  | n that the encoder is co    | rrectly wired.   |                                                                                                  |  |  |
| Check the encoder connector or<br>Corrective actions<br>Re-insert the encoder connecto<br>Monitor at occurrence of alarm<br>Name                                                                         | r and confirr  | n that the encoder is co    | rrectly wired.   |                                                                                                  |  |  |
| Check the encoder connector of<br>Corrective actions<br>Re-insert the encoder connecto<br>Monitor at occurrence of alarm<br>Name<br>Motor rotating speed<br>Speed reference<br>Internal torgue reference | r and confirr  | n that the encoder is co    | rrectly wired.   |                                                                                                  |  |  |
| Check the encoder connector of<br>Corrective actions<br>Re-insert the encoder connecto<br>Monitor at occurrence of alarm<br>Name<br>Motor rotating speed<br>Speed reference                              | r and confirr  | that the encoder is co      | rrectly wired.   |                                                                                                  |  |  |
| Check the encoder connector of<br>Corrective actions<br>Re-insert the encoder connecto<br>Monitor at occurrence of alarm<br>Name<br>Motor rotating speed<br>Speed reference<br>Internal torgue reference | value          | Unit<br>min-1<br>%<br>min-1 |                  | 4<br>7<br>7<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1 |  |  |

The alarm will be reset, and the alarm display will be cleared.

This concludes the procedure to reset alarms.

# Resetting Using /ALM-RST (Alarm Reset) Signal

| Туре  | Signal Name | Connector Pin No. | Description |  |  |  |
|-------|-------------|-------------------|-------------|--|--|--|
| Input | /ALM-RST    | CN1-7             | Alarm reset |  |  |  |
|       |             |                   |             |  |  |  |

You can change the setting for the /ALM-RST signal with PnB52.

|       | Parameter              | Meaning                                                                 | When Enabled  |
|-------|------------------------|-------------------------------------------------------------------------|---------------|
|       | 0<br>(default setting) | Resets alarms by switching input signal from OFF (open) to ON (closed). |               |
| PnB52 | 1                      | Resets alarms by switching input signal from ON (closed) to OFF (open). | After restart |
|       | 2<br>3                 | Does not reset alarms. (Signal is ignored.)                             |               |

# **Resetting Alarms Using the Digital Operator**

Press the **ALARM RESET** Key on the Digital Operator. Refer to the following manual for details on resetting alarms.

Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

Information The alarm of the INDEXER module cannot be reset using the **ALARM RESET** Button on the digital operator. To reset the alarm of the INDEXER module, perform INDEXER alarm reset (FnB0C). For details, refer to the following section.

15.2.5 Displaying the INDEXER Alarm History

# 15.2.5 Displaying the INDEXER Alarm History

The alarm history displays up to the last ten alarms that have occurred in the SERVOPACK and INDEXER module.

#### Preparations

No preparations are required.

#### **Applicable Tools**

The following table lists the tools that you can use to display the alarm history.

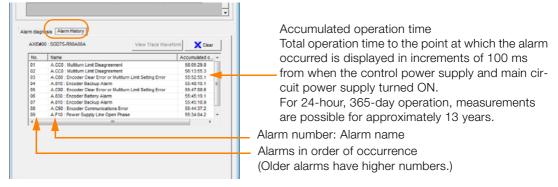
| Tool             | Fn No./Function Name            | Reference                                                                     |
|------------------|---------------------------------|-------------------------------------------------------------------------------|
| Digital Operator | FnB0D                           | Ω-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Troubleshooting – Display Alarm | Gerating Procedure on page 15-50                                              |

# **Operating Procedure**

Use the following procedure to display the alarm history.

- 1. Click the <u>Servo</u> Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Display Alarm in the Menu Dialog Box. The Alarm Display Dialog Box will be displayed.
- 3. Click the Alarm History Tab.

The following display will appear and you can check the alarms that occurred in the past.



- **Information** 1. If the same alarm occurs consecutively within one hour, it is not saved in the alarm history. If it occurs after an hour or more, it is saved.
  - 2. You can clear the alarm history by clicking the **Clear** Button. The alarm history is not cleared when alarms are reset or when the SERVOPACK main circuit power is turned OFF.

This concludes the procedure to display the alarm history.

# 15.2.6 Clearing the INDEXER Alarm History

You can clear the alarm history that is recorded in the SERVOPACK and INDEXER module.

The alarm history is not cleared when alarms are reset or when the SERVOPACK main circuit power is turned OFF. You must perform the following procedure.

#### Preparations

Always check the following before you clear the alarm history.

• The parameters must not be write prohibited.

# **Applicable Tools**

The following table lists the tools that you can use to clear the alarm history.

| Tool             | Fn No./Function Name            | Reference                                                                         |
|------------------|---------------------------------|-----------------------------------------------------------------------------------|
| Digital Operator | FnB0C                           | Chanal Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33) |
| SigmaWin+        | Troubleshooting – Display Alarm | B Operating Procedure on page 15-51                                               |

# **Operating Procedure**

Use the following procedure to reset the alarm history.

- 1. Click the <u>J</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Display Alarm in the Menu Dialog Box. The Alarm Display Dialog Box will be displayed.
- 3. Click the Alarm History Tab.
- 4. Click the Clear Button.

The alarm history will be cleared.

| No. | Name                                                                                                 | Accumulated o |     |
|-----|------------------------------------------------------------------------------------------------------|---------------|-----|
| 01  | A.CC0 : Multiturn Limit Disagreement                                                                 | 58:05:29.8    | -   |
| 02  | A.CC0 : Multiturn Linit Disagreement                                                                 | 56:13:55.3    | -11 |
| 02  | A.C60 : Multiturn Limit Disagreement<br>A.C80 : Encoder Clear Error or Multiturn Limit Setting Error | 55:52:55.1    | -11 |
| 03  | A.810 : Encoder Backup Alarm                                                                         | 55:48:10.1    |     |
| 05  | A.C80 : Encoder Clear Error or Multiturn Limit Setting Error                                         | 55:47:08.6    | -17 |
| 06  | A.830 : Encoder Battery Alarm                                                                        | 55:45:19.1    | -11 |
| 07  | A.810 : Encoder Backup Alarm                                                                         | 55:45:18.9    | -11 |
| 08  | A.C90 : Encoder Communications Error                                                                 | 55:44:37.2    | -   |
| 09  | A.F10 : Power Supply Line Open Phase                                                                 | 55:34:04.2    |     |
| 4   |                                                                                                      |               |     |
|     |                                                                                                      |               |     |

This concludes the procedure to reset the alarm history.

15.2.7 Resetting Alarms Detected in Option Modules

# 15.2.7 Resetting Alarms Detected in Option Modules

If any Option Modules are attached to the SERVOPACK, the SERVOPACK detects the presence and models of the connected Option Modules. If it finds any errors, it outputs alarms.

You can delete those alarms with this operation.

- **Information** This operation is the only way to reset alarms for Option Modules. The alarms are not reset when you reset other alarms or when you turn OFF the power supply to the SERVOPACK.
  - Always remove the cause of an alarm before you reset the alarm.

#### Preparations

Always check the following before you clear an alarm detected in an Option Module. • The parameters must not be write prohibited.

# **Applicable Tools**

The following table lists the tools that you can use to reset Option Module configuration errors.

| Tool             | Fn No./Function Name            | Reference                                                                       |
|------------------|---------------------------------|---------------------------------------------------------------------------------|
| Digital Operator | Fn014                           | Ω Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Troubleshooting – Display Alarm | Correcting Procedure on page 15-52                                              |

#### **Operating Procedure**

Use the following procedure to reset alarms detected in Option Modules.

- 1. Click the *P* Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Display Alarm in the Menu Dialog Box. The Display Alarm Dialog Box will be displayed.
- 3. Click the Reset axes Button.

| Alarm Display                                         |          |                 |                   |                  |  |  |
|-------------------------------------------------------|----------|-----------------|-------------------|------------------|--|--|
| larm-                                                 |          |                 |                   |                  |  |  |
| Axis                                                  |          |                 | <u></u>           | <b>^</b>         |  |  |
| AXIS#0001A : SGD7S-2                                  | R8A2UA   | A.E./1 : Safet  | y Option Module D | etection Failure |  |  |
|                                                       |          |                 |                   | •                |  |  |
| Alarm diagnosis Alarm History                         |          |                 |                   | Cause 1/4 	)     |  |  |
| Cause                                                 |          |                 |                   |                  |  |  |
| Faulty connection between the                         | SERVOPA  | CK and Safety C | ption Module.     | *                |  |  |
|                                                       |          |                 |                   | -                |  |  |
| Investigated actions                                  |          |                 |                   |                  |  |  |
| Check the connection between                          | the SERV | OPACK and Safe  | ty Option Module  | <b>A</b>         |  |  |
|                                                       |          |                 | ., .,             |                  |  |  |
|                                                       |          |                 |                   | Ŧ                |  |  |
| Corrective actions                                    |          |                 |                   |                  |  |  |
| Reconnect the Safety Option Mo                        | odule.   |                 |                   | ~                |  |  |
|                                                       |          |                 |                   | ~                |  |  |
| ,<br>Monitor at occurrence of alarm                   |          |                 |                   |                  |  |  |
| Name                                                  | Val      | Unit            |                   | *                |  |  |
| Motor rotating speed                                  | -        | min-1           |                   |                  |  |  |
| Speed reference                                       | -        | min-1           |                   |                  |  |  |
| Internal torque reference                             | -        | %               |                   |                  |  |  |
| Input reference pulse speed                           | -        | min-1           |                   | *                |  |  |
| The diagonosis results su<br>The real cause may not b |          |                 | the alarm.        |                  |  |  |
|                                                       |          |                 |                   |                  |  |  |

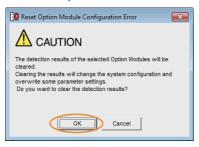
The Reset Option Module Configuration Error Dialog Box will be displayed.

15.2.7 Resetting Alarms Detected in Option Modules

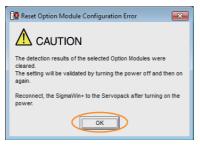
4. Select the Clear Check Box for the Option Module for which to reset the alarm and then click the Execute Button.

| 👰 Reset Op | tion Module Configuration Error AXIS#0001A                                                                                                                |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | Option Module error was detected.<br>Select the Clear check box of the Option Module and then<br>click the Execute button to clear the detection results. |
|            | Safety Option<br>Failed to detect Clear<br>Feedback Option<br>Normally detected Clear                                                                     |
|            | Execute                                                                                                                                                   |

5. Read the precaution and then click the OK Button.



6. Read the precaution and then click the OK Button.



7. Turn the power supply to the SERVOPACK OFF and ON again.

This concludes the procedure to reset alarms detected in Option Modules.

15.2.8 Resetting Motor Type Alarms

# 15.2.8 Resetting Motor Type Alarms

The SERVOPACK automatically determines the type of Servomotor that is connected to it. If the type of Servomotor that is connected is changed, an A.070 alarm (Motor Type Change Detected) will occur the next time the SERVOPACK is started. If an A.070 alarm occurs, you must set the parameters to match the new type of Servomotor.

An A.070 alarm is reset by executing the Reset Motor Type Alarm utility function.

- Information 1. This utility function is the only way to reset an A.070 alarm (Motor Type Change Detected). The errors are not reset when you reset alarms or turn OFF the power supply to the SER-VOPACK.
  - 2. If an A.070 alarm occurs, first set the parameters according to the newly connected Servomotor type and then execute the Reset Motor Type Alarm utility function.

#### Preparations

Always check the following before you reset a motor type alarm.

• The parameters must not be write prohibited.

# **Applicable Tools**

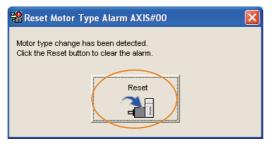
The following table lists the tools that you can use to clear the motor type alarm.

| Tool             | Fn No./Function Name                        | Reference                                                                       |
|------------------|---------------------------------------------|---------------------------------------------------------------------------------|
| Digital Operator | Fn021                                       | C Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Troubleshooting – Reset Motor<br>Type Alarm | Operating Procedure on page 15-54                                               |

# **Operating Procedure**

Use the following procedure to reset Motor Type alarm.

- 1. Click the <u>I</u> Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Reset Motor Type Alarm in the Menu Dialog Box. The Reset Motor Type Alarm Dialog Box will be displayed.
- 3. Click the Reset Button.



4. Read the precaution and then click the OK Button.



5. Read the precaution and then click the OK Button.



6. Turn the power supply to the SERVOPACK OFF and ON again.

This concludes the procedure to reset Motor Type alarms.

15.3.1 List of Warnings

# 15.3 Warning Displays

Warnings are displayed to warn you before an alarm occurs. If a warning occurs in the SERVO-PACK, the status is displayed as described below.

#### Status Display

| SERVOPACK Panel Display                                 | The alarm number will be displayed.<br>Refer to the following section for details.<br>The section of the section of |  |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Indicator                                               | Green indicator: Remains unlit<br>Red indicator: Remains lit<br>Refer to the following section for details.<br>3 <i>1.5.2 Indicators</i> on page 1-11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| Digital Operator                                        | When a warning occurs, the warning code is displayed at the top left of the screen.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| Response to the Alarm or Warning Read<br>Command (ALM)  | Warning code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| Response to the Most Recent Error Read<br>Command (ERR) | No change                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| ALM Signal                                              | No change                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| /WARN Signal                                            | Turns ON.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |

A list of warnings and the causes of and corrections for warnings are given below.

# 15.3.1 List of Warnings

This section gives the warning names, warning meanings, and warning code outputs in order of the warning numbers.

# List of Warnings

| Warning Warning Name | Warning Name                                        | Meaning                                                                                                                                                                                                 | Warning Code Output |       |       |
|----------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|-------|
| Number               |                                                     | Meaning                                                                                                                                                                                                 |                     | /ALO2 | /ALO3 |
| A.900                | Position Deviation<br>Overflow                      | The position deviation exceeded the percentage set<br>with the following formula:<br>(Pn520 × Pn51E/100)                                                                                                |                     | Н     | Н     |
| A.901                | Position Deviation<br>Overflow Alarm at<br>Servo ON | The position deviation when the servo was turned ON exceeded the percentage set with the following formula: (Pn526 × Pn528/100)                                                                         | H                   |       |       |
| A.910                | Overload                                            | This warning occurs before an overload alarm (A.710 or A.720) occurs. If the warning is ignored and operation is continued, an alarm may occur.                                                         |                     | Н     | Н     |
| A.911                | Vibration                                           | Abnormal vibration was detected during motor<br>operation. The detection level is the same as A.520.<br>Set whether to output an alarm or a warning by set-<br>ting Pn310 (Vibration Detection Switch). | L                   |       |       |

15.3.1 List of Warnings

| Continued from | previous | page. |
|----------------|----------|-------|
|----------------|----------|-------|

| Warning |                                                                           | Mananian                                                                                                                                                          | Warnin | g Code | Output |
|---------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|--------|
| Number  | Warning Name                                                              | Meaning                                                                                                                                                           |        | /ALO2  |        |
| A.912   | Internal Temperature<br>Warning 1 (Control<br>Board Temperature<br>Error) | The surrounding temperature of the control PCB is abnormal.                                                                                                       |        |        |        |
| A.913   | Internal Temperature<br>Warning 2 (Power<br>Board Temperature<br>Error)   | The surrounding temperature of the power PCB is abnormal.                                                                                                         |        |        |        |
| A.920   | Regenerative Overload                                                     | This warning occurs before an A.320 alarm (Regen-<br>erative Overload) occurs. If the warning is ignored<br>and operation is continued, an alarm may occur.       | Н      | L      | Н      |
| A.921   | Dynamic Brake Over-<br>load                                               | This warning occurs before an A.731 alarm<br>(Dynamic Brake Overload) occurs. If the warning is<br>ignored and operation is continued, an alarm may<br>occur.     | -      |        |        |
| A.923   | SERVOPACK Built-in<br>Fan Stopped                                         | The fan inside the SERVOPACK stopped.                                                                                                                             |        |        |        |
| A.930   | Absolute Encoder Bat-<br>tery Error                                       | This warning occurs when the voltage of absolute encoder's battery is low.                                                                                        |        |        |        |
| A.93B   | Overheat Warning                                                          | The input voltage (temperature) for the overheat protection input (TH) signal exceeded the setting of Pn61C (Overheat Warning Level).                             | L      | L      | Н      |
| A.942   | Speed Ripple Com-<br>pensation Information<br>Disagreement                | The speed ripple compensation information stored<br>in the encoder does not agree with the speed ripple<br>compensation information stored in the SERVO-<br>PACK. | Н      | Н      | L      |
| A.971   | Undervoltage                                                              | This warning occurs before an A.410 alarm (Under-<br>voltage) occurs. If the warning is ignored and oper-<br>ation is continued, an alarm may occur.              | L      | L      | L      |
| A.9A0   | Overtravel                                                                | Overtravel was detected while the servo was ON.                                                                                                                   | Н      | L      | L      |
| A.9b0   | Preventative Mainte-<br>nance Warning                                     | One of the consumable parts has reached the end of its service life.                                                                                              | Н      | L      | Н      |
| A.A9F   | Error                                                                     | Some kind of error has occurred at the INDEXER Module.*                                                                                                           | L      | Н      | Н      |

\* Refer to the following sections for details.

#### 15.3.3 INDEXER Module Error Displays and Troubleshooting

Note: 1. A warning code is not output unless you set Pn001 to n.1 [] (Output both alarm codes and warning codes).

2. Use Pn008 = n.□X□□ (Warning Detection Selection) to control warning detection. However, the following warnings are not affected by the setting of Pn008 = n.□X□□ and other parameter settings are required in addition to Pn008 = n.□X□□.

| Warning | Parameters That Must Be Set to Select Warning Detection                                                                                              | Reference |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| A.911   | $Pn310 = n.\Box\Box\BoxX$ (Vibration Detection Setting)                                                                                              | page 6-32 |
| A.930   | Pn008 = n.                                                                                                                                           | page 15-3 |
| A.942   | Pn423 = n. DDXD (Speed Ripple Compensation Information Dis-<br>agreement Warning Detection Selection)                                                | page 8-58 |
| A.971   | Pn008 = $n.\Box \Box X \Box$ (Function Selection for Undervoltage)<br>(Not affected by the setting of Pn008 = $n.\Box X \Box \Box$ .)                | page 6-12 |
| A.9A0   | Pn00D = $n.X\square\square\square$ (Overtravel Warning Detection Selection)<br>(Not affected by the setting of Pn008 = $n.\squareX\square\square$ .) | page 5-27 |
| A.9b0   | Pn00F = n.                                                                                                                                           | page 9-16 |

## 15.3.2 Troubleshooting Warnings

The causes of and corrections for the warnings are given in the following table. Contact your Yaskawa representative if you cannot solve a problem with the correction given in the table.

| Warning Number:<br>Warning Name                               | Possible Cause                                                                                                                                             | Confirmation                                                                                                                   | Correction                                                                                                                                                                                                                                                                                                                                | Reference |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                               | The Servomotor<br>U, V, and W wiring<br>is not correct.                                                                                                    | Check the wiring of the<br>Servomotor's Main Cir-<br>cuit Cables.                                                              | Make sure that there are no faulty connections in the wiring for the Servomotor and encoder.                                                                                                                                                                                                                                              | -         |
|                                                               | A SERVOPACK gain is too low.                                                                                                                               | Check the SERVO-<br>PACK gains.                                                                                                | Increase the servo gain,<br>e.g., by using autotuning<br>without a host reference.                                                                                                                                                                                                                                                        | page 8-23 |
| A.900:<br>Position Deviation<br>Overflow                      | The acceleration<br>of the position ref-<br>erence is too high.                                                                                            | Reduce the reference<br>acceleration and try<br>operating the SERVO-<br>PACK.                                                  | <ul> <li>Reduce the acceleration of<br/>the position reference with<br/>one of the following meth-<br/>ods.</li> <li>Reduce the acceleration<br/>rate (ACC) and decelera-<br/>tion rate (DEC) in the pro-<br/>gram table.</li> <li>Reduce the settings of<br/>PnB29 (Acceleration Rate)<br/>and PnB2B (Deceleration<br/>Rate).</li> </ul> | -         |
|                                                               | The excessive<br>position deviation<br>alarm level (Pn520<br>× Pn51E/100) is<br>too low for the<br>operating condi-<br>tions.                              | Check excessive posi-<br>tion deviation alarm<br>level (Pn520 × Pn51E/<br>100) to see if it is set to<br>an appropriate value. | Optimize the settings of<br>Pn520 and Pn51E.                                                                                                                                                                                                                                                                                              | page 8-7  |
|                                                               | A failure occurred<br>in the SERVO-<br>PACK.                                                                                                               | _                                                                                                                              | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If an alarm still<br>occurs, the SERVOPACK<br>may be faulty. Replace the<br>SERVOPACK.                                                                                                                                                                                     | -         |
| A.901:<br>Position Deviation<br>Overflow Alarm at<br>Servo ON | The position devi-<br>ation when the<br>servo was turned<br>ON exceeded the<br>percentage set<br>with the following<br>formula:<br>(Pn526 × Pn528/<br>100) | _                                                                                                                              | Optimize the setting of<br>Pn528 (Excessive Position<br>Error Warning Level at<br>Servo ON).                                                                                                                                                                                                                                              | -         |

Continued from previous page.

| Continued from previous page.                                            |                                                                                                                                               |                                                                                                          |                                                                                |           |
|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------|
| Warning Number:<br>Warning Name                                          | Possible Cause                                                                                                                                | Confirmation                                                                                             | Correction                                                                     | Reference |
|                                                                          | The wiring is not<br>correct or there is<br>a faulty connec-<br>tion in the motor<br>or encoder wiring.                                       | Check the wiring.                                                                                        | Make sure that the Servo-<br>motor and encoder are cor-<br>rectly wired.       | -         |
|                                                                          | Operation was<br>performed that<br>exceeded the<br>overload protec-<br>tion characteris-<br>tics.                                             | Check the motor over-<br>load characteristics and<br>Run command.                                        | Reconsider the load and operating conditions. Or, increase the motor capacity. | _         |
| A.910:<br>Overload (warning<br>before an A.710 or<br>A.720 alarm occurs) | An excessive load<br>was applied<br>during operation<br>because the Ser-<br>vomotor was not<br>driven because of<br>mechanical prob-<br>lems. | Check the operation<br>reference and motor<br>speed.                                                     | Remove the mechanical problem.                                                 | -         |
|                                                                          | The overload<br>warning level<br>(Pn52B) is not<br>suitable.                                                                                  | Check that the overload<br>warning level (Pn52B) is<br>suitable.                                         | Set a suitable overload warning level (Pn52B).                                 | page 5-39 |
|                                                                          | A failure occurred<br>in the SERVO-<br>PACK.                                                                                                  | _                                                                                                        | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                       | -         |
|                                                                          | Abnormal vibra-<br>tion was detected<br>during motor<br>operation.                                                                            | Check for abnormal<br>motor noise, and check<br>the speed and torque<br>waveforms during oper-<br>ation. | Reduce the motor speed.<br>Or, reduce the servo gain<br>with custom tuning.    | page 8-41 |
| A.911:<br>Vibration                                                      | The setting of<br>Pn103 (Moment of<br>Inertia Ratio) is<br>greater than the<br>actual moment of<br>inertia or was<br>greatly changed.         | Check the moment of inertia ratio or mass ratio.                                                         | Set Pn103 (Moment of Iner-<br>tia Ratio) to an appropriate<br>value.           | page 8-15 |
|                                                                          | The vibration<br>detection level<br>(Pn312 or Pn384)<br>is not suitable.                                                                      | Check that the vibration detection level (Pn312 or Pn384) is suitable.                                   | Set a suitable vibration<br>detection level (Pn312 or<br>Pn384).               | page 6-32 |

Continued from previous page.

| Warning Number:<br>Warning Name                                                         | Possible Cause                                                                                                                     | Confirmation                                                                                                                                                                | Correction                                                                                          | Reference             |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------|
|                                                                                         | The surrounding<br>temperature is too<br>high.                                                                                     | Check the surrounding<br>temperature using a<br>thermometer. Or, check<br>the operating status<br>with the SERVOPACK<br>installation environ-<br>ment monitor.              | Decrease the surrounding<br>temperature by improving<br>the SERVOPACK installa-<br>tion conditions. | page 3-7              |
|                                                                                         | An overload alarm<br>was reset by turn-<br>ing OFF the power<br>supply too many<br>times.                                          | Check the alarm display<br>to see if there is an<br>overload alarm.                                                                                                         | Change the method for resetting the alarm.                                                          | _                     |
| A.912:<br>Internal Tempera-<br>ture Warning 1<br>(Control Board Tem-<br>perature Error) | There was an<br>excessive load or<br>operation was<br>performed that<br>exceeded the<br>regenerative pro-<br>cessing capacity.     | Use the accumulated<br>load ratio to check the<br>load during operation,<br>and use the regenera-<br>tive load ratio to check<br>the regenerative pro-<br>cessing capacity. | Reconsider the load and operating conditions.                                                       | -                     |
|                                                                                         | The SERVOPACK<br>installation orien-<br>tation is not cor-<br>rect or there is<br>insufficient space<br>around the SER-<br>VOPACK. | Check the SERVO-<br>PACK installation con-<br>ditions.                                                                                                                      | Install the SERVOPACK according to specifications.                                                  | page 3-4,<br>page 3-7 |
|                                                                                         | A failure occurred<br>in the SERVO-<br>PACK.                                                                                       | -                                                                                                                                                                           | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                            | _                     |
|                                                                                         | The surrounding<br>temperature is too<br>high.                                                                                     | Check the surrounding<br>temperature using a<br>thermometer. Or, check<br>the operating status<br>with the SERVOPACK<br>installation environ-<br>ment monitor.              | Decrease the surrounding<br>temperature by improving<br>the SERVOPACK installa-<br>tion conditions. | page 3-7              |
|                                                                                         | An overload alarm<br>was reset by turn-<br>ing OFF the power<br>supply too many<br>times.                                          | Check the alarm display<br>to see if there is an<br>overload alarm.                                                                                                         | Change the method for resetting the alarm.                                                          | _                     |
| A.913:<br>Internal Tempera-<br>ture Warning 2<br>(Power Board Tem-<br>perature Error)   | There was an<br>excessive load or<br>operation was<br>performed that<br>exceeded the<br>regenerative pro-<br>cessing capacity.     | Use the accumulated<br>load ratio to check the<br>load during operation,<br>and use the regenera-<br>tive load ratio to check<br>the regenerative pro-<br>cessing capacity. | Reconsider the load and operating conditions.                                                       | -                     |
|                                                                                         | The SERVOPACK<br>installation orien-<br>tation is not cor-<br>rect or there is<br>insufficient space<br>around the SER-<br>VOPACK. | Check the SERVO-<br>PACK installation con-<br>ditions.                                                                                                                      | Install the SERVOPACK according to specifications.                                                  | page 3-4,<br>page 3-7 |
|                                                                                         | A failure occurred<br>in the SERVO-<br>PACK.                                                                                       | _                                                                                                                                                                           | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                            | -                     |

Continued from previous page.

| Warning Number:                                                                                                                                                                                          |                                                                                                                                                                                                           |                                                                                                                                           |                                                                                                                                                                                                                                          |           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Warning Number:<br>Warning Name                                                                                                                                                                          | Possible Cause                                                                                                                                                                                            | Confirmation                                                                                                                              | Correction                                                                                                                                                                                                                               | Reference |
|                                                                                                                                                                                                          | The power supply<br>voltage exceeded<br>the specified<br>range.                                                                                                                                           | Measure the power supply voltage.                                                                                                         | Set the power supply volt-<br>age within the specified range.                                                                                                                                                                            | -         |
| A.920:<br>Regenerative Over-<br>load (warning before<br>an A.320 alarm<br>occurs)                                                                                                                        | There is insuffi-<br>cient external<br>regenerative resis-<br>tance, regenera-<br>tive resistor<br>capacity, or SER-<br>VOPACK capac-<br>ity, or there has<br>been a continuous<br>regeneration<br>state. | Check the operating<br>conditions or the<br>capacity using the Sig-<br>maJunmaSize+ Capac-<br>ity Selection Software<br>or another means. | Change the regenerative<br>resistance value, regenera-<br>tive resistance capacity, or<br>SERVOPACK capacity.<br>Reconsider the operating<br>conditions using the Sigma-<br>JunmaSize+ Capacity<br>Selection Software or other<br>means. | -         |
|                                                                                                                                                                                                          | There was a con-<br>tinuous regenera-<br>tion state because<br>a negative load<br>was continuously<br>applied.                                                                                            | Check the load applied<br>to the Servomotor<br>during operation.                                                                          | Reconsider the system<br>including the servo,<br>machine, and operating<br>conditions.                                                                                                                                                   | _         |
|                                                                                                                                                                                                          | The Servomotor was rotated by an external force.                                                                                                                                                          | Check the operation status.                                                                                                               | Implement measures to<br>ensure that the motor will<br>not be rotated by an exter-<br>nal force.                                                                                                                                         | _         |
| A.921:<br>Dynamic Brake<br>Overload (warning<br>before an A.731<br>alarm occurs)                                                                                                                         | When the Servo-<br>motor was<br>stopped with the<br>dynamic brake,<br>the rotational or<br>linear kinetic<br>energy exceeded<br>the capacity of the<br>dynamic brake<br>resistor.                         | Check the power con-<br>sumed by the DB resis-<br>tor to see how<br>frequently the DB is<br>being used.                                   | <ul> <li>Reconsider the following:</li> <li>Reduce the Servomotor command speed.</li> <li>Decrease the moment of inertia or mass.</li> <li>Reduce the frequency of stopping with the dynamic brake.</li> </ul>                           | _         |
|                                                                                                                                                                                                          | A failure occurred<br>in the SERVO-<br>PACK.                                                                                                                                                              | -                                                                                                                                         | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                                                                                                                                                                 | -         |
| A.923:<br>SERVOPACK Built-<br>in Fan Stopped                                                                                                                                                             | The fan inside the<br>SERVOPACK<br>stopped.                                                                                                                                                               | Check for foreign mat-<br>ter inside the SERVO-<br>PACK.                                                                                  | Remove foreign matter from<br>the SERVOPACK. If an<br>alarm still occurs, the SER-<br>VOPACK may be faulty.<br>Replace the SERVOPACK.                                                                                                    | -         |
| A.930:<br>Absolute Encoder<br>Battery Error (The<br>absolute encoder<br>battery voltage was<br>lower than the spec-<br>ified level.) (Detected<br>only when an abso-<br>lute encoder is con-<br>nected.) | The battery con-<br>nection is faulty or<br>a battery is not<br>connected.                                                                                                                                | Check the battery con-<br>nection.                                                                                                        | Correct the battery connec-<br>tion.                                                                                                                                                                                                     | page 4-27 |
|                                                                                                                                                                                                          | The battery volt-<br>age is lower than<br>the specified value<br>(2.7 V).                                                                                                                                 | Measure the battery voltage.                                                                                                              | Replace the battery.                                                                                                                                                                                                                     | page 15-3 |
|                                                                                                                                                                                                          | A failure occurred<br>in the SERVO-<br>PACK.                                                                                                                                                              | -                                                                                                                                         | The SERVOPACK may be<br>faulty. Replace the SERVO-<br>PACK.                                                                                                                                                                              | _         |

Continued on next page.

Maintenance

Continued from previous page.

| Warning Number:<br>Warning Name                   | Possible Cause                                                                                                                            | Confirmation                                                       | Correction                                                                                                                                                                                                                         | Reference |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                   | The surrounding temperature is too high.                                                                                                  | Check the surrounding temperature using a thermometer.             | Lower the surrounding tem-<br>perature by improving the<br>installation conditions of the<br>Linear Servomotor or the<br>machine.                                                                                                  | -         |
|                                                   | Operation was<br>performed under<br>an excessive load.                                                                                    | Use the accumulated load ratio to check the load during operation. | Reconsider the load and operating conditions.                                                                                                                                                                                      | _         |
| A.93B:<br>Overheat Warning                        | A failure occurred<br>in the SERVO-<br>PACK.                                                                                              | -                                                                  | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                                                                                                                                                           | _         |
|                                                   | The temperature<br>detection circuit in<br>the Linear Servo-<br>motor is faulty or<br>the sensor<br>attached to the<br>machine is faulty. | _                                                                  | The temperature detection<br>circuit in the Linear Servo-<br>motor may be faulty or the<br>sensor attached to the<br>machine may be faulty.<br>Replace the Linear Servo-<br>motor or repair the sensor<br>attached to the machine. | -         |
|                                                   | The speed ripple                                                                                                                          | _                                                                  | Reset the speed ripple<br>compensation value on the<br>SigmaWin+.                                                                                                                                                                  | page 8-58 |
| A.942:<br>Speed Ripple Com-<br>pensation Informa- | compensation<br>information stored<br>in the encoder<br>does not agree<br>with the speed<br>ripple compensa-                              | _                                                                  | Set Pn423 to n. <b>D</b> 1 <b>D</b> (Do<br>not detect A.942 alarms).<br>However, changing the set-<br>ting may increase the speed<br>ripple.                                                                                       | page 8-58 |
| tion Disagreement                                 | tion information<br>stored in the SER-<br>VOPACK.                                                                                         | _                                                                  | Set Pn423 to n. DDD<br>(Disable torque ripple com-<br>pensation). However,<br>changing the setting may<br>increase the speed ripple.                                                                                               | page 8-58 |
| <b>A.971:</b><br>Undervoltage                     | For a 200-V SER-<br>VOPACK, the AC<br>power supply volt-<br>age dropped<br>below 140 V.                                                   | Measure the power supply voltage.                                  | Set the power supply volt-<br>age within the specified range.                                                                                                                                                                      | -         |
|                                                   | For a 100-V SER-<br>VOPACK, the AC<br>power supply volt-<br>age dropped<br>below 60 V.                                                    | Measure the power supply voltage.                                  | Set the power supply volt-<br>age within the specified range.                                                                                                                                                                      | -         |
|                                                   | A momentary<br>power interrup-<br>tion occurred.                                                                                          | Measure the power supply voltage.                                  | If you have changed the<br>setting of Pn509 (Momen-<br>tary Power Interruption Hold<br>Time), decrease the setting.                                                                                                                | page 6-11 |
|                                                   | The SERVOPACK fuse is blown out.                                                                                                          | -                                                                  | Replace the SERVOPACK and connect a reactor.                                                                                                                                                                                       | page 4-25 |
|                                                   | A failure occurred<br>in the SERVO-<br>PACK.                                                                                              | -                                                                  | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                                                                                                                                                           | -         |

Continued from previous page.

| Warning Number:<br>Warning Name                                | Possible Cause                                                                  | Confirmation                                                                                         | Correction                                                                                                                                                                                                                                                                                                                                                                                                         | Reference  |
|----------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| A.9A0:<br>Overtravel (Over-<br>travel status was<br>detected.) | Overtravel was<br>detected while the<br>servo was ON.                           | Check the status of the overtravel signals on the input signal monitor.                              | <ul> <li>Even if an overtravel signal<br/>is not shown by the input<br/>signal monitor, momentary<br/>overtravel may have been<br/>detected. Take the following<br/>precautions.</li> <li>Do not specify move-<br/>ments that would cause<br/>overtravel from the host<br/>controller.</li> <li>Check the wiring of the<br/>overtravel signals.</li> <li>Implement countermea-<br/>sures against noise.</li> </ul> | page 5-29  |
| A.9b0:<br>Preventative Mainte-<br>nance Warning                | One of the con-<br>sumable parts has<br>reached the end<br>of its service life. | -                                                                                                    | Replace the part. Contact<br>your Yaskawa representa-<br>tive for replacement.                                                                                                                                                                                                                                                                                                                                     | page 9-16  |
| A.A9F:<br>Error                                                | An error occurred<br>in the INDEXER<br>Module.                                  | Use the SigmaWin+ to<br>check the serial com-<br>mand negative<br>response of the<br>INDEXER Module. | Follow the correction for a serial command negative response from the INDEXER Module.                                                                                                                                                                                                                                                                                                                              | page 15-64 |

## 15.3.3 INDEXER Module Error Displays and Troubleshooting

Negative responses (error responses) to input signals, serial commands, or operations from the Digital Operator are known as errors.

The servo will not be turned OFF when an error occurs.

### Status Displays

| SERVOPACK Panel Display                                 | "A.A9F" is displayed for 2 seconds.                                                                                            |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Indicator                                               | Red indicator: Flashes for 2 seconds.<br>Refer to the following section for details.<br>3 <i>1.5.2 Indicators</i> on page 1-11 |
| Digital Operator                                        | "A.A9F" is displayed for 2 seconds at the top left of the screen.                                                              |
| Response to the Alarm or Warning Read<br>Command (ALM)  | No change                                                                                                                      |
| Response to the Most Recent Error Read<br>Command (ERR) | Error code (the most recent (closest) error code)                                                                              |
| ALM Signal                                              | No change                                                                                                                      |
| /WARN Signal                                            | The signal is valid for 2 seconds.                                                                                             |

The INDEXER Module error displays and the corrective actions are shown below.

| Serial<br>Command<br>Negative<br>Response | Alarm<br>Number | Error Name                          | Meaning                                                                                                                                                                                                                                                                                                                                                                        | Corrective Action         |
|-------------------------------------------|-----------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| E41E                                      | A.A9F           | Program Table<br>Save Failure Error | <ul> <li>While writing data to the flash memory, a failure occurred during one of the following operation.</li> <li>While saving a program table by using a PGMSTORE command</li> <li>While saving a program table by using FnB03</li> <li>While initializing a program table by using a PGMINIT command</li> <li>While initializing a program table by using FnB06</li> </ul> | Repair the hard-<br>ware. |
| E42E                                      | A.A9F           | ZONE Table Save<br>Failure Error    | <ul> <li>While writing data to the flash memory, a failure occurred during one of the following operation.</li> <li>While saving a ZONE table by using a ZONESTORE command</li> <li>While saving a ZONE table by using FnB04</li> <li>While initializing a ZONE table by using a ZONEINIT command</li> <li>While initializing a ZONE table by using FnB07</li> </ul>           | Repair the hard-<br>ware. |

Continued from previous page.

| Serial<br>Command<br>Negative<br>Response | Alarm<br>Number | Error Name                                                         | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Corrective Action                                                                                                                                                                                                                                               |
|-------------------------------------------|-----------------|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E43E                                      | A.A9F           | JOG Speed Table<br>Save Failure Error                              | <ul> <li>While writing data to the flash memory, a failure occurred during one of the following operation.</li> <li>While saving a JOG speed table by using a JSPDSTORE command</li> <li>While saving a JOG speed table by using FnB05</li> <li>While initializing a JOG speed table by using a JSPDINIT command</li> <li>While initializing a JOG speed table by using FnB08</li> </ul>                                                                                          | Repair the hard-<br>ware.                                                                                                                                                                                                                                       |
| E44E                                      | A.A9F           | Canceled Pro-<br>gram Table Error                                  | There was a request to start program table operation even though an E19A or E1BA alarm occurred when the control power supply was turned ON.                                                                                                                                                                                                                                                                                                                                      | Eliminate the cause of the alarm.                                                                                                                                                                                                                               |
| E46E                                      | A.A9F           | Canceled JOG<br>Speed Table Error                                  | There was a request to start JOG speed<br>table operation even though an E1FA or<br>E22A alarm occurred when the control<br>power supply was turned ON.                                                                                                                                                                                                                                                                                                                           | Eliminate the cause of the alarm.                                                                                                                                                                                                                               |
| E47E                                      | A.A9F           | Serial Communi-<br>cations Receiv-<br>ing Buffer<br>Overflow Error | <ul> <li>There was an overflow in the reception buffer used for serial commands.</li> <li>An error will occur if too many serial commands are sent consecutively without waiting for the responses.</li> <li>(Normally, the reception buffer will not overflow if there is command/response handshaking.)</li> <li>When an overflow has occurred, error code E47E will be returned and all of the data that has accumulated in the reception buffer will be discarded.</li> </ul> | Wait for a<br>response to be<br>received before<br>sending the next<br>command.<br>The reception<br>buffer can con-<br>tain up to 100<br>commands.                                                                                                              |
| E48E                                      | A.A9F           | Serial Communi-<br>cations Parity<br>Error                         | <ul> <li>A parity check error occurred with the serial command.</li> <li>This error will occur if even parity is not being used.</li> <li>The command that caused this error will be discarded and no response will be returned.</li> <li>There will be no response, but the /WARN output and LED indicators will indicate that an error has occurred.</li> </ul>                                                                                                                 | <ul> <li>Check the serial communications protocol (PnB00) and bit rate (PnB01) settings.</li> <li>Check the wiring.</li> <li>If noise may be causing the problem, take steps to reduce noise such as using communications cables with ferrite cores.</li> </ul> |

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| Serial<br>Command<br>Negative<br>Response | Alarm<br>Number | Error Name                                  | Meaning                                                                                                                                                                                                                                                                                                | Corrective Action                                                                                                                                                                                                                                               |  |
|-------------------------------------------|-----------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| E49E                                      | A.A9F           | Serial Communi-<br>cations Framing<br>Error | <ul> <li>A stop bit detection error occurred with the serial command.</li> <li>The command that caused this error will be discarded and no response will be returned.</li> <li>There will be no response, but the /WARN output and LED indicators will indicate that an error has occurred.</li> </ul> | <ul> <li>Check the serial communications protocol (PnB00) and bit rate (PnB01) settings.</li> <li>Check the wiring.</li> <li>If noise may be causing the problem, take steps to reduce noise such as using communications cables with ferrite cores.</li> </ul> |  |
| E4AE                                      | A.A9F           | Serial Communi-<br>cations Overrun<br>Error | <ul> <li>Serial command reception failed.</li> <li>The hardware's reception buffer was overwritten with the subsequent data.</li> <li>(Normally, data is read before it is overwritten, so this error does not occur.)</li> </ul>                                                                      | Repair the hard-<br>ware.                                                                                                                                                                                                                                       |  |
| E4BE                                      | A.A9F           | Moving Disabled<br>Error due to P-OT        | Travel in the forward direction was<br>requested when P-OT was in effect. (For-<br>ward movement is disabled when P-OT<br>(forward overtravel) is in effect.)                                                                                                                                          | <ul> <li>When P-OT is being used, move to a position where the P-OT is not in effect.</li> <li>When P-OT is not being used, disable P-OT in the parameter (PnB0F = 3).</li> </ul>                                                                               |  |
| E4CE                                      | A.A9F           | Moving Disabled<br>Error due to N-OT        | Travel in the reverse direction was<br>requested when N-OT was in effect.<br>(Reverse movement is disabled when N-OT<br>(reverse overtravel) is in effect.)                                                                                                                                            | <ul> <li>When N-OT is being used, move to a position where the N-OT is not in effect.</li> <li>When N-OT is not being used, disable N-OT in the parameter (PnB10 = 3).</li> </ul>                                                                               |  |

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| Serial                          | Alarm  |                                                |                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------|--------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Command<br>Negative<br>Response | Number | Error Name                                     | Meaning                                                                                                                                                            | Corrective Action                                                                                                                                                                                                                                                                                                                                                                                                               |
| E4DE                            | A.A9F  | Moving Disabled<br>Error due to P-LS           | The specified target position exceeds the position reference of forward software limit set in PnB21.                                                               | <ul> <li>Check the tar-<br/>get position<br/>specification.</li> <li>Check the for-<br/>ward software<br/>limit in PnB21.</li> <li>Check the mov-<br/>ing mode<br/>(rotary or lin-<br/>ear) set in<br/>PnB20.</li> <li>If software lim-<br/>its are not being<br/>used, either<br/>select a rotary<br/>moving mode in<br/>PnB20 or dis-<br/>able the soft-<br/>ware limits by<br/>setting PnB21<br/>= PnB23 = 0.</li> </ul>     |
| E4EE                            | A.A9F  | Moving Disabled<br>Error due to N-LS           | The specified target position exceeds the position reference of reverse software limit set in PnB23.                                                               | <ul> <li>Check the tar-<br/>get position<br/>specification.</li> <li>Check the<br/>reverse soft-<br/>ware limit in<br/>PnB23.</li> <li>Check the mov-<br/>ing mode<br/>(rotary or lin-<br/>ear) set in<br/>PnB20.</li> <li>If software lim-<br/>its are not being<br/>used, either<br/>select a rotary<br/>moving mode in<br/>PnB20 or dis-<br/>able the soft-<br/>ware limits by<br/>setting PnB21<br/>= PnB23 = 0.</li> </ul> |
| E4FE                            | A.A9F  | Position Refer-<br>ence Out-of-<br>range Error | The moving method is set to rotary (PnB20<br>= 1, 2, or 3) and the target position specifi-<br>cation exceeds the position reference limits<br>in PnB21 and PnB23. | <ul> <li>Check the tar-<br/>get position<br/>specification.</li> <li>Check the posi-<br/>tioning range<br/>set with PnB21<br/>and PnB23.</li> <li>Check the mov-<br/>ing method<br/>(rotary or lin-<br/>ear) set in<br/>PnB20.</li> </ul>                                                                                                                                                                                       |

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| Serial<br>Command<br>Negative<br>Response | Alarm<br>Number | Error Name                                      | Meaning                                                                                                                                                                                                 | Corrective Action                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------|-----------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E51E                                      | A.A9F           | Target Position<br>Unspecified Error            | Even though the target position was not<br>specified even once, there was a request by<br>the ST command to start positioning or a<br>request by the RS command to start regis-<br>tration positioning. | Specify a target<br>position with a<br>command such<br>as the POS com-<br>mand, STnnnnn-<br>nnn command, or<br>RSnnnnnnn<br>command.                                                                                                                                                                                                                                                                                                    |
| E52E                                      | A.A9F           | Registration Dis-<br>tance Unspecified<br>Error | Even though the registration distance was<br>not specified even once, there was a<br>request by the RS command to start regis-<br>tration positioning.                                                  | Specify a regis-<br>tration distance<br>with the RDST<br>command.                                                                                                                                                                                                                                                                                                                                                                       |
| E53E                                      | A.A9F           | Move Reference<br>Duplication Error             | There was a new move reference requested<br>even though the system was already mov-<br>ing in a positioning or other traveling opera-<br>tion.                                                          | <ul> <li>Send the next<br/>move reference<br/>request only<br/>after the current<br/>movement is<br/>completed<br/>(Position refer-<br/>ence distribu-<br/>tion is<br/>completed).</li> <li>A movement<br/>can be inter-<br/>rupted or can-<br/>celed with the<br/>HOLD or SKIP<br/>commands.<br/>Also, STOP can<br/>be specified in<br/>the target posi-<br/>tion specifica-<br/>tion (POS) with<br/>the program<br/>table.</li> </ul> |

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|                                           |                 |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Tom previous page.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------|-----------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Serial<br>Command<br>Negative<br>Response | Alarm<br>Number | Error Name                        | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Corrective Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| E54E                                      | A.A9F           | Servo ON Incom-<br>plete Error    | <ul> <li>The servo is not ON.</li> <li>There was a positioning request or other move reference request in servo OFF status.</li> <li>The servo went OFF during program table operation.</li> <li>(Program table operation will be interrupted while just the step that was being executed is canceled (If LOOP ≠ 1, the first LOOP is canceled.))</li> </ul>                                                                                                                                                                | Send the move<br>reference request<br>only after turning<br>the servo ON by<br>turning ON the<br>/S-ON signal,<br>setting PnBOE =<br>2 so that the /S-<br>ON signal is<br>always ON, or<br>executing the<br>SVON command.<br>There are two<br>possibilities.<br>• The program<br>can be can-<br>celed with the<br>/PGMRES sig-<br>nal or PGM-<br>RES command.<br>• The servo can<br>be turned ON<br>and the pro-<br>gram can be<br>restarted with<br>the /START-<br>STOP signal or<br>the START<br>command. |
| E55E                                      | A.A9F           | Servo ON Failure<br>Error         | <ul> <li>The servo could not be turned ON within 2 s after turning ON the /S-ON signal or executing the SVON command.</li> <li>The motor is rotating during servo ON execution.</li> <li>The main power supply went OFF during servo ON execution.</li> <li>Hard wire base block status (HWBB status)</li> <li>Error E5BE will occur if there was an alarm when the servo ON request was sent using the SVON command. Error E5CE will occur if the main power supply was OFF when the servo ON request was sent.</li> </ul> | <ul> <li>Turn the servo<br/>ON when the<br/>motor is<br/>stopped.</li> <li>Check the main<br/>power supply.</li> <li>Turn ON signals<br/>/HWBB1,<br/>/HWBB2. After<br/>that, temporar-<br/>ily establish the<br/>servo OFF sta-<br/>tus by turning<br/>the /S-ON sig-<br/>nal OFF or<br/>sending the<br/>SVOFF com-<br/>mand, then turn<br/>the servo ON<br/>again.</li> </ul>                                                                                                                              |
| E56E                                      | A.A9F           | Undefined Serial<br>Command Error | <ul> <li>There was a syntax error in the serial command.</li> <li>There was a number in the serial command longer than 8 digits or 10 digits.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                    | Check the serial command's char-<br>acter string.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| E57E                                      | A.A9F           | Address Out-of-<br>range Error    | The specified address was incorrect for a parameter, program table, ZONE table, JOG speed table, alarm history, or monitor read/write command.                                                                                                                                                                                                                                                                                                                                                                              | Check the address.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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| Serial<br>Command<br>Negative<br>Response | Alarm<br>Number | Error Name                                                                   | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                       | Corrective Action                                                                                                                                |
|-------------------------------------------|-----------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| E58E                                      | A.A9F           | Data Out-of-<br>range Error                                                  | The specified setting was incorrect in a parameter or program table write command.                                                                                                                                                                                                                                                                                                                                            | Check the set-<br>ting.                                                                                                                          |
| E59E                                      | A.A9F           | Communication<br>Failure Error<br>between<br>INDEXER Module<br>and SERVOPACK | Communications between the INDEXER<br>Module and the SERVOPACK have failed.                                                                                                                                                                                                                                                                                                                                                   | Check the ver-<br>sion of the SER-<br>VOPACK.                                                                                                    |
| E5AE                                      | A.A9F           | Execution Dis-<br>abled while Servo<br>ON Error                              | Some of the utility functions, such as<br>parameter initialization, has been requested<br>while still in the servo ON status. For safety,<br>the following functions cannot be executed<br>in the servo ON status.<br>• Serial commands: Parameter initializa-<br>tion, absolute encoder<br>reset, motor current<br>zero adjustment<br>• SigmaWin+: Parameter initialization                                                  | Execute these<br>functions after<br>turning the servo<br>OFF.                                                                                    |
| E5BE                                      | A.A9F           | Execution Dis-<br>abled while Alarm<br>Activated Error                       | Servo ON was requested (the SVON com-<br>mand was executed) while there was an<br>alarm.                                                                                                                                                                                                                                                                                                                                      | Turn the servo<br>ON after eliminat-<br>ing the cause of<br>the alarm and<br>clearing the<br>alarm.                                              |
| E5CE                                      | A.A9F           | Execution Dis-<br>abled while Main<br>Power OFF Error                        | Servo ON was requested (the SVON com-<br>mand was executed) while the main power<br>supply was OFF.                                                                                                                                                                                                                                                                                                                           | Turn the servo<br>ON after turning<br>ON the main<br>power supply.                                                                               |
| E5DE                                      | A.A9F           | Homing Method<br>Unspecified Error                                           | <ul> <li>The homing method is not specified.</li> <li>Homing start was requested (/HOME signal was turned ON or ZRN command was executed) without setting the homing method.</li> </ul>                                                                                                                                                                                                                                       | Specify the hom-<br>ing method in<br>PnB31.                                                                                                      |
| E5EE                                      | A.A9F           | Execution Dis-<br>abled during Pro-<br>gram Table<br>Operation Error         | <ul> <li>There was a request to execute a process that is not allowed during program table operation while program table operation was in progress or on hold.</li> <li>There was an attempt to change the program table while program table operation was in progress or on hold.</li> <li>There was a request to start positioning by a serial command while program table operation was in progress or on hold.</li> </ul> | Request execu-<br>tion of the pro-<br>cess again after<br>canceling pro-<br>gram table oper-<br>ation by turning<br>the<br>/PGMRES signal<br>ON. |
| E5FE                                      | A.A9F           | Session Conflict<br>Error                                                    | There was a request that could not be exe-<br>cuted at the same time as the function that<br>was being executed.<br>Example:<br>There was a request to start program table<br>operation while the program table was<br>being initialized.                                                                                                                                                                                     | Execute the<br>operation again<br>after the execu-<br>tion of the current<br>function is com-<br>pleted.                                         |

Continued from previous page.

| Serial<br>Command<br>Negative<br>Response | Alarm<br>Number | Error Name                                       | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Corrective Action                                                                                                                                            |
|-------------------------------------------|-----------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| E61E                                      | A.A9F           | Encoder Mis-<br>match Error                      | <ul> <li>There was a request that was incompatible with the connected encoder.</li> <li>Examples:</li> <li>An Absolute Encoder Reset (ABSPGRES command) was requested when an incremental encoder is connected.</li> <li>Homing start was requested (/HOME signal was turned ON or ZRN command was executed) when an absolute encoder is connected.</li> <li>(An absolute encoder can be used as an incremental encoder if parameter Pn002.2 = 1.)</li> </ul>        | Check the<br>encoder.                                                                                                                                        |
| E62E                                      | A.A9F           | No A.CC0 Alarm<br>Occurred Error                 | A Multi-turn Limit Setting (MLTLIMSET<br>command) was requested even though<br>alarm A.CC0 has not occurred.<br>(Alarm A.CC0 indicates that Pn205 does<br>not match the setting in the encoder after<br>the multiturn limit setting in Pn205 was<br>changed and the control power supply was<br>turned OFF and ON.)                                                                                                                                                  | Use the Multi-<br>turn Limit Setting<br>operation to<br>adjust the setting<br>in the encoder to<br>match Pn205<br>only after alarm<br>A.CC0 has<br>occurred. |
| E63E                                      | A.A9F           | Continuous Stop<br>Execution Dis-<br>abled Error | <ul> <li>An attempt was made to execute a continuous stop under conditions where it could not be executed.</li> <li>Examples:</li> <li>The coordinates have been set to linear moving method.</li> <li>The immediately-preceding table target position is not ±INFINITE.</li> <li>The immediately-preceding table target position is ±INFINITE, but the registration distance is set.</li> <li>A value other than 1 has been set for the execution count.</li> </ul> | Execute a contin-<br>uous stop under<br>conditions where<br>it can be exe-<br>cuted.                                                                         |

## **15.4** Troubleshooting Based on the Operation and Conditions of the Servomotor

This section provides troubleshooting based on the operation and conditions of the Servomotor, including causes and corrections.

| Problem                         | Possible Cause                                                                                                          | Confirmation                                                                                                                        | Correction                                                                                                                                              | Reference              |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
|                                 | The control power supply is not turned ON.                                                                              | Measure the voltage<br>between control power<br>supply terminals.                                                                   | Turn OFF the power<br>supply to the servo<br>system.<br>Correct the wiring so<br>that the control power<br>supply is turned ON.                         | _                      |
|                                 | The main circuit power sup-<br>ply is not turned ON.                                                                    | Measure the voltage<br>across the main circuit<br>power input terminals.                                                            | Turn OFF the power<br>supply to the servo<br>system.<br>Correct the wiring so<br>that the main circuit<br>power supply is turned<br>ON.                 | _                      |
|                                 | The I/O signal connector<br>(CN1) pins are not wired cor-<br>rectly or are disconnected.                                | Turn OFF the power sup-<br>ply to the servo system.<br>Check the wiring condi-<br>tion of the I/O signal con-<br>nector (CN1) pins. | Correct the wiring of<br>the I/O signal connec-<br>tor (CN1) pins.                                                                                      | page 4-36,<br>page 9-5 |
|                                 | The wiring for the Servomo-<br>tor Main Circuit Cables or<br>Encoder Cable is discon-<br>nected.                        | Check the wiring condi-<br>tions.                                                                                                   | Turn OFF the power<br>supply to the servo<br>system.<br>Wire the cable cor-<br>rectly.                                                                  | -                      |
| Servomotor<br>Does Not<br>Start | There is an overload on the<br>Servomotor.                                                                              | Operate the Servomotor<br>with no load and check<br>the load status.                                                                | Turn OFF the power<br>supply to the servo<br>system.<br>Reduce the load or<br>replace the Servomo-<br>tor with a Servomotor<br>with a larger capacity.  | -                      |
|                                 | The type of encoder that is being used does not agree with the setting of $Pn002 = n.\Box X \Box \Box$ (Encoder Usage). | Check the type of the encoder that is being used and the setting of Pn002 = $n.\Box X \Box \Box$ .                                  | Set Pn002 = $n.\Box X \Box \Box$<br>according to the type of<br>the encoder that is<br>being used.                                                      | page 6-23              |
|                                 | Settings for input signals<br>PnB03 to PnB12 are incor-<br>rect.                                                        | Check settings of input signals PnB03 to PnB12.                                                                                     | Correct the settings of input signals PnB03 to PnB12.                                                                                                   | page 6-3,<br>page 9-5  |
|                                 | The /S-ON (Servo ON) signal was not received.                                                                           | Check the commands sent from the host con-<br>troller.                                                                              | Turn ON the /S-ON sig-<br>nal from the host con-<br>troller.                                                                                            | page 9-5               |
|                                 | The P-OT (Forward Drive<br>Prohibit) or N-OT (Reverse<br>Drive Prohibit) signal is still<br>OFF.                        | Check the P-OT and N-<br>OT signals.                                                                                                | Turn ON the P-OT and N-OT signals.                                                                                                                      | page 9-5               |
|                                 | The current position of the servomotor is outside the software limit setting range.                                     | Check the error at the INDEXER Module.                                                                                              | Check the motor posi-<br>tion and software limit<br>setting (PnB21,<br>PnB23), then move the<br>servomotor into the<br>software limit setting<br>range. | _                      |
|                                 | There is no position refer-<br>ence, or it is incorrect.                                                                | Check the error at the INDEXER Module.                                                                                              | Set the program table correctly.                                                                                                                        | -                      |

|                                    |                                                                                                                    |                                                                                                                                                                                                                          | Continued from pre                                                                                                                                                                                     | vious page. |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Problem                            | Possible Cause                                                                                                     | Confirmation                                                                                                                                                                                                             | Correction                                                                                                                                                                                             | Reference   |
| Servomotor<br>Does Not             | The safety input signals<br>(/HWBB1 or /HWBB2) were<br>not turned ON.                                              | Check the /HWBB1 and<br>/HWBB2 input signals.                                                                                                                                                                            | Turn ON the /HWBB1<br>and /HWBB2 input sig-<br>nals. If you are not<br>using the safety func-<br>tion, connect the Safety<br>Jumper Connector<br>(provided as an acces-<br>sory) to CN8.               | page 9-5    |
|                                    | A failure occurred in the SER-<br>VOPACK.                                                                          | -                                                                                                                                                                                                                        | Turn OFF the power<br>supply to the servo<br>system.<br>Replace the SERVO-<br>PACK.                                                                                                                    | _           |
| Start                              |                                                                                                                    | Check the setting of<br>Pn080 =n.□□□X (Polar-<br>ity Sensor Selection).                                                                                                                                                  | Correct the parameter setting.                                                                                                                                                                         | page 5-23   |
|                                    | The polarity detection was not executed.                                                                           | Check the /S-ON (Servo<br>ON) signal.                                                                                                                                                                                    | <ul> <li>If you are using an incremental linear encoder, input the /S-ON signal from the host controller.</li> <li>If you are using an absolute linear encoder, execute polarity detection.</li> </ul> | page 5-24   |
|                                    | There is a mistake in the Ser-<br>vomotor wiring.                                                                  | Turn OFF the power sup-<br>ply to the servo system.<br>Check the wiring.                                                                                                                                                 | Wire the Servomotor correctly.                                                                                                                                                                         | _           |
|                                    | There is a mistake in the wir-<br>ing of the encoder or Serial<br>Converter Unit.                                  | Turn OFF the power sup-<br>ply to the servo system.<br>Check the wiring.                                                                                                                                                 | Wire the Serial Con-<br>verter Unit correctly.                                                                                                                                                         | _           |
| Servomotor<br>Moves                | There is a mistake in the lin-<br>ear encoder wiring.                                                              | Turn OFF the power sup-<br>ply to the servo system.<br>Check the wiring.                                                                                                                                                 | Wire the cable cor-<br>rectly.                                                                                                                                                                         | _           |
| Instanta-<br>neously,              | The setting of Pn282 (Linear Encoder Pitch) is not correct.                                                        | Check the setting of Pn282.                                                                                                                                                                                              | Correct the setting of Pn282.                                                                                                                                                                          | page 5-16   |
| and Then<br>Stops                  | The count-up direction of the linear encoder does not match the forward direction of the Moving Coil in the motor. | Check the directions.                                                                                                                                                                                                    | Change the setting of<br>Pn080 = $n.\Box\Box X\Box$<br>(Motor Phase Selec-<br>tion). Place the linear<br>encoder and motor in<br>the same direction.                                                   | page 5-21   |
|                                    | Polarity detection was not<br>performed correctly.                                                                 | Check to see if electrical angle 2 (electrical angle from polarity origin) at any position is between $\pm 10^{\circ}$ .                                                                                                 | Correct the settings for<br>the polarity detection-<br>related parameters.                                                                                                                             | _           |
| Servomotor<br>Speed Is<br>Unstable | There is a faulty connection in the Servomotor wiring.                                                             | The connector connec-<br>tions for the power line<br>(U, V, and W phases) and<br>the encoder or Serial<br>Converter Unit may be<br>unstable.<br>Turn OFF the power sup-<br>ply to the servo system.<br>Check the wiring. | Tighten any loose ter-<br>minals or connectors<br>and correct the wiring.<br>Continued on                                                                                                              | -           |

Maintenance

|                                                         |                                                                                                                    |                                                                                                                                                                                                                                                       | Continued from pre                                                                                                                                                                                                                                                                                                                                                                                               | vious page. |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Problem                                                 | Possible Cause                                                                                                     | Confirmation                                                                                                                                                                                                                                          | Correction                                                                                                                                                                                                                                                                                                                                                                                                       | Reference   |
| Servomotor<br>Moves with-<br>out a Refer-<br>ence Input | A failure occurred in the SER-<br>VOPACK.                                                                          |                                                                                                                                                                                                                                                       | Turn OFF the power<br>supply to the servo<br>system.<br>Replace the SERVO-<br>PACK.                                                                                                                                                                                                                                                                                                                              | -           |
|                                                         | The count-up direction of the linear encoder does not match the forward direction of the Moving Coil in the motor. | Check the directions.                                                                                                                                                                                                                                 | Change the setting of<br>Pn080 = n. $\Box$ X $\Box$<br>(Motor Phase Selec-<br>tion).<br>Match the linear<br>encoder direction and<br>Servomotor direction.                                                                                                                                                                                                                                                       | page 5-21   |
|                                                         | Polarity detection was not performed correctly.                                                                    | Check to see if electrical<br>angle 2 (electrical angle<br>from polarity origin) at any<br>position is between ±10°.                                                                                                                                  | Correct the settings for<br>the polarity detection-<br>related parameters.                                                                                                                                                                                                                                                                                                                                       | -           |
|                                                         | The setting of Pn001 =<br>n.                                                                                       | Check the setting of Pn001 = $n.\Box\Box\BoxX$ .                                                                                                                                                                                                      | Set Pn001 = n.□□□X<br>correctly.                                                                                                                                                                                                                                                                                                                                                                                 | -           |
| Dynamic<br>Brake Does<br>Not Operate                    | The dynamic brake resistor is disconnected.                                                                        | Check the moment of<br>inertia, motor speed, and<br>dynamic brake frequency<br>of use. If the moment of<br>inertia, motor speed, or<br>dynamic brake frequency<br>of use is excessive, the<br>dynamic brake resis-<br>tance may be discon-<br>nected. | Turn OFF the power<br>supply to the servo<br>system.<br>Replace the SERVO-<br>PACK. To prevent dis-<br>connection, reduce the<br>load.                                                                                                                                                                                                                                                                           | _           |
|                                                         | There was a failure in the dynamic brake drive circuit.                                                            | _                                                                                                                                                                                                                                                     | There is a defective<br>component in the<br>dynamic brake circuit.<br>Turn OFF the power<br>supply to the servo<br>system.<br>Replace the SERVO-<br>PACK.                                                                                                                                                                                                                                                        | -           |
| Abnormal<br>Noise from<br>Servomotor                    | The Servomotor vibrated considerably while perform-<br>ing the tuning-less function with the default settings.     | Check the waveform of the motor speed.                                                                                                                                                                                                                | Reduce the load so<br>that the moment of<br>inertia ratio or mass<br>ratio is within the allow-<br>able value, or increase<br>the load level or reduce<br>the rigidity level in the<br>tuning-less level set-<br>tings.<br>If the situation is not<br>improved, disable the<br>tuning-less function<br>(i.e., set Pn170 to<br>n.□□□0) and execute<br>autotuning either with<br>or without a host refer-<br>ence. | page 8-11   |

|                        | Continued from previous                                                              |                                                                                                                                                                                                                                                                                 |                                                         |           |  |
|------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-----------|--|
| Problem                | Possible Cause                                                                       | Confirmation                                                                                                                                                                                                                                                                    | Correction                                              | Reference |  |
|                        |                                                                                      | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if there are<br>any loose mounting<br>screws.                                                                                                                                                               | Tighten the mounting screws.                            | _         |  |
|                        | The machine mounting is not secure.                                                  | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if there is<br>misalignment in the cou-<br>pling.                                                                                                                                                           | Align the coupling.                                     | _         |  |
|                        |                                                                                      | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if the cou-<br>pling is balanced.                                                                                                                                                                           | Balance the coupling.                                   | -         |  |
|                        | The bearings are defective.                                                          | Turn OFF the power sup-<br>ply to the servo system.<br>Check for noise and<br>vibration around the bear-<br>ings.                                                                                                                                                               | Replace the Servomo-<br>tor.                            | _         |  |
| Abnormal<br>Noise from | There is a vibration source at the driven machine.                                   | Turn OFF the power sup-<br>ply to the servo system.<br>Check for any foreign<br>matter, damage, or defor-<br>mation in the machine's<br>moving parts.                                                                                                                           | Consult with the machine manufacturer.                  | -         |  |
| Servomotor             | Noise interference occurred because of incorrect I/O signal cable specifications.    | Turn OFF the power sup-<br>ply to the servo system.<br>Check the I/O signal<br>cables to see if they sat-<br>isfy specifications. Use<br>shielded twisted-pair wire<br>cables or screened<br>twisted-pair cables with<br>conductors of at least<br>0.12 mm <sup>2</sup> .       | Use cables that satisfy the specifications.             | _         |  |
|                        | Noise interference occurred because an I/O signal cable is too long.                 | Turn OFF the power sup-<br>ply to the servo system.<br>Check the lengths of the<br>I/O signal cables.                                                                                                                                                                           | The I/O signal cables<br>must be no longer than<br>3 m. | -         |  |
|                        | Noise interference occurred<br>because of incorrect Encoder<br>Cable specifications. | Turn OFF the power sup-<br>ply to the servo system.<br>Check the Encoder Cable<br>to see if it satisfies speci-<br>fications. Use shielded<br>twisted-pair cables or<br>screened twisted-pair<br>cables with conductors of<br>at least 0.12 mm <sup>2</sup><br>(stranded wire). | Use cables that satisfy the specifications.             | -         |  |

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| Problem                              | Possible Cause                                                                                                                    | Confirmation                                                                                                                                                                                                                                                                                                                             | Correction                                                                                                                                                                                                                                                                                                             | Reference |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                      | Noise interference occurred<br>because the Encoder Cable<br>is too long.                                                          | Turn OFF the power sup-<br>ply to the servo system.<br>Check the length of the<br>Encoder Cable.                                                                                                                                                                                                                                         | <ul> <li>Rotary Servomotors:<br/>The Encoder Cable<br/>length must be 50 m<br/>max.</li> <li>Linear Servomotors:<br/>Make sure that the<br/>Serial Converter Unit<br/>cable is no longer<br/>than 20 m and that<br/>the Linear Encoder<br/>Cable and the Sensor<br/>Cable are no longer<br/>than 15 m each.</li> </ul> | -         |
|                                      | Noise interference occurred<br>because the Encoder Cable<br>is damaged.                                                           | Turn OFF the power sup-<br>ply to the servo system.<br>Check the Encoder Cable<br>to see if it is pinched or<br>the sheath is damaged.                                                                                                                                                                                                   | Replace the Encoder<br>Cable and correct the<br>cable installation envi-<br>ronment.                                                                                                                                                                                                                                   | _         |
|                                      | The Encoder Cable was sub-<br>jected to excessive noise interference.                                                             | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if the<br>Encoder Cable is bundled<br>with a high-current line or<br>installed near a high-cur-<br>rent line.                                                                                                                                                        | Correct the cable lay-<br>out so that no surge is<br>applied by high-current<br>lines.                                                                                                                                                                                                                                 | _         |
|                                      | There is variation in the FG<br>potential because of the<br>influence of machines on the<br>Servomotor side, such as a<br>welder. | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if the<br>machines are correctly<br>grounded.                                                                                                                                                                                                                        | Properly ground the machines to separate them from the FG of the encoder.                                                                                                                                                                                                                                              | _         |
| Abnormal<br>Noise from<br>Servomotor | There is a SERVOPACK pulse counting error due to noise.                                                                           | Check to see if there is<br>noise interference on the<br>signal line from the<br>encoder.                                                                                                                                                                                                                                                | Turn OFF the power<br>supply to the servo<br>system.<br>Implement counter-<br>measures against noise<br>for the encoder wiring.                                                                                                                                                                                        | _         |
|                                      | The encoder was subjected to excessive vibration or shock.                                                                        | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if vibration<br>from the machine<br>occurred. Check the Ser-<br>vomotor installation<br>(mounting surface preci-<br>sion, securing state, and<br>alignment).<br>Check the linear encoder<br>installation (mounting sur-<br>face precision and secur-<br>ing method). | Reduce machine vibra-<br>tion. Improve the<br>mounting state of the<br>Servomotor or linear<br>encoder.                                                                                                                                                                                                                | _         |
|                                      | A failure occurred in the encoder.                                                                                                | _                                                                                                                                                                                                                                                                                                                                        | Turn OFF the power<br>supply to the servo<br>system.<br>Replace the Servomo-<br>tor.                                                                                                                                                                                                                                   | _         |
|                                      | A failure occurred in the Serial Converter Unit.                                                                                  | _                                                                                                                                                                                                                                                                                                                                        | Turn OFF the power<br>supply to the servo<br>system.<br>Replace the Serial Con-<br>verter Unit.                                                                                                                                                                                                                        | _         |
|                                      | A failure occurred in the linear encoder.                                                                                         | _                                                                                                                                                                                                                                                                                                                                        | Turn OFF the power<br>supply to the servo<br>system.<br>Replace the linear<br>encoder.                                                                                                                                                                                                                                 | _         |

| Continued from pre                                   |                                                                                             |                                                                           |                                                   |           |  |
|------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------|-----------|--|
| Problem                                              | Possible Cause                                                                              | Confirmation                                                              | Correction                                        | Reference |  |
| Servomotor<br>Vibrates at<br>Frequency<br>of Approx. | The servo gains are not bal-<br>anced.                                                      | Check to see if the servo gains have been cor-<br>rectly tuned.           | Perform autotuning without a host refer-<br>ence. | page 8-23 |  |
|                                                      | The setting of Pn100 (Speed Loop Gain) is too high.                                         | Check the setting of<br>Pn100.<br>The default setting is Kv =<br>40.0 Hz. | Set Pn100 to an appropriate value.                | _         |  |
|                                                      | The setting of Pn102 (Posi-<br>tion Loop Gain) is too high.                                 | Check the setting of<br>Pn102.<br>The default setting is Kp<br>= 40.0/s.  | Set Pn102 to an appropriate value.                | _         |  |
| 200 to 400<br>Hz.                                    | The setting of Pn101 (Speed<br>Loop Integral Time Con-<br>stant) is not appropriate.        | Check the setting of<br>Pn101.<br>The default setting is Ti =<br>20.0 ms. | Set Pn101 to an appropriate value.                | _         |  |
|                                                      | The setting of Pn103<br>(Moment of Inertia Ratio or<br>Mass Ratio) is not appropri-<br>ate. | Check the setting of Pn103.                                               | Set Pn103 to an appropriate value.                | _         |  |
|                                                      | The servo gains are not bal-<br>anced.                                                      | Check to see if the servo gains have been cor-<br>rectly tuned.           | Perform autotuning without a host reference.      | page 8-23 |  |
|                                                      | The setting of Pn100 (Speed Loop Gain) is too high.                                         | Check the setting of<br>Pn100.<br>The default setting is Kv =<br>40.0 Hz. | Set Pn100 to an appropriate value.                | _         |  |
| Large Motor<br>Speed                                 | The setting of Pn102 (Posi-<br>tion Loop Gain) is too high.                                 | Check the setting of<br>Pn102.<br>The default setting is Kp<br>= 40.0/s.  | Set Pn102 to an appropriate value.                | _         |  |
| Overshoot<br>on Starting<br>and Stop-<br>ping        | The setting of Pn101 (Speed<br>Loop Integral Time Con-<br>stant) is not appropriate.        | Check the setting of<br>Pn101.<br>The default setting is Ti =<br>20.0 ms. | Set Pn101 to an appropriate value.                | _         |  |
| <u>к</u> А                                           | The setting of Pn103<br>(Moment of Inertia Ratio or<br>Mass Ratio) is not appropri-<br>ate. | Check the setting of Pn103.                                               | Set Pn103 to an appropriate value.                | _         |  |
|                                                      | The torque reference is saturated.                                                          | Check the waveform of the torque reference.                               | Use the mode switch.                              | _         |  |
|                                                      | The force limits (Pn483 and Pn484) are set to the default values.                           | The default values of the force limits and Pn483 = 30% and Pn484 = 30%.   | Set Pn483 and Pn484 to appropriate values.        | page 6-22 |  |

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|                                                                                    |                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                        | Continued from pre                                                                                                                                                                                                                                                                                                     | evious page. |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Problem                                                                            | Possible Cause                                                                                                                    | Confirmation                                                                                                                                                                                                                                                                                                                           | Correction                                                                                                                                                                                                                                                                                                             | Reference    |
| Absolute<br>Encoder                                                                | Noise interference occurred<br>because of incorrect Encoder<br>Cable specifications.                                              | Turn OFF the power sup-<br>ply to the servo system.<br>Check the Encoder Cable<br>to see if it satisfies speci-<br>fications.<br>Use a shielded twisted-<br>pair wire cable or a<br>screened twisted-pair<br>cable with conductors of<br>at least 0.12 mm <sup>2</sup> .                                                               | Use cables that satisfy the specifications.                                                                                                                                                                                                                                                                            | -            |
|                                                                                    | Noise interference occurred<br>because the Encoder Cable<br>is too long.                                                          | Turn OFF the power sup-<br>ply to the servo system.<br>Check the length of the<br>Encoder Cable.                                                                                                                                                                                                                                       | <ul> <li>Rotary Servomotors:<br/>The Encoder Cable<br/>length must be 50 m<br/>max.</li> <li>Linear Servomotors:<br/>Make sure that the<br/>Serial Converter Unit<br/>cable is no longer<br/>than 20 m and that<br/>the Linear Encoder<br/>Cable and the Sensor<br/>Cable are no longer<br/>than 15 m each.</li> </ul> | -            |
| Position<br>Deviation<br>Error (The<br>position<br>that was<br>saved in the        | Noise interference occurred because the Encoder Cable is damaged.                                                                 | Turn OFF the power sup-<br>ply to the servo system.<br>Check the Encoder Cable<br>to see if it is pinched or<br>the sheath is damaged.                                                                                                                                                                                                 | Replace the Encoder<br>Cable and correct the<br>cable installation envi-<br>ronment.                                                                                                                                                                                                                                   | -            |
| host con-<br>troller when<br>the power<br>was turned<br>OFF is dif-<br>ferent from | The Encoder Cable was subject to excessive noise inter-<br>ference.                                                               | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if the<br>Encoder Cable is bundled<br>with a high-current line or<br>installed near a high-cur-<br>rent line.                                                                                                                                                      | Correct the cable lay-<br>out so that no surge is<br>applied by high-current<br>lines.                                                                                                                                                                                                                                 | _            |
| the posi-<br>tion when<br>the power<br>was next<br>turned ON.)                     | There is variation in the FG<br>potential because of the<br>influence of machines on the<br>Servomotor side, such as a<br>welder. | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if the<br>machines are correctly<br>grounded.                                                                                                                                                                                                                      | Properly ground the machines to separate them from the FG of the encoder.                                                                                                                                                                                                                                              | -            |
|                                                                                    | There is a SERVOPACK pulse counting error due to noise.                                                                           | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if there is<br>noise interference on the<br>I/O signal line from the<br>encoder or Serial Con-<br>verter Unit.                                                                                                                                                     | Implement counter-<br>measures against noise<br>for the encoder or<br>Serial Converter Unit<br>wiring.                                                                                                                                                                                                                 | -            |
|                                                                                    | The encoder was subjected to excessive vibration or shock.                                                                        | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if vibration<br>from the machine<br>occurred.<br>Check the Servomotor<br>installation (mounting sur-<br>face precision, securing<br>state, and alignment).<br>Check the linear encoder<br>installation (mounting sur-<br>face precision and secur-<br>ing method). | Reduce machine vibra-<br>tion. Improve the<br>mounting state of the<br>Servomotor or linear<br>encoder.                                                                                                                                                                                                                | -            |

| Problem                                                                                                                                                                                      | Possible Cause                                                                     | Confirmation                                                                                                   | Continued from pre                                                                                     | Reference |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-----------|--|
| Absolute<br>Encoder<br>Position<br>Deviation<br>Error (The                                                                                                                                   | A failure occurred in the encoder.                                                 | _                                                                                                              | Turn OFF the power<br>supply to the servo<br>system.<br>Replace the Servomo-<br>tor or linear encoder. | -         |  |
| position<br>that was<br>saved in the<br>host con-<br>troller when<br>the power<br>was turned<br>OFF is dif-<br>ferent from<br>the posi-<br>tion when<br>the power<br>was next<br>turned ON.) | A failure occurred in the SER-<br>VOPACK.                                          |                                                                                                                | Turn OFF the power<br>supply to the servo<br>system.<br>Replace the SERVO-<br>PACK.                    | _         |  |
|                                                                                                                                                                                              |                                                                                    | Check the external power supply (+24 V) voltage for the input signals.                                         | Correct the external<br>power supply (+24 V)<br>voltage for the input<br>signals.                      | _         |  |
|                                                                                                                                                                                              | The P-OT/N-OT (Forward<br>Drive Prohibit or Reverse<br>Drive Prohibit) signal was  | Check the operating con-<br>dition of the overtravel<br>limit switches.                                        | Make sure that the overtravel limit switches operate correctly.                                        | _         |  |
|                                                                                                                                                                                              | input.                                                                             | Check the wiring of the overtravel limit switches.                                                             | Correct the wiring of the overtravel limit switches.                                                   | page 5-27 |  |
|                                                                                                                                                                                              |                                                                                    | Check the settings of PnB0F and PnB10.                                                                         | Set the parameters to correct values.                                                                  | page 5-27 |  |
| Overtravel<br>Occurred                                                                                                                                                                       |                                                                                    | Check for fluctuation in<br>the external power supply<br>(+24 V) voltage for the<br>input signals.             | Eliminate fluctuation<br>from the external power<br>supply (+24 V) voltage<br>for the input signals.   | -         |  |
|                                                                                                                                                                                              | The P-OT/N-OT (Forward<br>Drive Prohibit or Reverse<br>Drive Prohibit) signal mal- | Check to see if the opera-<br>tion of the overtravel limit switches is unstable.                               | Stabilize the operating condition of the over-<br>travel limit switches.                               | _         |  |
|                                                                                                                                                                                              | functioned.                                                                        | Check the wiring of the<br>overtravel limit switches<br>(e.g., check for cable<br>damage and loose<br>screws). | Correct the wiring of the overtravel limit switches.                                                   | _         |  |
|                                                                                                                                                                                              | The selection of the Servo-<br>motor stopping method is<br>not correct.            | Check the servo OFF<br>stopping method set in<br>Pn001 = n.□□□X or<br>PnB1F.                                   | Select a Servomotor<br>stopping method other<br>than coasting to a stop.                               | page 5-28 |  |
| Improper<br>Stop Posi-                                                                                                                                                                       | The limit switch position and dog length are not appropriate.                      | _                                                                                                              | Install the limit switch at the appropriate position.                                                  | _         |  |
| tion for<br>Overtravel<br>(OT) Signal                                                                                                                                                        | The overtravel limit switch position is too close for the coasting distance.       | _                                                                                                              | Install the overtravel limit switch at the appropriate position.                                       | -         |  |

Maintenance

|                                 |                                                                                                                                   |                                                                                                                                                                                                                                                                      | Continued from pre                                                                                                                                                                                                                                                                                                     | evious page. |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Problem                         | Possible Cause                                                                                                                    | Confirmation                                                                                                                                                                                                                                                         | Correction                                                                                                                                                                                                                                                                                                             | Reference    |
|                                 | Noise interference occurred<br>because of incorrect Encoder<br>Cable specifications.                                              | Turn OFF the power sup-<br>ply to the servo system.<br>Check the Encoder Cable<br>to see if it satisfies speci-<br>fications. Use a shielded<br>twisted-pair wire cable or<br>a screened twisted-pair<br>cable with conductors of<br>at least 0.12 mm <sup>2</sup> . | Use cables that satisfy the specifications.                                                                                                                                                                                                                                                                            | -            |
| Position                        | Noise interference occurred<br>because the Encoder Cable<br>is too long.                                                          | Turn OFF the power sup-<br>ply to the servo system.<br>Check the length of the<br>Encoder Cable.                                                                                                                                                                     | <ul> <li>Rotary Servomotors:<br/>The Encoder Cable<br/>length must be 50 m<br/>max.</li> <li>Linear Servomotors:<br/>Make sure that the<br/>Serial Converter Unit<br/>cable is no longer<br/>than 20 m and that<br/>the Linear Encoder<br/>Cable and the Sensor<br/>Cable are no longer<br/>than 15 m each.</li> </ul> | -            |
| Deviation<br>(without<br>Alarm) | Noise interference occurred because the Encoder Cable is damaged.                                                                 | Turn OFF the power sup-<br>ply to the servo system.<br>Check the Encoder Cable<br>to see if it is pinched or<br>the sheath is damaged.                                                                                                                               | Replace the Encoder<br>Cable and correct the<br>cable installation envi-<br>ronment.                                                                                                                                                                                                                                   | -            |
|                                 | The Encoder Cable was sub-<br>jected to excessive noise<br>interference.                                                          | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if the<br>Encoder Cable is bundled<br>with a high-current line or<br>installed near a high-cur-<br>rent line.                                                                                    | Correct the cable lay-<br>out so that no surge is<br>applied by high-current<br>lines.                                                                                                                                                                                                                                 | -            |
|                                 | There is variation in the FG<br>potential because of the<br>influence of machines on the<br>Servomotor side, such as a<br>welder. | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if the<br>machines are correctly<br>grounded.                                                                                                                                                    | Properly ground the machines to separate them from the FG of the encoder.                                                                                                                                                                                                                                              | _            |
|                                 | There is a SERVOPACK pulse counting error due to noise.                                                                           | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if there is<br>noise interference on the<br>I/O signal line from the<br>encoder or Serial Con-<br>verter Unit.                                                                                   | Implement counter-<br>measures against noise<br>for the encoder wiring<br>or Serial Converter Unit<br>wiring.                                                                                                                                                                                                          | _            |

| Continued from | previous | page. |
|----------------|----------|-------|
|----------------|----------|-------|

| Problem                                     | Possible Cause                                                                            | Confirmation                                                                                                                                                                                                                                                                                                                           | Correction                                                                                                                                              | Reference |
|---------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                             | The encoder was subjected to excessive vibration or shock.                                | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if vibration<br>from the machine<br>occurred.<br>Check the Servomotor<br>installation (mounting sur-<br>face precision, securing<br>state, and alignment).<br>Check the linear encoder<br>installation (mounting sur-<br>face precision and secur-<br>ing method). | Reduce machine vibra-<br>tion. Improve the<br>mounting state of the<br>Servomotor or linear<br>encoder.                                                 | _         |
|                                             | The coupling between the machine and Servomotor is not suitable.                          | Turn OFF the power sup-<br>ply to the servo system.<br>Check to see if position<br>offset occurs at the cou-<br>pling between machine<br>and Servomotor.                                                                                                                                                                               | Correctly secure the coupling between the machine and Servomotor.                                                                                       | _         |
| Position<br>Deviation<br>(without<br>Alarm) | Noise interference occurred<br>because of incorrect I/O sig-<br>nal cable specifications. | Turn OFF the power sup-<br>ply to the servo system.<br>Check the I/O signal<br>cables to see if they sat-<br>isfy specifications. Use a<br>shielded twisted-pair wire<br>cable or a screened<br>twisted-pair cable with<br>conductors of at least<br>0.12 mm <sup>2</sup> .                                                            | Use cables that satisfy the specifications.                                                                                                             | _         |
|                                             | Noise interference occurred because an I/O signal cable is too long.                      | Turn OFF the power sup-<br>ply to the servo system.<br>Check the lengths of the<br>I/O signal cables.                                                                                                                                                                                                                                  | The I/O signal cables<br>must be no longer than<br>3 m.                                                                                                 | _         |
|                                             | An encoder fault occurred.<br>(The pulse count does not<br>change.)                       | _                                                                                                                                                                                                                                                                                                                                      | Turn OFF the power<br>supply to the servo<br>system.<br>Replace the Servomo-<br>tor or linear encoder.                                                  | _         |
|                                             | A failure occurred in the SER-<br>VOPACK.                                                 | _                                                                                                                                                                                                                                                                                                                                      | Turn OFF the power<br>supply to the servo<br>system.<br>Replace the SERVO-<br>PACK.                                                                     | _         |
|                                             | The surrounding air tempera-<br>ture is too high.                                         | Measure the surrounding air temperature around the Servomotor.                                                                                                                                                                                                                                                                         | Reduce the surround-<br>ing air temperature to<br>40°C or less.                                                                                         | -         |
|                                             | The surface of the Servomo-<br>tor is dirty.                                              | Turn OFF the power sup-<br>ply to the servo system.<br>Visually check the surface<br>for dirt.                                                                                                                                                                                                                                         | Clean dirt, dust, and oil from the surface.                                                                                                             | _         |
| Servomotor<br>Overheated                    | There is an overload on the Servomotor.                                                   | Check the load status with a monitor.                                                                                                                                                                                                                                                                                                  | If the Servomotor is<br>overloaded, reduce the<br>load or replace the<br>Servo Drive with a<br>SERVOPACK and Ser-<br>vomotor with larger<br>capacities. | _         |
|                                             | Polarity detection was not performed correctly.                                           | Check to see if electrical angle 2 (electrical angle from polarity origin) at any position is between ±10°.                                                                                                                                                                                                                            | Correct the settings for<br>the polarity detection-<br>related parameters.                                                                              | -         |

# **Parameter Lists**

-16

This chapter provides information on the parameters.

| 16.1 | Parameter Configurations                                               |
|------|------------------------------------------------------------------------|
| 16.2 | List of Parameters16-3                                                 |
|      | 16.2.1Interpreting the Parameter Lists16-316.2.2List of Parameters16-4 |
| 16.3 | Parameter Recording Table                                              |

# 16.1 Parameter Configurations

|                                         |                                                                                                 | -<br>                                                                                                            |  |  |  |  |
|-----------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|--|--|--|--|
| Туре                                    | Parameter No.                                                                                   | Parameter No.                                                                                                    |  |  |  |  |
| Function Selection<br>Parameters        | Pn000 to Pn081<br>PnB1F                                                                         | Select basic and application functions such as the type of control mode or the stop method when an alarm occurs. |  |  |  |  |
| Servo Gain and Other<br>Parameters      | Pn100 to Pn170                                                                                  | Set numerical values such as speed and position loop gains.                                                      |  |  |  |  |
| Position Control<br>Parameters          | Pn205 to Pn217                                                                                  | Set position control parameters such as average move-<br>ment time.                                              |  |  |  |  |
| Speed Control<br>Parameters             | Pn304 to Pn324                                                                                  | Set speed control parameters such as the speed feedback filter.                                                  |  |  |  |  |
| Torque Control<br>Parameters            | Pn401 to Pn460                                                                                  | Set torque control parameters such as the torque limit values.                                                   |  |  |  |  |
| Sequence Parameters                     | Pn502 to Pn561<br>PnB03 to PnB1E<br>PnB4F<br>PnB51 to PnB52                                     | Set conditions for the sequence I/O signals.                                                                     |  |  |  |  |
| Positioning<br>Parameters               | PnB20 to PnB2F<br>PnB50                                                                         | Set parameters related to positioning.                                                                           |  |  |  |  |
| Homing Parameters                       | PnB31 to PnB39                                                                                  | Set parameters related to homing.                                                                                |  |  |  |  |
| Others                                  | Pn600 to Pn604                                                                                  | Set other parameters.                                                                                            |  |  |  |  |
| Serial Communica-<br>tions Parameters   | PnB00 to PnB02                                                                                  | Set parameters related to serial communications (CN12).                                                          |  |  |  |  |
| Setup Information<br>Parameters         | PnB3B to PnB4D                                                                                  | Do not change these parameters.<br>These are reserved parameters.                                                |  |  |  |  |
| Fully-closed Loop<br>Control Parameters | Pn20A, Pn22A, Pn281<br>Pn51B, Pn52A                                                             | Set parameters related to fully-closed loop control.                                                             |  |  |  |  |
| Linear Servomotor<br>Parameters         | Pn080<br>Pn181 to Pn182<br>Pn281 to Pn282<br>Pn383 to Pn385<br>Pn480 to Pn49F<br>Pn581 to Pn587 | Set parameters related to linear servomotors.                                                                    |  |  |  |  |

Parameters are comprised of the types shown in the following table.

16.2.1 Interpreting the Parameter Lists

Indicates when a change to the

parameter will be effective.

1

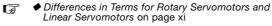
# 16.2 List of Parameters

#### 16.2.1 Interpreting the Parameter Lists

The types of Servomotors to which the parameter applies.

- All: The parameter is used for both Rotary Servomotors and Linear Servomotors.
- Rotary: The parameter is used for only Rotary Servomotors. • Linear: The parameter is used for only Linear Servomotors.

Rotary Servomotor terms are used for parameters that are applicable to all Servomotors. If you are using a Linear Servomotor, you need to interpret the terms accordingly. Refer to the following section for details.



|                  |        |                                                                        |                                                                         |                                                                                                                                                                            |                 |                    |                                     | 1/                                                      |                     |                  |  |
|------------------|--------|------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------|-------------------------------------|---------------------------------------------------------|---------------------|------------------|--|
| Parameter<br>No. | Size   | N                                                                      | ame                                                                     | Setting<br>Range                                                                                                                                                           | Setting<br>Unit | Default<br>Setting | Applica-<br>ble Motors              | When<br>Enabled                                         | Classi-<br>fication | Refer-<br>ence   |  |
|                  | 2      | 2 Basic Function Selections 0 0000h to 10B1h - 0000h All After restart |                                                                         |                                                                                                                                                                            |                 |                    |                                     |                                                         |                     |                  |  |
|                  |        | Servor<br>provid<br>• Top                                              | motor and Linea<br>ed for both.<br>5 row: For Rotar<br>ttom row: For Li | hear Servomotor                                                                                                                                                            | formation is    | · • •              | Setup<br>Funing<br>er to the follov | wing two class<br>ving section for<br>eter Classificati | details.            | ge 5-3           |  |
|                  |        |                                                                        |                                                                         | Rotation Direction Sylection                                                                                                                                               |                 |                    |                                     |                                                         |                     |                  |  |
| Pn000            | n.000X |                                                                        | 0 Use                                                                   | Use CCW as the forward direction.<br>Use the direction in which the linear encoder counts up as the forward direction.                                                     |                 |                    |                                     |                                                         |                     |                  |  |
|                  |        |                                                                        | 1 Use                                                                   | Use CW as the forward direction. (Reverse Rotation Mode)<br>Use the direction in which the linear encoder counts down as the<br>forward direction. (Reverse Movement Mode) |                 |                    |                                     |                                                         | – page c            | - page 5-15<br>- |  |
|                  | I      | n.🗆 🗆 🛛                                                                | XD Reserved parameter (Do not change.)                                  |                                                                                                                                                                            |                 |                    |                                     |                                                         |                     |                  |  |
|                  | I      | n.¤X¤¤                                                                 | Reserved par                                                            |                                                                                                                                                                            |                 |                    |                                     |                                                         |                     |                  |  |
|                  | Ī      |                                                                        | Rotary/Linear                                                           | Servomotor St                                                                                                                                                              | artup Selec     | ction When         | Encoder Is N                        | lot Connected                                           | Refere              | nce              |  |
|                  |        | n.XDDD                                                                 |                                                                         | 0 When an encoder is not connected, start as SERVOPACK for Rotary Servomotor.                                                                                              |                 |                    |                                     |                                                         |                     | 5-14             |  |
|                  |        |                                                                        |                                                                         | When an encoder is not connected, start as SERVOPACK for Lin-<br>ear Servomotor.                                                                                           |                 |                    |                                     |                                                         |                     | , 1-             |  |
|                  |        |                                                                        |                                                                         |                                                                                                                                                                            |                 |                    |                                     |                                                         |                     |                  |  |

2

#### List of Parameters 16.2.2

The following table lists the parameters.

Note: Do not change the following parameters from their default settings.

- Reserved parameters
- Parameters not given in this manualParameters that are not valid for the Servomotor that you are using, as given in the parameter table
  - The following parameters will be set automatically when the INDEXER Module is mounted. Do not change the settings of these parameters.
- Ø Pn002 = n. DDDX, Pn205, Pn207 = n.XDDD, Pn50A to Pn512, Pn517, and Pn522 • Parameters that are unique to the INDEXER Module will be set automatically the first time the Note power supply is turned on after the INDEXER Module is mounted. Up to 10 s may be required for the SERVOPACK to start.

| Parameter<br>No. | Size | Name                 |                                     |                                                                                                             | Setting<br>Range                  | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|------------------|------|----------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
|                  | 2    | Basic Fun<br>tions 0 | ction Sele                          | C-                                                                                                          | 0000h to<br>10B1h                 | -               | 0000h              | All                  | After<br>restart | Setup               | _              |
|                  | _    |                      | 1                                   |                                                                                                             |                                   |                 |                    |                      |                  | _                   |                |
|                  |      |                      | Rotation                            | Direc                                                                                                       | ction Selection                   | 1               |                    |                      |                  | Refere              | nce            |
|                  |      |                      | Moveme                              | nt Di                                                                                                       | rection Selecti                   | on              |                    |                      |                  | TICICIC             | nee            |
|                  |      |                      |                                     | Use                                                                                                         | CCW as the fo                     | orward dire     | ection.            |                      |                  |                     |                |
|                  | n    | n.🗆 🗆 🗆 X            | 0                                   |                                                                                                             | the direction ir<br>d direction.  | page 5-15       |                    |                      |                  |                     |                |
|                  |      |                      |                                     | Use                                                                                                         | CW as the for                     |                 |                    |                      |                  |                     |                |
| Pn000            |      |                      | 1                                   | Use the direction in which the linear encoder counts down as the forward direction. (Reverse Movement Mode) |                                   |                 |                    |                      |                  |                     |                |
|                  | n    | .00X0                | Reserve                             |                                                                                                             |                                   |                 |                    |                      |                  |                     |                |
|                  | n    | .DXDD                | Reserved parameter (Do not change.) |                                                                                                             |                                   |                 |                    |                      |                  |                     |                |
|                  |      |                      | Rotary/L<br>nected                  | inear.                                                                                                      | Servomotor S                      | tartup Se       | lection Wh         | en Encoder I         | s Not Con-       | Refere              | nce            |
|                  | n    | n.XDDD               | 0                                   |                                                                                                             | en an encoder i<br>ary Servomotor |                 | nected, sta        | rt as SERVOF         | PACK for         | DOGO E              | 14             |
|                  |      |                      | 1                                   |                                                                                                             | en an encoder i<br>Servomotor.    | s not conr      | nected, sta        | rt as SERVOF         | PACK for Lin-    | – page 5            | -14            |
|                  |      |                      |                                     |                                                                                                             |                                   |                 |                    |                      |                  |                     |                |

Continued from previous page.

| Parameter<br>No. | Size                                            | 1                                                           | Name                                |                                                                                                                              | Setting<br>Range                                   | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled      | Classi-<br>fication | Refe<br>enc |  |
|------------------|-------------------------------------------------|-------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-----------------|--------------------|----------------------|----------------------|---------------------|-------------|--|
|                  | 2                                               | Application<br>Selections                                   | n Functior<br>s 1                   | l                                                                                                                            | 0000h to<br>1142h                                  | _               | 0000h              | All                  | After<br>restart     | Setup               | _           |  |
|                  |                                                 |                                                             |                                     |                                                                                                                              |                                                    |                 |                    |                      |                      |                     |             |  |
|                  |                                                 |                                                             |                                     | Motor Stopping Method for Servo OFF and Group 1 Alarms           0         Stop the motor by applying the dynamic brake.     |                                                    |                 |                    |                      |                      |                     |             |  |
|                  | n                                               | .000X                                                       | 0                                   | Stop                                                                                                                         | the motor by                                       | hen release     | page 5             | -35                  |                      |                     |             |  |
|                  |                                                 |                                                             | 2                                   |                                                                                                                              | dynamic brake<br>st the motor to                   |                 | thout the c        | lynamic brake        | э.                   |                     |             |  |
|                  | n                                               | .00X0                                                       | Reserved                            | d para                                                                                                                       | ameter (Do no                                      | t change.)      |                    |                      |                      |                     |             |  |
| n001             | Main Circuit Power Supply AC/DC Input Selection |                                                             |                                     |                                                                                                                              |                                                    |                 |                    |                      |                      |                     |             |  |
|                  |                                                 | .0X00                                                       | 0                                   |                                                                                                                              | t AC power as<br>L3 terminals (d                   |                 |                    |                      | ng the L1, L2,       |                     |             |  |
|                  |                                                 |                                                             | 1                                   | and                                                                                                                          | t DC power as<br>⊖ 2 terminals<br>verter or the sh | or the B1       | and $\ominus$ 2 t  |                      | 0 0                  | page 5              | -12         |  |
|                  |                                                 |                                                             | Warning                             | Code                                                                                                                         | e Output Selec                                     | tion            |                    |                      |                      | Reference           |             |  |
|                  | n                                               | .X000                                                       | 0                                   | 0 Output only alarm codes on the /ALO1 to /ALO3 terminals.                                                                   |                                                    |                 |                    |                      |                      |                     |             |  |
|                  |                                                 |                                                             | 1                                   | 1 Output both warning codes and alarm codes on the /ALO1 to /ALO3 terminals. If there is an alarm, the alarm code is output. |                                                    |                 |                    |                      |                      |                     |             |  |
|                  | 2                                               | Applications<br>Selections                                  | n Functior<br>s 2                   | 1                                                                                                                            | 0000h to<br>4213h                                  | -               | 0000h*1            | _                    | After<br>restart     | Setup               | _           |  |
|                  | r                                               | 1.000X                                                      | Reserved                            | Reserved parameter (Do not change.)                                                                                          |                                                    |                 |                    |                      |                      |                     |             |  |
|                  | r                                               |                                                             | Reserved parameter (Do not change.) |                                                                                                                              |                                                    |                 |                    |                      |                      |                     |             |  |
|                  |                                                 |                                                             | Encoder                             | Usag                                                                                                                         | je                                                 |                 |                    |                      | Applicable<br>Motors | Refere              | nce         |  |
|                  | r                                               | . Use the encoder according to encoder specifica-<br>tions. |                                     |                                                                                                                              |                                                    |                 |                    | specifica-           | All                  |                     |             |  |
|                  |                                                 |                                                             | 1                                   |                                                                                                                              | the encoder a                                      |                 |                    |                      |                      | page 6              | -23         |  |
| n002             |                                                 |                                                             | 2                                   |                                                                                                                              | the encoder a oder.                                | s a single-     | turn absolı        | ute                  | Rotary               |                     |             |  |
|                  |                                                 |                                                             | External                            | Enco                                                                                                                         | der Usage                                          |                 |                    |                      | Applicable<br>Motors | Refere              | nce         |  |
|                  |                                                 |                                                             | 0                                   | Do r                                                                                                                         | not use an exte                                    | ernal enco      | der.               |                      |                      |                     |             |  |
|                  | r                                               | X000                                                        | 1                                   |                                                                                                                              | external encod<br>for CCW moto                     |                 | in the forw        | ard direc-           |                      |                     |             |  |
|                  |                                                 |                                                             | 2                                   | Res                                                                                                                          | erved paramet                                      | er (Do not      | change.)           |                      | Rotary               | page 1              | 0-6         |  |
|                  |                                                 |                                                             | 3                                   |                                                                                                                              | external encod<br>for CCW moto                     |                 | in the reve        | rse direc-           |                      |                     |             |  |
|                  |                                                 |                                                             | 4                                   | Res                                                                                                                          | erved paramet                                      | er (Do not      | change.)           |                      |                      |                     |             |  |

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| Parameter | 0    |                           |                                                         | Sotting                                                                                                                                             | Sotting         | Default                  | Applicable                   | tinued from<br>When | Classi-  | Refer        |  |  |
|-----------|------|---------------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------|------------------------------|---------------------|----------|--------------|--|--|
| No.       | Size | N                         | lame                                                    | Setting<br>Range                                                                                                                                    | Setting<br>Unit | Setting                  | Motors                       | Enabled             | fication | ence         |  |  |
|           | 2    | Application<br>Selections |                                                         | 0000h to<br>105Fh                                                                                                                                   | -               | 0002h                    | All                          | Immedi-<br>ately    | Setup    | page<br>9-10 |  |  |
|           |      |                           |                                                         |                                                                                                                                                     |                 |                          |                              |                     |          |              |  |  |
|           |      |                           | Analog Monitor 1 Signal Selection                       |                                                                                                                                                     |                 |                          |                              |                     |          |              |  |  |
|           |      |                           | 00                                                      | Motor speed (1 V/1,000 min <sup>-1</sup> )                                                                                                          |                 |                          |                              |                     |          |              |  |  |
|           |      |                           |                                                         | Motor speed (1                                                                                                                                      | V/1,000 m       | nm/s)                    |                              |                     |          |              |  |  |
|           |      | 01                        | 01 Speed reference (1 V/1,000 min <sup>-1</sup> )       |                                                                                                                                                     |                 |                          |                              |                     |          |              |  |  |
|           |      |                           |                                                         | Speed reference                                                                                                                                     | ( )             | ,                        |                              |                     |          |              |  |  |
|           |      |                           | 02                                                      | Torque reference                                                                                                                                    | ,               |                          | . ,                          |                     |          |              |  |  |
|           |      |                           |                                                         | Force reference                                                                                                                                     |                 |                          | ,                            |                     |          |              |  |  |
|           |      |                           | 03                                                      | Position deviation                                                                                                                                  |                 |                          | ,                            |                     |          |              |  |  |
|           |      |                           | 04                                                      | Position amplifie                                                                                                                                   |                 | •                        | 0 / (                        |                     | •        | unit)        |  |  |
|           |      |                           |                                                         | Position amplifie<br>pulse unit)                                                                                                                    | er deviation    | n (after elec            | ctronic gear) (              | 0.05 V/lineai       | rencoder |              |  |  |
|           |      | 05                        | Position reference speed (1 V/1,000 min <sup>-1</sup> ) |                                                                                                                                                     |                 |                          |                              |                     |          |              |  |  |
|           |      |                           | Position reference speed (1 V/1,000 mm/s)               |                                                                                                                                                     |                 |                          |                              |                     |          |              |  |  |
|           |      |                           | 06                                                      | Reserved parameter (Do not change.)                                                                                                                 |                 |                          |                              |                     |          |              |  |  |
| n006      |      | n.□□XX                    | 07                                                      | Load-motor position deviation (0.01 V/reference unit)           Positioning completion (positioning completed: 5 V, positioning not completed: 0 V) |                 |                          |                              |                     |          |              |  |  |
|           |      |                           | 08                                                      |                                                                                                                                                     |                 |                          |                              |                     |          |              |  |  |
|           |      |                           | 09                                                      | Speed feedforw                                                                                                                                      | ard (1 V/1      | ,000 min <sup>-1</sup> ) |                              |                     |          |              |  |  |
|           |      |                           | 03                                                      | Speed feedforw                                                                                                                                      | ard (1 V/1      | ,000 mm/s                | )                            |                     |          |              |  |  |
|           |      |                           | OA                                                      | Torque feedforw                                                                                                                                     | ard (1 V/1      | 00% rated                | torque)                      |                     |          |              |  |  |
|           |      |                           |                                                         | Force feedforwa                                                                                                                                     | rd (1 V/10      | 0% rated f               | orce)                        |                     |          |              |  |  |
|           |      |                           | 0B                                                      | Active gain (1st                                                                                                                                    | gain: 1 V,      | 2nd gain: 2              | 2 V)                         |                     |          |              |  |  |
|           |      |                           | 0C                                                      | Completion of p<br>pleted: 0 V)                                                                                                                     | osition ref     | erence dist              | ribution (com                | pleted: 5 V,        | not com- |              |  |  |
|           |      |                           | 0D                                                      | External encode                                                                                                                                     | er speed (1     | V/1,000 r                | nin <sup>-1</sup> : value at | the motor s         | haft)    |              |  |  |
|           |      |                           | 0E                                                      | Reserved param                                                                                                                                      | neter (Do r     | ot change                | .)                           |                     |          |              |  |  |
|           |      |                           | 0F                                                      | Reserved param                                                                                                                                      | neter (Do r     | ot change                | .)                           |                     |          |              |  |  |
|           |      |                           | 10                                                      | Main circuit DC                                                                                                                                     | voltage         |                          |                              |                     |          |              |  |  |
|           |      |                           | 11 to 5F                                                | Reserved param                                                                                                                                      | neters (Do      | not chang                | e.)                          |                     |          |              |  |  |
|           |      | n.0X00                    | Reserved                                                | parameter (Do no                                                                                                                                    | ot change.      | )                        |                              |                     |          |              |  |  |
|           |      | n.X000                    | Reserved                                                | parameter (Do no                                                                                                                                    | ot change       | )                        |                              |                     |          |              |  |  |
|           | _    |                           |                                                         |                                                                                                                                                     |                 |                          |                              |                     |          |              |  |  |

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| Parameter<br>No. | Size                                       | N                         | ame       | Setting<br>Range                                                                        | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Reference    |  |  |
|------------------|--------------------------------------------|---------------------------|-----------|-----------------------------------------------------------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|--------------|--|--|
|                  | 2                                          | Application<br>Selections |           | 0000h to<br>105Fh                                                                       | _               | 0000h              | All                  | Immedi-<br>ately | Setup               | page<br>9-10 |  |  |
|                  |                                            |                           | Analog Mo | nitor 2 Signal Se                                                                       | election        |                    |                      |                  |                     | _            |  |  |
|                  |                                            |                           |           | Motor speed (1 V/1,000 min <sup>-1</sup> )                                              |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | 00        | Motor speed (1                                                                          |                 | ,                  |                      |                  |                     |              |  |  |
|                  |                                            |                           | 01        | Speed reference                                                                         |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           |           | Speed reference                                                                         |                 | ,                  |                      |                  |                     |              |  |  |
|                  |                                            |                           | 02        | Torque reference                                                                        |                 | ,                  | raue)                |                  |                     |              |  |  |
|                  |                                            |                           |           | Force reference                                                                         |                 |                    | . ,                  |                  |                     |              |  |  |
|                  |                                            |                           | 03        | Position deviation (0.05 V/reference unit)                                              |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           |           | Position amplifier deviation (after electronic gear) (0.05 V/encode                     |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            | n.□□XX                    | 04        | Position amplifier deviation (after electronic gear) (0.05 V/linear encoder pulse unit) |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | 05        | Position reference speed (1 V/1,000 min <sup>-1</sup> )                                 |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | 05        | Position reference speed (1 V/1,000 mm/s)                                               |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | 06        | Reserved parameter (Do not change.)                                                     |                 |                    |                      |                  |                     |              |  |  |
| Pn007            |                                            |                           | 07        | Load-motor position deviation (0.01 V/reference unit)                                   |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | 08        | Positioning completion (positioning completed: 5 V, positioning not completed: 0 V)     |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | 09        | Speed feedforward (1 V/1,000 min <sup>-1</sup> )                                        |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           |           | Speed feedforward (1 V/1,000 mm/s)                                                      |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | 0A        | Torque feedforward (1 V/100% rated torque)                                              |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           |           | Force feedforward (1 V/100% rated force)                                                |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | 0B        | Active gain (1st                                                                        | 0               | 0                  | ,                    |                  |                     |              |  |  |
|                  |                                            |                           | 0C        | Completion of p<br>pleted: 0 V)                                                         | osition ref     | erence dist        | ribution (com        | pleted: 5 V,     | not com-            |              |  |  |
|                  |                                            |                           | 0D        | External encoder speed (1 V/1,000 min <sup>-1</sup> : value at the motor shaft)         |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | 0E        |                                                                                         |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | OF        |                                                                                         |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | 10        | Main circuit DC voltage                                                                 |                 |                    |                      |                  |                     |              |  |  |
|                  |                                            |                           | 11 to 5F  | Reserved param                                                                          | neters (Do      | not change         | ə.)                  |                  |                     |              |  |  |
|                  |                                            | n.¤X¤¤                    | Reserved  | parameter (Do no                                                                        | ot change       | .)                 |                      |                  |                     |              |  |  |
|                  | n.XDDD Reserved parameter (Do not change.) |                           |           |                                                                                         |                 |                    |                      |                  |                     |              |  |  |

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|                  |                                             |                          |                                                   |                                                                                                                                                                                                                                                           |                   |                 |                    | Con                  | tinued from      | n previous          | s page         |
|------------------|---------------------------------------------|--------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No. | Size                                        |                          | Name                                              |                                                                                                                                                                                                                                                           |                   | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|                  | 2                                           | Application<br>Selection | on Function<br>s 8                                | ſ                                                                                                                                                                                                                                                         | 0000h to<br>7121h | -               | 4000h              | Rotary               | After<br>restart | Setup               | -              |
|                  | Low Battery Voltage Alarm/Warning Selection |                          |                                                   |                                                                                                                                                                                                                                                           |                   |                 |                    |                      |                  |                     |                |
|                  |                                             |                          | -                                                 | -                                                                                                                                                                                                                                                         | <u> </u>          |                 |                    |                      |                  |                     | nce            |
|                  | n.□□□X                                      |                          | 0                                                 | Output alarm (A.830) for low battery voltage.                                                                                                                                                                                                             |                   |                 |                    |                      |                  |                     | 5-2            |
|                  |                                             |                          | 1 Output warning (A.930) for low battery voltage. |                                                                                                                                                                                                                                                           |                   |                 |                    |                      |                  |                     |                |
|                  | Function Sel                                |                          |                                                   | Sele                                                                                                                                                                                                                                                      | ction for Unde    | rvoltage        |                    |                      |                  | Reference           |                |
| Dn009            |                                             |                          | 0                                                 | 0 Do not detect undervoltage.                                                                                                                                                                                                                             |                   |                 |                    |                      |                  |                     |                |
| Pn008            | I                                           | n.DDXD                   | 1                                                 | Detect undervoltage warning and limit torque at host controller.                                                                                                                                                                                          |                   |                 |                    |                      |                  |                     | -12            |
|                  |                                             |                          | 2                                                 | Detect undervoltage warning and limit torque with Pn424 and Pn425 (i.e., only in SERVOPACK).                                                                                                                                                              |                   |                 |                    |                      |                  |                     |                |
|                  |                                             |                          | Warning Detection Selection                       |                                                                                                                                                                                                                                                           |                   |                 |                    |                      |                  | Reference           |                |
|                  | n.                                          |                          | 0                                                 |                                                                                                                                                                                                                                                           |                   |                 |                    |                      |                  |                     | 5-             |
|                  |                                             |                          | 1                                                 | Do r                                                                                                                                                                                                                                                      | ot detect warr    | nings exce      | pt for A.97        | 1.                   |                  | 56                  |                |
|                  | n.XDDD Reserved parameter (Do not change.)  |                          |                                                   |                                                                                                                                                                                                                                                           |                   |                 |                    |                      |                  |                     |                |
|                  |                                             |                          |                                                   | •                                                                                                                                                                                                                                                         |                   |                 |                    |                      |                  |                     |                |
|                  | 2 Application Function<br>Selections 9      |                          |                                                   | 0000h to<br>0121h                                                                                                                                                                                                                                         | -                 | 0010h           | All                | After<br>restart     | Tuning           | _                   |                |
|                  | n.□□□X Reserved parameter (Do not change.)  |                          |                                                   |                                                                                                                                                                                                                                                           |                   |                 |                    |                      |                  |                     |                |
|                  | Current Control Mode Selection              |                          |                                                   |                                                                                                                                                                                                                                                           |                   |                 |                    |                      |                  | Reference           |                |
| Pn009            |                                             | n.00X0                   | 1                                                 | <ul> <li>SERVOPACK Models SGD7S-R70A, -R90A, -1R6A, -2R8A,<br/>-3R8A, -5R5A, and -7R6A: Use current control mode 1.</li> <li>SERVOPACK Models SGD7S-120A, -180A, -200A, -330A,<br/>-470A, -550A, -590A, and -780A: Use current control mode 2.</li> </ul> |                   |                 |                    |                      |                  | page 8-70           |                |
|                  |                                             |                          | 2 Use current control mode 2.                     |                                                                                                                                                                                                                                                           |                   |                 |                    |                      |                  |                     |                |
|                  |                                             |                          | Speed D                                           | etect                                                                                                                                                                                                                                                     | ion Method Se     | election        |                    |                      |                  | Reference           |                |
|                  | n.¤X¤¤                                      |                          | 0 Use speed detection 1.                          |                                                                                                                                                                                                                                                           |                   |                 |                    |                      |                  |                     | 71             |
|                  |                                             |                          | 1 Use speed detection 2.                          |                                                                                                                                                                                                                                                           |                   |                 |                    |                      |                  | page 8-71           |                |
|                  |                                             | n.XDDD                   | Reserve                                           | d para                                                                                                                                                                                                                                                    | ameter (Do no     | t change.)      |                    |                      |                  |                     |                |
|                  |                                             |                          |                                                   |                                                                                                                                                                                                                                                           |                   |                 |                    |                      |                  |                     |                |

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|                  |                  |                                                                                             |                                                                                                                                                       | 1                                                                                                                               |                                                                                               |                                          |                  | previous            |                         |  |  |
|------------------|------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------|------------------|---------------------|-------------------------|--|--|
| Parameter<br>No. | Size             | Name                                                                                        | Setting<br>Range                                                                                                                                      | Setting<br>Unit                                                                                                                 | Default<br>Setting                                                                            | Applicable<br>Motors                     | When<br>Enabled  | Classi-<br>fication | Refer<br>ence           |  |  |
| Pn00A            | 2 Application    | on Function<br>Is A                                                                         | 0000h to<br>1044h                                                                                                                                     | _                                                                                                                               | 0001h                                                                                         | All                                      | After<br>restart | Setup               | _                       |  |  |
|                  |                  | 0                                                                                           | Decelerate the motor to a stop using the torque set in Pn406 as                                                                                       |                                                                                                                                 |                                                                                               |                                          |                  |                     |                         |  |  |
|                  | n.□□□X           | 2                                                                                           | Decelerate the m<br>the maximum tor<br>Decelerate the m<br>Pn30A. Use the s<br>stopping.                                                              | otor to a s<br>que and th<br>otor to a s                                                                                        | top using t                                                                                   | notor coast.<br>he deceleratio           | on time set ir   | page                | 5-36                    |  |  |
|                  | n.DDXD           | 4                                                                                           | 4     Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.       Reserved parameter (Do not change.) |                                                                                                                                 |                                                                                               |                                          |                  |                     |                         |  |  |
|                  | n.□X□□<br>n.X□□□ |                                                                                             | parameter (Do n<br>parameter (Do n                                                                                                                    |                                                                                                                                 | ,                                                                                             |                                          |                  |                     |                         |  |  |
|                  | 2 Application    | on Function<br>Is B                                                                         | 0000h to<br>1121h                                                                                                                                     | _                                                                                                                               | 0000h                                                                                         | All                                      | After<br>restart | Setup               | _                       |  |  |
|                  | n.000X           | Operator Parameter Display Selection0Display only setup parameters.1Display all parameters. |                                                                                                                                                       |                                                                                                                                 |                                                                                               |                                          |                  |                     |                         |  |  |
|                  |                  |                                                                                             | . , , ,                                                                                                                                               | parameter                                                                                                                       |                                                                                               |                                          |                  | Referei             |                         |  |  |
| Pn00B            | n.00X0           | 1DMotor Stop00S1As                                                                          | . , , ,                                                                                                                                               | parameter<br>ers.<br>Group 2 A<br>setting the<br>brake or o<br>set in Pn00                                                      | S.<br>Alarms<br>e speed ref<br>coast the n<br>$01 = n.\Box\Box$                               | notor to a stop<br>□X).                  | p (use the       |                     | -3<br>Ice               |  |  |
| Pn00B            | n.□□X□           | 1DMotor StopS0S1A2S                                                                         | ping Method for<br>top the motor by<br>pply the dynamic<br>opping method s                                                                            | parameter<br>ers.<br>Group 2 A<br>setting the<br>brake or o<br>set in Pn00<br>method wit                                        | s.<br>Alarms<br>e speed ref<br>coast the n<br>$1^1 = n.\square$<br>h Pn00A =                  | notor to a sto<br>□X).<br>n.□□□X.        | o (use the       | Page 5              | -3<br>ice<br>-36        |  |  |
| Pn00B            | n.□□X□<br>n.□X□□ | 1DMotor StopS0S1A2SPower Input0U1U1U                                                        | ping Method for<br>top the motor by<br>pply the dynamic<br>opping method s<br>et the stopping n                                                       | parameter<br>ers.<br>Group 2 A<br>setting the<br>brake or o<br>set in Pn00<br>nethod wit<br>nree-phas<br>power sup<br>power sup | s.<br>Alarms<br>e speed rei<br>coast the n<br>D1 = n.<br>h Pn00A =<br>e SERVOP<br>oply input. | notor to a sto<br>□X).<br>n.□□□X.<br>ACK |                  | Page 5              | -3<br>nce<br>-36<br>nce |  |  |

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|                  |                                                                                                     |                                       |                                                                                            |                                                  |                 |                    | Con                  | tinued from      | ı previous          | s page.        |  |
|------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|--|
| Parameter<br>No. | Size                                                                                                | Name                                  |                                                                                            | Setting<br>Range                                 | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |
|                  | 2                                                                                                   | Application<br>Selections             | n Function<br>C                                                                            | 0000h to<br>0131h                                | _               | 0000h              | -                    | After<br>restart | Setup               | page<br>7-21   |  |
| -                |                                                                                                     |                                       |                                                                                            |                                                  | 1               |                    |                      |                  |                     |                |  |
|                  |                                                                                                     |                                       | Function Selection for Test without a Motor                                                |                                                  |                 |                    |                      |                  |                     | ole<br>s       |  |
|                  |                                                                                                     | n.□□□X                                |                                                                                            | able tests with                                  |                 |                    |                      |                  | All                 |                |  |
|                  | 1                                                                                                   |                                       | 1       Enable tests without a motor.         Encoder Resolution for Tests without a Motor |                                                  |                 |                    |                      |                  |                     | ole            |  |
| Pn00C            |                                                                                                     |                                       | 0 Us                                                                                       | Motors                                           |                 |                    |                      |                  |                     |                |  |
|                  |                                                                                                     | n.¤¤X¤                                | 1 Use 20 bits.                                                                             |                                                  |                 |                    |                      |                  |                     | /              |  |
|                  |                                                                                                     |                                       |                                                                                            | e 22 bits.<br>e 24 bits.                         |                 |                    |                      |                  |                     |                |  |
|                  | -                                                                                                   |                                       | 0 03                                                                                       | 6 24 0113.                                       |                 |                    |                      |                  |                     |                |  |
|                  |                                                                                                     | n.0X00                                |                                                                                            | Encoder Type Selection for Tests without a Motor |                 |                    |                      |                  |                     |                |  |
|                  |                                                                                                     |                                       |                                                                                            | e an increment<br>e an absolute e                |                 |                    |                      |                  | - All               |                |  |
|                  | -                                                                                                   |                                       | I US                                                                                       | e an absolute e                                  | encoder.        |                    |                      |                  |                     |                |  |
|                  | -                                                                                                   | n.XDDD                                | Reserved pa                                                                                | rameter (Do no                                   | ot change.      | )                  |                      |                  |                     |                |  |
|                  | 2                                                                                                   | Application<br>Selections             | n Function<br>D                                                                            | 0000h to<br>2001h                                | _               | 0000h              | All                  | Immedi-<br>ately | Setup               | -              |  |
|                  |                                                                                                     |                                       |                                                                                            |                                                  |                 |                    |                      |                  |                     |                |  |
|                  | Stand-alone Mode (Test Operation) Selection                                                         |                                       |                                                                                            |                                                  |                 |                    |                      |                  |                     |                |  |
|                  | n.□□□X 0 Enable connection with the Command Option Module.                                          |                                       |                                                                                            |                                                  |                 |                    |                      |                  |                     |                |  |
|                  |                                                                                                     |                                       | 1 Disable connection with the Command Option Module.                                       |                                                  |                 |                    |                      |                  |                     |                |  |
| Pn00D            | n.□□X□     Reserved parameter (Do not change.)       n.□X□□     Reserved parameter (Do not change.) |                                       |                                                                                            |                                                  |                 |                    |                      |                  |                     |                |  |
|                  |                                                                                                     |                                       |                                                                                            |                                                  |                 |                    |                      |                  |                     |                |  |
|                  |                                                                                                     |                                       | Overtravel Warning Detection Selection                                                     |                                                  |                 |                    |                      |                  |                     | nce            |  |
|                  |                                                                                                     | n.XDDD                                | 0 Do not detect overtravel warnings.                                                       |                                                  |                 |                    |                      |                  |                     |                |  |
|                  |                                                                                                     |                                       | Detect overtravel warnings.     Reserved parameter (Do not change.)                        |                                                  |                 |                    |                      |                  | page 5-29           |                |  |
| -                |                                                                                                     |                                       |                                                                                            |                                                  |                 |                    |                      |                  |                     |                |  |
| Pn00E            | 2                                                                                                   | Reserved p                            | parameter (Do<br>e.)                                                                       | _                                                | -               | 0000h              | All                  | _                | -                   | _              |  |
|                  | 2                                                                                                   | Application<br>Selections             |                                                                                            | 0000h to<br>2011h                                | _               | 0000h              | All                  | After<br>restart | Setup               | _              |  |
| -                |                                                                                                     |                                       |                                                                                            |                                                  |                 |                    |                      |                  |                     |                |  |
|                  | Preventative Maintenance Warning Selection                                                          |                                       |                                                                                            |                                                  |                 |                    |                      |                  |                     | nce            |  |
|                  |                                                                                                     | n.DDDX                                | 0 Do not detect preventative maintenance warnings.                                         |                                                  |                 |                    |                      |                  |                     | -16            |  |
| Pn00F            | 1 Detect preventative maintenance warnings.                                                         |                                       |                                                                                            |                                                  |                 |                    |                      |                  | page 9-16           |                |  |
|                  | n.□□X□ Reserved parameter (Do not change.)                                                          |                                       |                                                                                            |                                                  |                 |                    |                      |                  |                     |                |  |
|                  | n.□X□□ Reserved parameter (Do not change.)                                                          |                                       |                                                                                            |                                                  |                 |                    |                      |                  |                     |                |  |
|                  |                                                                                                     | n.XDDD                                | Reserved pa                                                                                | rameter (Do no                                   | ot change.      | )                  |                      |                  |                     |                |  |
| Pn010            | 2                                                                                                   | Axis Addre<br>(For UART<br>munication | ess Selection<br>/USB com-<br>ns)                                                          | 0000h to<br>007Fh                                | _               | 0001h              | All                  | After<br>restart | Setup               | _              |  |
| Pn021            | 2                                                                                                   |                                       | ,<br>parameter (Do                                                                         | _                                                | _               | 0000h              | All                  | _                | _                   | _              |  |
|                  |                                                                                                     | not change                            | 0.)                                                                                        |                                                  | 1               |                    |                      | Continue         | 1                   |                |  |

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|------------------|-------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------|----------------------|------------------|---------------------|----------------|--|--|
| Parameter<br>No. | Size                                                                                                              | ١                        | lame                           | Setting<br>Range                                 | Setting<br>Unit                                                                                                 | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |  |
| Pn022            | 2                                                                                                                 | Reserved<br>not chang    | parameter (Do<br>le.)          | <u> </u>                                         | _                                                                                                               | 0000h              | All                  | -                | _                   | -              |  |  |
|                  | 2                                                                                                                 | Σ-V Comp<br>tion Switc   | atible Func-                   | 0000h to<br>2111h                                | _                                                                                                               | 0000h              | _                    | After<br>restart | Setup               | _              |  |  |
|                  |                                                                                                                   |                          |                                |                                                  |                                                                                                                 |                    |                      |                  |                     |                |  |  |
|                  | n.□□□X Reserved parameter (Do not change.)                                                                        |                          |                                |                                                  |                                                                                                                 |                    |                      |                  |                     |                |  |  |
|                  | Encoder Resolution Compatibility Selection                                                                        |                          |                                |                                                  |                                                                                                                 |                    |                      |                  |                     |                |  |  |
| Pn040            | n.l                                                                                                               |                          |                                | the encoder res                                  |                                                                                                                 |                    | notor.               |                  | Motor               | S              |  |  |
|                  |                                                                                                                   |                          |                                | M7J,<br>notor.                                   | Rotary                                                                                                          |                    |                      |                  |                     |                |  |  |
|                  | n.                                                                                                                |                          |                                | ameter (Do not                                   |                                                                                                                 |                    |                      |                  |                     |                |  |  |
|                  |                                                                                                                   |                          | •                              | ameter (Do not                                   | <b>,</b>                                                                                                        |                    |                      |                  |                     |                |  |  |
|                  |                                                                                                                   |                          |                                | <b>X</b>                                         |                                                                                                                 |                    |                      |                  |                     |                |  |  |
|                  | 2                                                                                                                 | Applicatio<br>Selections | n Function<br>80               | 0000h to<br>1111h                                | -                                                                                                               | 0000h              | Linear               | After<br>restart | Setup               | -              |  |  |
|                  |                                                                                                                   | 1                        |                                |                                                  | 1                                                                                                               |                    |                      | 1                | 1                   |                |  |  |
|                  |                                                                                                                   |                          | Polarity Sens                  | Polarity Sensor Selection 0 Use polarity sensor. |                                                                                                                 |                    |                      |                  |                     |                |  |  |
|                  | n                                                                                                                 |                          | 0 Us<br>1 Do                   |                                                  | — page 5-23                                                                                                     |                    |                      |                  |                     |                |  |  |
|                  |                                                                                                                   |                          | Motor Phase Sequence Selection |                                                  |                                                                                                                 |                    |                      |                  |                     | nce            |  |  |
| Pn080            | n                                                                                                                 |                          | 0 Set                          | a phase-A lead                                   | d as a pha                                                                                                      |                    |                      |                  | page 5              | -21            |  |  |
|                  | 1     Set a phase-B lead as a phase sequence of U, V, and W.       n.□X□□     Reserved parameter (Do not change.) |                          |                                |                                                  |                                                                                                                 |                    |                      |                  |                     | _              |  |  |
|                  | n                                                                                                                 |                          | •                              | •                                                | <b>,</b>                                                                                                        |                    |                      |                  | Refere              |                |  |  |
|                  |                                                                                                                   |                          |                                |                                                  | ethod for Maximum Speed or Encoder Output Pulses<br>sulate the encoder output pulse setting for a fixed maximum |                    |                      |                  |                     |                |  |  |
|                  | n                                                                                                                 | .X000                    | spe                            | eed.<br>Iculate the maxi                         | — page 17-4                                                                                                     |                    |                      |                  |                     |                |  |  |
|                  |                                                                                                                   |                          | 1 set                          |                                                  |                                                                                                                 |                    |                      |                  |                     |                |  |  |
|                  | 2                                                                                                                 | Applicatio               | n Function                     | 0000h to                                         | _                                                                                                               | 0000h              | All                  | After            | Setup               | page           |  |  |
|                  |                                                                                                                   | Selections               | \$ 81                          | 1111h                                            |                                                                                                                 | 000011             | 7.0                  | restart          | ootap               | 6-17           |  |  |
|                  |                                                                                                                   |                          | Phase-C Pu                     | lse Output Sele                                  | ection                                                                                                          |                    |                      |                  |                     |                |  |  |
|                  |                                                                                                                   | n.000X                   |                                | utput phase-C p<br>utput phase-C p               | ,                                                                                                               |                    |                      |                  | 15.                 |                |  |  |
| Pn081            |                                                                                                                   | n.00X0                   |                                | arameter (Do no                                  |                                                                                                                 |                    |                      |                  |                     |                |  |  |
|                  |                                                                                                                   | n.0X00                   | •                              | arameter (Do no                                  | •                                                                                                               | ,                  |                      |                  |                     | _              |  |  |
|                  |                                                                                                                   | n.X000                   | •                              | arameter (Do no                                  |                                                                                                                 | ,                  |                      |                  |                     | _              |  |  |
|                  |                                                                                                                   |                          |                                |                                                  |                                                                                                                 | /                  |                      |                  |                     |                |  |  |
| Pn100            | 2                                                                                                                 | Speed Lo                 | op Gain                        | 10 to 20,000                                     | 0.1 Hz                                                                                                          | 400                | All                  | Immedi-<br>ately | Tuning              | page<br>8-73   |  |  |
| Pn101            | 2                                                                                                                 | Speed Lo<br>Time Con     | op Integral<br>stant           | 15 to 51,200                                     | 0.01 ms                                                                                                         | 2000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-73   |  |  |
| Pn102            | 2                                                                                                                 | Position L               |                                | 10 to 20,000                                     | 0.1/s                                                                                                           | 400                | All                  | Immedi-<br>ately | Tuning              | page<br>8-73   |  |  |
| Pn103            | 2                                                                                                                 | Moment o                 | of Inertia Ratio               | 0 to 20,000                                      | 1%                                                                                                              | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-73   |  |  |
|                  |                                                                                                                   | Second S                 | need Loon                      | -                                                |                                                                                                                 |                    |                      | Immedi-          | 0                   | page           |  |  |
| Pn104            | 2                                                                                                                 | Gain                     | peed Loop                      | 10 to 20,000                                     | 0.1 Hz                                                                                                          | 400                | All                  | ately            | Tuning              | 8-64           |  |  |

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|                  |          | 1                        |                            |                                    | T                                   |                            |                    | Cont                 | tinued from      | previous            | s page.                       |  |
|------------------|----------|--------------------------|----------------------------|------------------------------------|-------------------------------------|----------------------------|--------------------|----------------------|------------------|---------------------|-------------------------------|--|
| Parameter<br>No. | Size     | 1                        | Name                       |                                    | Setting<br>Range                    | Setting<br>Unit            | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence                |  |
| Pn105            | 2        | Second S<br>Integral T   | peed Loo<br>ime Const      | p<br>ant                           | 15 to 51,200                        | 0.01 ms                    | 2000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-64                  |  |
| Pn106            | 2        | Second P<br>Gain         | Position Lo                | ор                                 | 10 to 20,000                        | 0.1/s                      | 400                | All                  | Immedi-<br>ately | Tuning              | page<br>8-64                  |  |
| Pn109            | 2        | Feedforwa                | ard                        |                                    | 0 to 100                            | 1%                         | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-84                  |  |
| Pn10A            | 2        | Feedforwa<br>Constant    | ard Filter T               | ime                                | 0 to 6,400                          | 0.01 ms                    | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-84                  |  |
|                  | 2        | Gain Appl<br>tions       | lication Se                | cation Selec- 0000h to _ 0000h All |                                     |                            |                    |                      | _                | Setup               | -                             |  |
|                  |          |                          |                            |                                    |                                     |                            |                    |                      | NA //            |                     |                               |  |
|                  |          |                          | Mode Sv                    | vitchi                             | ng Selection                        | When<br>Enabled            | Refere             | nce                  |                  |                     |                               |  |
|                  |          |                          | 0                          |                                    | the internal tor<br>I setting: Pn10 |                            | nce as the         | condition            |                  |                     |                               |  |
|                  |          |                          | 4                          |                                    | the speed refe<br>Pn10D).           | rence as t                 | he conditio        | on (level set-       |                  |                     |                               |  |
|                  | n        | .000X                    | 1                          |                                    | the speed refe<br>Pn181).           | rence as t                 | he conditio        | on (level set-       |                  |                     |                               |  |
|                  |          |                          | 0                          |                                    | the acceleratic<br>ng: Pn10E).      | n referenc                 | e as the c         | ondition (level      | Immedi-<br>ately | page 8              | -84                           |  |
| Pn10B            |          |                          | 2                          |                                    | the acceleratic ng: Pn182).         | n referenc                 | e as the c         | ondition (level      |                  |                     |                               |  |
|                  |          |                          | 3                          |                                    | the position de<br>Pn10F).          | eviation as                | the condit         | ion (level set-      |                  |                     |                               |  |
|                  |          |                          | 4                          | Do r                               | not use mode s                      | witching.                  |                    |                      |                  |                     |                               |  |
|                  |          |                          | Speed L                    | oop (                              | Control Method                      | ł                          |                    |                      | When<br>Enabled  | Refere              | nce                           |  |
|                  | n.□□X□ 0 |                          |                            |                                    | ontrol                              |                            | After              |                      | 70               |                     |                               |  |
|                  |          |                          |                            |                                    | control<br>erved paramete           | ers (Do not                | t change.)         |                      | restart          | page 8              | -79                           |  |
|                  | n        | n.□X□□ Reserved p        |                            |                                    | parameter (Do not change.)          |                            |                    |                      |                  |                     |                               |  |
|                  | n        | .X000                    | Reserve                    | d para                             | ameter (Do not                      | t change.)                 |                    |                      |                  |                     |                               |  |
|                  |          | 1                        |                            |                                    | 1                                   |                            |                    | 11                   |                  | 1                   | 1                             |  |
| Pn10C            | 2        | Mode Sw<br>for Torque    | e Referenc                 | e                                  | 0 to 800                            | 1%                         | 200                | All                  | Immedi-<br>ately | Tuning              | page<br>8-84                  |  |
| Pn10D            | 2        |                          | itching Lev<br>I Referenc  |                                    | 0 to 10,000                         | 1 min <sup>-1</sup>        | 0                  | Rotary               | Immedi-<br>ately | Tuning              | page<br>8-84                  |  |
| Pn10E            | 2        | Mode Sw<br>for Accele    | itching Leveration         | vel                                | 0 to 30,000                         | 1 min <sup>-1</sup> /<br>s | 0                  | Rotary               | Immedi-<br>ately | Tuning              | page<br>8-84                  |  |
| Pn10F            | 2        |                          | itching Lev<br>on Deviatio |                                    | 0 to 10,000                         | 1 refer-<br>ence<br>unit   | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-84                  |  |
| Pn11F            | 2        | Position Ir<br>Constant  | ntegral Tin                | ne                                 | 0 to 50,000                         | 0.1 ms                     | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-87                  |  |
| Pn121            | 2        |                          | ompensat                   | ion                                | 10 to 1,000                         | 1%                         | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-64,<br>page<br>8-67 |  |
| Pn122            | 2        | Second F<br>pensation    | riction Co<br>Gain         | m-                                 | 10 to 1,000                         | 1%                         | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-64,<br>page<br>8-67 |  |
| Pn123            | 2        | Friction C<br>Coefficien | ompensat<br>it             | ion                                | 0 to 100                            | 1%                         | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-67                  |  |
| Pn124            | 2        |                          | ompensat<br>y Correctio    |                                    | -10,000 to<br>10,000                | 0.1 Hz                     | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-67                  |  |
| Pn125            | 2        | Friction C<br>Gain Corr  | ompensat<br>ection         | ion                                | 1 to 1,000                          | 1%                         | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-67                  |  |
|                  | I        | 1                        |                            |                                    | 1                                   | 1                          |                    | 1                    | Continue         | <br>-               |                               |  |

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|------------------|------|----------------------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|--|--|
| Parameter<br>No. | Size | N                          | ame                                                                                               | Setting<br>Range                                                                                                                                            | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |  |
| Pn131            | 2    | Gain Switc                 | ching Time 1                                                                                      | 0 to 65,535                                                                                                                                                 | 1 ms            | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-64   |  |  |
| Pn132            | 2    | Gain Swite                 | ching Time 2                                                                                      | 0 to 65,535                                                                                                                                                 | 1 ms            | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-64   |  |  |
| Pn135            | 2    | Time 1                     | ching Waiting                                                                                     | 0 to 65,535                                                                                                                                                 | 1 ms            | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-64   |  |  |
| Pn136            | 2    | Time 2                     | ching Waiting                                                                                     | 0 to 65,535                                                                                                                                                 | 1 ms            | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-64   |  |  |
|                  | 2    | Automatic<br>ing Selection | Gain Switch-<br>ons 1                                                                             | 0000h to<br>0052h                                                                                                                                           | _               | 0000h              | All                  | Immedi-<br>ately | Tuning              | page<br>8-64   |  |  |
|                  | .    |                            | 1                                                                                                 |                                                                                                                                                             |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                            | Gain Switch                                                                                       | ng Selection                                                                                                                                                |                 |                    |                      |                  |                     |                |  |  |
|                  |      | n.DDDX                     | 0 Dis                                                                                             | able automatic                                                                                                                                              | gain swite      | ching.             |                      |                  |                     |                |  |  |
|                  |      |                            | 1 Re                                                                                              | Reserved parameter (Do not change.)                                                                                                                         |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                            | 2 En                                                                                              |                                                                                                                                                             |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                            | Cain Cuuitah                                                                                      | na Condition A                                                                                                                                              |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                            | Gain Switching Condition A         0       /COIN (Positioning Completion Output) signal turns ON. |                                                                                                                                                             |                 |                    |                      |                  |                     |                |  |  |
| Pn139            |      |                            |                                                                                                   | . 0                                                                                                                                                         | , ,             | . ,                | 8                    |                  |                     |                |  |  |
|                  |      |                            |                                                                                                   | OIN (Positioning                                                                                                                                            | , i             | 1 /                | signal turns (       | OFF.             |                     |                |  |  |
|                  |      | n.🗆 🗆 X 🗆                  | 2 /NEAR (Near Output) signal turns ON.                                                            |                                                                                                                                                             |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                            | 3 /NEAR (Near Output) signal turns OFF.                                                           |                                                                                                                                                             |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                            | 4 Position reference filter output is 0 and position reference input is OFF.                      |                                                                                                                                                             |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                            | 5 Po                                                                                              | sition reference                                                                                                                                            | input is O      | N.                 |                      |                  |                     |                |  |  |
|                  |      | n.¤X¤¤                     | Reserved pa                                                                                       | rameter (Do no                                                                                                                                              | ot change.      | )                  |                      |                  |                     |                |  |  |
|                  |      |                            | -                                                                                                 | rameter (Do no                                                                                                                                              |                 |                    |                      |                  |                     |                |  |  |
| Pn13D            |      | Current Co                 |                                                                                                   | 100 to 0.000                                                                                                                                                | 10/             | 2000               | All                  | Immedi-          | Tuning              | page           |  |  |
| Philod           | 2    | Current Ga                 | ain Levei                                                                                         | 100 to 2,000                                                                                                                                                | 1%              | 2000               | All                  | ately            | Tuning              | 8-70           |  |  |
|                  | 2    |                            | owing Con-<br>d Selections                                                                        | 0000h to<br>1121h                                                                                                                                           | -               | 0100h              | All                  | Immedi-<br>ately | Tuning              | -              |  |  |
|                  |      |                            |                                                                                                   |                                                                                                                                                             |                 |                    |                      |                  |                     |                |  |  |
|                  |      |                            | Model Following Control Selection                                                                 |                                                                                                                                                             |                 |                    |                      |                  |                     | nce            |  |  |
|                  |      | n.🗆 🗆 🗆 X                  | 0 Do not use model following control.                                                             |                                                                                                                                                             |                 |                    |                      |                  |                     | 01             |  |  |
|                  |      |                            | 1 Us                                                                                              | page 8-                                                                                                                                                     | 01              |                    |                      |                  |                     |                |  |  |
|                  |      |                            | Vibration Su                                                                                      | ppression Sele                                                                                                                                              | ction           |                    |                      |                  | Referer             | nce            |  |  |
|                  |      |                            |                                                                                                   | not perform vik                                                                                                                                             |                 | pression           |                      |                  |                     |                |  |  |
|                  |      | n.🗆🗆 X 🗆                   |                                                                                                   | rform vibration s                                                                                                                                           |                 | •                  | ecific frequenc      | 2V               | page 8-             | .81            |  |  |
| Pn140            |      |                            |                                                                                                   | rform vibration s                                                                                                                                           |                 |                    | 1                    | ,                | page o              | 01             |  |  |
|                  | -    |                            | 2 F6                                                                                              |                                                                                                                                                             | suppressio      |                    | specific freque      |                  |                     |                |  |  |
|                  |      |                            | Vibration Su                                                                                      | ppression Adju                                                                                                                                              | stment Se       | election           |                      |                  | Referer             | nce            |  |  |
|                  |      |                            |                                                                                                   | not adjust vibra                                                                                                                                            |                 |                    | tomatically du       | iring execu-     |                     |                |  |  |
|                  |      |                            | 0 tio                                                                                             | n of autotuning                                                                                                                                             | without a       | host refere        |                      |                  |                     |                |  |  |
|                  |      | n.¤X¤¤                     |                                                                                                   | st reference, an                                                                                                                                            |                 | Ŭ                  |                      |                  | page 8-             | 32             |  |  |
|                  |      |                            | 1 aut                                                                                             | Adjust vibration suppression automatically during execution of<br>autotuning without a host reference, autotuning with a host reference, and custom tuning. |                 |                    |                      |                  |                     |                |  |  |
|                  |      | n.XDDD                     | 1                                                                                                 | rameter (Do no                                                                                                                                              |                 | )                  |                      |                  |                     |                |  |  |
|                  |      |                            |                                                                                                   |                                                                                                                                                             |                 |                    |                      |                  |                     |                |  |  |
| Pn141            | 2    | Model Foll<br>trol Gain    | owing Con-                                                                                        | 10 to 20,000                                                                                                                                                | 0.1/s           | 500                | All                  | Immedi-<br>ately | Tuning              | page<br>8-81   |  |  |
| Pn142            | 2    | Model Foll<br>trol Gain C  | owing Con-<br>Correction                                                                          | 500 to 2,000                                                                                                                                                | 0.1%            | 1000               | All                  | Immedi-<br>ately | Tuning              | _              |  |  |
|                  | •    |                            |                                                                                                   | *                                                                                                                                                           | •               |                    | •                    | Continuo         | +                   |                |  |  |

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|                  |                                                 |                                   |                                        |                                                             |                 |                    |                      | tinued from      | · · · · · · · · · · · · · · · · · · · | s page.        |  |
|------------------|-------------------------------------------------|-----------------------------------|----------------------------------------|-------------------------------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------------------------|----------------|--|
| Parameter<br>No. | Size                                            | 1                                 | Name                                   | Setting<br>Range                                            | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication                   | Refer-<br>ence |  |
| Pn143            | 2                                               |                                   | llowing Con-<br>n the Forward          | 0 to 10,000                                                 | 0.1%            | 1000               | All                  | Immedi-<br>ately | Tuning                                | page<br>8-81   |  |
| Pn144            | 2                                               |                                   | llowing Con-<br>n the Reverse          | 0 to 10,000                                                 | 0.1%            | 1000               | All                  | Immedi-<br>ately | Tuning                                | page<br>8-81   |  |
| Pn145            | 2                                               | Vibration<br>Frequenc             | Suppression 1<br>y A                   | 10 to 2,500                                                 | 0.1 Hz          | 500                | All                  | Immedi-<br>ately | Tuning                                | page<br>8-57   |  |
| Pn146            | 2                                               | Vibration<br>Frequence            | Suppression 1<br>y B                   | 10 to 2,500                                                 | 0.1 Hz          | 700                | All                  | Immedi-<br>ately | Tuning                                | page<br>8-57   |  |
| Pn147            | 2                                               | Model Fo<br>trol Speed<br>Compens | llowing Con-<br>d Feedforward<br>ation | 0 to 10,000                                                 | 0.1%            | 1000               | All                  | Immedi-<br>ately | Tuning                                | page<br>8-81   |  |
| Pn148            | 2                                               | Second M<br>ing Contro            | lodel Follow-<br>ol Gain               | 10 to 20,000                                                | 0.1/s           | 500                | All                  | Immedi-<br>ately | Tuning                                | _              |  |
| Pn149            | 2                                               |                                   | Iodel Follow-<br>ol Gain Correc·       | 500 to 2,000                                                | 0.1%            | 1000               | All                  | Immedi-<br>ately | Tuning                                | -              |  |
| Pn14A            | 2                                               | Vibration<br>Frequenc             | Suppression 2<br>y                     | 10 to 2,000                                                 | 0.1 Hz          | 800                | All                  | Immedi-<br>ately | Tuning                                | page<br>8-57   |  |
| Pn14B            | 2                                               | Vibration<br>Correction           | Suppression 2<br>n                     | 10 to 1,000                                                 | 1%              | 100                | All                  | Immedi-<br>ately | Tuning                                | page<br>8-57   |  |
|                  | 2                                               | Control-R<br>tions                | elated Selec-                          | 0000h to<br>0021h                                           | -               | 0021h              | All                  | After<br>restart | Tuning                                | -              |  |
|                  |                                                 |                                   | Model Follov                           | Reference                                                   |                 |                    |                      |                  |                                       |                |  |
|                  | n                                               | .000X                             |                                        | e model followin<br>e model followin                        | 0               | <i>.</i>           |                      |                  | page 8                                | -83            |  |
| Pn14F            |                                                 |                                   | Tuning-less                            | Type Selection                                              |                 |                    |                      |                  | Refere                                | nce            |  |
|                  |                                                 |                                   |                                        | e tuning-less typ<br>e tuning-less typ<br>e tuning-less typ | be 2.           |                    |                      |                  | page 8-12                             |                |  |
|                  | n.🗆X🗆 🗆                                         |                                   | Reserved pa                            | rameter (Do not                                             | t change.)      |                    |                      |                  |                                       |                |  |
|                  | n                                               | .X000                             | Reserved pa                            | rameter (Do no                                              | t change.)      |                    |                      |                  |                                       |                |  |
|                  | 2                                               |                                   | onance Con-<br>ed Selections           | 0000h to<br>0011h                                           | -               | 0010h              | All                  | Immedi-<br>ately | Tuning                                | -              |  |
|                  | Anti-Resonance Control Selection                |                                   |                                        |                                                             |                 |                    |                      |                  |                                       | _              |  |
|                  | n.                                              | .000X                             |                                        | not use anti-res                                            | Refere          |                    |                      |                  |                                       |                |  |
|                  |                                                 |                                   | 1 Use                                  |                                                             |                 |                    |                      |                  |                                       |                |  |
|                  |                                                 |                                   | Anti-Resonar                           | nce Control Adj                                             | ustment S       | election           |                      |                  | Refere                                | nce            |  |
| Pn160            | n.                                              | .00X0                             | 0 tion                                 | not adjust anti-i<br>of autotuning w<br>rence, and cust     | vithout a h     | ost referen        |                      |                  | – page 8                              | 21             |  |
|                  |                                                 |                                   | 1 aut                                  | ust anti-resonar<br>otuning without<br>e, and custom        | a host refe     |                    |                      |                  | page o                                | -51            |  |
|                  | n.                                              | .0X00                             | Reserved par                           | rameter (Do not                                             | change.)        |                    |                      |                  |                                       |                |  |
|                  | n.                                              | .X000                             | Reserved par                           | rameter (Do not                                             | change.)        |                    |                      |                  |                                       |                |  |
| Pn161            | 2                                               | Anti-Resc<br>quency               | nance Fre-                             | 10 to 20,000                                                | 0.1 Hz          | 1000               | All                  | Immedi-<br>ately | Tuning                                | page<br>8-49   |  |
| Pn162            | 2                                               | Anti-Resc                         | nance Gain                             | 1 to 1,000                                                  | 1%              | 100                | All                  | Immedi-          | Tuning                                | page<br>8-49   |  |
|                  | Correction 1001,000 178 100 All ately Continued |                                   |                                        |                                                             |                 |                    |                      |                  | l<br>d on nex                         |                |  |

| Parameter<br>No. | Size | Name                                                     | Setting<br>Range   | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|------------------|------|----------------------------------------------------------|--------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
| Pn163            | 2    | Anti-Resonance Damp-<br>ing Gain                         | 0 to 300           | 1%              | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-49   |
| Pn164            | 2    | Anti-Resonance Filter<br>Time Constant 1 Cor-<br>rection | -1,000 to<br>1,000 | 0.01 ms         | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-49   |
| Pn165            | 2    | Anti-Resonance Filter<br>Time Constant 2 Cor-<br>rection | -1,000 to<br>1,000 | 0.01 ms         | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-49   |
| Pn166            | 2    | Anti-Resonance Damp-<br>ing Gain 2                       | 0 to 1,000         | 1%              | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-52   |
|                  | 2    | Tuning-less Function-<br>Related Selections              | 0000h to<br>2711h  | -               | 1401h              | All                  | -                | Setup               | page<br>8-11   |
|                  |      |                                                          |                    |                 |                    |                      |                  | Whe                 | n              |

|        | Tuning-l                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | When<br>Enabled                                                                         |                                                                                                                                                                                                                                                   |  |  |  |  |  |  |  |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|
| n.     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Disable tuning-less function.                                                           | After                                                                                                                                                                                                                                             |  |  |  |  |  |  |  |
|        | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Enable tuning-less function.                                                            | restart                                                                                                                                                                                                                                           |  |  |  |  |  |  |  |
| n.□□X□ | n.□□X□ Reserved parameter (Do not change.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                         |                                                                                                                                                                                                                                                   |  |  |  |  |  |  |  |
|        | Rigidity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Level                                                                                   | When<br>Enabled                                                                                                                                                                                                                                   |  |  |  |  |  |  |  |
|        | 0 to 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Set the rigidity level.                                                                 | Immedi-<br>ately                                                                                                                                                                                                                                  |  |  |  |  |  |  |  |
|        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 14/1                                                                                    |                                                                                                                                                                                                                                                   |  |  |  |  |  |  |  |
|        | Tuning-l                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ess Load Level                                                                          | When<br>Enabled                                                                                                                                                                                                                                   |  |  |  |  |  |  |  |
|        | 0 to 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Set the load level for the tuning-less function.                                        | Immedi-<br>ately                                                                                                                                                                                                                                  |  |  |  |  |  |  |  |
|        | n. 🗆 🗆 X 🗆 n. 🗆 X 🗆 n. 🗆 X 🗆 D III n. X 🗠 D III n. X III | n.□□□X 0<br>1<br>n.□□X□ Reserver<br>n.□X□ Rigidity<br>n.□X□□ 0 to 7<br>n.X□□□ Tuning-le | 0     Disable tuning-less function.       1     Enable tuning-less function.       n.□X□     Reserved parameter (Do not change.)       n.□X□□     Rigidity Level       0 to 7     Set the rigidity level.       n.X□□□     Tuning-less Load Level |  |  |  |  |  |  |  |

| Pn181 | 2 | Mode Switching Level<br>for Speed Reference         | 0 to 10,000            | 1 mm/s                               | 0                   | Linear | Immedi-<br>ately                                                     | Tuning | page<br>8-85 |
|-------|---|-----------------------------------------------------|------------------------|--------------------------------------|---------------------|--------|----------------------------------------------------------------------|--------|--------------|
| Pn182 | 2 | Mode Switching Level<br>for Acceleration            | 0 to 30,000            | 1 mm/s <sup>2</sup>                  | 0                   | Linear | Immedi-<br>ately                                                     | Tuning | page<br>8-85 |
| Pn205 | 2 | Multiturn Limit                                     | 0 to 65,535            | 1 rev                                | 65535 <sup>*2</sup> | Rotary | After<br>restart                                                     | Setup  | page<br>6-25 |
| Pn207 | 2 | Reserved parameter<br>(Do not change.)              | -                      | -                                    | 0010h*1             | All    | -                                                                    | -      | -            |
| Pn20A | 4 | Number of External<br>Encoder Scale Pitches         | 4 to<br>1,048,576      | 1 scale<br>pitch/<br>revolu-<br>tion | 32768               | Rotary | After<br>restart                                                     | Setup  | page<br>10-6 |
| Pn20E | 4 | Electronic Gear Ratio<br>(Numerator)                | 1 to<br>1,073,741,824  | 1                                    | 64                  | All    | After<br>restart                                                     | Setup  | page<br>5-42 |
| Pn210 | 4 | Electronic Gear Ratio<br>(Denominator)              | 1 to<br>1,073,741,824  | 1                                    | 1                   | All    | After<br>restart                                                     | Setup  | page<br>5-42 |
| Pn212 | 4 | Number of Encoder<br>Output Pulses                  | 16 to<br>1,073,741,824 | 1 P/Rev                              | 2048                | Rotary | After<br>restart                                                     | Setup  | page<br>6-20 |
| Pn217 | 2 | Average Movement<br>Time of Position Refer-<br>ence | 0 to 10,000            | 0.1 ms                               | 0                   | All    | After the<br>change<br>and also<br>after the<br>motor has<br>stopped | Setup  | -            |

Continued on next page.

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|                  |                                            |                                    |                                                                        | 1                                                                               |                                                                                |                    | Con                  | tinued from      | n previous          | s page        |  |  |  |
|------------------|--------------------------------------------|------------------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------|----------------------|------------------|---------------------|---------------|--|--|--|
| Parameter<br>No. | Size                                       | Na                                 | ame                                                                    | Setting<br>Range                                                                | Setting<br>Unit                                                                | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer<br>ence |  |  |  |
|                  | 2                                          | Fully-closed<br>Selections         | d Control                                                              | 0000h to<br>1003h                                                               | -                                                                              | 0000h              | Rotary               | After<br>restart | Setup               | page<br>10-10 |  |  |  |
|                  |                                            |                                    |                                                                        |                                                                                 |                                                                                |                    |                      |                  |                     |               |  |  |  |
|                  |                                            | n.DDDX                             | Reserved par                                                           | rameter (Do no                                                                  | ot change.                                                                     | )                  |                      |                  |                     |               |  |  |  |
| Pn22A            |                                            | n.□□X□                             | Reserved par                                                           | rameter (Do no                                                                  | ot change.                                                                     | )                  |                      |                  |                     |               |  |  |  |
|                  | n.□X□□ Reserved parameter (Do not change.) |                                    |                                                                        |                                                                                 |                                                                                |                    |                      |                  |                     |               |  |  |  |
|                  |                                            | n.X000                             | Fully-closed Control Speed Feedback Selection                          |                                                                                 |                                                                                |                    |                      |                  |                     |               |  |  |  |
|                  |                                            |                                    | 0     Use motor encoder speed.       1     Use external encoder speed. |                                                                                 |                                                                                |                    |                      |                  |                     |               |  |  |  |
| Pn230            | 2                                          | Reserved p<br>(Do not cha          |                                                                        | -                                                                               | -                                                                              | 0000h              | All                  | _                | _                   | -             |  |  |  |
| Pn231            | 4                                          | Reserved p<br>(Do not cha          | arameter<br>Inge.)                                                     | _                                                                               | _                                                                              | 0                  | All                  | -                | _                   | -             |  |  |  |
| Pn233            | 2                                          | Reserved p<br>(Do not cha          |                                                                        | _                                                                               | -                                                                              | 0                  | All                  | _                | _                   | -             |  |  |  |
| Pn281            | 2                                          | Encoder Ou<br>tion                 | utput Resolu-                                                          | 1 to 4,096                                                                      | 1 edge/<br>pitch                                                               | 20                 | All                  | After<br>restart | Setup               | page<br>6-21  |  |  |  |
| Pn282            | 4                                          | Linear Enco<br>Pitch               | oder Scale                                                             | 0 to<br>6,553,600                                                               | 0.01<br>μm                                                                     | 0                  | Linear               | After<br>restart | Setup               | page<br>5-16  |  |  |  |
| Pn304            | 2                                          | Jog Operation Speed                |                                                                        | 0 to 10,000                                                                     | Rotary:<br>1 min <sup>-1</sup><br>Direct<br>Drive:<br>0.1<br>min <sup>-1</sup> | 500                | Rotary               | Immedi-<br>ately | Setup               | page<br>7-6   |  |  |  |
| Pn305            | 2                                          | Soft Start Acceleration Time       |                                                                        | 0 to 10,000                                                                     | 1 ms                                                                           | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>7-6   |  |  |  |
| Pn306            | 2                                          | Soft Start D<br>Time               | eceleration                                                            | 0 to 10,000                                                                     | 1 ms                                                                           | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>7-6   |  |  |  |
| Pn308            | 2                                          | Speed Feed<br>Time Const           |                                                                        | 0 to 65,535                                                                     | 0.01 ms                                                                        | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>8-79  |  |  |  |
| Pn30A            | 2                                          | Deceleration<br>Servo OFF<br>Stops |                                                                        | 0 to 10,000                                                                     | 1 ms                                                                           | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>5-38  |  |  |  |
| Pn30C            | 2                                          | Reserved pa<br>not change          | arameter (Do<br>.)                                                     | -                                                                               | -                                                                              | 0                  | All                  | -                | _                   | -             |  |  |  |
|                  | 2                                          | Vibration De<br>Selections         | etection                                                               | 0000h to<br>0002h                                                               | _                                                                              | 0000h              | All                  | Immedi-<br>ately | Setup               | page<br>6-32  |  |  |  |
|                  |                                            |                                    |                                                                        |                                                                                 |                                                                                |                    |                      |                  |                     |               |  |  |  |
|                  |                                            |                                    | Vibration Det                                                          | ection Selection                                                                | on                                                                             |                    |                      |                  |                     |               |  |  |  |
|                  |                                            | n.DDDX                             |                                                                        | not detect vibr                                                                 |                                                                                |                    |                      |                  |                     |               |  |  |  |
| Pn310            |                                            | -                                  |                                                                        | put a warning<br>put an alarm (/                                                |                                                                                |                    |                      |                  |                     |               |  |  |  |
|                  |                                            | n.DDXD                             | Reserved par                                                           | Output an alarm (A.520) if vibration is detected.<br>parameter (Do not change.) |                                                                                |                    |                      |                  |                     |               |  |  |  |
|                  |                                            | n.¤X¤¤                             | Reserved par                                                           | parameter (Do not change.)                                                      |                                                                                |                    |                      |                  |                     |               |  |  |  |
|                  | 1                                          | n.XOOO                             | Reserved par                                                           | rameter (Do no                                                                  | ot change.                                                                     | )                  |                      |                  |                     |               |  |  |  |
| Pn311            | 2                                          | Vibration De sitivity              | etection Sen-                                                          | 50 to 500                                                                       | 1%                                                                             | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>6-32  |  |  |  |
| Pn312            | 2                                          | Vibration De<br>Level              | etection                                                               | 0 to 5,000                                                                      | 1 min <sup>-1</sup>                                                            | 50                 | Rotary               | Immedi-<br>ately | Tuning              | page<br>6-32  |  |  |  |
| Pn316            | 2                                          | Maximum N                          | Notor Speed                                                            | 0 to 65,535                                                                     | 1 min <sup>-1</sup>                                                            | 10000              | Rotary               | After<br>restart | Setup               | page<br>6-14  |  |  |  |
| Pn316            | 2                                          |                                    | Notor Speed                                                            | 0 to 65,535                                                                     | 1 min <sup>-1</sup>                                                            | 10000              | Rotary               | After            |                     | <             |  |  |  |

|                  | Continued from previous pag |                                                               |                   |                 |                    |                      |                  |                     | s paye.        |
|------------------|-----------------------------|---------------------------------------------------------------|-------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No. | Size                        | Name                                                          | Setting<br>Range  | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
| Pn324            | 2                           | Moment of Inertia Cal-<br>culation Starting Level             | 0 to 20,000       | 1%              | 300                | All                  | Immedi-<br>ately | Setup               | page<br>8-30   |
| Pn383            | 2                           | Jog Operation Speed                                           | 0 to 10,000       | 1 mm/s          | 50                 | Linear               | Immedi-<br>ately | Setup               | page<br>7-6    |
| Pn384            | 2                           | Vibration Detection<br>Level                                  | 0 to 5,000        | 1 mm/s          | 10                 | Linear               | Immedi-<br>ately | Tuning              | page<br>6-32   |
| Pn385            | 2                           | Maximum Motor Speed                                           | 1 to 100          | 100<br>mm/s     | 50                 | Linear               | After<br>restart | Setup               | page<br>6-14   |
| Pn401            | 2                           | First Stage First Torque<br>Reference Filter Time<br>Constant | 0 to 65,535       | 0.01 ms         | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-76   |
| Pn402            | 2                           | Forward Torque Limit                                          | 0 to 800          | 1%*3            | 800                | Rotary               | Immedi-<br>ately | Setup               | page<br>6-22   |
| Pn403            | 2                           | Reverse Torque Limit                                          | 0 to 800          | 1%*3            | 800                | Rotary               | Immedi-<br>ately | Setup               | page<br>6-22   |
| Pn404            | 2                           | Reserved parameter (Do not change.)                           | _                 | -               | 100                | All                  | _                | _                   | -              |
| Pn405            | 2                           | Reserved parameter (Do not change.)                           | Ι                 | _               | 100                | All                  | _                | _                   | -              |
| Pn406            | 2                           | Emergency Stop Torque                                         | 0 to 800          | 1%*3            | 800                | All                  | Immedi-<br>ately | Setup               | page<br>5-37   |
| Pn407            | 2                           | Reserved parameter (Do not change.)                           | -                 | -               | 10000              | Rotary               | -                | -                   | -              |
|                  | 2                           | Torque-Related Func-<br>tion Selections                       | 0000h to<br>1111h | _               | 0000h              | All                  | _                | Setup               |                |

|      |        | Notch F  | Filter Selection 1                 | When<br>Enabled | Reference |
|------|--------|----------|------------------------------------|-----------------|-----------|
|      | n.DDDX | 0        | Disable first stage notch filter.  | Immedi-         | page 9 76 |
|      |        | 1        | Enable first stage notch filter.   | ately           | page 8-76 |
|      | n.□□X□ | Reserve  | ed parameter (Do not change.)      |                 |           |
| n408 |        | Notch F  | Filter Selection 2                 | When<br>Enabled | Reference |
|      | n.□X□□ | 0        | Disable second stage notch filter. | Immedi-         | page 8-76 |
|      |        | 1        | Enable second stage notch filter.  | ately           | page 0-70 |
|      |        | Friction | Compensation Function Selection    | When<br>Enabled | Reference |
|      | n.X□□□ | 0        | Disable friction compensation.     | Immedi-         | nogo 9 67 |
|      |        | 1        | Enable friction compensation.      | ately           | page 8-67 |

| Pn409 | 2 | First Stage Notch Filter<br>Frequency                       | 50 to 5,000  | 1 Hz  | 5000 | All | Immedi-<br>ately | Tuning | page<br>8-76 |
|-------|---|-------------------------------------------------------------|--------------|-------|------|-----|------------------|--------|--------------|
| Pn40A | 2 | First Stage Notch Filter<br>Q Value                         | 50 to 1,000  | 0.01  | 70   | All | Immedi-<br>ately | Tuning | page<br>8-76 |
| Pn40B | 2 | First Stage Notch Filter<br>Depth                           | 0 to 1,000   | 0.001 | 0    | All | Immedi-<br>ately | Tuning | page<br>8-76 |
| Pn40C | 2 | Second Stage Notch Fil-<br>ter Frequency                    | 50 to 5,000  | 1 Hz  | 5000 | All | Immedi-<br>ately | Tuning | page<br>8-76 |
| Pn40D | 2 | Second Stage Notch Fil-<br>ter Q Value                      | 50 to 1,000  | 0.01  | 70   | All | Immedi-<br>ately | Tuning | page<br>8-76 |
| Pn40E | 2 | Second Stage Notch Fil-<br>ter Depth                        | 0 to 1,000   | 0.001 | 0    | All | Immedi-<br>ately | Tuning | page<br>8-76 |
| Pn40F | 2 | Second Stage Second<br>Torque Reference Filter<br>Frequency | 100 to 5,000 | 1 Hz  | 5000 | All | Immedi-<br>ately | Tuning | page<br>8-76 |
| Pn410 | 2 | Second Stage Second<br>Torque Reference Filter<br>Q Value   | 50 to 100    | 0.01  | 50   | All | Immedi-<br>ately | Tuning | page<br>8-76 |

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|                  |                                    |                                            |                                          |                                     | 1               |                    |                      | tinued from      | n previous          | s page.        |  |
|------------------|------------------------------------|--------------------------------------------|------------------------------------------|-------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|--|
| Parameter<br>No. | Size                               |                                            | ame                                      | Setting<br>Range                    | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |
| Pn412            | 2                                  | First Stage<br>Torque Ref<br>Time Cons     | ference Filter                           | 0 to 65,535                         | 0.01 ms         | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-64   |  |
|                  | 2                                  | Torque-Re<br>tion Select                   | lated Func-<br>ions 2                    | 0000h to<br>1111h                   | -               | 0000h              | All                  | Immedi-<br>ately | Setup               | page<br>8-78   |  |
|                  |                                    |                                            |                                          |                                     |                 |                    |                      |                  |                     |                |  |
|                  |                                    |                                            | Notch Filter S                           | Selection 3                         |                 |                    |                      |                  |                     |                |  |
|                  |                                    | n.🗆 🗆 🗆 X                                  |                                          | able third stage<br>ble third stage |                 |                    |                      |                  |                     |                |  |
|                  |                                    |                                            | Notch Filter S                           | Selection 4                         |                 |                    |                      |                  |                     |                |  |
| Pn416            |                                    | n.🗆 🗆 X 🗆                                  | 0     Disable fourth stage notch filter. |                                     |                 |                    |                      |                  |                     |                |  |
|                  |                                    |                                            | 1 Ena                                    | ble fourth stag                     | e notch fil     | ter.               |                      |                  |                     |                |  |
|                  |                                    | Notch Filter Selection 5                   |                                          |                                     |                 |                    |                      |                  |                     |                |  |
|                  |                                    | n.¤X¤¤                                     |                                          | able fifth stage                    |                 |                    |                      |                  |                     |                |  |
|                  | 1 Enable fifth stage notch filter. |                                            |                                          |                                     |                 |                    |                      |                  |                     | _              |  |
|                  |                                    | n.XDDD Reserved parameter (Do not change.) |                                          |                                     |                 |                    |                      |                  |                     |                |  |
| Pn417            | 2                                  | Third Stage<br>Frequency                   | e Notch Filter                           | 50 to 5,000                         | 1 Hz            | 5000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-78   |  |
| Pn418            | 2                                  | Third Stage<br>Q Value                     | e Notch Filter                           | 50 to 1,000                         | 0.01            | 70                 | All                  | Immedi-<br>ately | Tuning              | page<br>8-78   |  |
| Pn419            | 2                                  | Third Stage<br>Depth                       | e Notch Filter                           | 0 to 1,000                          | 0.001           | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-78   |  |
| Pn41A            | 2                                  | Fourth Sta<br>ter Freque                   | ge Notch Fil-<br>ncy                     | 50 to 5,000                         | 1 Hz            | 5000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-78   |  |
| Pn41B            | 2                                  | Fourth Sta<br>ter Q Value                  | ge Notch Fil-                            | 50 to 1,000                         | 0.01            | 70                 | All                  | Immedi-<br>ately | Tuning              | page<br>8-78   |  |
| Pn41C            | 2                                  | Fourth Sta<br>ter Depth                    | ge Notch Fil-                            | 0 to 1,000                          | 0.001           | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-78   |  |
| Pn41D            | 2                                  | Frequency                                  |                                          | 50 to 5,000                         | 1 Hz            | 5000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-78   |  |
| Pn41E            | 2                                  | Q Value                                    | Notch Filter                             | 50 to 1,000                         | 0.01            | 70                 | All                  | Immedi-<br>ately | Tuning              | page<br>8-78   |  |
| Pn41F            | 2                                  | Depth                                      | Notch Filter                             | 0 to 1,000                          | 0.001           | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-77   |  |
|                  | 2                                  | Speed Rip<br>sation Sele                   | ple Compen-<br>ections                   | 0000h to<br>1111h                   | -               | 0000h              | Rotary               | -                | Setup               | page<br>8-62   |  |
|                  |                                    |                                            |                                          |                                     |                 |                    |                      |                  |                     |                |  |
|                  |                                    |                                            | Speed Ripple                             | Compensatio                         | on Functio      | n Selectio         | n                    |                  | Whe<br>Enab         |                |  |
|                  |                                    | n.□□□X                                     |                                          | able speed ripp<br>ble speed ripp   |                 |                    |                      |                  | Imme<br>atel        |                |  |
|                  |                                    |                                            | Speed Ripple<br>tion Selectior           | Compensatio                         | on Informa      | tion Disag         | reement War          | ning Detec-      | Whe<br>Enab         |                |  |
| Pn423            |                                    | n.🗆🗆 X 🗆                                   |                                          | ect A.942 aları                     | ms.             |                    |                      |                  | Afte                |                |  |
|                  |                                    |                                            | 1 Do                                     | not detect A.9                      | 42 alarms.      |                    |                      |                  | resta               |                |  |
|                  |                                    |                                            | Speed Ripple                             | Compensatio                         | on Enable       | Condition          | Selection            |                  | Whe<br>Enabl        |                |  |
|                  |                                    | n.¤X¤¤                                     | · ·                                      | ed reference<br>or speed            |                 |                    |                      |                  | Afte<br>resta       |                |  |
|                  |                                    |                                            |                                          | •                                   |                 |                    |                      |                  | 10010               |                |  |
|                  |                                    | n.XDDD                                     | Reserved par                             | ameter (Do no                       | ot change.      | )                  |                      |                  |                     |                |  |
|                  |                                    |                                            |                                          |                                     |                 |                    |                      |                  |                     |                |  |

|                                           |                                           |                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                          |                                                                                                                                                         |                                                                                                              |                                                    | tinued from                                                                             |                                                  | page                          |  |  |
|-------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------|--|--|
| Parameter<br>No.                          | Size                                      | N                                                                                                                                                                       | lame                                                                                                                                                                                                                                                                                                                  | Setting<br>Range                                                                                                                                                                                                                                         | Setting<br>Unit                                                                                                                                         | Default<br>Setting                                                                                           | Applicable<br>Motors                               | When<br>Enabled                                                                         | Classi-<br>fication                              | Refer<br>ence                 |  |  |
| Pn424                                     | 2                                         | Torque Lin<br>cuit Voltag                                                                                                                                               | nit at Main Cir-<br>ge Drop                                                                                                                                                                                                                                                                                           | 0 to 100                                                                                                                                                                                                                                                 | 1%*3                                                                                                                                                    | 50                                                                                                           | All                                                | Immedi-<br>ately                                                                        | Setup                                            | page<br>6-13                  |  |  |
| Pn425                                     | 2                                         |                                                                                                                                                                         | ime for Torque<br>ain Circuit<br>rop                                                                                                                                                                                                                                                                                  | 0 to 1,000                                                                                                                                                                                                                                               | 1 ms                                                                                                                                                    | 100                                                                                                          | All                                                | Immedi-<br>ately                                                                        | Setup                                            | page<br>6-13                  |  |  |
| Pn426                                     | 2                                         | Reserved not chang                                                                                                                                                      | parameter (Do<br>ie.)                                                                                                                                                                                                                                                                                                 | _                                                                                                                                                                                                                                                        | _                                                                                                                                                       | 0                                                                                                            | All                                                | _                                                                                       | _                                                | -                             |  |  |
| Pn427                                     | 2                                         |                                                                                                                                                                         | ople Compen-<br>able Speed                                                                                                                                                                                                                                                                                            | 0 to 10,000                                                                                                                                                                                                                                              | 1 min <sup>-1</sup>                                                                                                                                     | 0                                                                                                            | Rotary                                             | Immedi-<br>ately                                                                        | Tuning                                           | page<br>8-62                  |  |  |
| Pn456                                     | 2                                         | Sweep To<br>ence Amp                                                                                                                                                    | rque Refer-<br>Ilitude                                                                                                                                                                                                                                                                                                | 1 to 800                                                                                                                                                                                                                                                 | 1%                                                                                                                                                      | 15                                                                                                           | All                                                | Immedi-<br>ately                                                                        | Tuning                                           | page<br>8-93                  |  |  |
|                                           | 2                                         | Notch Filte<br>Selections                                                                                                                                               | er Adjustment<br>3 1                                                                                                                                                                                                                                                                                                  | 0000h to<br>0101h                                                                                                                                                                                                                                        | _                                                                                                                                                       | 0101h                                                                                                        | All                                                | Immedi-<br>ately                                                                        | Tuning                                           | page<br>8-14,<br>page<br>8-31 |  |  |
|                                           |                                           | n.000X                                                                                                                                                                  | 0 Do<br>tuni<br>tuni                                                                                                                                                                                                                                                                                                  | Adjustment Sel<br>not adjust the f<br>ng without a ho<br>ng.<br>ust the first sta<br>nout a host refe                                                                                                                                                    | irst stage<br>ost referen<br>ge notch f                                                                                                                 | ce, autotui                                                                                                  | ning with a ho                                     | execution c                                                                             | , and cust                                       | om<br>ng                      |  |  |
| Pn460                                     |                                           | n.DDXD                                                                                                                                                                  | Reserved parameter (Do not change.)                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                          |                                                                                                                                                         |                                                                                                              |                                                    |                                                                                         |                                                  |                               |  |  |
|                                           |                                           | n.¤X¤¤                                                                                                                                                                  | auto                                                                                                                                                                                                                                                                                                                  | otuning with a l                                                                                                                                                                                                                                         | nost refere                                                                                                                                             | nce, and c                                                                                                   | ustom tuning                                       |                                                                                         |                                                  |                               |  |  |
|                                           |                                           | n.UXUU                                                                                                                                                                  | 1 Adju<br>1 tion<br>auto                                                                                                                                                                                                                                                                                              | att the second<br>is enabled or o<br>otuning with a l<br>ameter (Do no                                                                                                                                                                                   | stage not<br>during exe<br>host refere                                                                                                                  | ch filter au<br>cution of a<br>nce, and c                                                                    | tomatically wh<br>utotuning with                   | nen the tunin<br>hout a host r                                                          |                                                  | )C-                           |  |  |
|                                           |                                           | n.X000                                                                                                                                                                  | 1     Adjution       1     tion       Reserved par       pmpensation-                                                                                                                                                                                                                                                 | ust the second<br>is enabled or o<br>ptuning with a l                                                                                                                                                                                                    | stage not<br>during exe<br>host refere                                                                                                                  | ch filter au<br>cution of a<br>nce, and c                                                                    | tomatically wh<br>utotuning with                   | nen the tunin<br>hout a host r                                                          |                                                  | page<br>8-69                  |  |  |
| ²n475                                     | 2                                         | n.XDDD<br>Gravity Co<br>Related So<br>n.DDX<br>n.DDX                                                                                                                    | 1     Adjution<br>auto<br>auto       Reserved par       ompensation-<br>elections       Gravity Comp       0     Disional<br>Disional       1     Enand       Reserved par                                                                                                                                            | ust the second<br>is enabled or o<br>otuning with a l<br>ameter (Do no<br>0000h to<br>0001h<br>eensation Selec<br>able gravity con<br>able gravity con<br>ameter (Do not                                                                                 | stage not<br>during exe<br>host refere<br>t change.<br>-<br>tion<br>mpensation<br>npensation<br>change.)                                                | ch filter au<br>cution of a<br>nce, and c<br>0000h<br>0000h                                                  | tomatically with<br>utotuning with<br>ustom tuning | hen the tunin<br>hout a host r<br>After                                                 | eference,                                        | page                          |  |  |
| Pn475                                     | 2                                         | n.XDDD<br>Gravity Cc<br>Related Sa<br>n.DDDX                                                                                                                            | 1     Adjution<br>auto<br>auto       Reserved par       ompensation-<br>elections       Gravity Comp       0     Disional<br>Disional       1     Enand       Reserved par                                                                                                                                            | ust the second<br>is enabled or of<br>otuning with a l<br>ameter (Do no<br>0000h to<br>0001h<br>ensation Selec<br>able gravity con<br>able gravity con                                                                                                   | stage not<br>during exe<br>host refere<br>t change.<br>-<br>tion<br>mpensation<br>npensation<br>change.)                                                | ch filter au<br>cution of a<br>nce, and c<br>0000h<br>0000h                                                  | tomatically with<br>utotuning with<br>ustom tuning | hen the tunin<br>hout a host r<br>After                                                 | eference,                                        | page                          |  |  |
| Pn475                                     | 2                                         | n.XDDD<br>Gravity Co<br>Related So<br>n.DDX<br>n.DDX                                                                                                                    | 1     Adjution<br>auto       Reserved par       ompensation-<br>elections       Gravity Comp       0     Disc       1     Ena       Reserved par       Reserved par                                                                                                                                                   | ust the second<br>is enabled or o<br>otuning with a l<br>ameter (Do no<br>0000h to<br>0001h<br>eensation Selec<br>able gravity con<br>able gravity con<br>ameter (Do not                                                                                 | stage not<br>during exe<br>host refere<br>t change.<br>tion<br>mpensatio<br>change.)<br>change.)                                                        | ch filter au<br>cution of a<br>nce, and c<br>0000h<br>0000h                                                  | tomatically with<br>utotuning with<br>ustom tuning | hen the tunin<br>hout a host r<br>After                                                 | eference,                                        | page                          |  |  |
|                                           | 2                                         | n.XDDD<br>Gravity Cc<br>Related So<br>n.DDDX<br>n.DDDX<br>n.DDDX<br>n.XDD                                                                                               | 1     Adjution<br>auto       Reserved par       ompensation-<br>elections       Gravity Comp       0     Disc       1     Ena       Reserved par       Reserved par                                                                                                                                                   | ust the second<br>is enabled or o<br>otuning with a l<br>ameter (Do no<br>0000h to<br>0001h<br>eensation Selec<br>able gravity con<br>able gravity cor<br>ameter (Do not<br>ameter (Do not                                                               | stage not<br>during exe<br>host refere<br>t change.<br>tion<br>mpensatio<br>change.)<br>change.)                                                        | ch filter au<br>cution of a<br>nce, and c<br>0000h<br>0000h                                                  | tomatically with<br>utotuning with<br>ustom tuning | hen the tunin<br>hout a host r<br>After                                                 | eference,                                        | page<br>8-69                  |  |  |
| Pn476                                     | 2                                         | n.XDDD<br>Gravity Cc<br>Related Sc<br>n.DDX<br>n.DDX<br>n.DDX<br>n.XDD<br>n.XDD<br>Gravity Cc<br>Torque                                                                 | 1     Adjution<br>auto<br>auto<br>auto       Reserved par       ompensation-<br>elections       Gravity Comp<br>0       0       1       Enar       Reserved par       Reserved par       Reserved par       Reserved par       pompensation       parameter (Do                                                       | ust the second<br>is enabled or of<br>otuning with a l<br>ameter (Do no<br>0000h to<br>0001h<br>ensation Selec<br>able gravity con<br>able gravity con<br>able gravity con<br>ameter (Do not<br>ameter (Do not<br>ameter (Do not                         | stage not<br>during exe<br>host refere<br>t change.<br>tion<br>mpensation<br>change.)<br>change.)                                                       | ch filter au<br>cution of a<br>nce, and c<br>0000h<br>n.<br>n.                                               | All                                                | After<br>restart                                                                        | Setup                                            | page<br>8-69                  |  |  |
| Pn476<br>Pn480                            | 2                                         | n.XDDD<br>Gravity Cc<br>Related Se<br>n.DDX<br>n.DDX<br>n.DDX<br>n.XDD<br>n.XDD<br>Gravity Cc<br>Torque<br>Reserved                                                     | 1     Adjution<br>auto<br>auto<br>Adjution<br>auto<br>Adjution       Reserved para       Gravity Comp<br>0       0       1       Reserved para       Reserved para       Reserved para       Reserved para       parameter (Do<br>e.)                                                                                 | ust the second<br>is enabled or of<br>otuning with a l<br>ameter (Do no<br>0000h to<br>0001h<br>ensation Selec<br>able gravity con<br>able gravity con<br>able gravity con<br>ameter (Do not<br>ameter (Do not<br>ameter (Do not                         | stage not<br>during exe<br>host refere<br>t change.<br>-<br>tion<br>mpensation<br>change.)<br>change.)<br>0.1%                                          | ch filter au<br>cution of a<br>nce, and c<br>0000h<br>n.<br>n.<br>n.<br>0                                    | All                                                | After<br>restart                                                                        | Setup                                            | page<br>8-69                  |  |  |
| Pn475<br>Pn476<br>Pn480<br>Pn481<br>Pn482 | 2 2 2 2 2 2                               | n.XDDD<br>Gravity Cc<br>Related Se<br>n.DDX<br>n.DDX<br>n.DDX<br>n.DDX<br>Gravity Cc<br>Torque<br>Reserved<br>not chang<br>Polarity De<br>Speed Loo<br>Polarity De      | 1     Adjution<br>auto<br>tion<br>auto       Reserved par       ompensation-<br>elections       Gravity Comp       0     Disition       1     Ena       Reserved part       Reserved part       Reserved part       parameter (Do<br>le.)       etection<br>op Gain       etection<br>op Integral                     | ust the second<br>is enabled or of<br>otuning with a l<br>ameter (Do no<br>0000h to<br>0001h<br>eensation Selec<br>able gravity con<br>able gravity con<br>ameter (Do not<br>ameter (Do not<br>ameter (Do not<br>-1,000 to<br>1,000                      | stage not<br>during exe<br>host refere<br>t change.<br>tion<br>mpensatio<br>change.)<br>change.)<br>change.)<br>0.1%                                    | ch filter au<br>cution of a<br>nce, and c<br>0000h<br>n.<br>n.<br>n.<br>0<br>10000                           | All All Linear                                     | After<br>restart                                                                        | Setup Tuning _                                   | page<br>8-69                  |  |  |
| 2n476<br>2n480<br>2n481                   | 2<br>2<br>2<br>2<br>2<br>2<br>2           | n.XDDD<br>Gravity Cc<br>Related So<br>n.DDX<br>n.DDX<br>n.DDX<br>n.XDD<br>n.XDD<br>n.XDD<br>Reserved<br>not chang<br>Polarity De<br>Speed Loo<br>Time Cons              | 1     Adjution<br>auto<br>tion<br>auto       Reserved par       ompensation-<br>elections       Gravity Comp       0     Disition       1     Ena       Reserved part       Reserved part       Reserved part       parameter (Do<br>le.)       etection<br>op Gain       etection<br>op Integral                     | ust the second<br>is enabled or of<br>otuning with a l<br>ameter (Do no<br>0000h to<br>0001h<br>eensation Selec<br>able gravity con<br>able gravity con<br>ameter (Do not<br>ameter (Do not<br>ameter (Do not<br>-1,000 to<br>1,000<br>-<br>10 to 20,000 | stage not<br>during exe<br>host refere<br>t change.,<br>tion<br>mpensation<br>change.)<br>change.)<br>0.1%<br>0.1 Hz                                    | ch filter au<br>cution of a<br>nce, and c<br>0000h<br>n.<br>n.<br>n.<br>n.<br>0<br>10000<br>400              | All All Linear Linear                              | After<br>restart                                                                        | Eference,<br>Setup<br>Tuning<br>Tuning<br>Tuning | page<br>8-69                  |  |  |
| 2n476<br>2n480<br>2n481<br>2n482          | 2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2 | n.XDDD<br>Gravity Cc<br>Related So<br>n.DDX<br>n.DDX<br>n.DDX<br>n.XDD<br>n.XDD<br>n.XDD<br>Reserved<br>not chang<br>Polarity De<br>Speed Loo<br>Time Cons<br>Forward F | 1     Adjution<br>auto<br>tion<br>auto       Reserved par       ompensation-<br>elections       Gravity Comp       0     Disa       1     Ena       Reserved par       Reserved par       Reserved par       Reserved par       parameter (Do<br>e.)       etection<br>op Gain       etection<br>op Integral<br>stant | ust the second<br>is enabled or of<br>otuning with a l<br>ameter (Do no<br>0000h to<br>0001h<br>eensation Selec<br>able gravity con<br>able gravity con<br>ameter (Do not<br>ameter (Do not<br>ameter (Do not<br>-1,000 to<br>1,000<br>-<br>10 to 20,000 | stage not<br>during exe<br>host refere<br>it change.<br>tion<br>mpensatio<br>npensatio<br>change.)<br>change.)<br>change.)<br>0.1%<br>0.1 Hz<br>0.01 ms | ch filter au<br>cution of a<br>nce, and c<br>0<br>0000h<br>n.<br>n.<br>n.<br>n.<br>0<br>10000<br>400<br>3000 | All All Linear Linear Linear                       | After<br>restart<br>Immedi-<br>ately<br>Immedi-<br>ately<br>Immedi-<br>ately<br>Immedi- | Eference,<br>Setup<br>Tuning<br>Tuning<br>Tuning | page                          |  |  |

|                  |      |                                                                      |                       |                          |                     |                      | tinued from      | · · · · · · · · · · · · · · · · · · · |                              |
|------------------|------|----------------------------------------------------------------------|-----------------------|--------------------------|---------------------|----------------------|------------------|---------------------------------------|------------------------------|
| Parameter<br>No. | Size | Name                                                                 | Setting<br>Range      | Setting<br>Unit          | Default<br>Setting  | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication                   | Refer-<br>ence               |
| Pn486            | 2    | Polarity Detection Refer-<br>ence Acceleration/<br>Deceleration Time | 0 to 100              | 1 ms                     | 25                  | Linear               | Immedi-<br>ately | Tuning                                | _                            |
| Pn487            | 2    | Polarity Detection Con-<br>stant Speed Time                          | 0 to 300              | 1 ms                     | 0                   | Linear               | Immedi-<br>ately | Tuning                                | _                            |
| Pn488            | 2    | Polarity Detection Refer-<br>ence Waiting Time                       | 50 to 500             | 1 ms                     | 100                 | Linear               | Immedi-<br>ately | Tuning                                | -                            |
| Pn48E            | 2    | Polarity Detection<br>Range                                          | 1 to 65,535           | 1 mm                     | 10                  | Linear               | Immedi-<br>ately | Tuning                                | -                            |
| Pn490            | 2    | Polarity Detection Load<br>Level                                     | 0 to 20,000           | 1%                       | 100                 | Linear               | Immedi-<br>ately | Tuning                                | -                            |
| Pn495            | 2    | Polarity Detection Con-<br>firmation Force Refer-<br>ence            | 0 to 200              | 1%                       | 100                 | Linear               | Immedi-<br>ately | Tuning                                | _                            |
| Pn498            | 2    | Polarity Detection Allow-<br>able Error Range                        | 0 to 30               | 1 deg                    | 10                  | Linear               | Immedi-<br>ately | Tuning                                | -                            |
| Pn49F            | 2    | Speed Ripple Compen-<br>sation Enable Speed                          | 0 to 10,000           | 1 mm/s                   | 0                   | Linear               | Immedi-<br>ately | Tuning                                | page<br>8-62                 |
| Pn502            | 2    | Rotation Detection Level                                             | 0 to 10,000           | 1 min <sup>-1</sup>      | 20                  | Rotary               | Immedi-<br>ately | Setup                                 | page<br>1-10                 |
| Pn503            | 2    | Reserved parameter (Do not change.)                                  | -                     | _                        | 10                  | Rotary               | -                | -                                     | _                            |
| Pn506            | 2    | Brake Reference-Servo<br>OFF Delay Time                              | 0 to 50               | 10 ms                    | 0                   | All                  | Immedi-<br>ately | Setup                                 | page<br>5-31                 |
| Pn507            | 2    | Brake Reference Out-<br>put Speed Level                              | 0 to 10,000           | 1 min <sup>-1</sup>      | 100                 | Rotary               | Immedi-<br>ately | Setup                                 | page<br>5-31                 |
| Pn508            | 2    | Servo OFF-Brake Com-<br>mand Waiting Time                            | 10 to 100             | 10 ms                    | 50                  | All                  | Immedi-<br>ately | Setup                                 | page<br>5-31                 |
| Pn509            | 2    | Momentary Power Inter-<br>ruption Hold Time                          | 20 to 50,000          | 1 ms                     | 20                  | All                  | Immedi-<br>ately | Setup                                 | page<br>6-11                 |
| Pn50A            | 2    | Reserved parameter (Do not change.)                                  | -                     | -                        | 1881h*1             | All                  | -                | -                                     | -                            |
| Pn50B            | 2    | Reserved parameter (Do not change.)                                  | -                     | -                        | 8882h*1             | All                  | -                | -                                     | -                            |
| Pn50E            | 2    | Reserved parameter (Do not change.)                                  | -                     | -                        | 0000h <sup>*4</sup> | All                  | -                | -                                     | _                            |
| Pn50F            | 2    | Reserved parameter (Do not change.)                                  | _                     | _                        | 0100h*5             | All                  | -                | -                                     | _                            |
| Pn510            | 2    | Reserved parameter (Do not change.)                                  | -                     | -                        | 0000h <sup>*1</sup> | All                  | -                | _                                     | _                            |
| Pn511            | 2    | Reserved parameter (Do not change.)                                  | -                     | _                        | 6543h*6             | All                  | -                | -                                     | -                            |
| Pn512            | 2    | Reserved parameter (Do not change.)                                  | -                     | -                        | 0000h <sup>*7</sup> | All                  | -                | -                                     | -                            |
| Pn514            | 2    | Reserved parameter (Do not change.)                                  | -                     | _                        | 0000h               | All                  | -                | -                                     | -                            |
| Pn516            | 2    | Reserved parameter (Do not change.)                                  | -                     | _                        | 8888h               | All                  | -                | -                                     | _                            |
| Pn517            | 2    | Reserved parameter (Do not change.)                                  | -                     | _                        | 0000h <sup>*8</sup> | All                  | -                | -                                     | _                            |
| Pn518            | _    | Safety Module-Related<br>Parameters                                  | -                     | -                        | _                   | All                  | -                | -                                     | -                            |
| Pn51B            | 4    | Motor-Load Position<br>Deviation Overflow<br>Detection Level         | 0 to<br>1,073,741,824 | 1 refer-<br>ence<br>unit | 1000                | Rotary               | Immedi-<br>ately | Setup                                 | page<br>10-9                 |
| Pn51E            | 2    | Position Deviation Over-<br>flow Warning Level                       | 10 to 100             | 1%                       | 100                 | All                  | Immedi-<br>ately | Setup                                 | page<br>8-8                  |
| Pn520            | 4    | Position Deviation Over-<br>flow Alarm Level                         | 1 to<br>1,073,741,823 | 1 refer-<br>ence<br>unit | 5242880             | All                  | Immedi-<br>ately | Setup                                 | page<br>8-7,<br>page<br>8-83 |
| Pn522            | 4    | Reserved parameter (Do not change.)                                  | -                     | -                        | 7 <sup>*9</sup>     | All                  | -                | -                                     | _                            |
| Pn524            | 4    | Reserved parameter (Do not change.)                                  | _                     | -                        | 1073741824          | All                  | -                | -                                     | _                            |

|                  |      |                                                                                   |                       |                          |                    | Cont                 | tinued from                          | previous            | s page.        |
|------------------|------|-----------------------------------------------------------------------------------|-----------------------|--------------------------|--------------------|----------------------|--------------------------------------|---------------------|----------------|
| Parameter<br>No. | Size | Name                                                                              | Setting<br>Range      | Setting<br>Unit          | Default<br>Setting | Applicable<br>Motors | When<br>Enabled                      | Classi-<br>fication | Refer-<br>ence |
| Pn526            | 4    | Position Deviation Over-<br>flow Alarm Level at<br>Servo ON                       | 1 to<br>1,073,741,823 | 1 refer-<br>ence<br>unit | 5242880            | All                  | Immedi-<br>ately                     | Setup               | page<br>8-9    |
| Pn528            | 2    | Position Deviation Over-<br>flow Warning Level at<br>Servo ON                     | 10 to 100             | 1%                       | 100                | All                  | Immedi-<br>ately                     | Setup               | page<br>8-9    |
| Pn529            | 2    | Speed Limit Level at<br>Servo ON                                                  | 0 to 10,000           | 1 min <sup>-1</sup>      | 10000              | Rotary               | Immedi-<br>ately                     | Setup               | page<br>8-9    |
| Pn52A            | 2    | Multiplier per Fully-<br>closed Rotation                                          | 0 to 100              | 1%                       | 20                 | Rotary               | Immedi-<br>ately                     | Tuning              | page<br>10-9   |
| Pn52B            | 2    | Overload Warning Level                                                            | 1 to 100              | 1%                       | 20                 | All                  | Immedi-<br>ately                     | Setup               | page<br>5-39   |
| Pn52C            | 2    | Base Current Derating<br>at Motor Overload<br>Detection                           | 10 to 100             | 1%                       | 100                | All                  | After<br>restart                     | Setup               | page<br>5-40   |
|                  | 2    | Program Jog Operation-<br>Related Selections                                      | 0000h to<br>0005h     | _                        | 0000h              | All                  | Immedi-<br>ately                     | Setup               | page<br>7-13   |
|                  | 2    | Base Current Derating<br>at Motor Overload<br>Detection<br>Program Jog Operation- | 10 to 100<br>0000h to |                          | 100                | All                  | ately<br>After<br>restart<br>Immedi- | Setup               | 5-<br>pa<br>5- |

|       |         | Program   | Jog Operation Pattern                                                                                                                                                                                                |
|-------|---------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |         | 0         | (Waiting time in Pn535 $\rightarrow$ Forward by travel distance in Pn531) $\times$ Number of movements in Pn536                                                                                                      |
|       |         | 1         | (Waiting time in Pn535 $\rightarrow$ Reverse by travel distance in Pn531) $\times$ Number of movements in Pn536                                                                                                      |
|       |         | 2         | (Waiting time in Pn535 $\rightarrow$ Forward by travel distance in Pn531) × Number of movements in Pn536<br>(Waiting time in Pn535 $\rightarrow$ Reverse by travel distance in Pn531) × Number of movements in Pn536 |
| Pn530 | n.□□□X  | 3         | (Waiting time in Pn535 $\rightarrow$ Reverse by travel distance in Pn531) × Number of movements in Pn536<br>(Waiting time in Pn535 $\rightarrow$ Forward by travel distance in Pn531) × Number of movements in Pn536 |
|       |         | 4         | (Waiting time in Pn535 $\rightarrow$ Forward by travel distance in Pn531 $\rightarrow$ Waiting time in Pn535 $\rightarrow$ Reverse by travel distance in Pn531) $\times$ Number of movements in Pn536                |
|       |         | 5         | (Waiting time in Pn535 $\rightarrow$ Reverse by travel distance in Pn531 $\rightarrow$ Waiting time in Pn535 $\rightarrow$ Forward by travel distance in Pn531) $\times$ Number of movements in Pn536                |
|       | n.DDXD  | Reserved  | d parameter (Do not change.)                                                                                                                                                                                         |
|       | 11.00/0 | 116361760 |                                                                                                                                                                                                                      |
|       | n.🗆X🗆 🗆 | Reserved  | d parameter (Do not change.)                                                                                                                                                                                         |

| _ |        |              |               |           |   |   |   |
|---|--------|--------------|---------------|-----------|---|---|---|
|   | n.XDDD | Reserved par | ameter (Do no | t change. | ) |   |   |
|   |        |              |               |           |   |   |   |
|   |        |              |               |           |   | P |   |
|   |        |              |               |           | 1 | 1 | 1 |

| Pn531 | 4 | Program Jog Operation<br>Travel Distance                     | 1 to<br>1,073,741,824 | 1 refer-<br>ence<br>unit                                                       | 32768 | All    | Immedi-<br>ately | Setup | page<br>7-13 |
|-------|---|--------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------|-------|--------|------------------|-------|--------------|
| Pn533 | 2 | Program Jog Operation<br>Movement Jog Opera-<br>tion         | 1 to 10,000           | Rotary:<br>1 min <sup>-1</sup><br>Direct<br>Drive:<br>0.1<br>min <sup>-1</sup> | 500   | Rotary | Immedi-<br>ately | Setup | page<br>7-13 |
| Pn534 | 2 | Program Jog Operation<br>Acceleration/Decelera-<br>tion Time | 2 to 10,000           | 1 ms                                                                           | 100   | All    | Immedi-<br>ately | Setup | page<br>7-13 |
| Pn535 | 2 | Program Jog Operation<br>Waiting Time                        | 0 to 10,000           | 1 ms                                                                           | 100   | All    | Immedi-<br>ately | Setup | page<br>7-13 |
| Pn536 | 2 | Program Jog Operation<br>Number of Movements                 | 0 to 1,000            | Times                                                                          | 1     | All    | Immedi-<br>ately | Setup | page<br>7-13 |
| Pn550 | 2 | Analog Monitor 1 Offset<br>Voltage                           | -10,000 to<br>10,000  | 0.1 V                                                                          | 0     | All    | Immedi-<br>ately | Setup | page<br>9-11 |
| Pn551 | 2 | Analog Monitor 2 Offset<br>Voltage                           | -10,000 to<br>10,000  | 0.1 V                                                                          | 0     | All    | Immedi-<br>ately | Setup | page<br>9-11 |

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|                  |      |                                       |                       |                                                           |                      |                    | Con                  | tinued from      | n previous          | s page.                       |
|------------------|------|---------------------------------------|-----------------------|-----------------------------------------------------------|----------------------|--------------------|----------------------|------------------|---------------------|-------------------------------|
| Parameter<br>No. | Size | N                                     | ame                   | Setting<br>Range                                          | Setting<br>Unit      | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence                |
| Pn552            | 2    | Analog Mo<br>nification               | nitor 1 Mag-          | -10,000 to<br>10,000                                      | × 0.01               | 100                | All                  | Immedi-<br>ately | Setup               | page<br>9-11                  |
| Pn553            | 2    | Analog Mo<br>nification               | nitor 2 Mag-          | -10,000 to<br>10,000                                      | × 0.01               | 100                | All                  | Immedi-<br>ately | Setup               | page<br>9-11                  |
| Pn55A            | 2    | Power Cor<br>Monitor Ur               |                       | 1 to 1,440                                                | 1 min                | 1                  | All                  | Immedi-<br>ately | Setup               | _                             |
| Pn560            | 2    | Residual V<br>Detection V             |                       | 1 to 3,000                                                | 0.1%                 | 400                | All                  | Immedi-<br>ately | Setup               | page<br>8-54                  |
| Pn561            | 2    | Overshoot<br>Level                    | Detection             | 0 to 100                                                  | 1%                   | 100                | All                  | Immedi-<br>ately | Setup               | page<br>8-30,<br>page<br>8-39 |
| Pn581            | 2    | Zero Spee                             | d Level               | 1 to 10,000                                               | 1 mm/s               | 20                 | Linear               | Immedi-<br>ately | Setup               | page<br>1-10                  |
| Pn582            | 2    | Reserved p<br>not change              | parameter (Do<br>e.)  | _                                                         | -                    | 10                 | Linear               | -                | -                   | -                             |
| Pn583            | 2    | Brake Refe<br>put Speed               | erence Out-<br>Level  | 0 to 10,000                                               | 1 mm/s               | 10                 | Linear               | Immedi-<br>ately | Setup               | page<br>5-31                  |
| Pn584            | 2    | Speed Lim<br>Servo ON                 | it Level at           | 0 to 10,000                                               | 1 mm/s               | 10000              | Linear               | Immedi-<br>ately | Setup               | page<br>8-9                   |
| Pn585            | 2    | Program Jo<br>Movement                | og Operation<br>Speed | 1 to 10,000                                               | 1 mm/s               | 50                 | Linear               | Immedi-<br>ately | Setup               | page<br>7-13                  |
| Pn586            | 2    | Motor Run<br>Ratio                    | ning Cooling          | 0 to 100                                                  | 1%/<br>Max.<br>speed | 0                  | Linear               | Immedi-<br>ately | Setup               | _                             |
| Pn587            | 2    | Reserved p<br>(Do not cha             |                       | -                                                         | -                    | 0000h              | Linear               | _                | -                   | -                             |
| Pn600            | 2    | Regenerati<br>Capacity <sup>*10</sup> | ve Resistor           | Depends on model.*11                                      | 10 W                 | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>5-54                  |
| Pn601            | 2    | Dynamic B<br>tor Allowab<br>Consumpti |                       | 0 to 65,535                                               | 10 J                 | 0                  | All                  | After<br>restart | Setup               | *12                           |
| Pn603            | 2    | Regenerati<br>tance                   | ve Resis-             | 0 to 65,535                                               | 10 mΩ                | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>5-54                  |
| Pn604            | 2    | Dynamic B<br>tance                    | rake Resis-           | 0 to 65,535                                               | $10 \text{ m}\Omega$ | 0                  | All                  | After<br>restart | Setup               | *12                           |
|                  | 2    | Overheat F<br>Selections              | Protection            | 0000h to<br>0003h                                         | _                    | 0000h              | All                  | After<br>restart | Setup               | page<br>6-42                  |
|                  | 1    | n.000X                                | 0 Dis                 | otection Selectic<br>sable overheat prot                  | protection.          |                    | a Lincar Sara        | amotor *13       |                     |                               |
|                  |      |                                       | <sub>2</sub> Mo       | onitor a negative                                         | e voltage ir         |                    |                      |                  | nachine ar          | nd                            |
| Pn61A            |      |                                       | Us                    | e overheat prote<br>onitor a positive<br>e overheat prote | voltage in           | put from a         | sensor attach        | ned to the m     | achine an           | d                             |
|                  |      | n.00X0                                |                       | rameter (Do not                                           |                      |                    |                      |                  |                     |                               |
|                  |      | n.0X00                                |                       | rameter (Do not                                           | • •                  |                    |                      |                  |                     |                               |
|                  | I    | n.XOOO                                | Reserved pa           | rameter (Do not                                           | change.)             |                    |                      |                  |                     |                               |
| Pn61B            | 2    | Overheat A                            | larm Level            | 0 to 500                                                  | 0.01 V               | 250                | All                  | Immedi-<br>ately | Setup               | page<br>6-42                  |
| Pn61C<br>*14     | 2    | Overheat V                            | Varning Level         | 0 to 100                                                  | 1%                   | 100                | All                  | Immedi-<br>ately | Setup               | page<br>6-42                  |
| Pn61D<br>*14     | 2    | Overheat A<br>Time                    | larm Filter           | 0 to 65,535                                               | 1 s                  | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>6-42                  |
|                  | I    | L                                     |                       |                                                           |                      |                    |                      |                  | L                   |                               |

Continued from previous page.

| _                |                                                                                                                                                                               |                                                                                                                            |                                    | Continued from previous pa |                    |                      |                  |                     |               |  |  |  |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------|--------------------|----------------------|------------------|---------------------|---------------|--|--|--|
| Parameter<br>No. | Size                                                                                                                                                                          | Name                                                                                                                       | Setting<br>Range                   | Setting<br>Unit            | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer<br>ence |  |  |  |
|                  | 2                                                                                                                                                                             | Serial Communication<br>Protocol                                                                                           | 0 to 9                             | _                          | 1                  | All                  | After<br>restart | Setup               | page<br>14-6  |  |  |  |
|                  |                                                                                                                                                                               | 0 Full-duplex wirin                                                                                                        | g is used for co                   | ommunicat                  | ions metho         | od.                  |                  |                     |               |  |  |  |
|                  |                                                                                                                                                                               | 1 Full-duplex wirin acter.                                                                                                 | g is used for co                   | ommunicat                  | ions metho         | d. Echoback          | is performed     | l for each          | char-         |  |  |  |
|                  |                                                                                                                                                                               | 2 Half-duplex wirir                                                                                                        | -                                  |                            |                    |                      |                  |                     |               |  |  |  |
| D. D00           |                                                                                                                                                                               | 3 Half-duplex wirir performed for ea                                                                                       |                                    | ommunica                   | tions meth         | od. CR is use        | d as delimite    | r. Echoba           | ck is         |  |  |  |
| PnB00            |                                                                                                                                                                               | 4 Half-duplex wirir performed for ea                                                                                       |                                    | ommunica                   | tions meth         | od. CR is use        | d as delimite    | r. Echoba           | ck is         |  |  |  |
|                  |                                                                                                                                                                               | 5 Half-duplex wiring is used for communications method. CRLF is used as delimiter.                                         |                                    |                            |                    |                      |                  |                     |               |  |  |  |
|                  |                                                                                                                                                                               | 6 Half-duplex wiring is used for communications method. CRLF is used as delimiter. Echoba is performed for each character. |                                    |                            |                    |                      |                  |                     |               |  |  |  |
|                  | <ul> <li>Half-duplex wiring is used for communications method. CRLF is used as delimiter. Echo<br/>is performed for each command.</li> <li>8, 9 Reserved parameter</li> </ul> |                                                                                                                            |                                    |                            |                    |                      |                  |                     |               |  |  |  |
|                  | 2                                                                                                                                                                             | Bit rate                                                                                                                   | 0 to 2                             | _                          | 0                  | All                  | After<br>restart | Setup               | page<br>14-6  |  |  |  |
| PnB01            |                                                                                                                                                                               | 0 Sets bit rate at 9                                                                                                       | 9600 bps.                          |                            |                    |                      |                  |                     |               |  |  |  |
| 11201            |                                                                                                                                                                               | 1 Sets bit rate at 7                                                                                                       |                                    |                            |                    |                      |                  |                     |               |  |  |  |
|                  |                                                                                                                                                                               | 2 Sets bit rate at 3                                                                                                       | 38400 bps.                         |                            |                    |                      |                  |                     |               |  |  |  |
|                  | 2                                                                                                                                                                             | Response "OK"                                                                                                              | 0 or 1                             | _                          | 1                  | All                  | Immedi-<br>ately | Setup               | page<br>14-6  |  |  |  |
| PnB02            |                                                                                                                                                                               | 0 Does not return                                                                                                          | OK answer.                         |                            |                    |                      |                  |                     |               |  |  |  |
|                  |                                                                                                                                                                               | 1 Returns OK ans                                                                                                           | wer.                               |                            |                    |                      |                  |                     |               |  |  |  |
|                  | 2                                                                                                                                                                             | /MODE 0/1                                                                                                                  | 0 to 3                             | _                          | 0                  | All                  | After<br>restart | Setup               | page<br>6-4   |  |  |  |
|                  |                                                                                                                                                                               | 0 When input sign                                                                                                          | al is ON (close                    | d), mode is                | set to Mo          | de 0.                |                  |                     |               |  |  |  |
| PnB03            |                                                                                                                                                                               | 1 When input sign                                                                                                          | al is OFF (oper                    | ), mode is                 | set to Mod         | de 0.                |                  |                     |               |  |  |  |
|                  |                                                                                                                                                                               | 2 Always Mode 0.                                                                                                           |                                    |                            |                    |                      |                  |                     |               |  |  |  |
|                  |                                                                                                                                                                               | 3 Always Mode 1.                                                                                                           |                                    |                            |                    |                      |                  |                     |               |  |  |  |
|                  | 2                                                                                                                                                                             | /START-STOP; /HOME                                                                                                         | 0 to 3                             | _                          | 0                  | All                  | After<br>restart | Setup               | page<br>6-4   |  |  |  |
|                  |                                                                                                                                                                               | When /MODE s     /START-STOP signal tu     When /MODE s     ON (closes).                                                   | signal turns ON<br>rns OFF (opens  | l (closes). S<br>s).       | Stops prog         | ram table ope        | eration when     | the /STAI           | RT-           |  |  |  |
| PnB04            |                                                                                                                                                                               | When /MODE s     /START-STOP     STOP signal tu     When /MODE s     OFF (opens).                                          | signal turns OF<br>rns ON (closes) | F (opens).<br>).           | Stops prog         | gram table op        | eration wher     | n the /STA          | RT-           |  |  |  |
|                  | 2, 3<br>• When /MODE signal is ON (closed) (mode 0): The /START-STOP signal is not used.<br>• When /MODE signal is OFF (open) (mode 1): The /HOME signal is not used.         |                                                                                                                            |                                    |                            |                    |                      |                  |                     |               |  |  |  |

| Parameter | Ð    |            |                                  | Setting                                                                   | Setting                  | Default                 | Applicable     | tinued from<br>When | Classi-    | Refer       |
|-----------|------|------------|----------------------------------|---------------------------------------------------------------------------|--------------------------|-------------------------|----------------|---------------------|------------|-------------|
| No.       | Size | Na         | ame                              | Range                                                                     | Unit                     | Setting                 | Motors         | Enabled             | fication   | ence        |
|           | 2    | /PGMRES;   | /JOGP                            | 0 to 3                                                                    | _                        | 0                       | All            | After<br>restart    | Setup      | page<br>6-5 |
|           |      | 0 by       | y switching the<br>/hen /MODE si | ignal is ON (clo<br>9 /PGMRES sig<br>ignal is OFF (or<br>IOGP signal is ( | nal from C<br>ben) (mode | PF (open)<br>1): Execu  | to ON (closed  | d).                 | ·          |             |
| PnB05     |      | 1 by       | y switching the<br>/hen /MODE si | ignal is ON (clo<br>e /PGMRES sig<br>ignal is OFF (op<br>IOGP signal is ( | nal from C<br>ben) (mode | N (closed)<br>1): Execu | to OFF (oper   | n).                 |            |             |
|           |      | 23         |                                  | ignal is ON (clo<br>ignal is OFF (or                                      | , ,                      | , 0                     |                |                     |            |             |
|           | 2    | /SEL0; /JO | GN                               | 0 to 3                                                                    | _                        | 0                       | All            | After<br>restart    | Setup      | page<br>6-6 |
|           |      | 0 • W      | /hen /MODE si                    | ignal is ON (clo<br>ignal is OFF (or<br>IOGN signal is I                  | pen) (mode               | e 1): Execu             | 0              |                     |            | ,           |
| PnB06     |      | 1 • W      | /hen /MODE si                    | ignal is ON (clo<br>ignal is OFF (or<br>IOGN signal is (                  | pen) (mode               | e 1): Execu             | -              |                     |            |             |
|           |      |            |                                  | ignal is ON (clo<br>ignal is OFF (or                                      |                          |                         |                |                     |            |             |
|           |      | 3 • W      | /hen /MODE si                    | ignal is ON (clo<br>ignal is OFF (or                                      | sed) (mod                | e 0): The /             | SEL0 signal is | s always inac       | tive.      |             |
|           | 2    | /SEL1; /JO | G0                               | 0 to 3                                                                    | _                        | 0                       | All            | After<br>restart    | Setup      | page<br>6-6 |
|           |      | ()         |                                  | ignal is ON (clo<br>ignal is OFF (or                                      | , ,                      | ,                       | 0              |                     |            | '           |
| PnB07     |      | 1 • W      | /hen /MODE si                    | ignal is ON (clo<br>ignal is OFF (or                                      | sed) (mod                | e 0): The /             | SEL1 signal is | s active wher       | n OFF (ope | en).        |
|           |      | 2 • W      | /hen /MODE si                    | ignal is ON (clo<br>ignal is OFF (or                                      | sed) (mod                | e 0): The /             | SEL1 signal is | s always activ      | ve.        | ,           |
|           |      | .3 • W     | /hen /MODE si                    | ignal is ON (clo<br>ignal is OFF (or                                      | sed) (mod                | e 0): The /             | SEL1 signal is | s always inac       | tive.      |             |
|           | 2    | /SEL2; /JO | G1                               | 0 to 3                                                                    | _                        | 0                       | All            | After<br>restart    | Setup      | page<br>6-6 |
|           |      |            |                                  | ignal is ON (clo<br>ignal is OFF (or                                      |                          |                         |                |                     |            |             |
| PnB08     |      | - • W      | /hen /MODE si                    | ignal is ON (clo<br>ignal is OFF (or                                      | sed) (mod                | e 0): The /             | SEL2 signal is | s active wher       | n OFF (ope | en).        |
|           |      | 2 • W      | /hen /MODE si                    | ignal is ON (clo<br>ignal is OFF (or                                      | sed) (mod                | e 0): The /             | SEL2 signal is | s always activ      | ve.        | ,           |
|           |      | • W        |                                  | .g. io. io. or i (0p                                                      |                          |                         | Ser orginal la | a mayo doll         |            |             |

Continued from previous page.

|                  |                                                                                                                                                                                                           |                                               |                                   |                                    |                 |                    | Con                  | tinued from      | n previous          | 3 page.        |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------|------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No. | Size                                                                                                                                                                                                      | Name                                          |                                   | Setting<br>Range                   | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|                  | 2                                                                                                                                                                                                         | /SEL3; /JOG2                                  |                                   | 0 to 3                             | _               | 0                  | All                  | After<br>restart | Setup               | page<br>6-6    |
|                  | <ul> <li>When /MODE signal is ON (closed) (mode 0): The /SEL3 signal is active when ON (closed)</li> <li>When /MODE signal is OFF (open) (mode 1): The /JOG2 signal is active when ON (closed)</li> </ul> |                                               |                                   |                                    |                 |                    |                      |                  |                     | ,              |
| PnB09            |                                                                                                                                                                                                           |                                               |                                   | gnal is ON (clo<br>gnal is OFF (op |                 |                    | -                    |                  |                     |                |
|                  |                                                                                                                                                                                                           | 2                                             |                                   | gnal is ON (clo<br>gnal is OFF (op | , ,             | ,                  | 0                    | -                |                     |                |
|                  |                                                                                                                                                                                                           | 3                                             |                                   | gnal is ON (clo<br>gnal is OFF (op | , ,             | ,                  | 0                    | -                |                     |                |
|                  | 2                                                                                                                                                                                                         | /SEL4; /JOG3                                  |                                   | 0 to 3                             | _               | 0                  | All                  | After<br>restart | Setup               | page<br>6-6    |
|                  |                                                                                                                                                                                                           |                                               |                                   | gnal is ON (clo<br>gnal is OFF (op |                 |                    |                      |                  |                     |                |
| PnB0A            |                                                                                                                                                                                                           |                                               |                                   | gnal is ON (clo<br>gnal is OFF (op |                 |                    |                      |                  |                     |                |
|                  |                                                                                                                                                                                                           |                                               |                                   | gnal is ON (clo<br>gnal is OFF (op | , ,             | ,                  | 0                    | -                |                     |                |
|                  |                                                                                                                                                                                                           |                                               |                                   | gnal is ON (clo<br>gnal is OFF (op |                 |                    |                      |                  |                     |                |
|                  | 2                                                                                                                                                                                                         | /SEL5                                         |                                   | 0 to 3                             | _               | 0                  | All                  | After<br>restart | Setup               | page<br>6-7    |
|                  |                                                                                                                                                                                                           | 0 The /SE                                     | L5 signal                         | is active when                     | ON (close       | ed).               |                      |                  |                     |                |
| PnB0B            |                                                                                                                                                                                                           | 1 The /SEL5 signal is active when OFF (open). |                                   |                                    |                 |                    |                      |                  |                     |                |
|                  |                                                                                                                                                                                                           | 2 The /SE                                     | he /SEL5 signal is always active. |                                    |                 |                    |                      |                  |                     |                |
|                  |                                                                                                                                                                                                           | 3 The /SE                                     | L5 signal                         | is always inac                     | tive.           |                    |                      |                  |                     |                |
|                  | 2                                                                                                                                                                                                         | /SEL6                                         |                                   | 0 to 3                             | _               | 0                  | All                  | After<br>restart | Setup               | page<br>6-7    |
|                  |                                                                                                                                                                                                           | 0 The /SE                                     | L6 signal                         | is active wher                     | ON (close       | ed).               | 1                    | 1                |                     |                |
| PnB0C            |                                                                                                                                                                                                           |                                               | 0                                 | is active when                     |                 | ,                  |                      |                  |                     |                |
|                  |                                                                                                                                                                                                           | 2 The /SE                                     | L6 signal                         | is always activ                    | /e.             |                    |                      |                  |                     |                |
|                  |                                                                                                                                                                                                           | 3 The /SE                                     | L6 signal                         | is always inac                     | tive.           |                    |                      |                  |                     |                |
|                  | 2                                                                                                                                                                                                         | /SEL7                                         |                                   | 0 to 3                             | _               | 0                  | All                  | After<br>restart | Setup               | page<br>6-7    |
|                  |                                                                                                                                                                                                           | 0 The /SE                                     | L7 signal                         | is active when                     | ON (close       | ed).               |                      |                  |                     |                |
| PnB0D            |                                                                                                                                                                                                           | 1 The /SE                                     | L7 signal                         | is active when                     | OFF (ope        | n).                |                      |                  |                     |                |
|                  |                                                                                                                                                                                                           | 2 The /SE                                     | L7 signal                         | is always activ                    | /e.             |                    |                      |                  |                     |                |
|                  |                                                                                                                                                                                                           | 3 The /SE                                     | L7 signal                         | is always inac                     | tive.           |                    |                      |                  |                     |                |
|                  | 2                                                                                                                                                                                                         | /S-ON                                         |                                   | 0 to 3                             | _               | 0                  | All                  | After<br>restart | Setup               | page<br>6-3    |
|                  |                                                                                                                                                                                                           |                                               |                                   | ges to the SEF<br>signal turns Of  |                 | ate (power         | is supplied)         | and operatio     | n is enabl          | ed             |
| PnB0E            |                                                                                                                                                                                                           |                                               |                                   | ges to the SEF<br>signal turns OF  |                 |                    | r is supplied)       | and operatio     | n is enabl          | əd             |
|                  |                                                                                                                                                                                                           |                                               | servo ON                          |                                    |                 |                    |                      |                  |                     |                |
|                  |                                                                                                                                                                                                           | 3 Always                                      | servo OFI                         | F                                  |                 |                    |                      |                  |                     |                |
|                  |                                                                                                                                                                                                           |                                               |                                   |                                    |                 |                    |                      |                  |                     |                |

Continued on next page.

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| No.         Range         Unit         Setting         Motors         Enabled         fication         enabled           2         P-OT         0 to 3         -         0         All         reteard         Setup         Setup <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>tinued from</th> <th>· · · · · · · · · · · · · · · · · · ·</th> <th></th>                                                                                                                                               |                  |                                                                                     |                        |                  |                      |                    |                      | tinued from     | · · · · · · · · · · · · · · · · · · · |                |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------------------------------------------------------------------------|------------------------|------------------|----------------------|--------------------|----------------------|-----------------|---------------------------------------|----------------|--|--|
| 2         POI         0.03         -         0         All         restart         Setup         5.2           PnB0F         0         Forward drive is prohibited (forward overtravel) when P-OT is OF (open).         -         -         -         -         OT is OFF (open).           2         Forward run is always prohibited (reverse overtravel).         -         OT is OF (open).         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -<                                                                                                                                                                                                                                                                                                                                                                                         | Parameter<br>No. | Size                                                                                | Name                   | Setting<br>Range | Setting<br>Unit      | Default<br>Setting | Applicable<br>Motors | When<br>Enabled | Classi-<br>fication                   | Refer-<br>ence |  |  |
| PhBOF         1         Forward drive is prohibited (forward overtravel), when P-OT is ON (closed), 2         Forward run is always prohibited (forward overtravel), 3         Forward run is always prohibited (forward overtravel), 4           3         Forward run is always prohibited (forward overtravel), when N-OT is OFF (open), 7         0 to 3         -         0         All         After         Setup         9, 52           0         Reverse drive is prohibited (reverse overtravel) when N-OT is OFF (open), 7         1         Reverse run is always enabled, (N-OT signal is not used.)         -         0         All         After         52           2         Reverse run is always enabled, (N-OT signal is not used.)         -         0         All         After         63           3         Reverse run is always enabled, (N-OT signal is not used.)         -         0         All         After         63           9         Starts deceleration during horning when the /DEC signal turns ON (closes).         -         1         Starts         64         63           1         Starts deceleration during horning when the /DEC signal turns ON (closes).         -         0         After         64           9         Starts registration by switching the /RGRT signal from OFF (open).         -         0         All         After         64         64 <tr< td=""><td></td><td>2</td><td>P-OT</td><td>0 to 3</td><td>_</td><td>0</td><td>All</td><td></td><td>Setup</td><td>page<br/>5-28</td></tr<> |                  | 2                                                                                   | P-OT                   | 0 to 3           | _                    | 0                  | All                  |                 | Setup                                 | page<br>5-28   |  |  |
| 2         Forward run is always prohibited (forward over) ravel).           3         Forward run is always enabled. (P-OT signal is not used.)           2         N-OT         0 to 3         -         0         Alter feature           0         Reverse drive is prohibited (reverse overtravel) when N-OT is OFF (open).         1         Reverse drive is prohibited (reverse overtravel).         3           1         Reverse drive is prohibited (reverse overtravel).         3         Reverse overtravel).         3           1         Reverse run is always enabled. (N-OT signal is not used.)         3         Reverse run is always overtravel).         3           1         Reverse run is always enabled. (N-OT signal is not used.)         4         After restart         Setup         Reverse run is always over the reverse over travel).           2         /DEC         0 to 3         -         0         All         After restart         Setup         Restart           2         /DEC         0 to 3         -         0         All         After restart         Setup         Restart           2         /DEC         0 to 3         -         0         All         After restart         Setup         Restart           2         /RGRT         0 to 3         -         0         Al                                                                                                                                                                                                                                 |                  |                                                                                     | 0 Forward drive is     | prohibited (forv | vard overtr          | avel) when         | P-OT is OFF          | (open).         |                                       |                |  |  |
| 3         Forward run is always enabled. (P-OT signal is not used.)           PnB10         2         N-OT         0 to 3         -         0         All         After restart         Setup         Setup </td <td>PnB0F</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>(closed).</td> <td></td> <td></td>                                                                                                                                                         | PnB0F            |                                                                                     |                        |                  |                      |                    |                      | (closed).       |                                       |                |  |  |
| 2         N-OT         0 to 3         -         0         All         Alter<br>netart         Setup         Psg<br>Sz           PnB10         2         N-OT         0 to 3         -         0         All         Alter<br>netart         Setup         Psg<br>Sz           2         N-OT         0 to 3         -         0         All         Alter<br>netart         Setup         Setup           2         Reverse drive is prohibited (reverse overtravel) when N-OT is ON (closed).         2         Reverse run is always enabled. (N-OT signal is not used.)           PnB11         2         Reverse run is always enabled. (N-OT signal is not used.)         3         Setup         Reference           1         Starts deceleration during homing when the /DEC signal turns ON (closes).         1         Starts deceleration during homing when the /DEC signal turns OFF (opens).         2           2         Sets the homing limit switch always OFF.         3         Setup         Refer         Refer           0         Starts registration by switching the /RGRT signal from OFF (open) to ON (closed).         1         Starts registration by switching the /RGRT signal from ON (closed).         1         Starts registration.           2         //NPOSITION         0 to 3         -         0         All         After<br>restart         Setup                                                                                                                                                                         |                  |                                                                                     |                        | , .<br>, .       |                      | ,                  |                      |                 |                                       |                |  |  |
| 2         NOIL         0 to 3         -         0         All         restart         Setup         5.2           PnB10         0         Reverse drive is prohibited (reverse overtravel) when N-OT is OFF (open).         1         Reverse drive is prohibited (reverse overtravel) when N-OT is ON (closed).         2         Reverse run is always prohibited (reverse overtravel).         3         Reverse run is always enabled. (N-OT signal is not used.)           PnB11         2         DEC         0 to 3         -         0         All         After<br>restart         Setup         6.3           2         DEC         0 to 3         -         0         All         After<br>restart         Setup         6.3           2         Sets the homing limit switch always OFF.         3         Sets the homing limit switch always OFF.         5         5         5         5         5         5         5         5         5         5         5         5         5         5         7         5         5         5         7         6         3         5         5         7         6         3         5         5         7         7         0         All         After<br>restart         5         5         7         6         3         6         <                                                                                                                                                                                                                                                                       |                  |                                                                                     | 3 Forward run is al    | ways enabled.    | (P-OT sigr           | nal is not u       | sed.)                |                 |                                       |                |  |  |
| PnB10       1       Reverse drive is prohibited (reverse overtravel) when N-OT is ON (closed).         2       Reverse run is always prohibited (reverse overtravel).       3         3       Reverse run is always enabled. (N-OT signal is not used.)         PnB11       2       //DEC       0 to 3       -       0       All       After restart       Setup §43         0       Starts deceleration during homing when the //DEC signal turns ON (closes).       1       Starts deceleration during homing when the //DEC signal turns OFF (opens).       2       Sets the homing limit switch always OFF.         2       //RGRT       0 to 3       -       0       All       After restart       Setup §43         0       Starts registration by switching the //RGRT signal from OFF (open) to ON (closed).       1       Starts registration by switching the //RGRT signal from ON (closed).       1       Starts registration.         2       //INPOSITION       0 to 3       -       0       All       After restart       Setup §43         9nB13       2       //INPOSITION       0 to 3       -       0       All       After restart       Setup §45         9nB14       2       //INPOSITION       0 to 3       -       0       All       After restart       Setup §45         9nB14       0                                                                                                                                                                                                                                                       |                  | 2                                                                                   | N-OT                   | 0 to 3           | -                    | 0                  | All                  |                 | Setup                                 | page<br>5-28   |  |  |
| 2         Reverse run is always prohibited (reverse overtravel).           3         Reverse run is always enabled. (N-OT signal is not used.)           PnB11         2         //DEC         0 to 3         -         0         All         After restart         Setup         Page 5           9         Starts deceleration during homing when the /DEC signal turns ON (closes).         1         Starts deceleration during homing when the /DEC signal turns ON (closes).         1         Starts deceleration during homing when the /DEC signal turns ON (closes).         2         Sets the homing limit switch always ON.         3         Sets the homing limit switch always OFF.           PnB12         2         //RGRT         0 to 3         -         0         All         After start         Setup         Page 5           9         Starts registration by switching the /RGRT signal from OFF (open) to ON (closed).         1         Starts registration.         2         //NPOS/TION         0 to 3         -         0         All         After signal from ON (closed).         5           PnB13         2         //INPOS/TION         0 to 3         -         0         All         After restart         Setup         Page 6         Co           1         When positioning has been completed, the /INPOSITION signal turns ON (closes).         1         When positi                                                                                                                                                   |                  |                                                                                     | 0 Reverse drive is     | prohibited (reve | erse overtr          | avel) when         | N-OT is OFF          | (open).         |                                       |                |  |  |
| 3         Reverse run is always enabled. (N-OT signal is not used.)           PnB11         2         //DEC         0 to 3         -         0         All         After<br>restart         Setup         gas<br>6-3           PnB11         2         //Starts deceleration during homing when the //DEC signal turns ON (closes).         1         Starts deceleration during homing when the //DEC signal turns ON (closes).           1         Starts deceleration during homing when the //DEC signal turns ON (closes).         3           2         Sets the homing limit switch always ON.         3           2         Sets the homing limit switch always OFF.         6-4           0         Starts registration by switching the //RGRT signal from OFF (open) to ON (closed).         1           1         Starts registration by switching the //RGRT signal from ON (closed) to OFF (open).         2.3         Does not start registration.           2         //INPOSITION         0 to 3         -         0         All         After<br>restart         Setup         Pgas<br>6-3           0         When positioning has been completed, the //NPOSITION signal turns ON (closes).         1         When positioning has been completed, the //NPOSITION signal turns OFF (opens).         2.3         Reserved settings           2         /POUT0         0 or 1         0         All         After<br>restart                                                                                                                        | PnB10            |                                                                                     |                        |                  | J-OT is ON (closed). |                    |                      |                 |                                       |                |  |  |
| PnB11         2         //DEC         0 to 3         -         0         All         After restart         Setup         Page 5           0         Starts deceleration during homing when the /DEC signal turns ON (closes).         1         Starts deceleration during homing when the /DEC signal turns OFF (opens).         2         Sets the homing limit switch always ON.         3           2         Sets the homing limit switch always ON.         3         Sets the homing limit switch always OFF.           2         //RGRT         0 to 3         -         0         All         After restart         Setup         6.64           0         Starts registration by switching the /RGRT signal from OFF (open) to ON (closed).         1         Starts registration.         2         //NPOSITION         0 to 3         -         0         All         After restart         Setup         6.64           9         When positioning has been completed, the /INPOSITION signal turns ON (closed).         1         Setup         6.4         6.5           9         When positioning has been completed, the /INPOSITION signal turns OFF (opens).         2, 3         Reserved settings           1         When positioning has been completed, the /INPOSITION signal turns OFF (opens).         2, 3         Reserved settings         2         /POUT0         O or 1         -<                                                                                                                                                   |                  |                                                                                     |                        |                  |                      |                    |                      |                 |                                       |                |  |  |
| 2         J/JEC         0 0 3         -         0         All         restart         Setup         6.3           PnB11         0         Starts deceleration during homing when the /DEC signal turns ON (closes).         1         Starts deceleration during homing when the /DEC signal turns OFF (opens).         2         Sets the homing limit switch always ON.           2         Sets the homing limit switch always OFF.         0         All         After restart         Setup         Page           2         // CRGRT         0 to 3         -         0         All         After restart         Setup         Page           0         Starts registration by switching the /RGRT signal from OFF (open) to ON (closed).         1         Starts registration.         2         ///// Restart         Setup         Page           0         Starts registration.         3         Does not start registration.         0         After restart         Setup         Page           0         When positioning has been completed, the /INPOSITION signal turns ON (closes).         1         When positioning has been completed, the /INPOSITION signal turns ON (closes).         1         The /POUTO signal turns OFF (closes) when programmable output 0 is active.         1         The /POUTO signal turns OFF (closes) when programmable output 0 is active.         1         The /POUT1 signal turns OFF (closes) when                                                                                                        |                  |                                                                                     | 3 Reverse run is al    | ways enabled.    | (N-OT sigr           | nal is not u       | sed.)                |                 |                                       |                |  |  |
| PnB11       1       Starts deceleration during homing when the /DEC signal turns OFF (opens).         2       Sets the homing limit switch always ON.       3       Sets the homing limit switch always OFF.         PnB12       2       //RGRT       0 to 3       -       0       All       After restart       Setup       page 6.4         PnB12       0       Starts registration by switching the /RGRT signal from OFF (open) to ON (closed).       1       Starts registration by switching the /RGRT signal from ON (closed) to OFF (open).       2.3       Does not start registration.         2       /INPOSITION       0 to 3       -       0       All       After restart       Setup       Page 6.5         2.3       Does not start registration.       0       0 to 3       -       0       All       After restart       Setup       Page 6.5         2.3       Reserved settings       -       0       All       After restart       Setup       Page 6.5         2.3       Reserved settings       -       0       All       After restart       Setup       Page 6.5         2.3       Reserved settings       -       0       All       After restart       Setup       Page 6.5         PnB14       0       The /POUT0 signal turns ON (opens) when programmable o                                                                                                                                                                                                                                                                              |                  | 2                                                                                   | /DEC                   | 0 to 3           | _                    | 0                  | All                  |                 | Setup                                 | page<br>6-3    |  |  |
| 2       Sets the homing limit switch always ON.         3       Sets the homing limit switch always OFF.         PnB12       2       //RGRT       0 to 3       -       0       All       After restart       Setup       Page 4.4         0       Starts registration by switching the /RGRT signal from OFF (open) to ON (closed).       1       Starts registration by switching the /RGRT signal from ON (closed) to OFF (open).       2, 3       Does not start registration.         2, 3       Does not start registration.       0       All       After restart       Setup       Page 6.4         0       When positioning has been completed, the /INPOSITION signal turns ON (closes).       0       When positioning has been completed, the /INPOSITION signal turns OFF (opens).       2, 3       Reserved settings         2       /POUT0       0 or 1       -       0       All       After restart       Setup       Page 6.4         2       /POUT0       0 or 1       -       0       All       After restart       Setup       Page 6.4         1       The /POUT0 signal turns ON (opens) when programmable output 0 is active.       1       The /POUT0 signal turns OFF (closes) when programmable output 0 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         PnB16       0       The /POUT1 signa                                                                                                                                                                                    |                  |                                                                                     | 0 Starts deceleration  | on during homi   | ng when tl           | ne /DEC si         | gnal turns ON        | l (closes).     |                                       |                |  |  |
| 3       Sets the homing limit switch always OFF.         2       /RGRT       0 to 3       -       0       All       After restart       Setup                                                                                                                                                                                                                                                                                                                                                                          | PnB11            |                                                                                     | 1 Starts deceleration  | on during homi   | ng when tl           | ne /DEC si         | gnal turns OF        | F (opens).      |                                       |                |  |  |
| PnB12       2       /RGRT       0 to 3       -       0       All       After<br>restart       Setup       Page<br>6-4         0       Starts registration by switching the /RGRT signal from ON (closed).       1       Starts registration by switching the /RGRT signal from ON (closed).       1       Starts registration.       2       /INPOSITION       0 to 3       -       0       All       After<br>restart       Setup       Page         PnB13       2       /INPOSITION       0 to 3       -       0       All       After<br>restart       Setup       Page         0       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       The /POUTD       0 or 1       -       0       All       After<br>restart       Setup       Page         1       The /POUT0 signal turns ON (opens) when programmable output 0 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active. <t< td=""><td></td><td></td><td></td><td></td><td>,</td><td></td><td></td><td></td><td></td><td></td></t<>      |                  |                                                                                     |                        |                  | ,                    |                    |                      |                 |                                       |                |  |  |
| 2       /KGH1       0.16.3       -       0       All       restart       Setup       6.4         PnB12       0       Starts registration by switching the /RGRT signal from OFF (open) to ON (closed).       1       Starts registration by switching the /RGRT signal from ON (closed).       1       Starts registration by switching the /RGRT signal from ON (closed) to OFF (open).       2.3       Does not start registration.         PnB13       2       /INPOSITION       0 to 3       -       0       All       After restart       Setup       Page 6.5         0       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       When positioning has been completed, the /INPOSITION signal turns OFF (opens).       2.3       Reserved settings         PnB14       0       The /POUT0 signal turns ON (opens) when programmable output 0 is active.       Page 7.3       Reserved setting         PnB15       0       The /POUT0 signal turns OFF (closes) when programmable output 0 is active.       Page 7.4       Setup       Page 7.4         0       The /POUT1 signal turns ON (opens) when programmable output 1 is active.       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         PnB15       0       The /POUT2 signal turns ON (opens) when programmable output 1 is active.       Setup       Page 7.4         0       The /POUT2 signal turns O                                                                                                                      |                  |                                                                                     | 3 Sets the homing      | limit switch alv | vays OFF.            |                    |                      |                 |                                       |                |  |  |
| PnB12       1       Starts registration by switching the /RGRT signal from ON (closed) to OFF (open).         2, 3       Does not start registration.         PnB13       2       /INPOSITION       0 to 3       -       0       All       After restart       Setup       Page for the start registration.         PnB13       0       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       When positioning has been completed, the /INPOSITION signal turns ON (closes).         2, 3       Reserved settings       -       0       All       After restart       Setup       Page for the restart         PnB14       0       The /POUT0 signal turns ON (opens) when programmable output 0 is active.       1       The /POUT0 signal turns OFF (closes) when programmable output 0 is active.         PnB15       0       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         PnB16       0       The /POUT2 signal turns OFF (closes) when programmable output 1 is active.       1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.         PnB16       0       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.       1       The /POUT2 signal turns OFF (clo                                                                         |                  | 2                                                                                   | /RGRT                  | 0 to 3           | _                    | 0                  | All                  |                 | Setup                                 | page<br>6-4    |  |  |
| 1       Starts registration by switching the /RGRT signal from ON (closed) to OFF (open).         2,3       Does not start registration.         2,3       Does not start registration.         PnB13       2       /INPOSITION       0 to 3       -       0       All       After restart       Setup       Page 6-9         0       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       When positioning has been completed, the /INPOSITION signal turns OFF (opens).       2,3       Reserved settings         2,3       Reserved settings       -       0       All       After restart       Setup       Page 6-1         PnB14       0       The /POUT0 signal turns ON (opens) when programmable output 0 is active.       -       -       -       All       After restart       Setup       Page 6-1         PnB15       0       The /POUT0 signal turns ON (opens) when programmable output 0 is active.       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -                                                                                                                                                                                                                                                                                                                    | PnB12            | 0 Starts registration by switching the /RGRT signal from OFF (open) to ON (closed). |                        |                  |                      |                    |                      |                 |                                       |                |  |  |
| PnB13       2       /INPOSITION       0 to 3       -       0       All       After restart       Setup       Page 53         0       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       When positioning has been completed, the /INPOSITION signal turns OFF (opens).       2,3       Reserved settings         PnB14       2       /POUT0       0 or 1       -       0       All       After restart       Setup       Page 6-1         0       The /POUT0 signal turns ON (opens) when programmable output 0 is active.       1       The /POUT0 signal turns OFF (closes) when programmable output 0 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         PnB15       2       /POUT1       0 or 1       -       0       All       After restart       Setup       Page 6-1         0       The /POUT1 signal turns ON (opens) when programmable output 1 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         PnB16       2       /POUT2       0 or 1       -       0       All       After restart       Setup       Page 6-1         0       The /POUT2 signal turns ON (opens) when programmable output 1 is active.       1       The                                                                                                                                                                     | THETZ            |                                                                                     | 1 Starts registration  | n by switching   | the /RGR1            | signal fro         | m ON (closed         | ) to OFF (op    | en).                                  |                |  |  |
| PnB13       2       /INPOSITION       0 to 3       -       0       All       restart       Setup       6-5         PnB13       0       When positioning has been completed, the /INPOSITION signal turns ON (closes).       1       When positioning has been completed, the /INPOSITION signal turns ON (closes).       2, 3       Reserved settings         PnB14       2       /POUTO       0 or 1       -       0       All       After restart       Setup       Page 6-1         O       The /POUTO signal turns ON (opens) when programmable output 0 is active.       1       The /POUTO signal turns OFF (closes) when programmable output 0 is active.         PnB15       2       /POUT1       0 or 1       -       0       All       After restart       Setup       Page 6-1         O       The /POUT0 signal turns ON (opens) when programmable output 0 is active.       1       The /POUT1 signal turns ON (opens) when programmable output 1 is active.         PnB16       2       /POUT2       0 or 1       -       0       All       After restart       Setup       Page 6-1         O       The /POUT1 signal turns ON (opens) when programmable output 1 is active.       0       1       -       0       All       After restart       Setup       Page 6-1         O       The /POUT2 signal turns OFF (clo                                                                                                                                                                                                                                  |                  |                                                                                     | 2, 3 Does not start re | gistration.      |                      |                    |                      |                 |                                       |                |  |  |
| PnB13       1       When positioning has been completed, the /INPOSITION signal turns OFF (opens).         2, 3       Reserved settings         PnB14       2       /POUT0       0 or 1       -       0       All       After restart       Setup       Page 6-1         O       The /POUT0 signal turns ON (opens) when programmable output 0 is active.       1       The /POUT0 signal turns OFF (closes) when programmable output 0 is active.         PnB15       2       /POUT1       0 or 1       -       0       All       After restart       Setup       Page 6-1         O       The /POUT0 signal turns OFF (closes) when programmable output 0 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         PnB15       0       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         PnB16       2       /POUT2       0 or 1       -       0       All       After restart       Setup       Page 6-1         O       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.       1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.         PnB16       0       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.       Page 6-1      <                                                                                                                                                              |                  | 2                                                                                   | /INPOSITION            | 0 to 3           | -                    | 0                  | All                  |                 | Setup                                 | page<br>6-9    |  |  |
| 1       When positioning has been completed, the /INPOSITION signal turns OFF (opens).         2, 3       Reserved settings         PnB14       2       /POUT0       0 or 1       -       0       All       After restart       Setup       page feature         0       The /POUT0 signal turns ON (opens) when programmable output 0 is active.       1       The /POUT0 signal turns OFF (closes) when programmable output 0 is active.         PnB15       2       /POUT1       0 or 1       -       0       All       After restart       Setup       page feature         PnB16       2       /POUT1       0 or 1       -       0       All       After restart       Setup       feature         1       The /POUT1 signal turns ON (opens) when programmable output 1 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         PnB16       2       /POUT2       0 or 1       -       0       All       After restart       Setup       feature         PnB17       0       The /POUT2 signal turns ON (opens) when programmable output 2 is active.       2       /POUT3       0 or 1       -       0       All       After restart       Setup       feature       feature                                                                                                                                                                                                                                        | DpD12            |                                                                                     | 0 When positioning     | has been con     | npleted, th          | e /INPOSI          | FION signal tu       | Irns ON (clos   | ses).                                 |                |  |  |
| 2       /POUTO       0 or 1       -       0       All       After restart       Setup       page 6-1         PnB14       0       The /POUT0 signal turns ON (opens) when programmable output 0 is active.       1       The /POUT0 signal turns OFF (closes) when programmable output 0 is active.       1       The /POUT0 signal turns OFF (closes) when programmable output 0 is active.         PnB15       2       /POUT1       0 or 1       -       0       All       After restart       Setup       page 6-1         PnB15       2       /POUT1       0 or 1       -       0       All       After restart       Setup       page 6-1         PnB16       0       The /POUT1 signal turns ON (opens) when programmable output 1 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         PnB16       2       /POUT2       0 or 1       -       0       All       After restart       Setup       page 6-1         0       The /POUT2 signal turns ON (opens) when programmable output 2 is active.       1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.         2       /POUT3       0 or 1       -       0       All       After restart       Setup       page 6-1         0       The /POUT3 signal turns ON (opens) when programmable outpu                                                                                                                                                                                                                         | FIIDIS           |                                                                                     | 1 When positioning     | has been con     | npleted, th          | e /INPOSI          | FION signal tu       | ırns OFF (op    | ens).                                 |                |  |  |
| PnB14       2       /POUTO       0       All       restart       Setup       6-1         0       The /POUTO signal turns ON (opens) when programmable output 0 is active.       1       The /POUTO signal turns OFF (closes) when programmable output 0 is active.       1       The /POUTO signal turns OFF (closes) when programmable output 0 is active.         PnB15       2       /POUT1       0 or 1       -       0       All       After restart       Setup       Pace 6-1         PnB16       2       /POUT1       0 or 1       -       0       All       After restart       Setup       Pace 6-1         PnB16       2       /POUT1       0 or 1       -       0       All       After restart       Setup       Pace 6-1         0       The /POUT1 signal turns ON (opens) when programmable output 1 is active.       1       The /POUT2 signal turns OFF (closes) when programmable output 1 is active.         PnB16       0       The /POUT2 signal turns ON (opens) when programmable output 2 is active.       1         2       /POUT3       0 or 1       -       0       All       After restart       Setup       Pace 6-1         0       The /POUT2 signal turns ON (opens) when programmable output 2 is active.       1       0       All       After restart       Setup       Pace 6-                                                                                                                                                                                                                                                    |                  |                                                                                     | 2, 3 Reserved setting  | S                |                      |                    |                      |                 |                                       |                |  |  |
| 1       The /POUT0 signal turns OFF (closes) when programmable output 0 is active.         PnB15       2       /POUT1       0 or 1       -       0       All       After restart       Setup       Pace 6-1         0       The /POUT1 signal turns ON (opens) when programmable output 1 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         PnB16       2       /POUT2       0 or 1       -       0       All       After restart       Setup       Pace 6-1         0       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.       1       The /POUT2 signal turns OFF (closes) when programmable output 1 is active.         PnB16       0       The /POUT2 signal turns ON (opens) when programmable output 2 is active.       1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.         1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.       2       Pace 7         2       /POUT3       0 or 1       -       0       All       After restart       Setup       Pace 7         0       The /POUT3 signal turns ON (opens) when programmable output 2 is active.       0       All       After restart       Setup       Pace 7         0       The /POUT3 signal turns ON (opens) when programmable output 3 is active.       0                                                                                                                                                                           |                  | 2                                                                                   | /POUT0                 | 0 or 1           | _                    | 0                  | All                  |                 | Setup                                 | page<br>6-10   |  |  |
| 1       The /POUT0 signal turns OFF (closes) when programmable output 0 is active.         PnB15       2       /POUT1       0 or 1       -       0       All       After restart       Setup       Pace 6-1         0       The /POUT1 signal turns ON (opens) when programmable output 1 is active.       0       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.       0       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         PnB16       2       /POUT2       0 or 1       -       0       All       After restart       Setup       Pace 6-1         0       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.       0       1       -       0       All       After restart       Setup       Pace 6-1         0       The /POUT2 signal turns ON (opens) when programmable output 2 is active.       1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.       -         1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.       -       -       0       All       After restart       Setup       Pace 6-1         0       The /POUT3 signal turns ON (opens) when programmable output 3 is active.       -       -       0       All       After restart       Setup       Pace 6-1         0 <td>PnB14</td> <td></td> <td>0 The /POUT0 sign</td> <td>al turns ON (o</td> <td>oens) whe</td> <td>n programi</td> <td>mable output</td> <td>0 is active.</td> <td></td> <td></td>               | PnB14            |                                                                                     | 0 The /POUT0 sign      | al turns ON (o   | oens) whe            | n programi         | mable output         | 0 is active.    |                                       |                |  |  |
| PnB15       2       /POUT       0       All       restart       Setup       6-1         0       The /POUT1 signal turns ON (opens) when programmable output 1 is active.       1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.       1       active.       1       active.       1       active.       1       active.                                                                                                                                                                                                                                                                              |                  |                                                                                     | 1 The /POUT0 sign      | nal turns OFF (d | closes) whe          | en program         | nmable outpu         | t 0 is active.  |                                       |                |  |  |
| 1       The /POUT1 signal turns OFF (closes) when programmable output 1 is active.         2       /POUT2       0 or 1       -       0       All       After restart       Setup       Page 6-1         0       The /POUT2 signal turns ON (opens) when programmable output 2 is active.       1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.         1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.         2       /POUT3       0 or 1       -       0       All       After restart       Setup       Page 6-1         0       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.       1       Setup       Page 6-1         PnB17       0       The /POUT3 signal turns ON (opens) when programmable output 3 is active.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  | 2                                                                                   | /POUT1                 | 0 or 1           | _                    | 0                  | All                  |                 | Setup                                 | page<br>6-10   |  |  |
| PnB16       2       /POUT2       0 or 1       -       0       All       After restart       Setup       pace 6-1         0       The /POUT2 signal turns ON (opens) when programmable output 2 is active.       1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.       1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.         2       /POUT3       0 or 1       -       0       All       After restart       Setup       pace 6-1         PnB17       0       The /POUT3 signal turns ON (opens) when programmable output 3 is active.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | PnB15            |                                                                                     | 0 The /POUT1 sign      | al turns ON (o   | pens) whe            | n programi         | mable output         | 1 is active.    |                                       |                |  |  |
| PnB16     0     The /POUT2 signal turns ON (opens) when programmable output 2 is active.       1     The /POUT2 signal turns OFF (closes) when programmable output 2 is active.       2     /POUT3       0     The /POUT2 signal turns OFF (closes) when programmable output 2 is active.       1     The /POUT3 signal turns OFF (closes) when programmable output 2 is active.       2     /POUT3     0 or 1     -     0     All     After restart     Setup     Setup       0     The /POUT3 signal turns ON (opens) when programmable output 3 is active.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                                                                                     | 1 The /POUT1 sign      | al turns OFF (d  | closes) whe          | en progran         | nmable outpu         | t 1 is active.  |                                       |                |  |  |
| 1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.         2       /POUT3       0 or 1       -       0       All       After restart       Setup       6-1         0       The /POUT3 signal turns ON (opens) when programmable output 3 is active.       0       0       0       0       0       0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  | 2                                                                                   | /POUT2                 | 0 or 1           | _                    | 0                  | All                  |                 | Setup                                 | page<br>6-10   |  |  |
| 1       The /POUT2 signal turns OFF (closes) when programmable output 2 is active.         2       /POUT3       0 or 1       -       0       All       After restart       Setup       Page 6-1         0       The /POUT3 signal turns ON (opens) when programmable output 3 is active.       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | PnB16            |                                                                                     | 0 The /POUT2 sign      | al turns ON (o   | oens) whe            | n programi         | mable output         | 2 is active.    |                                       |                |  |  |
| PnB17     0     The /POUT3 signal turns ON (opens) when programmable output 3 is active.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |                                                                                     |                        |                  |                      |                    |                      |                 |                                       |                |  |  |
| PnB17     0     The /POUT3 signal turns ON (opens) when programmable output 3 is active.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  | 2                                                                                   | /POUT3                 | 0 or 1           | -                    | 0                  | All                  |                 | Setup                                 | page<br>6-10   |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | PnB17            |                                                                                     |                        | ol turne ON (a   |                      |                    |                      |                 |                                       | 0 10           |  |  |
| The rest of signal tarties of the losses of which programmable output ons active.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                                                                                     |                        |                  |                      |                    |                      |                 |                                       |                |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                                                                                     |                        |                  |                      | on program         |                      |                 |                                       |                |  |  |

Continued from previous page.

|                  |          |                                       |                                        |                                    |                    |                      | tinued from      | 10.000              | page          |  |  |  |
|------------------|----------|---------------------------------------|----------------------------------------|------------------------------------|--------------------|----------------------|------------------|---------------------|---------------|--|--|--|
| Parameter<br>No. | Size     | Name                                  | Setting<br>Range                       | Setting<br>Unit                    | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer<br>ence |  |  |  |
|                  | 2        | /POUT4                                | 0 or 1                                 | -                                  | 0                  | All                  | After<br>restart | Setup               | page<br>6-10  |  |  |  |
| PnB18            |          | 0 The /POUT4 sig                      | nal turns ON (or                       | oens) whe                          | n programr         | nable output         | 4 is active.     |                     |               |  |  |  |
|                  |          | 1 The /POUT4 sig                      |                                        |                                    |                    | -                    |                  |                     |               |  |  |  |
|                  |          |                                       | , , , , , , , , , , , , , , , , , , ,  | ,                                  |                    | •                    |                  |                     |               |  |  |  |
|                  | 2        | /POUT5                                | 0 or 1                                 | _                                  | 0                  | All                  | After<br>restart | Setup               | page<br>6-10  |  |  |  |
| PnB19            |          | 0 The /POUT5 sig                      | nal turns ON (or                       | oens) whe                          | n programr         | mable output         | 5 is active.     |                     |               |  |  |  |
|                  |          | 1 The /POUT5 sig                      | nal turns OFF (c                       | closes) wh                         | en program         | nmable outpu         | t 5 is active.   |                     |               |  |  |  |
|                  |          |                                       |                                        |                                    |                    |                      | After            |                     | 0000          |  |  |  |
|                  | 2        | /POUT6                                | 0 or 1                                 | -                                  | 0                  | All                  | restart          | Setup               | page<br>6-10  |  |  |  |
| PnB1A            |          | 0 The /POUT6 sig                      | nal turns ON (or                       | oens) whe                          | n program          | mable output         | 6 is active.     |                     |               |  |  |  |
|                  |          | 1 The /POUT6 sig                      |                                        |                                    |                    |                      |                  |                     |               |  |  |  |
|                  |          |                                       |                                        | ,                                  |                    |                      |                  |                     |               |  |  |  |
|                  | 2        | /POUT7                                | 0 or 1                                 | _                                  | 0                  | All                  | After<br>restart | Setup               | page<br>6-10  |  |  |  |
| PnB1B            |          | 0 The /POUT7 sig                      | nal turns ON (or                       | oens) whe                          | n programr         | mable output         | 7 is active.     |                     |               |  |  |  |
|                  |          | 1 The /POUT7 sig                      | nal turns OFF (c                       | closes) wh                         | en program         | nmable outpu         | t 7 is active.   |                     |               |  |  |  |
|                  | 2        | /WARN                                 | 0 or 1                                 | _                                  | 0                  | All                  | After<br>restart | Setup               | page<br>6-8   |  |  |  |
|                  |          | <u> </u>                              |                                        |                                    |                    |                      |                  |                     |               |  |  |  |
| PnB1C            |          | 0 When an error/w                     |                                        |                                    |                    |                      | -                |                     |               |  |  |  |
|                  |          | 1 When an error/w                     | varning occurs (                       | error/warr                         | ning status)       | , the /WARN          | signal turns     | OFF (oper           | າຣ).          |  |  |  |
|                  |          |                                       | 0.1                                    |                                    | -                  | A.II.                | After            |                     | page          |  |  |  |
|                  | 2        | /BK                                   | 0 or 1                                 | _                                  | 0                  | All                  | restart          | Setup               | 5-32          |  |  |  |
| PnB1D            |          | 0 When braking si                     | gnal /BK is ON                         | (closed), k                        | orake is rele      | eased.               |                  |                     |               |  |  |  |
|                  |          | 1 When braking si                     | gnal /BK is OFF                        | (open), b                          | rake is rele       | ased.                |                  |                     |               |  |  |  |
|                  |          | 1                                     |                                        | 1                                  |                    |                      |                  |                     | 1             |  |  |  |
|                  | 2        | /S-RDY                                | 0 or 1                                 | -                                  | 0                  | All                  | After<br>restart | Setup               | page<br>6-8   |  |  |  |
| PnB1E            |          | 0 When the SERV                       | OPACK is ready                         | $_{1}$ the /S_R                    | DV signal t        | urns ON (clos        | 200)             |                     |               |  |  |  |
|                  |          | 1 When the SERV                       |                                        |                                    | -                  |                      |                  |                     |               |  |  |  |
|                  |          |                                       |                                        | ,,                                 | B i olgitai t      |                      | 0110)1           |                     |               |  |  |  |
|                  | 2        | Overtravel (OT) Stop<br>Method        | 0 to 2                                 | _                                  | 0                  | All                  | After<br>restart | Setup               | page<br>5-28  |  |  |  |
|                  |          | 0 Stops the motor of Pn001 = $n.\Box$ |                                        | method as                          | s when the         | servo is turne       | ed OFF (acco     | ording to s         | etting        |  |  |  |
| PnB1F            |          | 1 Stops motor imr                     | ,                                      | hen chang                          | es motor s         | tate to servo        | lock.            |                     |               |  |  |  |
|                  |          | 2 Decelerates mot                     |                                        | deceleratio                        | on rate set        | with PnB2B,          | and then cha     | anges mot           | tor           |  |  |  |
|                  |          | <sup>2</sup> state to servo lo        | CK.                                    |                                    |                    |                      |                  |                     |               |  |  |  |
|                  | 2        | Moving Mode                           | 0 to 3                                 | _                                  | 0                  | All                  | After<br>restart | Setup               | page<br>12-2  |  |  |  |
|                  | -        |                                       |                                        |                                    |                    | <u> </u>             |                  | 1                   | .             |  |  |  |
|                  | <u> </u> |                                       | a ta linaar tura                       | 0 Sets coordinates to linear type. |                    |                      |                  |                     |               |  |  |  |
| PnB20            |          |                                       |                                        | Movina ~                           | ode is set         | ac chartant ~        | ath              |                     |               |  |  |  |
| PnB20            |          | 1 Sets coordinates                    | s to rotary type.                      | 0                                  |                    |                      |                  |                     |               |  |  |  |
| PnB20            |          |                                       | s to rotary type.<br>s to rotary type. | Moving m                           | node is alw        | ays set as for       | ward.            |                     |               |  |  |  |
| PnB20            |          | 1Sets coordinates2Sets coordinates    | s to rotary type.<br>s to rotary type. | Moving m                           | node is alw        | ays set as for       | ward.            |                     |               |  |  |  |
| PnB20<br>PnB21   | 4        | 1Sets coordinates2Sets coordinates    | s to rotary type.<br>s to rotary type. | Moving m                           | node is alw        | ays set as for       | ward.            | Setup               | page<br>12-2  |  |  |  |

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|                  | Continued from previous p |                                        |                                                                                                           |                                            |                                                  |                    |                      |                  | s page.             |                                                                  |
|------------------|---------------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------------|--------------------|----------------------|------------------|---------------------|------------------------------------------------------------------|
| Parameter<br>No. | Size                      |                                        | Name                                                                                                      | Setting<br>Range                           | Setting<br>Unit                                  | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence                                                   |
| PnB23            | 4                         | (PnB20<br>Softwar<br>Rotatio<br>(PnB20 | coordinates<br>0 = 0): Reverse<br>re Limit (N-LS)<br>nal coordinates<br>0 ≠ 0): First Rota-<br>Coordinate | -999999999 to<br>+999999999 <sup>*15</sup> | 1 refer-<br>ence<br>unit                         | -999999999         | All                  | After<br>restart | Setup               | page<br>12-2                                                     |
| PnB25            | 4                         | mental<br>Origin<br>When u<br>lute end | using an incre-<br>encoder:<br>using an abso-<br>coder:<br>te Encoder Offset                              | -99999999 to<br>+99999999 <sup>*15</sup>   | 1 refer-<br>ence<br>unit                         | 0                  | All                  | After<br>restart | Setup               | page<br>12-2,<br>page<br>12-6,<br>page<br>13-5,<br>page<br>14-12 |
| PnB27            | 4                         | Positior<br>Speed                      | ning/Registration                                                                                         | 1 to<br>999999999 <sup>*15</sup>           | 1000<br>Refer-<br>ence<br>units/<br>min          | 1000               | All                  | After<br>restart | Setup               | page<br>12-4                                                     |
| PnB29            | 4                         | Acceler                                | ration rate                                                                                               | 1 to<br>999999999 <sup>*15</sup>           | 1000<br>(Refer-<br>ence<br>units/<br>min)<br>/ms | 1000               | All                  | Immedi-<br>ately | Setup               | page                                                             |
| PnB2B            | 4                         | Deceleration rate                      |                                                                                                           | 1 to<br>999999999 <sup>*15</sup>           | 1000<br>(Refer-<br>ence<br>units/<br>min)<br>/ms | 1000               | All                  | Immedi-<br>ately | Setup               | 12-4                                                             |
| PnB2D            | 4                         | /INPOS                                 | SITION Width                                                                                              | 1 to 99999                                 | Refer-<br>ence<br>unit                           | 1                  | All                  | Immedi-<br>ately | Setup               | page<br>6-9                                                      |
| PnB2F            | 4                         | /NEAR                                  | Width                                                                                                     | 1 to 99999                                 | Refer-<br>ence<br>unit                           | 1                  | All                  | Immedi-<br>ately | Setup               | page<br>13-12                                                    |
|                  | 2                         | Homing                                 | g Method                                                                                                  | 0 to 3                                     | _                                                | 0                  | All                  | After<br>restart | Setup               | page<br>13-5,<br>page<br>14-12                                   |
| PnB31            |                           | 0 Homing is not executed.              |                                                                                                           |                                            |                                                  |                    |                      |                  |                     |                                                                  |
|                  |                           | 1                                      | /DEC and phase                                                                                            |                                            | homing.                                          |                    |                      |                  |                     |                                                                  |
|                  |                           | 2                                      | Only /DEC is use<br>Only phase C is                                                                       |                                            | g.                                               |                    |                      |                  |                     |                                                                  |
| DeP20            | 2                         | Homing                                 | g Direction                                                                                               | 0 or 1                                     | _                                                | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>13-5,<br>page<br>14-12                                   |
| PnB32            |                           | 0                                      | /HOME or ZRN c<br>/HOME or ZRN c                                                                          |                                            |                                                  | •                  |                      |                  |                     |                                                                  |
| PnB33            | 4                         | Homing                                 | g Moving Speed                                                                                            | 1 to<br>99999999 <sup>*15</sup>            | 1000<br>Refer-<br>ence<br>units/<br>min          | 1000               | All                  | Immedi-<br>ately | Setup               | page<br>13-5,<br>page<br>14-12                                   |
| PnB35            | 4                         | Homing<br>Speed                        | g Approach                                                                                                | 1 to<br>99999999 <sup>*15</sup>            | 1000<br>Refer-<br>ence<br>units/<br>min          | 1000               | All                  | Immedi-<br>ately | Setup               | page<br>13-6,<br>page<br>14-12                                   |
| PnB37            | 4                         | Homing                                 | g Creep Speed                                                                                             | 1 to<br>99999999 <sup>*15</sup>            | 1000<br>Refer-<br>ence<br>units/<br>min          | 1000               | All                  | Immedi-<br>ately | Setup               | page<br>13-6,<br>page<br>14-12                                   |

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|                   | Continued from previous pag |                                                  |                                                                                                                              |                          |                    |                      |                  | s page.             |                                |
|-------------------|-----------------------------|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------|----------------------|------------------|---------------------|--------------------------------|
| Parameter<br>No.  | Size                        | Name                                             | Setting<br>Range                                                                                                             | Setting<br>Unit          | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence                 |
| PnB39             | 4                           | Homing Final Move Dis<br>tance                   | 99999999 to<br>+99999999 <sup>*15</sup>                                                                                      | 1 refer-<br>ence<br>unit | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>13-6,<br>page<br>14-12 |
| PnB3B to<br>PnB4D | 4                           | Reserved parameters (Do not change.)             | _                                                                                                                            | -                        | 0                  | All                  | _                | Setup               | _                              |
|                   | 2                           | ZONE Signal Setting                              | 0000h or<br>0001h                                                                                                            | -                        | 0000h              | All                  | After<br>restart | Setup               | page<br>13-54                  |
| PnB4F             |                             | POUT7 signals                                    | ower is turned (                                                                                                             |                          |                    |                      |                  |                     |                                |
| PnB50             | 2                           | Backlash Compensatic                             | n -1000 to<br>+1000                                                                                                          | Refer-<br>ence<br>unit   | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>8-71                   |
|                   | 2                           | /ALO Output Selection                            | 0, 1                                                                                                                         | _                        | 0                  | All                  | After<br>restart | Setup               | page<br>6-7                    |
| PnB51             |                             |                                                  | ot output /ALO1 to /ALO3. (/WARN, /BK, and /S-RDY are output.)<br>s /ALO1 to /ALO3. (/WARN, /BK, and /S-RDY are not output.) |                          |                    |                      |                  |                     |                                |
|                   | 2                           | /ALM-RST                                         | 0 to 3                                                                                                                       | -                        | 0                  | All                  | After<br>restart | Setup               | page<br>15-49                  |
| PnB52             |                             | 0 Resets an alarr                                | n by switching th                                                                                                            | ne /ALM-R                | ST signal f        | rom OFF (ope         | en) to ON (cl    | osed).              |                                |
| FIIDD2            |                             | 1 Resets an alarr                                | n by switching th                                                                                                            | ne /ALM-R                | ST signal f        | rom ON (clos         | ed) to OFF (d    | open).              |                                |
|                   |                             | 2, 3 Does not reset alarms. (Signal is ignored.) |                                                                                                                              |                          |                    |                      |                  |                     |                                |
|                   | 2                           | Input Signal Monitor IN<br>Polarity Selection    | 0000h to<br>00FFh                                                                                                            | _                        | 0050h              | All                  | After<br>restart | Setup               | _                              |
|                   |                             |                                                  | onitor IN1 Bit 0 (/<br>t the data (defau                                                                                     |                          | 1: Invert ti       | ne data.)            |                  |                     |                                |
|                   |                             |                                                  | nitor IN1 Bit 1 (/<br>t the data (defau                                                                                      |                          |                    | ne data.)            |                  |                     |                                |
|                   |                             |                                                  | nitor IN1 Bit 2 (/<br>t the data (defau                                                                                      |                          | 1: Invert tl       | ne data.)            |                  |                     |                                |
| PnB53             |                             |                                                  | onitor IN1 Bit 3 (/<br>t the data (defau                                                                                     |                          | 1: Invert ti       | ne data.)            |                  |                     |                                |
|                   |                             |                                                  | nitor IN1 Bit 4 (/<br>t the data, 1: Inv                                                                                     |                          | ta (default        | setting).)           |                  |                     |                                |
|                   |                             |                                                  | onitor IN1 Bit 5 (r<br>t the data (defau                                                                                     |                          | 1: Invert th       | ne data.)            |                  |                     |                                |
|                   |                             | Bit 6 Input Signal Mo<br>(0: Do not inve         | onitor IN1 Bit 6 (/<br>t the data, 1: Inv                                                                                    | RGRT)<br>rert the da     | ta (default        | setting).)           |                  |                     |                                |
|                   |                             |                                                  | onitor IN1 Bit 7 (r<br>t the data (defau                                                                                     |                          | 1: Invert ti       | ne data.)            |                  |                     |                                |
| PnB54             | 2                           | Speed/Position Expan-<br>sion Function Selection | 0, 1                                                                                                                         | -                        | 0                  | All                  | After<br>restart | Setup               | _                              |

\*1. The following parameters are automatically set when the INDEXER Module is mounted to the SERVOPACK. Do not change the setting.

• Pn002 = n.□□□0

• Pn207 = n.1

• Pn50A = 8881h

• Pn50B = 8888h

• Pn510 = 0000h

\*2. This parameter is automatically set to 0 if a single-turn absolute encoder is used and Pn002 is set to n.  $\Box 0 \Box \Box$ .

\*3. Set a percentage of the motor rated torque.

\*4. When the INDEXER Module is mounted to the SERVOPACK, Pn50E is set to 0000h or 3000h according to the setting of PnB51. Do not change the setting.

- \*5. When the INDEXER Module is mounted to the SERVOPACK, Pn50F is set to 0000h or 1200h according to the setting of PnB51. Do not change the setting.
- \*6. When the INDEXER Module is mounted to the SERVOPACK, this parameter is automatically set according to the settings of PnB11 and PnB12. (Pn511 = n.8□■8, where □ = 4, 8, or D and = 6, 8, or F) Do not change the setting.

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- \*7. When the INDEXER Module is mounted to the SERVOPACK, this parameter is automatically set according to the settings of PnB1C, PnB1D, PnB1E, and PnB51. (Pn512 = n.0□□□, where □ = 0 or 1) Do not change the setting.
- \*8. When the INDEXER Module is mounted to the SERVOPACK, Pn517 is set to 0000h or 0321h according to the setting of PnB51. Do not change the setting.
- \*9. When the INDEXER Module is mounted to the SERVOPACK, this parameter is automatically set to between 0 and 99,999 according to the setting of PnB2D. Do not change the setting.

\*10.Normally set this parameter to 0. If you use an External Regenerative Resistor, set the capacity (W) of the External Regenerative Resistor.

- \*11. The upper limit is the maximum output capacity (W) of the SERVOPACK.
- \*12. These parameters are for SERVOPACKs with the Dynamic Brake Hardware Option. Refer to the following manual for details.

#### Ω Σ-7-Series AC Servo Drive Σ-7S/Σ-7W SERVOPACK with Dynamic Brake Hardware Option Specifications Product Manual (Manual No.: SIEP S800001 73)

\*13. The SGLFW2 is the only Yaskawa Linear Servomotor that supports this function.

- \*14. Enabled only when Pn61A is set to  $n.\square\square\square2$  or  $n.\square\square\square3$ .
- \*15.If you set PnB54 to 1 (Enable Expansion Mode), the following setting ranges will change.

| Parameter No. | Name                                                                                                                                                       | Setting Range                       |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| PnB21         | <ul> <li>Linear coordinates (PnB20 = 0): Forward Software Limit (P-LS)</li> <li>Rotational coordinates (PnB20 ≠ 0): Last Rotational Coordinate</li> </ul>  | -536,870,911 to +536,870,911        |
| PnB23         | <ul> <li>Linear coordinates (PnB20 = 0): Reverse Software Limit (N-LS)</li> <li>Rotational coordinates (PnB20 ≠ 0): First Rotational Coordinate</li> </ul> | -536,870,911 to +536,870,911        |
| PnB25         | <ul><li>When using an incremental encoder: Origin</li><li>When using an absolute encoder: Absolute Encoder Offset</li></ul>                                | -1,073,741,823 to<br>+1,073,741,823 |
| PnB27         | Positioning/Registration Speed                                                                                                                             | 1 to 199,999,999                    |
| PnB29         | Acceleration Rate                                                                                                                                          | 1 to 199,999,999                    |
| PnB2B         | Deceleration Rate                                                                                                                                          | 1 to 199,999,999                    |
| PnB33         | Homing Movement Speed                                                                                                                                      | 1 to 199,999,999                    |
| PnB35         | Homing Approach Speed                                                                                                                                      | 1 to 199,999,999                    |
| PnB37         | Homing Creep Speed                                                                                                                                         | 1 to 199,999,999                    |
| PnB39         | Homing Final Travel Distance                                                                                                                               | -1,073,741,823 to<br>+1,073,741,823 |

## 16.3 Parameter Recording Table

Use the following table to record the settings of the parameters.

| Parameter<br>No. | Default<br>Setting | Name                                                         | When<br>Enabled |
|------------------|--------------------|--------------------------------------------------------------|-----------------|
| Pn000            | 0000h              | Basic Function Selections<br>0                               | After restart   |
| Pn001            | 0000h              | Application Function Selec-<br>tions 1                       | After restart   |
| Pn002            | 0000h*1            | Application Function Selec-<br>tions 2                       | After restart   |
| Pn006            | 0002h              | Application Function Selec-<br>tions 6                       | Immediately     |
| Pn007            | 0000h              | Application Function Selec-<br>tions 7                       | Immediately     |
| Pn008            | 4000h              | Application Function Selec-<br>tions 8                       | After restart   |
| Pn009            | 0010h              | Application Function Selec-<br>tions 9                       | After restart   |
| Pn00A            | 0001h              | Application Function Selec-<br>tions A                       | After restart   |
| Pn00B            | 0000h              | Application Function Selec-<br>tions B                       | After restart   |
| Pn00C            | 0000h              | Application Function Selec-<br>tions C                       | After restart   |
| Pn00D            | 0000h              | Application Function Selec-<br>tions D                       | Immediately     |
| Pn00E            | 0000h              | Reserved parameter                                           | -               |
| Pn00F            | 0000h              | Application Function Selec-<br>tions F                       | After restart   |
| Pn010            | 0001h              | Axis Address Selection<br>(For UART/USB communi-<br>cations) | After restart   |
| Pn021            | 0000               | Reserved parameter                                           | _               |
| Pn022            | 0000h              | Reserved parameter                                           | _               |
| Pn040            | 0000h              | Σ-V Compatible Function<br>Switch                            | After restart   |
| Pn080            | 0000h              | Application Function Selec-<br>tions 80                      | After restart   |
| Pn081            | 0000h              | Application Function Selec-<br>tions 81                      | After restart   |
| Pn100            | 400                | Speed Loop Gain                                              | Immediately     |
| Pn101            | 2000               | Speed Loop Integral Time<br>Constant                         | Immediately     |
| Pn102            | 400                | Position Loop Gain                                           | Immediately     |
| Pn103            | 100                | Moment of Inertia Ratio                                      | Immediately     |
| Pn104            | 400                | Second Speed Loop Gain                                       | Immediately     |
| Pn105            | 2000               | Second Speed Loop Inte-<br>gral Time Constant                | Immediately     |
| Pn106            | 400                | Second Position Loop Gain                                    | Immediately     |
| Pn109            | 0                  | Feedforward                                                  | Immediately     |
| Pn10A            | 0                  | Feedforward Filter Time<br>Constant                          | Immediately     |
| Pn10B            | 0000h              | Gain Application Selections                                  | *2              |

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| Parameter<br>No. | Default<br>Setting | Name                                                           | When<br>Enabled |
|------------------|--------------------|----------------------------------------------------------------|-----------------|
| Pn10C            | 200                | Mode Switching Level for<br>Torque Reference                   | Immediately     |
| Pn10D            | 0                  | Mode Switching Level for<br>Speed Reference                    | Immediately     |
| Pn10E            | 0                  | Mode Switching Level for<br>Acceleration                       | Immediately     |
| Pn10F            | 0                  | Mode Switching Level for<br>Position Deviation                 | Immediately     |
| Pn11F            | 0                  | Position Integral Time Con-<br>stant                           | Immediately     |
| Pn121            | 100                | Friction Compensation<br>Gain                                  | Immediately     |
| Pn122            | 100                | Second Friction Compen-<br>sation Gain                         | Immediately     |
| Pn123            | 0                  | Friction Compensation<br>Coefficient                           | Immediately     |
| Pn124            | 0                  | Friction Compensation Fre-<br>quency Correction                | Immediately     |
| Pn125            | 100                | Friction Compensation<br>Gain Correction                       | Immediately     |
| Pn131            | 0                  | Gain Switching Time 1                                          | Immediately     |
| Pn132            | 0                  | Gain Switching Time 2                                          | Immediately     |
| Pn135            | 0                  | Gain Switching Waiting<br>Time 1                               | Immediately     |
| Pn136            | 0                  | Gain Switching Waiting<br>Time 2                               | Immediately     |
| Pn139            | 0000h              | Automatic Gain Switching<br>Selections 1                       | Immediately     |
| Pn13D            | 2000               | Current Gain Level                                             | Immediately     |
| Pn140            | 0100h              | Model Following Control-<br>Related Selections                 | Immediately     |
| Pn141            | 500                | Model Following Control<br>Gain                                | Immediately     |
| Pn142            | 1000               | Model Following Control<br>Gain Correction                     | Immediately     |
| Pn143            | 1000               | Model Following Control<br>Bias in the Forward Direc-<br>tion  | Immediately     |
| Pn144            | 1000               | Model Following Control<br>Bias in the Reverse Direc-<br>tion  | Immediately     |
| Pn145            | 500                | Vibration Suppression 1<br>Frequency A                         | Immediately     |
| Pn146            | 700                | Vibration Suppression 1<br>Frequency B                         | Immediately     |
| Pn147            | 1000               | Model Following Control<br>Speed Feedforward Com-<br>pensation | Immediately     |
| Pn148            | 500                | Second Model Following<br>Control Gain                         | Immediately     |
| Pn149            | 1000               | Second Model Following<br>Control Gain Correction              | Immediately     |
| Pn14A            | 800                | Vibration Suppression 2<br>Frequency                           | Immediately     |
| Pn14B            | 100                | Vibration Suppression 2<br>Correction                          | Immediately     |

| Continued from previous | page. |
|-------------------------|-------|
|-------------------------|-------|

| Parameter<br>No. | Default<br>Setting  | Name                                                   | When<br>Enabled                         |
|------------------|---------------------|--------------------------------------------------------|-----------------------------------------|
| Pn14F            | 0011h               | Control-Related Selections                             | After restart                           |
| Pn160            | 0010h               | Anti-Resonance Control-<br>Related Selections          | Immediately                             |
| Pn161            | 1000                | Anti-Resonance Frequency                               | Immediately                             |
| Pn162            | 100                 | Anti-Resonance Gain Cor-<br>rection                    | Immediately                             |
| Pn163            | 0                   | Anti-Resonance Damping<br>Gain                         | Immediately                             |
| Pn164            | 0                   | Anti-Resonance Filter Time<br>Constant 1 Correction    | Immediately                             |
| Pn165            | 0                   | Anti-Resonance Filter Time<br>Constant 2 Correction    | Immediately                             |
| Pn166            | 0                   | Anti-Resonance Damping<br>Gain 2                       | Immediately                             |
| Pn170            | 1401h               | Tuning-less Function-<br>Related Selections            | *2                                      |
| Pn181            | 0                   | Mode Switching Level for<br>Speed Reference            | Immediately                             |
| Pn182            | 0                   | Mode Switching Level for<br>Acceleration               | Immediately                             |
| Pn205            | 65535 <sup>*1</sup> | Multiturn Limit                                        | After restart                           |
| Pn207            | 0010h <sup>*1</sup> | Reserved parameter (Do not change.)                    | After restart                           |
| Pn20A            | 32768               | Number of External Scale<br>Pitches                    | After restart                           |
| Pn20E            | 64                  | Electronic Gear Ratio<br>(Numerator)                   | After restart                           |
| Pn210            | 1                   | Electronic Gear Ratio<br>(Denominator)                 | After restart                           |
| Pn212            | 2048                | Number of Encoder Out-<br>put Pulses                   | After restart                           |
| Pn217            | 0                   | Average Movement Time of<br>Position Reference         | Immediately<br>after the<br>motor stops |
| Pn22A            | 0000h               | Fully-closed Control Selec-<br>tions                   | After restart                           |
| Pn230            | 0000h               | Reserved parameter<br>(Do not change.)                 | _                                       |
| Pn231            | 0                   | (Do not change.)                                       | -                                       |
| Pn233            | 0                   | (Do not change.)                                       | -                                       |
| Pn281            | 20                  | Encoder Output Resolution                              | After restart                           |
| Pn282            | 0                   | Linear Encoder Pitch                                   | After restart                           |
| Pn304            | 500                 | Jog Operation Speed                                    | Immediately                             |
| Pn305            | 0                   | Soft Start Acceleration<br>Time                        | Immediately                             |
| Pn306            | 0                   | Soft Start Deceleration<br>Time                        | Immediately                             |
| Pn308            | 0                   | Speed Feedback Filter<br>Time Constant                 | Immediately                             |
| Pn30A            | 0                   | Deceleration Time for<br>Servo OFF and Forced<br>Stops | Immediately                             |

| Parameter<br>No. | Default<br>Setting | Continued from p                                                 | When<br>Enabled |
|------------------|--------------------|------------------------------------------------------------------|-----------------|
| Pn30C            | 0                  | Reserved parameter (Do not change.)                              | _               |
| Pn310            | 0000h              | Vibration Detection Selec-<br>tions                              | Immediately     |
| Pn311            | 100                | Vibration Detection Sensi-<br>tivity                             | Immediately     |
| Pn312            | 50                 | Vibration Detection Level                                        | Immediately     |
| Pn316            | 10000              | Maximum Motor Speed                                              | After restart   |
| Pn324            | 300                | Moment of Inertia Calcula-<br>tion Starting Level                | Immediately     |
| Pn383            | 50                 | Jog Operation Speed                                              | Immediately     |
| Pn384            | 10                 | Vibration Detection Level                                        | Immediately     |
| Pn385            | 50                 | Maximum Motor Speed                                              | After restart   |
| Pn401            | 100                | First Stage First Torque<br>Reference Filter Time Con-<br>stant  | Immediately     |
| Pn402            | 800                | Forward Torque Limit                                             | Immediately     |
| Pn403            | 800                | Reverse Torque Limit                                             | Immediately     |
| Pn404            | 100                | Reserved parameter (Do not change.)                              | _               |
| Pn405            | 100                | Reserved parameter (Do not change.)                              | _               |
| Pn406            | 800                | Emergency Stop Torque                                            | Immediately     |
| Pn407            | 10000              | Reserved parameter (Do not change.)                              | _               |
| Pn408            | 0000h              | Torque-Related Function<br>Selections                            | *2              |
| Pn409            | 5000               | First Stage Notch Filter Fre-<br>quency                          | Immediately     |
| Pn40A            | 70                 | First Stage Notch Filter Q<br>Value                              | Immediately     |
| Pn40B            | 0                  | First Stage Notch Filter<br>Depth                                | Immediately     |
| Pn40C            | 5000               | Second Stage Notch Filter<br>Frequency                           | Immediately     |
| Pn40D            | 70                 | Second Stage Notch Filter<br>Q Value                             | Immediately     |
| Pn40E            | 0                  | Second Stage Notch Filter<br>Depth                               | Immediately     |
| Pn40F            | 5000               | Second Stage Second<br>Torque Reference Filter<br>Frequency      | Immediately     |
| Pn410            | 50                 | Second Stage Second<br>Torque Reference Filter Q<br>Value        | Immediately     |
| Pn412            | 100                | First Stage Second Torque<br>Reference Filter Time Con-<br>stant | Immediately     |
| Pn416            | 0000h              | Torque-Related Function<br>Selections 2                          | Immediately     |
| Pn417            | 5000               | Third Stage Notch Filter<br>Frequency                            | Immediately     |
| Pn418            | 70                 | Third Stage Notch Filter Q<br>Value                              | Immediately     |
| Pn419            | 0                  | Third Stage Notch Filter Depth Continued                         | Immediately     |

| Deversete        | Default            |                                                                       | previous page.  |
|------------------|--------------------|-----------------------------------------------------------------------|-----------------|
| Parameter<br>No. | Default<br>Setting | Name                                                                  | When<br>Enabled |
| Pn41A            | 5000               | Fourth Stage Notch Filter<br>Frequency                                | Immediately     |
| Pn41B            | 70                 | Fourth Stage Notch Filter Q<br>Value                                  | Immediately     |
| Pn41C            | 0                  | Fourth Stage Notch Filter<br>Depth                                    | Immediately     |
| Pn41D            | 5000               | Fifth Stage Notch Filter Fre-<br>quency                               | Immediately     |
| Pn41E            | 70                 | Fifth Stage Notch Filter Q<br>Value                                   | Immediately     |
| Pn41F            | 0                  | Fifth Stage Notch Filter<br>Depth                                     | Immediately     |
| Pn423            | 0000h              | Speed Ripple Compensa-<br>tion Selections                             | *2              |
| Pn424            | 50                 | Torque Limit at Main Circuit<br>Voltage Drop                          | Immediately     |
| Pn425            | 100                | Release Time for Torque<br>Limit at Main Circuit Volt-<br>age Drop    | Immediately     |
| Pn426            | 0                  | Reserved parameter                                                    | _               |
| Pn427            | 0                  | Speed Ripple Compensa-<br>tion Enable Speed                           | Immediately     |
| Pn456            | 15                 | Sweep Torque Reference<br>Amplitude                                   | Immediately     |
| Pn460            | 0101h              | Notch Filter Adjustment<br>Selections 1                               | Immediately     |
| Pn475            | 0000h              | Gravity Compensation-<br>Related Selections                           | After restart   |
| Pn476            | 0                  | Gravity Compensation<br>Torque                                        | Immediately     |
| Pn480            | 10000              | Reserved parameter                                                    | -               |
| Pn481            | 400                | Polarity Detection Speed<br>Loop Gain                                 | Immediately     |
| Pn482            | 3000               | Polarity Detection Speed<br>Loop Integral Time Con-<br>stant          | Immediately     |
| Pn483            | 30                 | Forward Force Limit                                                   | Immediately     |
| Pn484            | 30                 | Reverse Force Limit                                                   | Immediately     |
| Pn485            | 20                 | Polarity Detection Refer-<br>ence Speed                               | Immediately     |
| Pn486            | 25                 | Polarity Detection Refer-<br>ence Acceleration/Deceler-<br>ation Time | Immediately     |
| Pn487            | 0                  | Polarity Detection Constant<br>Speed Time                             | Immediately     |
| Pn488            | 100                | Polarity Detection Reference Waiting Time                             | Immediately     |
| Pn48E            | 10                 | Polarity Detection Range                                              | Immediately     |
| Pn490            | 100                | Polarity Detection Load<br>Level                                      | Immediately     |
| Pn495            | 100                | Polarity Detection Confir-<br>mation Force Reference                  | Immediately     |
| Pn498            | 10                 | Polarity Detection Allow-<br>able Error Range                         | Immediately     |
| Pn49F            | 0                  | Speed Ripple Compensa-<br>tion Enable Speed                           | Immediately     |

Parameter Lists

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| Parameter<br>No. | Default<br>Setting  | Name                                                           | When<br>Enabled |
|------------------|---------------------|----------------------------------------------------------------|-----------------|
| Pn502            | 20                  | Rotation Detection Level                                       | Immediately     |
| Pn503            | 10                  | Reserved parameter                                             | _               |
| Pn506            | 0                   | Brake Reference-Servo<br>OFF Delay Time                        | Immediately     |
| Pn507            | 100                 | Brake Reference Output<br>Speed Level                          | Immediately     |
| Pn508            | 50                  | Servo OFF-Brake Com-<br>mand Waiting Time                      | Immediately     |
| Pn509            | 20                  | Momentary Power Interrup-<br>tion Hold Time                    | Immediately     |
| Pn50A            | 1881h <sup>*1</sup> | Reserved parameter                                             | -               |
| Pn50B            | 8882h*1             | Reserved parameter                                             | -               |
| Pn50E            | 0000h*1             | Reserved parameter                                             | _               |
| Pn50F            | 0100h <sup>*1</sup> | Reserved parameter                                             | _               |
| Pn510            | 0000h*1             | Reserved parameter                                             | _               |
| Pn511            | 6543h*1             | Reserved parameter                                             | _               |
| Pn512            | 0000h <sup>*1</sup> | Reserved parameter                                             | _               |
| Pn514            | 0000h               | Reserved parameter                                             | _               |
| Pn516            | 8888h               | Reserved parameter                                             | _               |
| Pn517            | 0000h*1             | Reserved parameter                                             | _               |
| Pn51B            | 1000                | Motor-Load Position Devia-<br>tion Overflow Detection<br>Level | Immediately     |
| Pn51E            | 100                 | Position Deviation Over-<br>flow Warning Level                 | Immediately     |
| Pn520            | 5242880             | Position Deviation Over-<br>flow Alarm Level                   | Immediately     |
| Pn522            | 7*1                 | Reserved parameter                                             | -               |
| Pn524            | 1073741824          | Reserved parameter                                             | -               |
| Pn526            | 5242880             | Position Deviation Over-<br>flow Alarm Level at Servo<br>ON    | Immediately     |
| Pn528            | 100                 | Position Deviation Over-<br>flow Warning Level at<br>Servo ON  | Immediately     |
| Pn529            | 10000               | Speed Limit Level at Servo<br>ON                               | Immediately     |
| Pn52A            | 20                  | Multiplier per Fully-closed<br>Rotation                        | Immediately     |
| Pn52B            | 20                  | Overload Warning Level                                         | Immediately     |
| Pn52C            | 100                 | Base Current Derating at<br>Motor Overload Detection           | After restart   |
| Pn530            | 0000h               | Program Jog Operation-<br>Related Selections                   | Immediately     |
| Pn531            | 32768               | Program Jog Operation<br>Travel Distance                       | Immediately     |
| Pn533            | 500                 | Program Jog Operation<br>Movement Speed                        | Immediately     |
| Pn534            | 100                 | Program Jog Operation<br>Acceleration/Deceleration<br>Time     | Immediately     |
| Pn535            | 100                 | Program Jog Operation<br>Waiting Time                          | Immediately     |

| Continued from previous page. |                    |  |  |                                                             |                 |
|-------------------------------|--------------------|--|--|-------------------------------------------------------------|-----------------|
| Parameter<br>No.              | Default<br>Setting |  |  | Name                                                        | When<br>Enabled |
| Pn536                         | 1                  |  |  | Program Jog Operation<br>Number of Movements                | Immediately     |
| Pn550                         | 0                  |  |  | Analog Monitor 1 Offset<br>Voltage                          | Immediately     |
| Pn551                         | 0                  |  |  | Analog Monitor 2 Offset<br>Voltage                          | Immediately     |
| Pn552                         | 100                |  |  | Analog Monitor 1 Magnifi-<br>cation                         | Immediately     |
| Pn553                         | 100                |  |  | Analog Monitor 2 Magnifi-<br>cation                         | Immediately     |
| Pn55A                         | 1                  |  |  | Power Consumption Moni-<br>tor Unit Time                    | Immediately     |
| Pn560                         | 400                |  |  | Residual Vibration Detec-<br>tion Width                     | Immediately     |
| Pn561                         | 100                |  |  | Overshoot Detection Level                                   | Immediately     |
| Pn581                         | 20                 |  |  | Zero Speed Level                                            | Immediately     |
| Pn582                         | 10                 |  |  | Reserved parameter                                          | _               |
| Pn583                         | 10                 |  |  | Brake Reference Output<br>Speed Level                       | Immediately     |
| Pn584                         | 10000              |  |  | Speed Limit Level at Servo<br>ON                            | Immediately     |
| Pn585                         | 50                 |  |  | Program Jog Operation<br>Movement Speed                     | Immediately     |
| Pn586                         | 0                  |  |  | Motor Running Cooling<br>Ratio                              | Immediately     |
| Pn587                         | 0000h              |  |  | Reserved parameter                                          | -               |
| Pn600                         | 0                  |  |  | Regenerative Resistor<br>Capacity                           | Immediately     |
| Pn601                         | 0                  |  |  | Dynamic Brake Resistor<br>Allowable Energy Con-<br>sumption | After restart   |
| Pn603                         | 0                  |  |  | Regenerative Resistance                                     | Immediately     |
| Pn604                         | 0                  |  |  | Dynamic Brake Resistance                                    | After restart   |
| Pn61A                         | 0000h              |  |  | Overheat Protection Selec-<br>tions                         | After restart   |
| Pn61B                         | 250                |  |  | Overheat Alarm Level                                        | Immediately     |
| Pn61C                         | 100                |  |  | Overheat Warning Level                                      | Immediately     |
| Pn61D                         | 0                  |  |  | Overheat Alarm Filter Time                                  | Immediately     |
| PnB00                         | 1                  |  |  | Serial Communication Pro-<br>tocol                          | After restart   |
| PnB01                         | 0                  |  |  | Bit rate                                                    | After restart   |
| PnB02                         | 1                  |  |  | Response "OK"                                               | Immediately     |
| PnB03                         | 0                  |  |  | /MODE 0/1                                                   | After restart   |
| PnB04                         | 0                  |  |  | /START-STOP; /HOME                                          | After restart   |
| PnB05                         | 0                  |  |  | /PGMRES; /JOGP                                              | After restart   |
| PnB06                         | 0                  |  |  | /SEL0; /JOGN                                                | After restart   |
| PnB07                         | 0                  |  |  | /SEL1; /JOG0                                                | After restart   |
| PnB08                         | 0                  |  |  | /SEL2; /JOG1                                                | After restart   |
| PnB09                         | 0                  |  |  | /SEL3; /JOG2                                                | After restart   |
| PnB0A                         | 0                  |  |  | /SEL4; /JOG3                                                | After restart   |
| PnB0B                         | 0                  |  |  | /SEL5                                                       | After restart   |
| PnB0C                         | 0                  |  |  | /SEL6                                                       | After restart   |
| PnB0D                         | 0                  |  |  | /SEL7                                                       | After restart   |

| Continued from previou |                    |  |                                                                                                                                                                              |                 |
|------------------------|--------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Parameter<br>No.       | Default<br>Setting |  | Name                                                                                                                                                                         | When<br>Enabled |
| PnB0E                  | 0                  |  | /S-ON                                                                                                                                                                        | After restart   |
| PnB0F                  | 0                  |  | P-OT                                                                                                                                                                         | After restart   |
| PnB10                  | 0                  |  | N-OT                                                                                                                                                                         | After restart   |
| PnB11                  | 0                  |  | /DEC                                                                                                                                                                         | After restart   |
| PnB12                  | 0                  |  | /RGRT                                                                                                                                                                        | After restart   |
| PnB13                  | 0                  |  | /INPOSITION                                                                                                                                                                  | After restart   |
| PnB14                  | 0                  |  | /POUT0                                                                                                                                                                       | After restart   |
| PnB15                  | 0                  |  | /POUT1                                                                                                                                                                       | After restart   |
| PnB16                  | 0                  |  | /POUT2                                                                                                                                                                       | After restart   |
| PnB17                  | 0                  |  | /POUT3                                                                                                                                                                       | After restart   |
| PnB18                  | 0                  |  | /POUT4                                                                                                                                                                       | After restart   |
| PnB19                  | 0                  |  | /POUT5                                                                                                                                                                       | After restart   |
| PnB1A                  | 0                  |  | /POUT6                                                                                                                                                                       | After restart   |
| PnB1B                  | 0                  |  | /POUT7                                                                                                                                                                       | After restart   |
| PnB1C                  | 0                  |  | /WARN                                                                                                                                                                        | After restart   |
| PnB1D                  | 0                  |  | /BK                                                                                                                                                                          | After restart   |
| PnB1E                  | 0                  |  | /S-RDY                                                                                                                                                                       | After restart   |
| PnB1F                  | 0                  |  | Overtravel (OT) Stop<br>Method                                                                                                                                               | After restart   |
| PnB20                  | 0                  |  | Moving Mode                                                                                                                                                                  | After restart   |
| PnB21                  | +99999999          |  | <ul> <li>(PnB20 = 0): Forward<br/>Software Limit (P-LS)</li> <li>Rotational coordinates<br/>(PnB20 ≠ 0): Last Rota-<br/>tional Coordinate</li> </ul>                         | After restart   |
| PnB23                  | -99999999          |  | <ul> <li>Linear coordinates<br/>(PnB20 = 0): Reverse<br/>Software Limit (N-LS)</li> <li>Rotational coordinates<br/>(PnB20 ≠ 0): First Rota-<br/>tional Coordinate</li> </ul> | After restart   |
| PnB25                  | 0                  |  | <ul> <li>When using an incremen-<br/>tal encoder: Origin</li> <li>When using an absolute<br/>encoder: Absolute<br/>Encoder Offset</li> </ul>                                 | After restart   |
| PnB27                  | 1000               |  | Positioning/Registration<br>Speed                                                                                                                                            | After restart   |
| PnB29                  | 1000               |  | Acceleration rate                                                                                                                                                            | Immediately     |
| PnB2B                  | 1000               |  | Deceleration rate                                                                                                                                                            | Immediately     |
| PnB2D                  | 1                  |  | /INPOSITION Width                                                                                                                                                            | Immediately     |
| PnB2F                  | 1                  |  | /NEAR Width                                                                                                                                                                  | Immediately     |
| PnB31                  | 0                  |  | Homing Method                                                                                                                                                                | After restart   |
| PnB32                  | 0                  |  | Homing Direction                                                                                                                                                             | Immediately     |
| PnB33                  | 1000               |  | Homing Moving Speed                                                                                                                                                          | Immediately     |
| PnB35                  | 1000               |  | Homing Approach Speed                                                                                                                                                        | Immediately     |
| PnB37                  | 1000               |  | Homing Creep Speed                                                                                                                                                           | Immediately     |
| PnB39                  | 0                  |  | Homing Final Move Dis-<br>tance                                                                                                                                              | Immediately     |
| PnB3B to<br>PnB4D      | 0                  |  | Reserved parameters                                                                                                                                                          | -               |
| PnB4F                  | 0000h              |  | ZONE Signal Setting                                                                                                                                                          | After restart   |
| PnB50                  | 0                  |  | Backlash Compensation                                                                                                                                                        | Immediately     |

| Parameter<br>No. | Default<br>Setting |  | Name                                           | When<br>Enabled |
|------------------|--------------------|--|------------------------------------------------|-----------------|
| PnB51            | 0                  |  | /ALO Output Selection                          | After restart   |
| PnB52            | 0                  |  | /ALM-RST                                       | After restart   |
| PnB53            | 0050h              |  | Input Signal Monitor IN1<br>Polarity Selection | After restart   |
| PnB54            | 0                  |  | Speed/Position Expansion<br>Function Selection | After restart   |

\*1. This parameter is automatically set when the INDEXER Module is mounted to the SERVOPACK. Do not change the setting. Refer to the following sections for details.

16.2 List of Parameters on page 16-3

\*2. The enable timing depends on the digit that is changed. Refer to the following section for details.

## Appendices

The appendix provides information on compatibility between SERVOPACK functions and SigmaWin+ functions, Digital Operator procedures, an alphabetized list of serial commands, and a table of corresponding parameter numbers. 17

| 17.1 | Corresp | onding SERVOPACK and SigmaWin+ Function Names 17-2        |
|------|---------|-----------------------------------------------------------|
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|      | 17.1.2  | Corresponding SERVOPACK Monitor Display<br>Function Names |
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17.1.1 Corresponding SERVOPACK Utility Function Names

17.1 Corresponding SERVOPACK and SigmaWin+ Function Names

This section gives the names and numbers of the utility functions and monitor display functions used by the SERVOPACKs and the names used by the SigmaWin+.

## 17.1.1 Corresponding SERVOPACK Utility Function Names

|                                 | SigmaWin+                   |        | SERVOPACK                                                                |                                    |  |  |
|---------------------------------|-----------------------------|--------|--------------------------------------------------------------------------|------------------------------------|--|--|
| Button in<br>Menu<br>Dialog Box | Function Name               | Fn No. | Function Name                                                            | Serial Command                     |  |  |
|                                 | Initialize                  | FnB0B  | Initialize INDEXER<br>Parameter Settings                                 | PRMINIT                            |  |  |
|                                 | Software Reset              | Fn030  | Software Reset                                                           | -                                  |  |  |
|                                 | Setup Wizard                | _      | _                                                                        | _                                  |  |  |
|                                 | I/O Signal Allocation       | _      | _                                                                        | _                                  |  |  |
| Basic<br>Functions              |                             | Fn011  | Display Servomotor<br>Model                                              | MTTYPE, MTSIZE,<br>PGTYPE, SVYSPEC |  |  |
|                                 |                             | Fn012  | Display Software Version                                                 | SVVER, PGVER, VER                  |  |  |
|                                 | Product Information         | Fn01E  | Display SERVOPACK<br>and Servomotor IDs                                  | TYPE                               |  |  |
|                                 |                             | Fn01F  | Display Servomotor ID<br>from Feedback Option<br>Module                  | _                                  |  |  |
|                                 | Reset Absolute Encoder      | Fn008  | Reset Absolute Encoder                                                   | ABSPGRES                           |  |  |
|                                 | Multi-turn Limit Setup      | Fn013  | Multiturn Limit Setting<br>after Multiturn Limit Dis-<br>agreement Alarm | MLTLIMSET                          |  |  |
| En e e el e u                   | Search Origin               | Fn003  | Origin Search                                                            | _                                  |  |  |
| Encoder<br>Setting              | Zero Point Position Setting | Fn020  | Set Absolute Linear<br>Encoder Origin                                    | _                                  |  |  |
|                                 | Polarity Detection          | Fn080  | Polarity Detection                                                       | -                                  |  |  |
|                                 | Motor Parameter Scale Write | _      | -                                                                        | _                                  |  |  |
|                                 | -                           | FnB09  | Set Absolute Encoder<br>Origin                                           | ZSET                               |  |  |
|                                 | Edit Program Table          | FnB03  | Edit/Save Program Table                                                  | PGMSTORE                           |  |  |
|                                 |                             | FnB06  | Initialize Program Table                                                 | PGMINIT                            |  |  |
|                                 | Edit ZONE Table             | FnB04  | Edit/Save ZONE Table                                                     | ZONESTORE                          |  |  |
| Table                           |                             | FnB07  | Initialize ZONE Table                                                    | ZONEINIT                           |  |  |
| Editing                         | Edit Jog Speed Table        | FnB05  | Edit/Save Jog Speed<br>Table                                             | JSPDSTORE                          |  |  |
|                                 |                             | FnB08  | Initialize Jog Speed<br>Table                                            | JSPDINIT                           |  |  |
|                                 |                             | FnB0D  | Display INDEXER Alarm<br>History                                         | ALMn                               |  |  |
|                                 | Display Alarm               | FnB0C  | Reset INDEXER Alarm<br>History                                           | ALMTRCCLR                          |  |  |
| Trouble-<br>shooting            |                             |        | Reset INDEXER Alarm                                                      | ARES                               |  |  |
| Shooting                        |                             | Fn014  | Reset Option Module<br>Configuration Error                               | _                                  |  |  |
|                                 | Alarm Trace                 | -      | -                                                                        | -                                  |  |  |
|                                 | Reset Motor Type Alarm      | Fn021  | Reset Motor Type Alarm                                                   | -                                  |  |  |
| Operation                       | Jog                         | Fn002  | Jog                                                                      | -                                  |  |  |
| opolation                       | Program JOG Operation       | Fn004  | Jog Program                                                              | -                                  |  |  |

### 17.1.1 Corresponding SERVOPACK Utility Function Names

Continued from previous page.

|                    | SigmaWin+                                                    | Continued from previous page. SERVOPACK |                                                               |                                                                                             |  |
|--------------------|--------------------------------------------------------------|-----------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------|--|
| Button in          | Signawin+                                                    |                                         |                                                               |                                                                                             |  |
| Menu<br>Dialog Box | Function Name                                                | Fn No.                                  | Function Name                                                 | Serial Command                                                                              |  |
|                    | Trace                                                        | _                                       | -                                                             | _                                                                                           |  |
|                    | Real Time Trace                                              | -                                       | -                                                             | _                                                                                           |  |
| Monitor            | Monitor                                                      | FnB0A                                   | INDEXER Status Monitor                                        | ALM, ERR, IN2, OUT2,<br>STS, PUN, PFB, POS,<br>DST, RPOS, RDST,<br>PGMSTEP, EVTIME,<br>LOOP |  |
|                    | Life Monitor                                                 | -                                       | _                                                             | _                                                                                           |  |
|                    | Tuning -<br>Autotuning without Host Refer-<br>ence           | Fn201                                   | Advanced Autotuning<br>without Reference                      |                                                                                             |  |
|                    | Tuning -<br>Autotuning with Host Reference                   | Fn202                                   | Advanced Autotuning with Reference                            |                                                                                             |  |
|                    | Tuning -<br>Custom Tuning                                    | Fn203                                   | One-Parameter Tuning                                          | _                                                                                           |  |
| Tuning             | Tuning -<br>Custom Tuning -<br>Adjust Anti-resonance Control | Fn204                                   | Adjust Anti-resonance<br>Control                              |                                                                                             |  |
|                    | Tuning -<br>Custom Tuning -<br>Vibration Suppression         | Fn205                                   | Vibration Suppression                                         |                                                                                             |  |
|                    | System Tuning                                                | -                                       | _                                                             | _                                                                                           |  |
|                    | Response Level Setting                                       | Fn200                                   | Tuning-less Level Setting                                     | _                                                                                           |  |
|                    | Edit Online Parameters                                       | _                                       | -                                                             | _                                                                                           |  |
|                    | Mechanical Analysis                                          | _                                       | -                                                             | _                                                                                           |  |
| Discussio          | Easy FFT                                                     | Fn206                                   | Easy FFT                                                      | _                                                                                           |  |
| Diagnostic         | Ripple Compensation                                          | _                                       | -                                                             | _                                                                                           |  |
|                    | Online Vibration Monitor                                     | _                                       | -                                                             | _                                                                                           |  |
|                    | Adjust the Apples Meniter Output                             | Fn00C                                   | Adjust Analog Monitor<br>Output Offset                        | _                                                                                           |  |
|                    | Adjust the Analog Monitor Output                             | Fn00D                                   | Adjust Analog Monitor<br>Output Gain                          | _                                                                                           |  |
|                    | Adjust the Motor Current Dates                               | Fn00E                                   | Autotune Motor Current<br>Detection Signal Offset             | CURZERO                                                                                     |  |
| Others             | Adjust the Motor Current Detec-<br>tion Offsets              | Fn00F                                   | Manually Adjust Motor<br>Current Detection Sig-<br>nal Offset | -                                                                                           |  |
|                    | Initialize Vibration Detection Level                         | Fn01B                                   | Initialize Vibration Detec-<br>tion Level                     | _                                                                                           |  |
|                    | Parameter Converter                                          | -                                       | -                                                             | _                                                                                           |  |
|                    | SERVOPACK Axis Name Setting                                  | _                                       | _                                                             | _                                                                                           |  |
|                    | Write Prohibited Setting                                     | Fn010                                   | Write Prohibition Setting                                     | _                                                                                           |  |
|                    | Motor Parameter SERVOPACK<br>Write                           | _                                       | -                                                             | _                                                                                           |  |

17.1.2 Corresponding SERVOPACK Monitor Display Function Names

# 17.1.2 Corresponding SERVOPACK Monitor Display Function Names

|                                 | SigmaWin+                                                                                                                                                                                                                                                                                               | SERVOPACK |                                                                                                                                                                                                                                                                                                                                                                     |                |  |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--|
| Button in<br>Menu<br>Dialog Box | Name [Unit]                                                                                                                                                                                                                                                                                             | Un No.    | Name [Unit]                                                                                                                                                                                                                                                                                                                                                         | Serial Command |  |
|                                 | Motor Speed [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                        | Un000     | Motor Speed [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                                                                                    | NFB            |  |
|                                 | Speed Reference [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                    | Un001     | Speed Reference [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                                                                                | -              |  |
|                                 | Torque Reference [%]                                                                                                                                                                                                                                                                                    | Un002     | Torque Reference [%]<br>(percentage of rated<br>torque)                                                                                                                                                                                                                                                                                                             | TREF           |  |
| Motion<br>Monitor               | <ul> <li>Rotary Servomotors:<br/>Rotational Angle 1 [encoder<br/>pulses]<br/>(number of encoder pulses from<br/>origin within one encoder rotation)</li> <li>Linear Servomotors:<br/>Electrical Angle 1 [linear encoder<br/>pulses]<br/>(linear encoder pulses from the<br/>polarity origin)</li> </ul> | Un003     | <ul> <li>Rotary Servomotors:<br/>Rotational Angle 1<br/>[encoder pulses]<br/>(number of encoder<br/>pulses from origin<br/>within one encoder<br/>rotation displayed in<br/>decimal)</li> <li>Linear Servomotors:<br/>Electrical Angle 1 [lin-<br/>ear encoder pulses]<br/>(linear encoder pulses<br/>from the polarity origin<br/>displayed in decimal)</li> </ul> | _              |  |
|                                 | <ul> <li>Rotary Servomotors:<br/>Rotational Angle 2 [deg]<br/>(electrical angle from origin within<br/>one encoder rotation)</li> <li>Linear Servomotors:<br/>Electrical Angle 2 [deg]<br/>(electrical angle from polarity ori-<br/>gin)</li> </ul>                                                     | Un004     | <ul> <li>Rotary Servomotors:<br/>Rotational Angle 2<br/>[deg]<br/>(electrical angle from<br/>polarity origin)</li> <li>Linear Servomotors:<br/>Electrical Angle 2<br/>[deg]<br/>(electrical angle from<br/>polarity origin)</li> </ul>                                                                                                                              |                |  |
|                                 | Input Reference Pulse Speed [min <sup>-1</sup> ]                                                                                                                                                                                                                                                        | Un007     | Input Reference Pulse<br>Speed [min <sup>-1</sup> ]<br>(displayed only during<br>position control)                                                                                                                                                                                                                                                                  | NREF           |  |
|                                 | Position Deviation [reference units]                                                                                                                                                                                                                                                                    | Un008     | Position Error Amount<br>[reference units]<br>(displayed only during<br>position control)                                                                                                                                                                                                                                                                           | PER            |  |
|                                 | Accumulated Load Ratio [%]                                                                                                                                                                                                                                                                              | Un009     | Accumulated Load<br>Ratio [%]<br>(percentage of rated<br>torque: effective torque<br>in cycles of 10 seconds)                                                                                                                                                                                                                                                       | TRMS           |  |
|                                 | Regenerative Load Ratio [%]                                                                                                                                                                                                                                                                             | Un00A     | Regenerative Load<br>Ratio [%]<br>(percentage of process-<br>able regenerative<br>power: regenerative<br>power consumption in<br>cycles of 10 seconds)                                                                                                                                                                                                              | RGRMS          |  |
|                                 | Dynamic Brake Resistor Power Con-<br>sumption [%]                                                                                                                                                                                                                                                       | Un00B     | Power Consumed by<br>DB Resistance [%]<br>(percentage of process-<br>able power at DB acti-<br>vation: displayed in<br>cycles of 10 seconds)                                                                                                                                                                                                                        | DBRMS          |  |

### 17.1.2 Corresponding SERVOPACK Monitor Display Function Names

Continued from previous page.

|                                 | SigmaWin+                                                                                           | Continued from previous pages SERVOPACK |                                                                                                           |                |  |
|---------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------|--|
| Button in<br>Menu<br>Dialog Box | Name [Unit]                                                                                         | Un No.                                  | Name [Unit]                                                                                               | Serial Command |  |
|                                 | Input Reference Pulse Counter [ref-<br>erence units]                                                | Un00C                                   | Input Reference Pulse<br>Counter [reference<br>units]                                                     |                |  |
|                                 | Feedback Pulse Counter [encoder pulses]                                                             | Un00D                                   | Feedback Pulse<br>Counter [encoder<br>pulses]                                                             |                |  |
|                                 | Fully-closed Loop Feedback Pulse<br>Counter [external encoder resolu-<br>tion]                      | Un00E                                   | Fully-closed Loop<br>Feedback Pulse<br>Counter [external<br>encoder resolution]                           |                |  |
|                                 | Upper Limit Setting of Motor Maxi-<br>mum Speed/Upper Limit Setting of<br>Encoder Output Resolution | Un010 <sup>*1</sup>                     | Upper Limit Setting of<br>Motor Maximum<br>Speed/Upper Limit Set-<br>ting of Encoder Output<br>Resolution |                |  |
|                                 | Total Operation Time [100 ms]                                                                       | Un012                                   | Total Operation Time<br>[100 ms]                                                                          |                |  |
|                                 | Feedback Pulse Counter [reference units]                                                            | Un013                                   | Feedback Pulse<br>Counter [reference<br>units]                                                            |                |  |
|                                 | Overheat Protection Input [0.01 V]                                                                  | Un02F                                   | Overheat Protection<br>Input [0.01 V]                                                                     |                |  |
| Motion<br>Monitor               | Current Backlash Compensation<br>Value [0.1 reference units]                                        | Un030                                   | Current Backlash Com-<br>pensation Value [0.1<br>reference units]                                         | _              |  |
|                                 | Backlash Compensation Value Set-<br>ting Limit [0.1 reference units]                                | Un031                                   | Backlash Compensa-<br>tion Value Setting Limit<br>[0.1 reference units]                                   |                |  |
|                                 | Power Consumption [W]                                                                               | Un032                                   | Power Consumption<br>[W]                                                                                  |                |  |
|                                 | Consumed Power [0.001 Wh]                                                                           | Un033                                   | Consumed Power<br>[0.001 Wh]                                                                              |                |  |
|                                 | Cumulative Power Consumption<br>[Wh]                                                                | Un034                                   | Cumulative Power Con-<br>sumption [Wh]                                                                    |                |  |
|                                 | Absolute Encoder Multiturn Data                                                                     | Un040                                   | Absolute Encoder Multi-<br>turn Data                                                                      |                |  |
|                                 | Position within One Rotation of Absolute Encoder [encoder pulses]                                   | Un041                                   | Position within One<br>Rotation of Absolute<br>Encoder [encoder<br>pulses]                                |                |  |
|                                 | Lower Bits of Absolute Encoder<br>Position [encoder pulses]                                         | Un042                                   | Lower Bits of Absolute<br>Encoder Position<br>[encoder pulses]                                            |                |  |
|                                 | Upper Bits of Absolute Encoder<br>Position [encoder pulses]                                         | Un043                                   | Upper Bits of Absolute<br>Encoder Position<br>[encoder pulses]                                            |                |  |

17.1.2 Corresponding SERVOPACK Monitor Display Function Names

|                                 | SigmaWin                                                | SERVOPACK |                                                                         |                                    |  |
|---------------------------------|---------------------------------------------------------|-----------|-------------------------------------------------------------------------|------------------------------------|--|
| Dutter :                        | SigmaWin+                                               | SERVOPACK |                                                                         |                                    |  |
| Button in<br>Menu<br>Dialog Box | Name [Unit]                                             | Un No.    | Name [Unit]                                                             | Serial Command                     |  |
|                                 | Error Monitor                                           |           |                                                                         |                                    |  |
|                                 | Current issue position                                  |           |                                                                         |                                    |  |
|                                 | Current motor position                                  |           |                                                                         |                                    |  |
|                                 | Target position                                         |           |                                                                         |                                    |  |
|                                 | Target distance                                         |           |                                                                         |                                    |  |
|                                 | Registration target position                            |           |                                                                         | ALM, ERR, IN2,                     |  |
|                                 | Registration target distance                            |           |                                                                         | OUT2, STS, PUN,                    |  |
| Motion<br>Monitor               | Program step                                            | FnB0A     | INDEXER Status Moni-                                                    | PFB, POS, DST,<br>RPOS, RDST, PGM- |  |
| WORITO                          | Program event lapse time                                |           |                                                                         | STEP, EVTIME, and                  |  |
|                                 | Program loop pass through time                          | -         |                                                                         | LOOP                               |  |
|                                 | Number of serial command receipt letter                 |           |                                                                         |                                    |  |
|                                 | Number of serial command trans-<br>mission error letter |           |                                                                         |                                    |  |
|                                 | Number of serial command trans-<br>mission letter       |           |                                                                         |                                    |  |
|                                 | Polarity Sensor Signal Monitor                          | Un011     | Polarity Sensor Signal<br>Monitor                                       | HALLSENS                           |  |
| Status<br>Monitor               | Active Gain Monitor                                     | Un014     | Effective Gain Monitor<br>(gain settings 1 = 1,<br>gain settings 2 = 2) | _                                  |  |
|                                 | Safety I/O Signal Monitor                               | Un015     | Safety I/O Signal Moni-<br>tor                                          |                                    |  |
| Input Sig-<br>nal Moni-<br>tor  | Input Signal Monitor                                    | Un005     | Input Signal Monitor                                                    | IN1                                |  |
| Output<br>Signal<br>Monitor     | Output Signal Monitor                                   | Un006     | Output Signal Monitor                                                   | OUT1                               |  |

#### 17.1.2 Corresponding SERVOPACK Monitor Display Function Names

Continued from previous page.

|                                 | <b>0</b>                                                       |        |                                                                                      |                |  |
|---------------------------------|----------------------------------------------------------------|--------|--------------------------------------------------------------------------------------|----------------|--|
|                                 | SigmaWin+                                                      |        | SERVOPACK                                                                            |                |  |
| Button in<br>Menu<br>Dialog Box | Name [Unit]                                                    | Un No. | Name [Unit]                                                                          | Serial Command |  |
|                                 | Installation Environment Monitor –<br>SERVOPACK                | Un025  | SERVOPACK Installa-<br>tion Environment Moni-<br>tor [%]                             |                |  |
|                                 | Installation Environment Monitor –<br>Servomotor <sup>*2</sup> | Un026  | Servomotor Installation<br>Environment Monitor<br>[%]                                |                |  |
| Service<br>Life Moni-           | Service Life Prediction Monitor –<br>Built-in Fan              | Un027  | Built-in Fan Remaining<br>Life Ratio [%]                                             |                |  |
| tor                             | Service Life Prediction Monitor –<br>Capacitor                 | Un028  | Capacitor Remaining<br>Life Ratio [%]                                                |                |  |
|                                 | Service Life Prediction Monitor –<br>Surge Prevention Circuit  | Un029  | Surge Prevention Circuit<br>Remaining Life Ratio<br>[%]                              |                |  |
|                                 | Service Life Prediction Monitor –<br>Dynamic Brake Circuit     | Un02A  | Dynamic Brake Circuit<br>Remaining Life Ratio<br>[%]                                 | -              |  |
| Product<br>Informa-             | Motor Docolution                                               | Un084  | Linear Encoder Pitch<br>(Scale pitch = Un084 ×<br>10 <sup>Un085</sup> [pm])          |                |  |
| tion                            | Motor – Resolution                                             | Un085  | Linear Encoder Pitch<br>Exponent (Scale pitch =<br>Un084 × 10 <sup>Un085</sup> [pm]) |                |  |
|                                 | _                                                              | Un020  | Rated Motor Speed [min <sup>-1</sup> ]                                               |                |  |
| _                               | -                                                              | Un021  | Maximum Motor Speed<br>[min <sup>-1</sup> ]                                          |                |  |

\*1. You can use Un010 to monitor the upper limit setting for the maximum motor speed or the upper limit setting for the encoder output resolution.

You can monitor the upper limit of the encoder output resolution setting (Pn281) for the current maximum motor speed setting (Pn385), or you can monitor the upper limit of the maximum motor speed setting for the current encoder output resolution setting.

Select which signal to monitor with Pn080 = n.XDDD (Calculation Method for Maximum Speed or Divided Output Pulses).

If Pn080 = n.0□□□, the encoder output resolution (Pn281) that can be set is displayed.
If Pn080 = n.1□□□, the maximum motor speed (Pn385) that can be set is displayed in mm/s.

\*2. This applies to the following motors. The display will show 0 for all other models. SGM7M, SGM7J, SGM7A, SGM7P, SGM7G, SGMMV, SGM7E, SGM7F, and SGMCV

17.2.1 Overview

# **17.2 Operation of Digital Operator**

## 17.2.1 Overview

## **Functions List**

The table below shows whether functions of the digital operator can or cannot be used when an INDEXER Module is installed.

This chapter describes the operating procedures for the functions indicated with the thick-bordered frame in the table below. Refer to the following manual for information on functions that are not marked with bold lines.

Ω Σ-7-Series Servo Drive Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

|                                              | Parameters/Monitoring Functions |                                 |                                 | Utility Functions              |                                        | Parameter Copy Functions |                                 |
|----------------------------------------------|---------------------------------|---------------------------------|---------------------------------|--------------------------------|----------------------------------------|--------------------------|---------------------------------|
|                                              | SERVOPACK<br>Parameters         | SERVOPACK<br>Monitor<br>Display | INDEXER<br>Module<br>Parameters | SERVOPACK<br>Utility Functions | INDEXER<br>Module Utility<br>Functions | SERVOPACK<br>Parameters  | INDEXER<br>Module<br>Parameters |
|                                              | Pn000 to<br>Pn95F               | Un000 to<br>Un085               | PnB00 to<br>PnB52               | Fn000 to<br>Fn207              | FnB03 to<br>FnB0D                      | Pn000 to<br>Pn95F        | PnB00 to<br>PnB52               |
| When an<br>INDEXER<br>Module is<br>installed | ~                               | ~                               | ~                               | ✓*1                            | ✓*1                                    | ~                        | _*2                             |
| When no<br>INDEXER<br>Module is<br>installed | ~                               | ~                               | _                               | ~                              | _                                      | ~                        | -                               |

✓: Supported

-: Not supported

\*1. Refer to the following section for details.

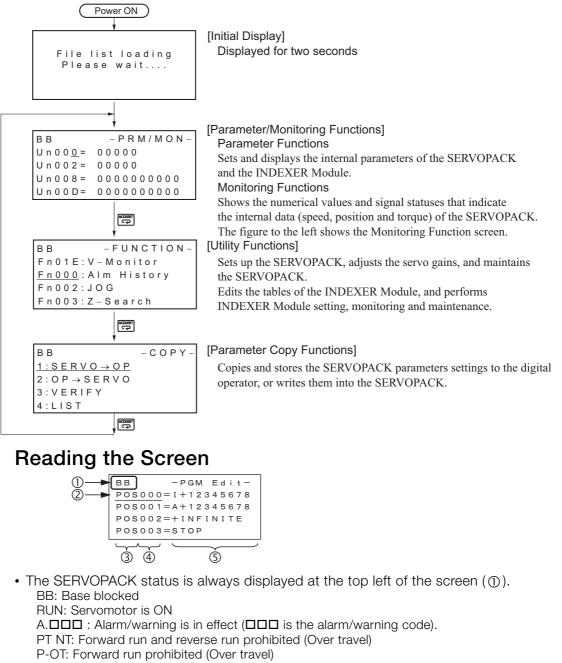
17.2.2 Operation of Utility Functions on page 17-10

\*2. To copy the INDEXER Module parameters (PnB00 to PnB52), use the SigmaWin+ parameter editing function.

17.2.1 Overview

## **Changing the Function**

Connect the digital operator to the SERVOPACK, and turn ON the power to the SERVOPACK. The initial display appears, and then the Parameter/Monitoring Function screen appears. Press the 😇 key to change the function.



- N-OT: Reverse run prohibited (Over travel)
- P-LS: Forward software limit
- N-LS: Reverse software limit
- NO-OP: Setting disabled or setting error
- HBB: During hard wire base block
- The figure of editing screen used in the program tables, ZONE tables and JOG speed tables has the following elements.
  - ②: The article and table number currently selected
  - ③: The article of the table
  - ④: The table number
  - (5): The table settings
- Note: The line beneath POS000 shows that this indication is flashing. This line does not appear on the actual screen. Note also that the part that flashes is referred to as the cursor in this document.

# 17.2.2 Operation of Utility Functions

## **Utility Functions**

The following table shows whether utility functions can be set or not with the digital operator.

| Fn No. | Function                                                                                      | Possi-<br>ble/Not<br>Possible | Remarks and Reference                                                 |
|--------|-----------------------------------------------------------------------------------------------|-------------------------------|-----------------------------------------------------------------------|
| Fn000  | Alarm history display                                                                         | ×                             | This utility function cannot be used.<br>Execute FnB0D instead.       |
| Fn002  | JOG operation                                                                                 | 0                             | Σ-7-Series Servo Drive                                                |
| Fn003  | Origin search                                                                                 | 0                             | Digital Operator<br>Operating Manual<br>(Manual No.: SIEP S800001 33) |
| Fn004  | Program JOG operation                                                                         | 0                             |                                                                       |
| Fn005  | Initializing parameter settings                                                               | ×                             | This utility function cannot be used.<br>Execute FnB0B instead.       |
| Fn006  | Clearing alarm history                                                                        | ×                             | This utility function cannot be used.<br>Execute FnB0C instead.       |
| Fn008  | Absolute encoder multiturn reset and encoder alarm reset                                      | 0                             |                                                                       |
| Fn00C  | Offset adjustment of analog monitor output                                                    | 0                             |                                                                       |
| Fn00D  | Gain adjustment of analog monitor output                                                      | 0                             |                                                                       |
| Fn00E  | Automatic offset-signal adjustment of motor current detection signal                          | 0                             |                                                                       |
| Fn00F  | Manual offset-signal adjustment of motor cur-<br>rent detection signal                        | 0                             |                                                                       |
| Fn010  | Write prohibited setting                                                                      | 0                             |                                                                       |
| Fn011  | Servomotor model display                                                                      | 0                             |                                                                       |
| Fn012  | SERVOPACK software version display                                                            | 0                             |                                                                       |
| Fn013  | Multiturn limit value setting change when a multiturn limit disagreement alarm (A.CC0) occurs | 0                             |                                                                       |
| Fn014  | Resetting configuration error in option module                                                | 0                             | Σ-7-Series Servo Drive                                                |
| Fn01B  | Vibration detection level initialization                                                      | 0                             | Digital Operator<br>Operating Manual                                  |
| Fn01E  | Display of SERVOPACK and servomotor ID                                                        | 0                             | (Manual No.: SIEP S800001 33)                                         |
| Fn01F  | Display of servomotor ID in feedback option module                                            | 0                             |                                                                       |
| Fn020  | Origin setting                                                                                | 0                             |                                                                       |
| Fn030  | Software reset                                                                                | 0                             |                                                                       |
| Fn080  | Polarity detection                                                                            | 0                             |                                                                       |
| Fn200  | Tuning-less levels setting                                                                    | 0                             |                                                                       |
| Fn201  | Advanced autotuning                                                                           | 0                             |                                                                       |
| Fn202  | Advanced autotuning by reference                                                              | 0                             |                                                                       |
| Fn203  | One-parameter tuning                                                                          | 0                             |                                                                       |
| Fn204  | Anti-resonance control adjustment function                                                    | 0                             |                                                                       |
| Fn205  | Vibration suppression function                                                                | 0                             |                                                                       |
| Fn206  | EasyFFT                                                                                       | 0                             |                                                                       |
| Fn207  | Online vibration monitor                                                                      | 0                             |                                                                       |
| FnB03  | Program table edit/save                                                                       | 0                             | Program Table Edit/Save (FnB03) on page 17-11                         |
| FnB04  | ZONE table edit/save                                                                          | 0                             | <i>ZONE Table Edit/Save (FnB04)</i> on page 17-17                     |

O: Possible x: Not possible

Continued on next page.

17.2 Operation of Digital Operator

17.2.2 Operation of Utility Functions

Continued from previous page.

| Fn No. | Function                                 | Possi-<br>ble/Not<br>Possible | Remarks and Reference                                          |
|--------|------------------------------------------|-------------------------------|----------------------------------------------------------------|
| FnB05  | JOG speed table edit/save                | 0                             | JOG Speed Table Edit/Save (FnB05) on page 17-19                |
| FnB06  | Program table initialization             | 0                             | Program Table Initialization (FnB06) on page 17-21             |
| FnB07  | ZONE table initialization                | 0                             | ZONE Table Initialization (FnB07) on page 17-22                |
| FnB08  | JOG speed table initialization           | 0                             | JOG Speed Table Initialization (FnB08) on page 17-23           |
| FnB09  | Absolute encoder origin setting          | 0                             | Absolute Encoder Origin Setting (FnB09)<br>on page 17-24       |
| FnB0A  | INDEXER status monitor                   | 0                             | INDEXER Status Monitor (FnB0A) on page 17-25                   |
| FnB0B  | INDEXER parameter setting initialization | 0                             | INDEXER Parameter Setting Initialization (FnB0B) on page 17-28 |
| FnB0C  | INDEXER alarm reset                      | 0                             | INDEXER Alarm Reset (FnB0C) on page 17-29                      |
| FnB0D  | INDEXER alarm history display            | 0                             | INDEXER Alarm History Display (FnB0D) on page 17-30            |

O: Possible  $\times$ : Not possible

## Program Table Edit/Save (FnB03)

This function edits and saves program tables. Saving a program table to flash memory after editing it ensures that the data will be retained even after the control power has been turned off.

#### Codes Displayed on the Program Table Editing Screen

Refer to the following section for information on interpreting the displays.

| PGM<br>STEP | POS    | SPD    | RDST    | RSPD    | ACC    | DEC    | POUT    | EVENT  | LOOP    | NEXT    |
|-------------|--------|--------|---------|---------|--------|--------|---------|--------|---------|---------|
| 0           | POS000 | SPD000 | RDST000 | RSPD000 | ACC000 | DEC000 | POUT000 | EVT000 | LOOP000 | NEXT000 |
| 1           | POS001 | SPD001 | RDST001 | RSPD001 | ACC001 | DEC001 | POUT001 | EVT001 | LOOP001 | NEXT001 |
| :           | ÷      |        | ÷       |         | ÷      | ÷      |         |        | :       | :       |
| 255         | POS255 | SPD255 | RDST255 | RSPD255 | ACC255 | DEC255 | POUT255 | EVT255 | LOOP255 | NEXT255 |

#### Preparation

The following conditions must be met to edit and save program tables.

- The write-prohibited setting (Fn010) must not be set to write-protect parameters.
- The program must not be running or on hold.
- A program table save operation must not be in progress for any means other than the digital operator.
- Execution of the RES command must not be in progress.

## ◆ Editing Program Table

The operating procedure when setting the acceleration (ACC) in program step 5 is explained here.

| Step | Display after Operation                                          | Keys | Operation                                                                                        |
|------|------------------------------------------------------------------|------|--------------------------------------------------------------------------------------------------|
| 1    | BB-FUNCTION-Fn207V-MonitorFnB03PGMEditFnB04ZONEEditFnB05JSPDEdit |      | Press the 😇 key to open the Utility Function<br>Mode main menu, and move the cursor with the<br> |

\* If setting is attempted in an operation prohibited state, it will not be possible to change the setting. In this case, make the setting again by referring to *◆ Preparation* on page 17-11.

#### Method for Moving the Cursor

The values within the frames in the figure below are the articles and steps of the program table displayed at the digital operator.

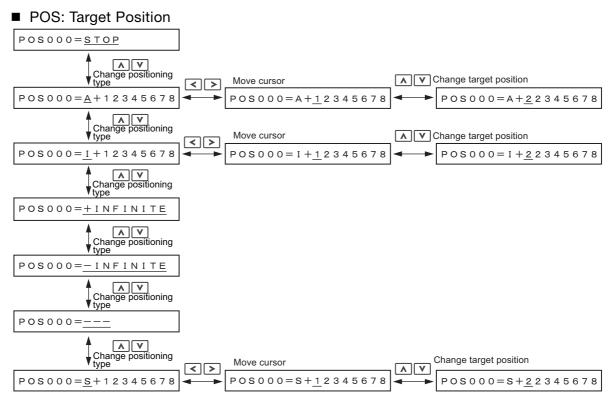
|                            | POS                                                             |                                                                 | RDST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | RSPD                                                                                                            |                                                                                                  |                  |        | SPD    | RDST    | RSPD   |
|----------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------|--------|--------|---------|--------|
| 0                          | POS000                                                          | SPD000                                                          | RDST000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | RSPD                                                                                                            |                                                                                                  |                  | POS000 | SPD000 | RDST000 | RSPD   |
| 1                          | POS001                                                          | SPD001                                                          | RDST001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | RSF                                                                                                             | <>                                                                                               |                  | POS001 | SPD001 | RDST001 | RSF    |
| 2                          | POS002                                                          | SPD002                                                          | RDST002                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | RS                                                                                                              |                                                                                                  |                  | POS002 | SPD002 | RDST002 | RS     |
| 3                          | POS003                                                          | SPD003                                                          | RDST003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | R                                                                                                               | ← →                                                                                              |                  | POS003 | SPD003 | RDST003 | RS     |
| 4                          | POS004                                                          | SPD004                                                          | RDST004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | RS                                                                                                              | Moves the displayed                                                                              |                  | POS004 | SPD004 | RDST004 | RS     |
| 5                          | POS005                                                          | SPD005                                                          | RDST005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | RSPL                                                                                                            | column one column at a                                                                           |                  | POS005 | SPD005 | RDST005 | RSPD   |
| 6                          | POS006                                                          | SPD006                                                          | RDST006                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | RSPDO                                                                                                           | time to the left or right.                                                                       |                  | POS006 | SPD006 | RDST006 | RSPDO  |
| :                          |                                                                 | 1                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                 | On reaching the edge of the table, movement                                                      |                  |        | 1      |         |        |
| 255                        | POS255                                                          | ODDOCC                                                          | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1                                                                                                               |                                                                                                  |                  | POS255 | SPD255 | DDOTOSS | RSPD25 |
|                            |                                                                 |                                                                 | n reaching s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | tep 0, the                                                                                                      | stops.<br>ws up or down one row at a<br>next movement is to step 2<br>he next movement is to ste | 255.             | 106235 | 3PD233 | RDST255 | NOPUZ  |
| PGMSTEP                    | POS                                                             |                                                                 | Noves the dis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | played row<br>step 0, the                                                                                       | stops.<br>ws up or down one row at a<br>next movement is to step 2                               | a time.*<br>255. | 106235 | 3PD233 | RUST255 | norD23 |
| PGMSTEP                    |                                                                 |                                                                 | Noves the dis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | splayed rov<br>step 0, the<br>step 255, t                                                                       | stops.<br>ws up or down one row at a<br>next movement is to step 2                               | a time.*<br>255. | 108235 | SPD235 | RUS1255 | norD23 |
|                            | POS                                                             | SPD                                                             | Noves the dis<br>n reaching s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | splayed rov<br>step 0, the<br>step 255, t                                                                       | stops.<br>ws up or down one row at a<br>next movement is to step 2                               | a time.*<br>255. | P05203 | 3PD203 | HD51255 | NOPUZS |
| 0                          | POS<br>POS000                                                   | SPD<br>SPD000                                                   | A V<br>Noves the dis<br>On reaching s<br>On reaching s<br>RDST<br>RDST000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | splayed rov<br>step 0, the<br>step 255, t                                                                       | stops.<br>ws up or down one row at a<br>next movement is to step 2                               | a time.*<br>255. | P03233 | 3PD203 | HUSI200 | NOPUZ  |
| 0                          | POS<br>POS000<br>POS001                                         | SPD<br>SPD000<br>SPD001                                         | A V<br>Noves the dis<br>on reaching s<br>n reaching s<br>RDST<br>RDST000<br>RDST001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | splayed rov<br>step 0, the<br>step 255, t                                                                       | stops.<br>ws up or down one row at a<br>next movement is to step 2                               | a time.*<br>255. | P03203 | 3PD203 | HUSI200 | RopDa  |
| 0 1 2                      | POS<br>POS000<br>POS001<br>POS002                               | SPD<br>SPD000<br>SPD001<br>SPD002                               | A V<br>Noves the dison reaching son reaching so | splayed rov<br>step 0, the<br>step 255, t                                                                       | stops.<br>ws up or down one row at a<br>next movement is to step 2                               | a time.*<br>255. | 103233 | 3PD203 | HUS1205 | ROPUZ  |
| 0<br>1<br>2<br>3           | POS<br>POS000<br>POS001<br>POS002<br>POS003                     | SPD<br>SPD000<br>SPD001<br>SPD002<br>SPD003                     | A V<br>Noves the dison reaching son reaching so | eplayed row<br>step 0, the<br>step 255, t<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP | stops.<br>ws up or down one row at a<br>next movement is to step 2                               | a time.*<br>255. | 103233 | 3PD203 | HUSI200 | horbe  |
| 0<br>1<br>2<br>3<br>4      | POS<br>POS000<br>POS001<br>POS002<br>POS003<br>POS004           | SPD<br>SPD000<br>SPD001<br>SPD002<br>SPD003<br>SPD004           | A V<br>Noves the dis<br>on reaching s<br>no reaching s<br>RDST<br>RDST000<br>RDST001<br>RDST002<br>RDST003<br>RDST004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | splayed row<br>step 0, the<br>step 255, t<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP<br>RSP | stops.<br>ws up or down one row at a<br>next movement is to step 2                               | a time.*<br>255. | 103233 | 3PD203 | HUSI200 | NoPD23 |
| 0<br>1<br>2<br>3<br>4<br>5 | POS<br>POS000<br>POS001<br>POS002<br>POS003<br>POS004<br>POS005 | SPD<br>SPD000<br>SPD001<br>SPD002<br>SPD003<br>SPD004<br>SPD005 | A V<br>Aveces the disconnecting s<br>on reaching s<br>ADST<br>ADSTO00<br>ADST001<br>ADST002<br>ADST003<br>ADST004<br>ADST005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | RSPT<br>RSPT<br>RS<br>RS<br>RS<br>RS<br>RS<br>RS<br>RS<br>RS<br>RS<br>RS<br>RS<br>RS<br>RS                      | stops.<br>ws up or down one row at a<br>next movement is to step 2                               | a time.*<br>255. | P03233 | 3PD203 | HUSI200 | horbes |

\* You can move 4 rows at a time by holding down the 🔨 or 🔽 key. By using the 🕅 key at the same time as these keys, you can move 30 rows at a time.

#### Details on How to Set Table Settings

Details on the setting method for step 5 in *Editing Program Table* on page 17-12 are shown below.

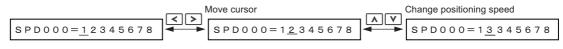
If the number of display digits is exceeded when Expansion Mode is enabled (PnB54 = 1), the table name will be abbreviated. Refer to the following section for details.  $\square$  12.4.6 Digital Operator Displays on page 12-12



Note: Refer to the following section for details on positioning types and target positions.

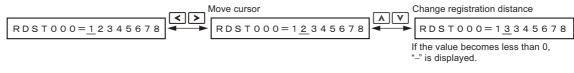
13.3.5 Settings in the Program Table on page 13-13

#### SPD: Positioning Speed



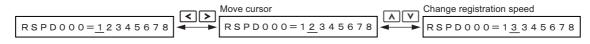
Note: Refer to the following section for details on the positioning speed. *13.3.5 Settings in the Program Table* on page 13-13

#### RDST: Registration Distance



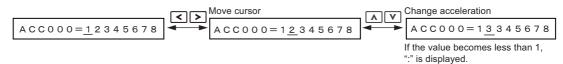
Note: Refer to the following section for details on the registration distance. 13.3.5 Settings in the Program Table on page 13-13

#### RSPD: Registration Speed



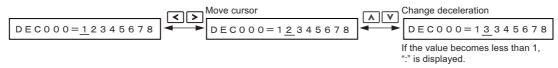
Note: Refer to the following section for details on the registration speed. *13.3.5 Settings in the Program Table* on page 13-13

#### ACC: Acceleration



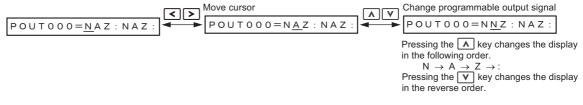
Note: Refer to the following section for details on the acceleration rate.

#### DEC: Deceleration



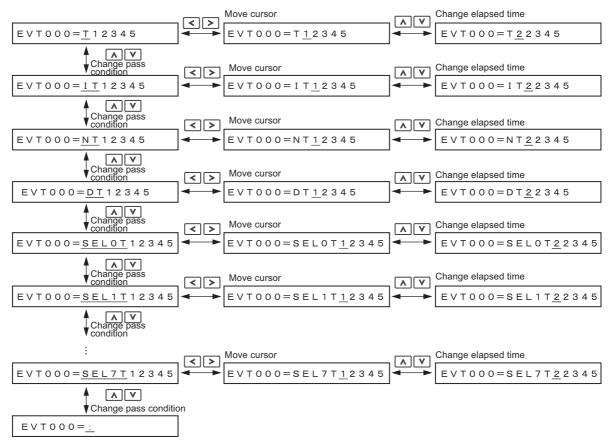
Note: Refer to the following section for details on the deceleration rate.

#### ■ POUT: Programmable Output Signals



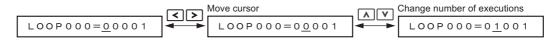
Note: Refer to the following section for details on the programmable output signals. 13.3.5 Settings in the Program Table on page 13-13

#### ■ EVENT: Pass Condition



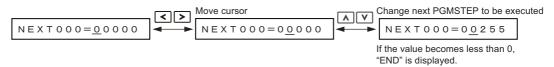
Note: Refer to the following section for details on the pass condition and elapsed time. 13.3.5 Settings in the Program Table on page 13-13

#### LOOP: Number of Executions



Note: Refer to the following section for details on the number of executions. 13.3.5 Settings in the Program Table on page 13-13

#### ■ NEXT: PGMSTEP to be Executed Next



Note: Refer to the following section for details on the program step to execute next.

13.3.5 Settings in the Program Table on page 13-13

## Saving Program Tables

The operating procedure for saving program tables is shown below.

| Step | Display after Operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Keys     | Operation                                                                                                                                                                                                       |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | BB         -PGM         Edit         -           POS000         = STOP         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -          - | _        | Display the program table editing screen.                                                                                                                                                                       |
| 2    | BB -PGM Edit-<br>STORE PGM TABLE?<br><u>CANCEL</u> STORE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |          | Press the were key to view the program table save operation screen.                                                                                                                                             |
| 3    | BB -PGM Edit-<br>STORE PGM TABLE?<br>CANCEL <u>STORE</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | < >      | <ul> <li>Move the cursor with the &lt; &gt; keys to select "STORE".</li> <li>Note: Selecting "CANCEL" and pressing the <sup>™</sup> key will return the display to the program table editing screen.</li> </ul> |
| 4    | BB -PGM Edit-<br>Storing now<br>Please wait.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | DATA     | Press the Mathematic key to start saving the program table to flash memory.*<br>Do not turn off the control power supply until saving has been completed normally.                                              |
| 5    | BB         -PGM         Edit           POS000         = STOP           POS001         = STOP           POS002         = STOP           POS003         = STOP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | _        | When saving to flash memory has been com-<br>pleted normally, the display returns to the pro-<br>gram table editing screen.                                                                                     |
| 6    | BB-FUNCTION-Fn207V-MonitorFnB03PGMEditFnB04ZONEEditFnB05JSPDEdit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | MODE/SET | Press the 😇 key to return to the Utility Function<br>Mode main menu.                                                                                                                                            |

\* If the we key is pressed in an operation prohibited state, "Error." is displayed for approximately 2 seconds and then the display returns to the program table editing screen. In this case, make the setting again by referring to the program table editing screen. In this case, make the setting again by referring to referring to referring to the program table editing screen.

## ZONE Table Edit/Save (FnB04)

This function edits and saves ZONE tables. Saving a ZONE table to flash memory after editing it ensures that the data will be retained even after the control power has been turned off.

#### Codes Displayed on the ZONE Table Editing Screen

For details on how to read the screen, refer to *Reading the Screen* on page 17-9.

| ZONE<br>Number | ZONE P | ZONE N |
|----------------|--------|--------|
| 0              | ZP000  | ZN000  |
| 1              | ZP001  | ZN001  |
| ÷              | :      | ÷      |
| 31             | ZP031  | ZN031  |

#### Preparation

The following conditions must be met to edit and save ZONE tables.

- The write-prohibited setting (Fn010) must not be set to write-protect parameters.
- A ZONE table save operation must not be in progress for any means other than the digital operator.

## ◆ Editing ZONE Tables

The operating procedure when setting ZONE N in ZONE number 5 is explained here.

| Step | Display after Operation                                                                                                                                                                                                                                               | Keys | Operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | BB -FUNCTION-<br>FnB03 PGM Edit<br><u>FnB04 ZONE Edit</u><br>FnB05 JSPD Edit<br>FnB06 PGM Init                                                                                                                                                                        |      | Press the 😇 key to open the Utility Function<br>Mode main menu, and move the cursor with the<br><a href="https://www.communication.com">www.communication.com</a><br><a href="https://www.communication.com">www.communication.com</a><br><a href="https://www.communication.com">www.communication.com</a><br><a href="https://www.communication.com">www.communication.com</a><br><a href="https://www.communication.com">www.communication.com</a><br><a href="https://www.communication.com">www.communication.com</a><br><a a="" href="https://www.communication.com" www.com"="" www.com<=""></a> |
| 2    | BB         -ZONE         Edit         -           ZP000         =+0000000         000         0           ZP001         =+00000000         0         0           ZP002         =+00000000         0         0           ZP003         =+000000000         0         0 | DATA | Press the Imm key to view the FnB04 operation screen.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 3    | BB       -ZONE       Editt         ZN002=+0000000       ZN003=+0000000         ZN003=+00000000       ZN004=+0000000000000000000000000000000000                                                                                                                        | < >  | Move the cursor using the <> keys and<br>Y keys to select the ZONE table number to<br>be edited. Refer to the following section for details<br>on the methods to move the cursor.<br># Method for Moving the Cursor on page 17-13                                                                                                                                                                                                                                                                                                                                                                       |
| 4    | BB       -ZONE       Editt         ZN002=+0000000       ZN003=+0000000         ZN003=+0000000       ZN004=+00000000         ZN005=+00000000       ZN0050000                                                                                                           | DATA | Press the Max key to move the cursor to the set-<br>ting side of the table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 5    | BB       -ZONE       Edit         ZN002=+0000000         ZN003=+0000000         ZN004=+0000000         ZN005=+12345678                                                                                                                                                | < >  | Move the cursor using the <> keys and<br>change the ZONE boundary values using the<br><> v keys.*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 6    | BB       -ZONE       Edit         ZN002=+0000000       ZONE       Edit         ZN003=+0000000       ZONE       ZONE         ZN004=+0000000       ZONE       ZONE         ZN005=+12345678       ZONE       ZONE                                                        | DATA | On pressing the was key, the setting is entered<br>and the cursor returns to the ZONE table number<br>side.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 7    |                                                                                                                                                                                                                                                                       |      | mpleting the setting of all the ZONE tables to be llowing the procedure in <i>◆ Saving ZONE Tables</i> on                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

#### Method for Moving the Cursor

The values within the frames in the figure below are the ZONE table numbers displayed at the digital operator.

| বিচ                          | ZONE N | ZONE P | ZONE Number |
|------------------------------|--------|--------|-------------|
|                              | ZN 000 | ZP000  | 0           |
|                              | ZN001  | ZP001  | 1           |
| Moves the displa             | ZN 002 | ZP002  | 2           |
| column one colu              | ZN 003 | ZP003  | 3           |
| at a time to the I<br>right. | ZN004  | ZP004  | 4           |
| On reaching the              | ZN 005 | ZP005  | 5           |
| of the table,                | ZN006  | ZP006  | 6           |
| movement stops               | :      | :      |             |
|                              | ZN031  | ZP031  | 31          |

|         |   | ZP000 | ZN000  |
|---------|---|-------|--------|
|         | 1 | ZP001 | ZN001  |
| layed   | 2 | ZP002 | ZN 002 |
| lumn    | 3 | ZP003 | ZN 003 |
| left or | 4 | ZP004 | ZN004  |
| e edge  |   | ZP005 | ZN005  |
|         |   | ZP006 | ZN006  |
| DS.     |   | :     | :      |
|         |   | ZP031 | ZN031  |



Moves the displayed rows up or down one row at a time.\* On reaching step 0, the next movement is to step 31.

On reaching step 31, the next movement is to step 0.

| ZONE Number | ZONE P | ZONE N      |
|-------------|--------|-------------|
|             | 201121 |             |
|             | ZP000  | ZN000       |
|             | ZP001  | ZN001       |
|             | ZP002  | ZN002       |
|             | ZP003  | ZN003       |
|             | ZP004  | ZN004       |
|             | ZP005  | ZN005       |
|             | ZP006  | ZN006       |
|             |        | *<br>*<br>* |
|             | ZP031  | ZN031       |

\* You can move 3 rows at a time by holding down the 🔥 or 🔽 key.

## ♦ Saving ZONE Tables

The operating procedure for saving ZONE tables is shown below.

| Step | Display after Operation                                                                                                                                                                                                                                              | Keys | Operation                                                                                                                                                                 |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | BB       -ZONE       Edit       t         ZP000       =+00000000       000       000         ZP001=+00000000       ZP002=+0000000       ZP002       ZP0000000         ZP003=+000000000       ZP0000000       ZP00000000       ZP000000000000000000000000000000000000 | _    | Display the ZONE table editing screen.                                                                                                                                    |
| 2    | BB -ZONE Edit-<br>STORE ZONE TABLE?<br><u>CANCEL</u> STORE                                                                                                                                                                                                           |      | Press the wreak key to view the ZONE table save screen.                                                                                                                   |
| 3    | BB -ZONE Edit-<br>STORE ZONE TABLE?<br>CANCEL <u>STORE</u>                                                                                                                                                                                                           | < >  | Move the cursor with the <> keys to select<br>"STORE".<br>Note: Selecting "CANCEL" and pressing the makey will<br>return the display to the ZONE table editing<br>screen. |
| 4    | BB -ZONE Edit-<br><u>Storing now</u><br>Please wait.                                                                                                                                                                                                                 | DATA | Press the main key to start saving the ZONE table<br>to flash memory.*<br>Do not turn off the control power supply until sav-<br>ing has been completed normally.         |

Continued on next page.

Continued from previous page.

| Step | Display after Operation                                                                                                                                                                                                          | Keys     | Operation                                                                                                      |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------|
| 5    | BB         -ZONE         Editt           ZP000         =+00000000         000           ZP001         =+00000000         000           ZP002         =+000000000         000           ZP003         =+000000000         0000000 | _        | When saving to flash memory has been completed normally, the display returns to the ZONE table editing screen. |
| 6    | BB-FUNCTION-FnB03PGMEditFnB04ZONEEditFnB05JSPDEditFnB06PGMInit                                                                                                                                                                   | MODE/SET | Press the 🚟 key to return to the Utility Function<br>Mode main menu.                                           |

\* If the key is pressed in an operation prohibited state, "Error." is displayed for approximately 2 seconds and then the display returns to the ZONE table editing screen. In this case, make the setting again by referring to the ZONE table editing screen. In this case, make the setting again by referring to referring to referring to the ZONE table editing screen. In this case, make the setting again by referring to the properties of the table edition.

## JOG Speed Table Edit/Save (FnB05)

This function edits and saves JOG speed tables. Saving a JOG speed table to flash memory after editing it ensures that the data will be retained even after the control power has been turned off.

Refer to the following section for information on interpreting the displays. *Reading the Screen* on page 17-9

#### Preparation

The following conditions must be met to save and edit JOG speed tables.

- The write-prohibited setting (Fn010) must not be set to write-protect parameters.
- A JOG speed table save operation must not be in progress for any means other than the digital operator.

## Editing JOG Speed Tables

The operating procedure when setting the value for JOG speed table number 5 is explained here.

| Step | Display after Operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Keys | Operation                                                                                                                                                                                                                                                                           |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | BB-FUNCTION-FnB04ZONEEditFnB05JSPDEditFnB06PGMInitFnB07ZONEInit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | Press the 😇 key to open the Utility Function<br>Mode main menu, and move the cursor with the<br><a>V</a> keys to select FnB05.                                                                                                                                                      |
| 2    | BB         -JSPD         Edit         t           JSPD000         =         0000100         0           JSPD001         =         0000100         0           JSPD002         =         0000100         0           JSPD002         =         0000100         0           JSPD002         =         00001000         0           JSPD003         =         00001000         0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | DATA | Press the Example to view the FnB05 operation screen.                                                                                                                                                                                                                               |
| 3    | BB       -JSPD       Edit       Edit         JSPD002=00001000       JO00       JO00       JO00       JO00       JO00         JSPD004=00001000       JSPD005=00001000       JO00       JO |      | Move the cursor using the  v keys to select<br>the JOG speed table number to be edited.<br>Pressing the v key when the cursor is on JOG<br>speed table number 0 moves it to number 15.<br>Pressing the key when the cursor is on JOG<br>speed table number 15 moves it to number 0. |
| 4    | BB       -JSPD       Edit         JSPD002=00001000         JSPD003=00001000         JSPD004=00001000         JSPD005=00001000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | DATA | Press the Image key to move the cursor to the set-<br>ting side of the table.                                                                                                                                                                                                       |
| 5    | BB       -JSPD       Editt         JSPD002=00001000         JSPD003=00001000         JSPD004=00001000         JSPD005=12345678                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | < >  | Move the cursor with the <> keys, and<br>change the JOG speed setting with the A V<br>keys.*                                                                                                                                                                                        |

Continued on next page.

Appendices

Continued from previous page.

| Step | Display after Operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Keys                | Operation                                                                                                      |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------|
| 6    | BB         -JSPD         Edit         -           JSPD002=00001000         J000         J0000         J0000         J0000 | DATA                | On pressing the wakey, the setting is entered<br>and the cursor returns to the JOG speed table<br>number side. |
| 7    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | G speed tables to f | Dn completing the setting of all the JOG speed lash memory by following the procedure in $\blacklozenge$ Sav-  |

\* If setting is attempted in an operation prohibited state, it will not be possible to change the setting. In this case, make the setting again by referring to *◆ Preparation* on page 17-19.

## ◆ Saving JOG Speed Tables

The operating procedure for saving JOG speed tables is shown below.

| Step | Display after Operation                                                                                                                                                                                                                                                                                                    | Keys     | Operation                                                                                                                                                                      |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | BB       -JSPD       Edit         JSPD000       = 00001000         JSPD001       = 00001000         JSPD002       = 00001000         JSPD003       = 00001000                                                                                                                                                              | _        | Display the JOG speed table editing screen.                                                                                                                                    |
| 2    | BB -JSPD Edit-<br>STORE JSPD TABLE?<br><u>CANCEL</u> STORE                                                                                                                                                                                                                                                                 | WRITE ST | Press the wreak key to view the JOG speed table save screen.                                                                                                                   |
| 3    | BB -JSPD Edit-<br>STORE JSPD TABLE?<br>CANCEL <u>STORE</u>                                                                                                                                                                                                                                                                 | < >      | Move the cursor with the <> keys to select<br>"STORE".<br>Note: Selecting "CANCEL" and pressing the makey will<br>return the display to the JOG speed table editing<br>screen. |
| 4    | BB -JSPD Edit-<br><u>Storing now</u><br>Please wait.                                                                                                                                                                                                                                                                       | DATA     | Press the mathematic key to start saving the JOG speed table to flash memory.*<br>Do not turn off the control power supply until saving has been completed normally.           |
| 5    | BB         -JSPD         Edit         -           JSPD000         =         00001000         0           JSPD001         =         00001000         0           JSPD002         =         00001000         0           JSPD002         =         00001000         0           JSPD003         =         00001000         0 | _        | When saving to flash memory has been com-<br>pleted normally, the display returns to the JOG<br>speed table editing screen.                                                    |
| 6    | BB -FUNCTION-<br>FnB04 ZONE Edit<br><u>FnB05 JSPD Edit</u><br>FnB06 PGM Init<br>FnB07 ZONE Init                                                                                                                                                                                                                            | MODE/SET | Press the 😇 key to return to the Utility Function<br>Mode main menu.                                                                                                           |

\* If the we is pressed in an operation prohibited state, "Error." is displayed for approximately 2 seconds and then the display returns to the JOG speed table editing screen. In this case, make the setting again by referring to *Preparation* on page 17-19.

## Program Table Initialization (FnB06)

This function initializes the program tables and restores the settings on shipment from the factory.

#### Preparation

The following conditions must be met to initialize the program table.

- The write-prohibited setting (Fn010) must not be set to write-protect parameters.
- The program must not be running or on hold.
- A program table save operation must not be in progress for any means other than the digital operator.
- Execution of the RES command must not be in progress.

| Step | Display after Operation                                                                         | Keys     | Operation                                                                                                                                                                                                                                                                                                                                             |
|------|-------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | BB -FUNCTION-<br>FnB05 JSPD Edit<br><u>FnB06 PGM Init</u><br>FnB07 ZONE Init<br>FnB08 JSPD Init |          | Press the 😇 key to open the Utility Function<br>Mode main menu, and move the cursor with the                                                                                                                                                                                                                                                          |
| 2    | BB — PGM Init—<br>Start : [DATA]<br>Return: [SET]                                               | DATA     | Press the Mathin key to view the FnB06 operation screen.                                                                                                                                                                                                                                                                                              |
| 3    | BB — PGM Init—<br><u>Restoring now</u><br>Please wait.                                          | DATA     | Press the math key to start program table initial-<br>ization.*<br>Do not turn off the control power supply until ini-<br>tialization has been completed normally.<br>To cancel the FnB06 operation, press the<br>key before pressing the math key. The display<br>returns to the Utility Function Mode main menu<br>without executing the operation. |
| 4    | BB — PGM Init—<br>Done.<br><u>Press [SET] key.</u>                                              | _        | When program table initialization has been completed normally, "Done." is displayed.                                                                                                                                                                                                                                                                  |
| 5    | BB-FUNCTION-FnB05JSPDEditFnB06PGMInitFnB07ZONEInitFnB08JSPDInit                                 | MODE/SET | Press the 🛱 key to return to the Utility Function<br>Mode main menu.                                                                                                                                                                                                                                                                                  |

#### Operating Procedure

\* If the I key is pressed in an operation prohibited state, "Error." is displayed for approximately 2 seconds and then the display returns to the FnB06 operation screen. In this case, make the setting again by referring to ◆ *Preparation* on page 17-21.

## **ZONE Table Initialization (FnB07)**

This function initializes ZONE tables and restores the settings on shipment from the factory.

## Preparation

The following conditions must be met to initialize ZONE tables.

- The write-prohibited setting (Fn010) must not be set to write-protect parameters.
- A ZONE table save operation must not be in progress for any means other than the digital operator.
- Execution of the RES command must not be in progress.

## Operating Procedure

| Step | Display after Operation                                                                    | Keys     | Operation                                                                                                                                                                                                                                                                                                                                          |
|------|--------------------------------------------------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | BB -FUNCTION-<br>FnB06 PGM Init<br><u>FnB07 ZONE Init</u><br>FnB08 JSPD Init<br>FnB09 ZSET |          | Press the 🛱 key to open the Utility Function<br>Mode main menu, and move the cursor with the<br><a>v</a> keys to select FnB07.                                                                                                                                                                                                                     |
| 2    | BB —ZONE Init—<br>Start : [DATA]<br>Return: [SET]                                          | DATA     | Press the Mathin key to view the FnB07 operation screen.                                                                                                                                                                                                                                                                                           |
| 3    | BB — ZONE Init—<br><u>Restoring now</u><br>Please wait.                                    | DATA     | Press the Mathematical Key to start ZONE table initialization.*<br>Do not turn off the control power supply until initialization has been completed normally.<br>To cancel the FnB07 operation, press the<br>key before pressing the Mathematical Key. The display returns to the Utility Function Mode main menu without executing the operation. |
| 4    | BB — ZONE Init—<br>Done.<br><u>Press [SET] key.</u>                                        | _        | When ZONE table initialization has been completed normally, "Done." is displayed.                                                                                                                                                                                                                                                                  |
| 5    | BB-FUNCTION-FnB06PGMInitFnB07ZONEInitFnB08JSPDInitFnB09ZSET                                | MODE/SET | Press the 😇 key to return to the Utility Function<br>Mode main menu.                                                                                                                                                                                                                                                                               |

\* If the we is pressed in an operation prohibited state, "Error." is displayed for approximately 2 seconds and then the display returns to the FnB07 operation screen. In this case, make the setting again by referring to ◆ *Preparation* on page 17-22.

## JOG Speed Table Initialization (FnB08)

This function initializes JOG speed tables and restores the default settings.

## Preparation

The following conditions must be met to initialize JOG speed tables.

- The write-prohibited setting (Fn010) must not be set to write-protect parameters.
- A JOG speed table save operation must not be in progress for any means other than the digital operator.
- Execution of the RES command must not be in progress.

#### ◆ Operating Procedure

| Step | Display after Operation                                                                   | Keys     | Operation                                                                                                                                                                                                                                                                                                                               |
|------|-------------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | BB -FUNCTION-<br>FnB07 ZONE Init<br><u>FnB08 JSPD Init</u><br>FnB09 ZSET<br>FnB0A Monitor |          | Press the 😇 key to open the Utility Function<br>Mode main menu, and move the cursor with the                                                                                                                                                                                                                                            |
| 2    | BB -JSPD Init-<br>Start : [DATA]<br>Return: [SET]                                         | DATA     | Press the Mathin key to view the FnB08 operation screen.                                                                                                                                                                                                                                                                                |
| 3    | BB — JSPD Init—<br><u>Restoring now</u><br>Please wait.                                   | DATA     | Press the math key to start JOG speed table initialization.*<br>Do not turn off the control power supply until initialization has been completed normally.<br>To cancel the FnB08 operation, press the<br>key before pressing the math key. The display returns to the Utility Function Mode main menu without executing the operation. |
| 4    | BB — JSPD Init—<br>Done.<br><u>Press [SET] key.</u>                                       | _        | When JOG speed table initialization has been completed normally, "Done." is displayed.                                                                                                                                                                                                                                                  |
| 5    | BB -FUNCTION-<br>FnB07 ZONE Init<br><u>FnB08 JSPD Init</u><br>FnB09 ZSET<br>FnB0A Monitor | MODE/SET | Press the 😇 key to return to the Utility Function<br>Mode main menu.                                                                                                                                                                                                                                                                    |

\* If the we is pressed in an operation prohibited state, "Error." is displayed for approximately 2 seconds and then the display returns to the FnB08 operation screen. In this case, make the setting again by referring to • *Preparation* on page 17-23.

## Absolute Encoder Origin Setting (FnB09)

This utility function replaces the current position with a specified position. Also updates PnB25 with the absolute position offset value to achieve the position specified by this utility function.

# **A** DANGER

- This function replaces the coordinates of the reference position and is therefore very dangerous. After executing this function, check that the new coordinates match the reference position before starting operation.
- If the settings for any of parameters Pn20E to Pn210, Pn205, or PnB20 to PnB25 have been changed, turn the control power supply off and back on to bring the settings into effect before executing operation.

Important • The absolute position offset value is saved in parameter PnB25, so do not rewrite this value.

## Preparation

The following conditions must be met to perform the absolute encoder origin setting.

- The write-prohibited setting (Fn010) must not be set to write-protect parameters.
- Distribution of position references must not be in progress.
- The absolute position offset value must not be outside the range for PnB25.
- An absolute encoder must be connected and Pn002 must be set to n.  $\Box 0 \Box \Box$ .

## Operating Procedure

| Step | Display after Operation                                                                                                                                     | Keys    | Operation                                                                                                                                                                                                                                                                                                         |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | BB -FUNCTION-<br>FnB08 JSPD Init<br><u>FnB09 ZSET</u><br>FnB0A Monitor<br>FnB0B Prm Init                                                                    |         | Press the 😇 key to open the Utility Function<br>Mode main menu, and move the cursor with the<br><a>V</a> keys to select FnB09.                                                                                                                                                                                    |
| 2    | BB -ZSET-<br>Pos=+00000000<br>Start : [DATA]<br>Return: [SET]                                                                                               | DATA    | Press the Ima key to view the FnB09 operation screen.                                                                                                                                                                                                                                                             |
| 3    | BB -ZSET-<br>Pos=+0000 <u>1</u> 000<br>Start : [DATA]<br>Return: [SET]                                                                                      | < >     | Move the cursor with the $<>$ keys, and change the setting for the position whose current position is to be replaced with the $\land$ v keys.                                                                                                                                                                     |
| 4    | BB -ZSET-<br>Storing now                                                                                                                                    | DATA    | Press the main key to start origin setting.*<br>Do not turn off the control power supply until origin setting<br>has been completed normally.<br>To cancel the FnB09 operation, press the repressing the main key. The display returns to the Utility<br>Function Mode main menu without executing the operation. |
| 5    | BB -ZSET-<br>Done.<br><u>Press [SET] key.</u>                                                                                                               | _       | When origin setting has been completed normally,<br>"Done." is displayed.                                                                                                                                                                                                                                         |
| 6    | BB -FUNCTION-<br>FnB08 JSPD Init<br><u>FnB09 ZSET</u><br>FnB0A Monitor<br>FnB0B Prm Init                                                                    | MODERET | Press the 😇 key to return to the Utility Function<br>Mode main menu.                                                                                                                                                                                                                                              |
| 7    | Check that the current distributed position (PUN) and the current (actual) motor position (PFB) have changed to the specified positions by executing FnB0A. |         |                                                                                                                                                                                                                                                                                                                   |

\* If the we key is pressed in an operation prohibited state, "Error." is displayed for approximately 2 seconds and then the display returns to the FnB09 operation screen. In this case, make the setting again by referring to ◆ *Preparation* on page 17-24.

## INDEXER Status Monitor (FnB0A)

This function shows the internal status of the INDEXER Module, such as the current position and input/output signals.

## Preparation

None

## Operating Procedure

| Step | p Display after Operation Keys Operation                                                 |          | Operation                                                                                                                                                                                                                                                                                                                     |  |
|------|------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 1    | BB -FUNCTION-<br>FnB09 ZSET<br><u>FnB0A Monitor</u><br>FnB0B Prm Init<br>FnB0C ALM Reset |          | Press the 😇 key to open the Utility Function<br>Mode main menu, and move the cursor with the<br><a>V</a> keys to select FnB0A.                                                                                                                                                                                                |  |
| 2    | BB -MONITOR-<br><u>ALM</u> =BB<br>ERR=NONE<br>PFB=+12345678<br>PGMSTEP=12345             | DATA     | Press the Ima key to view the FnB0A operation screen.                                                                                                                                                                                                                                                                         |  |
| 3    | BB -MONITOR-<br><u>STS</u> =                                                             | < >      | Use the <> keys to change the monitor display content.<br>Note: Press the > key to change the content being displayed in the following order.<br>ALM → ERR → IN2 → OUT2 → STS → PUN → PFB → POS → DST → RPOS → RDST → PGM-STEP → EVTIME → LOOP<br>Press the < key to change the content being displayed in the reverse order. |  |
| 4    | BB -FUNCTION-<br>FnB09 ZSET<br><u>FnB0A Monitor</u><br>FnB0B Prm Init<br>FnB0C ALM Reset | MODE/SET | Press the 😇 key to return to the Utility Function<br>Mode main menu.                                                                                                                                                                                                                                                          |  |

#### Monitor Display Content List

| Display<br>Code | Display Content  | Display Example                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Units | Serial<br>Command |
|-----------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------|
| ALM             | Alarm or Warning | <ul> <li>ALM = A.xxx: A SERVOPACK alarm/<br/>warning is in effect (xxx is<br/>the alarm/warning code).</li> <li>ALM = ExxA: An INDEXER Module alarm<br/>is in effect (ExxA is the<br/>alarm code).</li> <li>ALM = HBB: During hard wire base block</li> <li>ALM = P-OT: Forward run prohibited<br/>(Over travel)</li> <li>ALM = N-OT: Reverse run prohibited<br/>(Over travel)</li> <li>ALM = P-LS: Forward software limit</li> <li>ALM = N-LS: Reverse software limit</li> <li>ALM = BB: Base blocked</li> <li>ALM = HOLD: Positioning interrupted</li> <li>ALM = NEAR: Near position status<br/>reached in positioning</li> <li>ALM = RUN: Motor running</li> <li>ALM = .: Status other than above</li> </ul> | _     | ALM               |

Continued on next page.

Appendices

| Display<br>Code | Display Content                | E                             | Display Example                                            | Units | Serial<br>Command |
|-----------------|--------------------------------|-------------------------------|------------------------------------------------------------|-------|-------------------|
| ERR             | Most Recent (Closest)<br>Error | • ERR = NONE<br>• ERR = ExxE: |                                                            | _     | ERR               |
|                 |                                | IN2 =<br>                     |                                                            |       |                   |
|                 |                                | Number                        |                                                            |       |                   |
|                 |                                | 1                             | /MODE0/1                                                   |       |                   |
| IN2             | INDEXER Module Input           | 2                             | /START-STOP; /HOME                                         | _     | IN2               |
| IINZ            | Signal                         | 3                             | /PGMRES; /JOGP                                             |       | 11 NZ             |
|                 |                                | 4                             | /SEL0; /JOGN                                               |       |                   |
|                 |                                | 5                             | /SEL1; /JOG0                                               |       |                   |
|                 |                                | 6                             | /SEL2; /JOG1                                               |       |                   |
|                 |                                | 7                             | /SEL3; /JOG2                                               |       |                   |
|                 |                                | 8                             | /SEL4; /JOG3                                               |       |                   |
|                 |                                | 9                             | /SEL5                                                      |       |                   |
|                 |                                | 10                            | /SEL6                                                      |       |                   |
|                 |                                | 11                            | /SEL7                                                      |       |                   |
|                 |                                | Upper level: Pl               | <br>6 5 4 3 2 1 digit<br>notocoupler ON<br>notocoupler OFF |       |                   |
|                 |                                | Display<br>Digit<br>Number    | Signal Name                                                |       |                   |
| OUT2            | INDEXER Module                 | 1                             | /INPOSITION                                                | _     | OUT2              |
| 2012            | Output Signal                  | 2                             | /POUT0                                                     |       | 0012              |
|                 |                                | 3                             | /POUT1                                                     |       |                   |
|                 |                                | 4                             | /POUT2                                                     |       |                   |
|                 |                                | 5                             | /POUT3                                                     |       |                   |
|                 |                                | 6                             | /POUT4                                                     |       |                   |
|                 |                                | 7                             | /POUT5                                                     |       |                   |
|                 |                                | 8                             | /POUT6                                                     |       |                   |
|                 |                                | 9                             | /POUT7                                                     |       |                   |

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| Display         |                                        | Continued from previous pag                                                          |                                                                          |                     |         |
|-----------------|----------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------|---------|
| Display<br>Code | Display Content                        |                                                                                      | Display Example                                                          | Units               | Command |
|                 |                                        | STS =<br>             <br>7 6 5 4 3 2 1 digit<br>Upper level: ON<br>Lower level: OFF |                                                                          |                     |         |
|                 |                                        | Display<br>Digit<br>Number                                                           | Status Flag                                                              |                     |         |
|                 |                                        | 1                                                                                    | INPOSITION (Positioning complete)                                        |                     |         |
| STS             | Status Flag                            | 2                                                                                    | NEAR (Near position)                                                     | _                   | STS     |
|                 |                                        | 3                                                                                    | DEN (positioning refer-<br>ence distribution com-<br>pleted)             |                     |         |
|                 |                                        | 4                                                                                    | When positioning or pro-<br>gram operation is inter-<br>rupted (on hold) |                     |         |
|                 |                                        | 5                                                                                    | During program operation                                                 |                     |         |
|                 |                                        | 6                                                                                    | When the current (torque) is being limited                               |                     |         |
|                 |                                        | 7                                                                                    | When the main power supply is ON                                         |                     |         |
| PUN             | Position Reference<br>Current Position | PUN = +12345678                                                                      |                                                                          | Refer-<br>ence unit | PUN     |
| PFB             | Current (Actual) Motor<br>Position     | PFB = +1234                                                                          | 5678                                                                     | Refer-<br>ence unit | PFB     |
| POS             | Target Position                        | POS = +1234                                                                          | 5678                                                                     | Refer-<br>ence unit | POS     |
| DST             | Target Distance                        | DST = +1234                                                                          | 5678                                                                     | Refer-<br>ence unit | DST     |
| RPOS            | Registration Target<br>Position        | RPOS = +123                                                                          | 345678                                                                   | Refer-<br>ence unit | RPOS    |
| RDST            | Registration Target<br>Distance        | RDST = 1234                                                                          | 5678                                                                     | Refer-<br>ence unit | RDST    |
| PGMSTEP         | Program Step<br>(PGMSTEP)              | running                                                                              | End: When the program is not<br>12345: The program step<br>ed            | _                   | PGMSTEP |
| EVTIME          | Program EVENT Elapsed<br>Time          | EVTIME = 12345                                                                       |                                                                          | ms                  | EVTIME  |
| LOOP            | Loop Pass Through                      | LOOP = 1234                                                                          | 5                                                                        | Times               | LOOP    |

## **INDEXER** Parameter Setting Initialization (FnB0B)

This function restores the default settings and initializes the parameters of both the SERVO-PACK and the INDEXER Module.

- Always carry out initialization of the parameter settings in the servo OFF status. It cannot be done in the servo ON status.
- To bring the settings into effect, always turn the SERVOPACK power supply off and back on after this operation.
  - When you execute Fn005, only the SERVOPACK parameters are initialized. The INDEXER Module parameters are not initialized. To initialize the INDEXER Module parameters, execute FnB0B.

#### Preparation

The following conditions must be met to initialize INDEXER parameter settings.

- The write-prohibited setting (Fn010) must not be set to write-protect parameters.
- The servo OFF status must be established.
- Initializing the parameter settings must not be in progress for any tool.
- The RES command must not being executed.

#### Operating Procedure

| Step | Display after Operation                                                                          | Keys            | Operation                                                                                                                                                                                                                                                                                                                                |
|------|--------------------------------------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | BB — FUNCTION—<br>FnBOA Monitor<br><u>FnBOB Prm Init</u><br>FnBOC ALM Reset<br>FnBOD Indexer ALM |                 | Press the 😇 key to open the Utility Function<br>Mode main menu, and move the cursor with the<br><a>v</a> keys to select FnB0B.                                                                                                                                                                                                           |
| 2    | BB — Prm Init—<br>Start : [DATA]<br>Return: [SET]                                                | DATA            | Press the Imm key to view the FnB0B operation screen.                                                                                                                                                                                                                                                                                    |
| 3    | BB — Prm Init—<br><u>Restoring now</u><br>Please wait.                                           | DATA            | Press the Imm key to start initialization of the parameters.*<br>Do not turn off the control power supply until initialization has been completed normally.<br>To cancel the FnB0B operation, press the Imm key before pressing the Imm key. The display returns to the Utility Function Mode main menu without executing the operation. |
| 4    | BB — Prm Init—<br>Done.<br><u>Press [SET] key.</u>                                               | _               | When parameter initialization has been completed normally, "Done." is displayed.                                                                                                                                                                                                                                                         |
| 5    | BB — FUNCTION—<br>FnBOA Monitor<br><u>FnBOB Prm Init</u><br>FnBOC ALM Reset<br>FnBOD Indexer ALM | MODE/SET        | Press the 😇 key to return to the Utility Function<br>Mode main menu.                                                                                                                                                                                                                                                                     |
| 6    | To bring the settings into effect,                                                               | turn the SERVOP | ACK power supply off and back on.                                                                                                                                                                                                                                                                                                        |

\* If the we is pressed in an operation prohibited state, "Error." is displayed for approximately 2 seconds and then the display returns to the FnB0B operation screen. In this case, make the setting again by referring to • *Preparation* on page 17-28.

## INDEXER Alarm Reset (FnB0C)

This function resets alarms at both the SERVOPACK and INDEXER Module, and clears the alarm history at the INDEXER Module.

- INDEXER Module alarms are not reset by the "ALARM RESET" button of the digital operator. To reset INDEXER Module alarms, execute alarm resetting with FnB0C.
- Eliminate the causes of alarms before resetting them.

Important
 When you execute Fn006, only the SERVOPACK alarm history is cleared. The INDEXER Module alarm history is not cleared. To clear the INDEXER Module alarm history, execute alarm history clearance with FnB0C.

## Preparation

When Resetting Alarms

None

 $\bigcirc$ 

#### ■ When Clearing the Alarm History

The following conditions must be met to reset INDEXER alarms.

- The write-prohibited setting (Fn010) must not be set to write-protect parameters.
- The ALMTRCCLR command must not being executed.
- The RES command must not being executed.

## Operating Procedure

| Step | Display after Operation                                                                                  | Keys | Operation                                                                                                                                                                                                                                          |
|------|----------------------------------------------------------------------------------------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | A. AEF — FUNCTION—<br>FnBOB Prm Init<br><u>FnBOC ALM Reset</u><br>FnBOD Indexer ALM<br>FnOOO Alm History |      | Press the 🛱 key to open the Utility Function<br>Mode main menu, and move the cursor with the<br>A V keys to select FnB0C.                                                                                                                          |
| 2    | A. AEF -ALM Reset-<br>Mode= <u>ALM state</u><br>Start : [DATA]<br>Return: [SET]                          | DATA | Press the Example to view the FnB0C operation screen.                                                                                                                                                                                              |
| 3-1  | A. AEF -ALM Reset-<br>Mode= <u>ALM state</u><br>Start : [DATA]<br>Return: [SET]                          |      | ■ When Resetting Alarms<br>Use the <a>T</a> keys to select "ALM state".                                                                                                                                                                            |
| 3-2  | A. AEF -ALM Reset-<br>Mode= <u>ALM History</u><br>Start : [DATA]<br>Return: [SET]                        |      | ■ When Clearing the Alarm History<br>Use the <a>T</a> keys to select "ALM History".                                                                                                                                                                |
| 4    | A. AEF — ALM Reset—<br><u>Resetting</u>                                                                  | DATA | Press the main key to reset the alarms or clear the alarm history.*<br>To cancel the FnBOC operation, press the main key before pressing the main key. The display returns to the Utility Function Mode main menu without executing the operation. |
| 5    | BB — ALM Reset—<br>Mode= <u>ALM state</u><br>Start : [DATA]<br>Return: [SET]                             | _    | When alarm resetting or alarm history clearance<br>is completed, the display returns to the Mode<br>selection screen.                                                                                                                              |

Continued on next page.

Continued from previous page.

| Step | Display after Operation                                                                              | Keys    | Operation                                                            |
|------|------------------------------------------------------------------------------------------------------|---------|----------------------------------------------------------------------|
| 6    | BB — FUNCTION—<br>FnBOB Prm Init<br><u>FnBOC ALM Reset</u><br>FnBOD Indexer ALM<br>Fn000 Alm History | MODERET | Press the 😇 key to return to the Utility Function<br>Mode main menu. |

\* If the the key is pressed in an operation prohibited state, "Error." is displayed for approximately 2 seconds and then the display returns to the FnBOC operation screen. In this case, make the setting again by referring to  $\blacklozenge$  Preparation.

## **INDEXER Alarm History Display (FnB0D)**

This function displays the history of alarms that have occurred at the SERVOPACK and INDEXER Module.

#### Preparation

None

## Operating Procedure

| Step | Display after Operation                                                                                                                                              | Keys     | Operation                                                                                                                                                      |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | BB-FUNCTION-FnBOCALMResetFnBODIndexerALMFn000AlmHistoryFn002JOG                                                                                                      |          | Press the 😇 key to open the Utility Function<br>Mode main menu, and move the cursor with the<br><a href="https://www.communication.com">www.communication.</a> |
| 2    | BB -ALM Trace-<br>ALMO=A. F10<br>ALM1=E19A<br>ALM2=NONE<br>ALM3=NONE                                                                                                 | DATA     | Press the 📟 key to view the alarm history.<br>If no alarms occur, "NONE" is displayed.                                                                         |
| 3    | BB       -ALM       Trace-         ALM0=A.       F10         ALM1=E19A       ALM2=NONE         ALM3=NONE         BB       -ALM         Trace-         ALM1=E19A      |          |                                                                                                                                                                |
| 3    | A L M 2 = N O N E<br>A L M 3 = N O N E<br>A L M 4 = N O N E<br>B - A L M Trace -<br>A L M 6 = N O N E<br>A L M 7 = N O N E<br>A L M 8 = N O N E<br>A L M 9 = N O N E |          | Use the 🔊 🔽 keys to scroll the alarm history.                                                                                                                  |
| 4    | BB -FUNCTION-<br>FnBOC ALM Reset<br><u>FnBOD Indexer ALM</u><br>FnOOO Alm History<br>FnOO2 JOG                                                                       | MODE/SET | Press the 😇 key to return to the Utility Function<br>Mode main menu.                                                                                           |

Information To clear the alarm history, execute the Reset INDEXER Alarm (FnB0C) utility function with *Mode* set to *ALM History* (clear alarm history). The alarm history is not cleared when you reset an alarm (Mode = ALM state) or when the control power supply to the SERVOPACK is turned OFF. Refer to the following section for the procedure.

# 17.3 Alphabetical List of Serial Commands

The following table lists the usable serial commands in alphabetical order.

| Serial Command     | Function                                          | Reference  |
|--------------------|---------------------------------------------------|------------|
| ABSPGRES           | Absolute Encoder Reset                            | page 14-30 |
| ACCnnnnnnn         | Acceleration Specification                        | page 14-15 |
| ACCTsss            | Program Table ACC Read                            | page 14-24 |
| ACCTsss=           | Program Table ACC Write                           | page 14-24 |
| ALM                | Alarm or Warning Read                             | page 14-30 |
| ALMn               | Alarm History Read                                | page 14-30 |
| ALMTRCCLR          | Alarm Trace Clear                                 | page 14-30 |
| ARES               | Alarm Reset                                       | page 14-11 |
| CURZERO            | Motor Current Zero Adjustment                     | page 14-30 |
| DBRMS              | Dynamic-Brake Load Ratio Monitor                  | page 14-30 |
| DECnnnnnnn         | Deceleration Specification                        | page 14-15 |
| DECTsss            | Program Table DEC Read                            | page 14-24 |
| DECTsss=           | Program Table DEC Write                           | page 14-24 |
| DST or MON9        | Target Distance Monitor                           | page 14-30 |
| ERR                | Most Recent Error Read                            | page 14-30 |
| EVENTTsss          | Program Table EVENT Read                          | page 14-24 |
| EVENTTsss=         | Program Table EVENT Write                         | page 14-24 |
| EVTIME             | Program EVENT Elapsed Time Monitor                | page 14-30 |
| HALLSENS           | Hall Sensor Monitor For Linear Servomotors        | page 14-30 |
| HOLD               | Positioning Interruption                          | page 14-15 |
| IN1                | SERVOPACK Input Signal Monitor (CN1)              | page 14-30 |
| IN2                | INDEXER Module Input Signal Monitor (CN11)        | page 14-30 |
| IN2TESTbbbbbbbbbbb | INDEXER Module Input Signal Specification (CN11)  | page 14-30 |
| IN3                | Safety Function Input Signal Monitor              | page 14-30 |
| JOGPnnnnnnn        | JOG Forward                                       | page 14-15 |
| JOGNnnnnnnn        | JOG Reverse                                       | page 14-15 |
| JSPDINIT           | JOG Speed Table Initialization                    | page 14-29 |
| JSPDSTORE          | JOG Speed Table Save                              | page 14-29 |
| JSPDTdd            | JOG Speed Table Read                              | page 14-29 |
| JSPDTdd=           | JOG Speed Table Write                             | page 14-29 |
| LOOP               | Program Table LOOP Pass Through Monitor           | page 14-30 |
| LOOPTsss           | Program Table LOOP Read                           | page 14-24 |
| LOOPTsss=          | Program Table LOOP Write                          | page 14-24 |
| MLTLIMSET          | Multi-turn Limit Setting                          | page 14-30 |
| MONn               | Monitor Read                                      | page 14-30 |
| MTSIZE             | Monitor Capacity Display                          | page 14-30 |
| MTTYPE             | Motor Model Code Display                          | page 14-30 |
| NEXTTsss           | Program Table NEXT Read                           | page 14-24 |
| NEXTTsss=          | Program Table NEXT Write                          | page 14-24 |
| NFB or MON3        | Motor Speed Monitor                               | page 14-30 |
| NREF or MON4       | Speed Reference Monitor                           | page 14-30 |
| OUT1               | SERVOPACK Output Signal Monitor (CN1)             | page 14-30 |
| OUT2               | INDEXER Module Output Signal Monitor (CN11)       | page 14-30 |
| OUT2TESTbbbbbbbbb  | INDEXER Module Output Signal Specification (CN11) | page 14-30 |
| PER or MON2        | Position Error Monitor                            | page 14-30 |
| PFB or MON7        | Current (Actual) Motor Position Monitor           | page 14-30 |
| PGMINIT            | Program Table Initialization                      | page 14-24 |

Appendices

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Continued on next page.

|                                      | Contir                                                                            | nued from previous page. |
|--------------------------------------|-----------------------------------------------------------------------------------|--------------------------|
| Serial Command                       | Function                                                                          | Reference                |
| PGMRES                               | Program Table Operation Reset                                                     | page 14-28               |
| PGMSTEP                              | Program Step (PGMSTEP) Monitor                                                    | page 14-30               |
| PGMSTORE                             | Program Table Save                                                                | page 14-24               |
| PGTYPE                               | Encoder Model Code Display                                                        | page 14-30               |
| PGVER                                | Encoder Firmware Version Display                                                  | page 14-30               |
| POS (±) nnnnnnnn<br>POSA (±) nnnnnnn | Target Position Specification (Absolute Position)                                 | page 14-15               |
| POS or MON8                          | Target Position Monitor                                                           | page 14-30               |
| POSI (±) nnnnnnn                     | Target Position Specification (Relative Distance)                                 | page 14-15               |
| POSTsss                              | Program Table POS Read                                                            | page 14-24               |
| POSTsss=                             | Program Table POS Write                                                           | page 14-24               |
| POUT                                 | POUT Monitor                                                                      | page 14-30               |
| POUTnnnnnnn                          | POUT Specification                                                                | page 14-15               |
| POUTTsss                             | Program Table POUT Read                                                           | page 14-24               |
| POUTTsss=                            | Program Table POUT Write                                                          | page 14-24               |
| PRMINIT                              | Parameter Initialization                                                          | page 14-30               |
| PRMppp                               | Parameter Read                                                                    | page 14-30               |
| PRMppp=                              | Parameter Write                                                                   | page 14-30               |
| PUN or MON1                          | Position Reference Current Position                                               | page 14-30               |
| RDST or MON11                        | Registration Target Distance Monitor                                              | page 14-30               |
| RDSTnnnnnnn                          | Registration Distance Specification                                               | page 14-15               |
| RDSTTsss                             | Program Table RDST Read                                                           | page 14-24               |
| RDSTTsss=                            | Program Table RDST Write                                                          | page 14-24               |
| RES                                  | Reset                                                                             | page 14-11               |
| RGRMS                                | Regeneration Load Ratio Monitor                                                   | page 14-30               |
| RPOS or MON10                        | Registration Target Position Monitor                                              | page 14-30               |
| RS                                   | Positioning Start with Registration                                               | page 14-15               |
| RS (±) nnnnnnn<br>RSA (±) nnnnnnn    | Positioning Start with Registration (Absolute Position)                           | page 14-15               |
| RSI (±) nnnnnnn                      | Positioning Start with Registration (Relative Distance)                           | page 14-15               |
| RSPDnnnnnnn                          | Registration Speed Specification                                                  | page 14-15               |
| RSPDTsss                             | Program Table RSPD Read                                                           | page 14-24               |
| RSPDTsss=                            | Program Table RSPD Write                                                          | page 14-24               |
| SKIP                                 | Positioning Stop                                                                  | page 14-15               |
| SPDnnnnnn                            | Positioning Speed Specification                                                   | page 14-15               |
| SPDTsss                              | Program Table SPD Read                                                            | page 14-24               |
| SPDTsss=                             | Program Table SPD Write                                                           | page 14-24               |
| ST                                   | Positioning Start                                                                 | page 14-15               |
| ST (±) nnnnnnn<br>STA (±) nnnnnnn    | Positioning Start (Absolute Position)                                             | page 14-15               |
| START                                | Program Table Operation Restart                                                   | page 14-28               |
| STARTsss                             | Program Table Operation Start                                                     | page 14-28               |
| STI (±) nnnnnnn                      | Positioning Start (Relative Position)                                             | page 14-15               |
| STOP                                 | Program Table Operation Interruption                                              | page 14-28               |
| STS or MON6                          | Status Flag Monitor                                                               | page 14-30               |
| SVOFF                                | Servo OFF                                                                         | page 14-11               |
| SVON                                 | Servo ON                                                                          | page 14-11               |
| SVTYPE                               | SERVOPACK Model Code Display                                                      | page 14-11               |
| SVVER                                | SERVOPACK Firmware Version Display                                                |                          |
| SVVER                                | SERVOPACK Firmware version Display<br>SERVOPACK Special Specification No. Display | page 14-30               |
| -                                    |                                                                                   | page 14-30               |
| TREF or MON5                         | Internal Torque Reference Monitor                                                 | page 14-30               |

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| Serial Command   | Function                                         | Reference  |
|------------------|--------------------------------------------------|------------|
| TRMppp=          | Temporary Parameter Write                        | page 14-30 |
| TRMS             | Cumulative Load Ratio Monitor                    | page 14-30 |
| TYPE             | INDEXER Module Model Code Display                | page 14-30 |
| VER              | INDEXER Module Firmware Version Display          | page 14-30 |
| YSPEC            | INDEXER Module Special Specification No. Display | page 14-30 |
| ZONEINIT         | ZONE Table Initialization                        | page 14-29 |
| ZONENTzz         | ZONE Table ZONE N Read                           | page 14-29 |
| ZONENTzz=        | ZONE Table ZONE N Write                          | page 14-29 |
| ZONEPTzz         | ZONE table ZONE P Read                           | page 14-29 |
| ZONEPTzz=        | ZONE Table ZONE P Write                          | page 14-29 |
| ZONESTORE        | ZONE Table Save                                  | page 14-29 |
| ZRN              | Homing Start                                     | page 14-15 |
| ZSET (±) nnnnnnn | Coordinates Setting                              | page 14-15 |

Continued from previous page.

# 17.4 Corresponding Parameter Numbers

The following table shows the corresponding parameters between the SGDV-OCA03A INDEXER Module and the INDEXER Module for SGDH SERVOPACKs (JUSP-NS600).

| Parameter Name                                                                                                                                             | SGDV-OCA03A<br>Parameter No.     | JUSP-NS600<br>Parameter No. |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------|
| Axis Address Selection                                                                                                                                     | Pn010<br>(setting range: 1 to F) | Rotary Switch (ADRS)        |
| Serial Communication Protocol                                                                                                                              | PnB00                            | Pn800                       |
| Bit rate                                                                                                                                                   | PnB01                            | Pn801                       |
| Response "OK"                                                                                                                                              | PnB02                            | Pn802                       |
| /MODE 0/1                                                                                                                                                  | PnB03                            | Pn803                       |
| /START-STOP; /HOME                                                                                                                                         | PnB04                            | Pn804                       |
| /PGMRES; /JOGP                                                                                                                                             | PnB05                            | Pn805                       |
| /SEL0; /JOGN                                                                                                                                               | PnB06                            | Pn806                       |
| /SEL1; /JOG0                                                                                                                                               | PnB07                            | Pn807                       |
| /SEL2; /JOG1                                                                                                                                               | PnB08                            | Pn808                       |
| /SEL3; /JOG2                                                                                                                                               | PnB09                            | Pn809                       |
| /SEL4; /JOG3                                                                                                                                               | PnB0A                            | Pn80A                       |
| /SEL5                                                                                                                                                      | PnB0B                            | Pn833                       |
| /SEL6                                                                                                                                                      | PnB0C                            | Pn834                       |
| /SEL7                                                                                                                                                      | PnB0D                            | _                           |
| /S-ON                                                                                                                                                      | PnB0E                            | Pn80B                       |
| P-OT                                                                                                                                                       | PnB0F                            | Pn80C                       |
| N-OT                                                                                                                                                       | PnB10                            | Pn80D                       |
| /DEC                                                                                                                                                       | PnB11                            | Pn80E                       |
| /BGRT                                                                                                                                                      | PnB12                            | Pn80F                       |
| /INPOSITION                                                                                                                                                | PnB13                            | Pn810                       |
| /POUT0                                                                                                                                                     | PnB14                            | Pn811                       |
| /POUT1                                                                                                                                                     | PnB15                            | Pn812                       |
| /POUT2                                                                                                                                                     | PnB16                            | Pn813                       |
| /POUT3                                                                                                                                                     | PnB17                            | Pn814                       |
| /POUT4                                                                                                                                                     | PnB18                            | Pn815                       |
| /POUT5                                                                                                                                                     | PnB19                            | -                           |
| /POUT6                                                                                                                                                     | PnB1A                            |                             |
| /POUT7                                                                                                                                                     | PnB1A<br>PnB1B                   | _                           |
| /WARN                                                                                                                                                      | PnB1C                            | -<br>Pn816                  |
| /BK                                                                                                                                                        | PnB1D                            | Pn817                       |
| /SRDY                                                                                                                                                      | PnB1D<br>PnB1E                   | Pn818                       |
| Overtravel (OT) Stop Method                                                                                                                                | PnB1E<br>PnB1F                   | Pn819                       |
| Moving Mode                                                                                                                                                | PnB20                            | Pn81A                       |
|                                                                                                                                                            | FIIDZU                           | FIIOTA                      |
| <ul> <li>Linear coordinates (PnB20 = 0): Forward Software Limit (P-LS)</li> <li>Rotational coordinates (PnB20 ≠ 0): Last Rotational Coordinate</li> </ul>  | PnB21<br>(PnB22)                 | Pn81B                       |
| <ul> <li>Linear coordinates (PnB20 = 0): Reverse Software Limit (N-LS)</li> <li>Rotational coordinates (PnB20 ≠ 0): First Rotational Coordinate</li> </ul> | PnB23<br>(PnB24)                 | Pn81C                       |
| <ul> <li>When using an incremental encoder: Origin</li> <li>When using an absolute encoder: Absolute<br/>Encoder Offset</li> </ul>                         | PnB25<br>(PnB26)                 | Pn81D                       |
| Positioning/Registration Speed                                                                                                                             | PnB27<br>(PnB28)                 | Pn81E                       |

Continued on next page.

| Continued from previous page                |                  |               |  |
|---------------------------------------------|------------------|---------------|--|
| Parameter Name                              | SGDV-OCA03A      | JUSP-NS600    |  |
|                                             | Parameter No.    | Parameter No. |  |
| Acceleration rate                           | PnB29<br>(PnB2A) | Pn81F         |  |
| Deceleration rate                           | PnB2B<br>(PnB2C) | Pn820         |  |
| /INPOSITION Width                           | PnB2D<br>(PnB2E) | Pn821         |  |
| /NEAR Width                                 | PnB2F<br>(PnB30) | Pn822         |  |
| Homing Method                               | PnB31            | Pn823         |  |
| Homing Direction                            | PnB32            | Pn824         |  |
| Homing Moving Speed                         | PnB33<br>(PnB34) | Pn825         |  |
| Homing Approach Speed                       | PnB35<br>(PnB36) | Pn826         |  |
| Homing Creep Speed                          | PnB37<br>(PnB38) | Pn827         |  |
| Homing Final Move Distance                  | PnB39<br>(PnB3A) | Pn828         |  |
| Reserved (setup information)                | PnB3B<br>(PnB3C) | Pn829         |  |
| Reserved (setup information)                | PnB3D<br>(PnB3E) | Pn82A         |  |
| Reserved (setup information)                | PnB3F<br>(PnB40) | Pn82B         |  |
| Reserved (setup information)                | PnB41<br>(PnB42) | Pn82C         |  |
| Reserved (setup information)                | PnB43<br>(PnB44) | Pn82D         |  |
| Reserved (setup information)                | PnB45<br>(PnB46) | Pn82E         |  |
| Reserved (setup information)                | PnB47<br>(PnB48) | Pn82F         |  |
| Reserved (setup information)                | PnB49<br>(PnB4A) | Pn830         |  |
| Reserved (setup information)                | PnB4B<br>(PnB4C) | Pn831         |  |
| Reserved (setup information)                | PnB4D<br>(PnB4E) | Pn832         |  |
| ZONE Signal Setting                         | PnB4F            | Pn835         |  |
| Backlash Compensation                       | PnB50            | Pn836         |  |
| /ALO Output Selection                       | PnB51            | -             |  |
| /ALM-RST                                    | PnB52            | -             |  |
| Input Signal Monitor IN1 Polarity Selection | PnB53            | -             |  |

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# $\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK **Command Option Attachable Type** with INDEXER Module **Product Manual**

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YASKAWA ELECTRIC CORPORATION

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