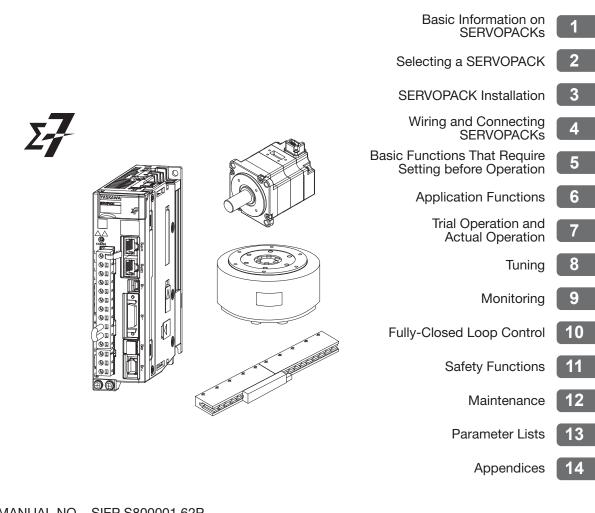
# YASKAWA

# $\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with **MECHATROLINK-III Communications References RJ-45** Connectors **Product Manual**

Model: SGD7S-DDDD30A



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## About this Manual

This manual provides information required to select  $\Sigma$ -7S SERVOPACKs with MECHATROLINK-III Communications References and RJ-45 Connectors for  $\Sigma$ -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  $\Sigma$ -7-Series AC Servo Drives.

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

## **Outline of Manual**

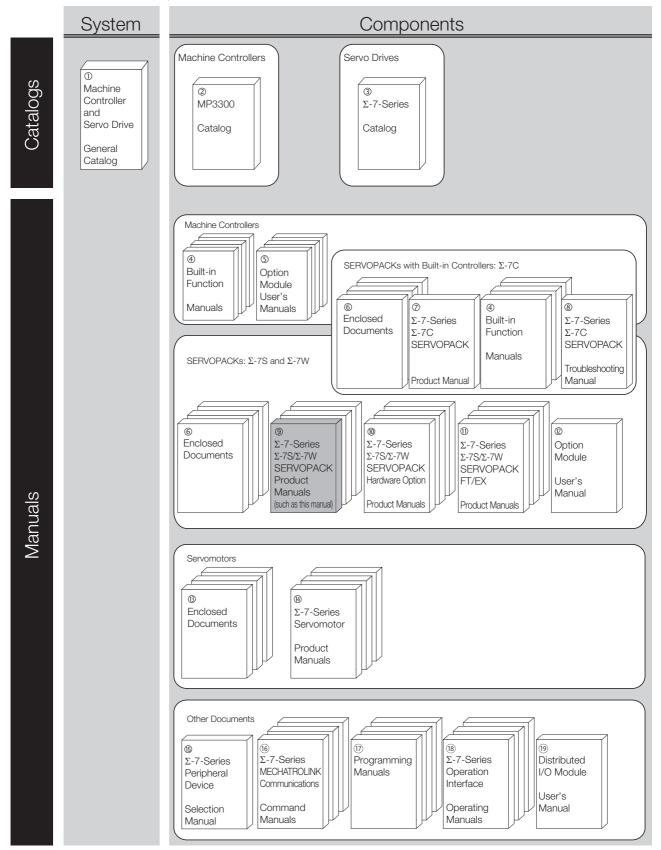
The contents of the chapters of this manual are described in the following table.

Refer to these chapters as required.

Chapter	Chapter Title	Contents
1	Basic Information on SERVOPACKs	Provides information required to select SERVOPACKs, such as SER- VOPACK models 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	SERVOPACK Installation	Provides information on installing SERVOPACKs in the required loca- tions.
4	Wiring and Connecting SERVOPACKs	Provides information on wiring and connecting SERVOPACKs to power supplies and peripheral devices.
5	Basic Functions That Require Set- ting 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 and Actual 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	Maintenance	Provides information on the meaning of, causes of, and corrections for alarms and warnings.
13	Parameter Lists	Provides information on the parameters.
14	Appendices	Provides information on interpreting panel displays and tables of corresponding SERVOPACK and SigmaWin+ function names.

## **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 $\Sigma$ -7-Series AC Servo Drives.	
@ MP3300 Catalog	Machine Controller MP3300	KAEP C880725 03	Provides detailed information on MP3300 Machine Controllers, including features and specifica- tions.	
<ul><li>③</li><li>Σ-7-Series Catalog</li></ul>	AC Servo Drives $\Sigma$ -7 Series	KAEP S800001 23	Provides detailed information on $\Sigma$ - 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 $\Sigma$ - 7-Series $\Sigma$ -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 $\Sigma$ -7-Series $\Sigma$ -7C SERVO- PACKs.	
	Machine Controller MP2000 Series Communication Module User's Manual	SIEP C880700 04	Provide detailed information on the specifications and communica- tions methods for the Communica- tions Modules that can be mounted to MP3000-Series Machine Con- trollers and $\Sigma$ -7-Series $\Sigma$ -7C	
	Machine Controller MP2000 Series 262IF-01 FL-net Communication Module User's Manual	SIEP C880700 36		
© Option Module	Machine Controller MP2000 Series 263IF-01 EtherNet/IP Communication Module User's Manual	SIEP C880700 39	SERVOPACKs.	
User's Manuals	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 $\Sigma$ - 7-Series $\Sigma$ -7C SERVOPACKs.	
	Machine Controller MP2000 Series Counter Module CNTR-01 User's Manual			

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Classification	Document Name	Document No.	Description
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S, $\Sigma$ -7W, and $\Sigma$ -7C SER- VOPACK Safety Precautions	TOMP C710828 00	Provides detailed information for the safe usage of $\Sigma$ -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.
	$\begin{array}{l} \Sigma \text{-V-Series} \\ \text{for Large-Capacity Models} \\ \Sigma \text{-7-Series} \\ \text{Installation Guide} \\ \text{Command Option Module} \end{array}$	TOBP C720829 01	Provides detailed procedures for installing the Command Option Module in a SERVOPACK.
© Enclosed Documents	$ \begin{array}{c} \Sigma \text{-V-Series} / \Sigma \text{-V-Series} \\ \text{for Large-Capacity Models} / \\ \Sigma \text{-7-Series} \\ \text{Installation Guide} \\ \text{Fully-closed Module} \\ \hline \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 03	Provides detailed procedures for installing the Fully-closed Module in a SERVOPACK.
		TOBP C720829 06	Provides detailed procedures for installing the Safety Module in a SERVOPACK.
	$\Sigma$ -V-Series/ $\Sigma$ -V-Series for Large-Capacity Models/ $\Sigma$ -7-Series Installation Guide INDEXER Module	TOBP C720829 02	Provides detailed procedures for installing the INDEXER Module in a SERVOPACK.
	$\begin{array}{l} \Sigma \text{-V-Series} \\ \text{for Large-Capacity Models} \\ \Sigma \text{-7-Series} \\ \text{Installation Guide} \\ \text{DeviceNet Module} \end{array}$	TOBP C720829 07	Provides detailed procedures for installing the DeviceNet Module in a SERVOPACK.
<ul> <li>Ø</li> <li>Σ-7-Series</li> <li>Σ-7C SERVOPACK</li> <li>Product Manual</li> </ul>	Σ-7-Series AC Servo Drive Σ-7C SERVOPACK Product Manual	SIEP S800002 04	Provides detailed information on selecting $\Sigma$ -7-Series $\Sigma$ -7C SERVO-PACKs; installing, connecting, setting, testing in trial operation, and tuning Servo Drives; writing, monitoring, and maintaining programs; and other information.
$^{\textcircled{8}}$ Σ-7-Series Σ-7C SERVOPACK Troubleshooting Manual	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7C SERVOPACK Troubleshooting Manual	SIEP S800002 07	Provides detailed troubleshooting information for $\Sigma$ -7-Series $\Sigma$ -7C SERVOPACKs.

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Classification	Document Name	Document No.	Description
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with MECHATROLINK-4 Communications References Product Manual	SIEP S800002 31	
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with MECHATROLINK-III Communications References Product Manual	SIEP S800001 28	
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with MECHATROLINK-II Communications References Product Manual	SIEP S800001 27	
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with Analog Voltage/Pulse Train References Product Manual	SIEP S800001 26	
⑨ Σ-7-Series Σ-7S/Σ-7W SERVOPACK	Σ-7-Series AC Servo Drive           Σ-7S SERVOPACK           Command Option Attachable           Type with INDEXER Module           K	SIEP S800001 64	Provide detailed information on selecting $\Sigma$ -7-Series $\Sigma$ -7S and $\Sigma$ -7W SERVOPACKs; installing, connecting, setting, testing in trial operation, tuning, monitoring, and maintaining Servo Drives; and other information.
Product Manuals	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK Command Option Attachable Type with DeviceNet Module Product Manual	SIEP S800001 70	
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with MECHATROLINK-III Communications References RJ-45 Connectors Product Manual	This manual (SIEP S800001 62)	
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7W SERVOPACK with MECHATROLINK-III Communications References Product Manual	SIEP S800001 29	
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7W SERVOPACK with MECHATROLINK-III Communications References RJ-45 Connectors Product Manual	SIEP S800001 63	
$ $	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S/ $\Sigma$ -7W SERVOPACK with Hardware Option Specifica- tions Dynamic Brake Product Manual	SIEP S800001 73	Provide detailed information on
SERVOPACK with Hardware Option Specifications Product Manuals	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7W/ $\Sigma$ -7C SERVOPACK with Hardware Option Specifica- tions HWBB Function Product Manual	SIEP S800001 72	- Hardware Options for Σ-7-Series SERVOPACKs.

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Classification	Document Name	Document No.	Continued from previous page. Description	
OldSinodion	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with FT/EX Specification for Index- ing Application Product Manual	SIEP S800001 84		
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -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		
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with FT/EX Specification for Press and injection Molding Application Product Manual	SIEP S800001 94		
$\Sigma^{0}$ -7-Series	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with FT/EX Specification for Transfer and Alignment Application Product Manual	SIEP S800001 95	Provide detailed information on the	
Σ-7S/Σ-7W SERVOPACK FT/EX Product Manuals	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with FT/EX Specification for Torque/Force Assistance for Conveyance Application Product Manual	SIEP S800002 09	FT/EX Option for Σ-7-Series SERVOPACKs.	
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with FT/EX Specification for Cutting Application Feed Shaft Motor Product Manual	SIEP S800002 10		
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with FT/EX Specification for Three-Point Latching for Conveyance Application Product Manual	SIEP S800002 17		
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7S SERVOPACK with FT/EX Specification for Semi-/Fully-Closed Loop Control Online Switching for Conveyance Application Product Manual	SIEP S800002 27		
	$\Sigma$ -7-Series AC Servo Drive $\Sigma$ -7W SERVOPACK with FT/EX Specification for Gantry Applications Product Manual	SIEP S800002 29		
© Option Module User's Manual	AC Servo Drives $\Sigma$ -V Series/ $\Sigma$ -V Series for Large-Capacity Models/ $\Sigma$ -7 Series User's Manual Safety Module	SIEP C720829 06	Provides detailed information required for the design and mainte- nance of a Safety Module.	

			Continued from previous page.
Classification	Document Name	Document No.	Description
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 Servomo- tors.
	Σ-7-Series AC Servo Drive Rotary Servomotor Product Manual	SIEP S800001 36	
<sup>®</sup> 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 $\Sigma$ -7-Series Servomotors.
	$\Sigma$ -7-Series AC Servo Drive Direct Drive Servomotor Product Manual	SIEP S800001 38	
$\Sigma$ -7-Series Peripheral Device Selection Manual	Σ-7-Series AC Servo Drive Peripheral Device Selection Manual	SIEP S800001 32	<ul> <li>Provides the following information in detail for Σ-7-Series Servo Sys- tems.</li> <li>Cables: Models, dimensions, wir- ing materials, connector models, and connection specifications</li> <li>Peripheral devices: Models, specifications, diagrams, and selection (calculation) methods</li> </ul>
	Σ-7-Series AC Servo Drive MECHATROLINK-II Communications Command Manual	SIEP S800001 30	Provides detailed information on the MECHATROLINK-II communications commands that are used for a $\Sigma$ -7-Series Servo System.
<sup>®</sup> Σ-7-Series MECHATROLINK Communications Command Manuals	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 $\Sigma$ -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 $\Sigma$ -7- Series Servo System.
Ū	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 $\Sigma$ - 7-Series $\Sigma$ -7C SERVOPACKs.
Programming Manuals	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 $\Sigma$ - 7-Series $\Sigma$ -7C SERVOPACKs.
	System Integrated Engineering Tool MPE720 Version 7 USER'S MANUAL	SIEP C880761 03	Describes in detail how to operate MPE720 version 7.
<sup>®</sup> Σ-7-Series Operation Interface Operating Manuals	Σ-7-Series AC Servo Drive Digital Operator Operating Manual	SIEP S800001 33	Describes the operating proce- dures for a Digital Operator for a $\Sigma$ -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 $\Sigma$ -7-Series Servo System.

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Classification	Document Name	Document No.	Description
® Distributed	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.
I/O Module User's Manual	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 $\Sigma$ -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 $\Sigma$ -7-Series $\Sigma$ -7S Servo Amplifier with MECHATROLINK-III Communications References.		
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.		
MECHATROLINK-III Communications Cable (RJ-45)	MECHATROLINK-III Communications Cable for RJ-45 connectors.		
SigmaWin+	The Engineering Tool for setting up and tuning Servo Drives or a computer in which the Engi- neering 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 <sup>-1</sup>	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.

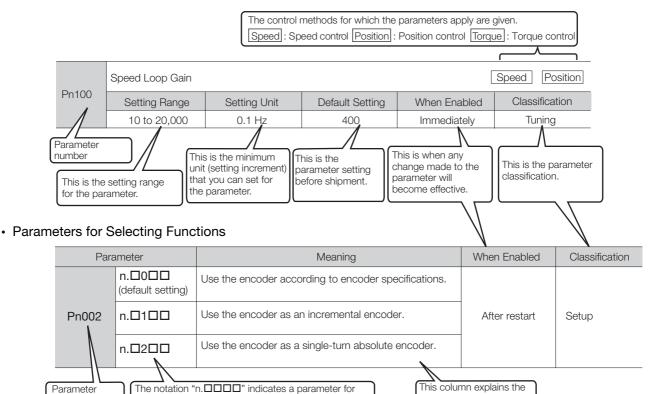
#### Notation Example

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



selections for the function.

Notation Example

Parameter

number



Each I indicates the setting for one digit. The notation shown here means that the third digit

selecting functions.

from the right is set to 2.

	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.
L	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.
- MECHATROLINK is a trademark of the MECHATROLINK Members Association.
- 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.

Č 🕲
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  $\Omega$  or less for a SERVOPACK with a 100-VAC or 200-VAC power supply, and 10  $\Omega$  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 specifications 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 circuit 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

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 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, 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.)
SERVOPACKs	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 ISO13849-1: 2015
SERVOPACKs		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 50178 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.

#### Safety Standards

Product	Model	Safety Standards	Standards
SERVOPACKs	SGD7S	Safety of Machinery	EN ISO13849-1: 2015 IEC 60204-1
		Functional Safety	IEC 61508 series IEC 62061 IEC 61800-5-2
		EMC	IEC 61326-3-1

#### Safety Parameters

Item	Standards	Performance Level	
Safety Integrity Level	IEC 61508	SIL3	
Salety Integrity Level	IEC 62061	SILCL3	
Mission Time	IEC 61508	10 years	20 years
Probability of Dangerous Failure per Hour	IEC 61508 IEC 62061	PFH = 4.04×10 <sup>-9</sup> [1/h] (4.04% of SIL3)	PFH = 4.05×10 <sup>-9</sup> [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	IEC 60204-1	Stop category 0	
Safety Function	IEC 61800-5-2	STO	
Hardware Fault Tolerance	IEC 61508	HFT = 1	
Subsystem	IEC 61508	В	

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**Revision History** 

## Basic Information on SERVOPACKs

This chapter provides information required to select SERVOPACKs, such as SERVOPACK models and combinations with Servomotors.

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## **1.1** The $\Sigma$ -7 Series

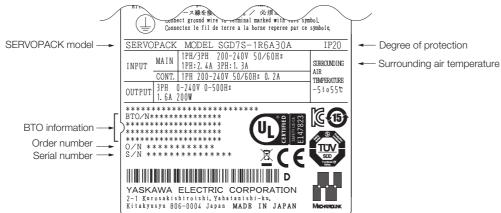
The  $\Sigma$ -7-series SERVOPACKs are designed for applications that require frequent high-speed and high-precision positioning. The SERVOPACK will make the most of machine performance in the shortest time possible, thus contributing to improving productivity.

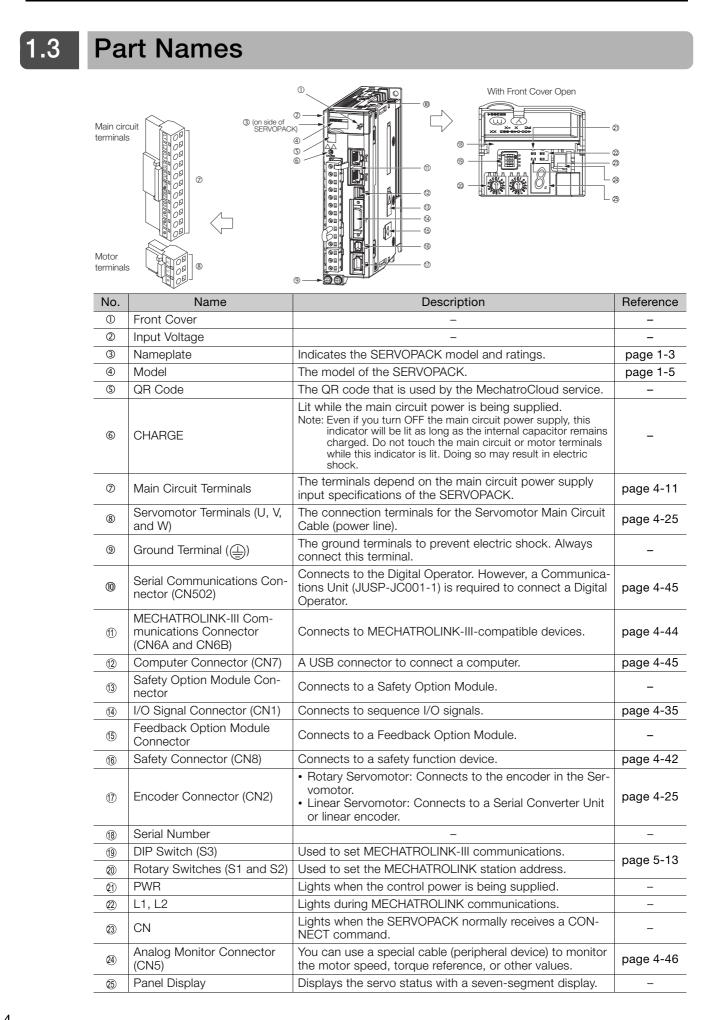
The following three types of  $\Sigma$ -7-Series Servo Drives are available.

Туре	Description		
Σ-7S	Single-axis SERVOPACKs		
Σ-7W	Two-axis SERVOPACKs		
Σ-7C	Two-axis SERVOPACKs with Built-in Controllers		

## **1.2** Interpreting the Nameplate

#### The following basic information is provided on the nameplate.





#### 1.4.1 Interpreting SERVOPACK Model Numbers

## 1.4 Model Designations

## 1.4.1 Interpreting SERVOPACK Model Numbers

Σ-7-S Σ-7S SERV		- R70 1st+2nd+3rd digits	A 4th digit	digits digit	00 8th+9th+ digits		Hardwa	re Options
			4th dig				n+10th digits Specific	ation Applicable
Voltage	Code R70 <sup>*1</sup>	Specification 0.05 kW	Code	Specification		Code	Specification	Models
	B90*1	0.03 KW	A F	200 VAC 100 VAC		None		A.H
	1B6*1	0.1 KW	Г	TUU VAC		000	Without options	All models
	2R8*1	0.2 KW	5th+6t	h digits Interface*3				SGD7S-R70A to -330A
	3R8 5B5 <sup>*1</sup>	0.5 kW 0.75 kW	Code	Specification MECHATROLINK-III		001	Rack-mounted	SGD7S-R70F to -2R8F
-	706	1.0 kW	30	communications references and RJ-45 connectors       00         digit       Design Revision Order       00			Duct-ventilated	SGD7S-470A to -780A
Three- Phase.	120*2	1.5 kW						
200 VAC	180	2.0 kW				002	Varnished	All models
	200	3.0 kW	_			008	Single-phase, 200-VAC power supply input	SGD7S-120A
	330	5.0 kW	A					SGD7S-R70A
	470	6.0 kW						to -2R8A
	550	7.5 kW				020*4		SGD7S-R70F
	590	11 kW				020		to -2R8F
	780	15 kW					External dynamic brake resistor	SGD7S-3R8A to -780A
Cincela	R70	0.05 kW					DIANG IGSISIUI	10-700A
Single- Phase,	R90	0.1 kW				$11th\pm 1$	2th+13th digits FT/E	X Specification
100 VAC	2R1	0.2 kW						
	2R8	0.4 kW				Code	Specification	
						None	None	
						000		

 14th digit
 BTO Specification\*5

 Code
 Specification

 None
 None

	NULLE
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-120A30A008).
- \*3. The same SERVOPACKs are used for both Rotary Servomotors and Linear Servomotors.
- \*4. Refer to the following manual for details.
- Ω Σ-7-Series Σ-7Š/Σ-7W SERVOPACK with Dynamic Brake Hardware Option Specifications Product Manual (Manual No.: SIEP S800001 73)
- \*5. The BTO specification indicates if the SEVOPACK is customized by using the MechatroCloud BTO service. You need a BTO number to order SERVOPACKs with customized specifications. Refer to the following catalog for details on the BTO specification.
  - $\square$  AC Servo Drives  $\Sigma$ -7 Series (Manual No.: KAEP S800001 23)

Basic Information on SERVOPACKs

1.4.2 Interpreting Servomotor Model Numbers

## 1.4.2 Interpreting Servomotor Model Numbers

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

- $\square$   $\Sigma$ -7-Series Rotary Servomotor Product Manual (Manual No.: SIEP S800001 36)
- $\square$   $\Sigma$ -7-Series Linear Servomotor Product Manual (Manual No.: SIEP S800001 37)
- $\square$   $\Sigma$ -7-Series Direct Drive Servomotor Product Manual (Manual No.: SIEP S800001 38)

## **Rotary Servomotors**

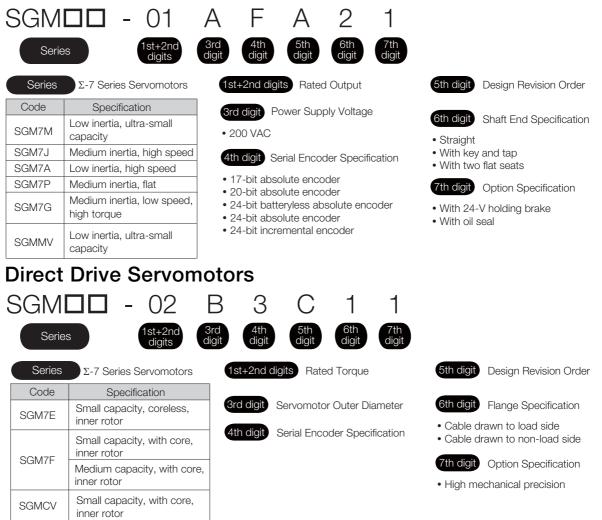
Small capacity, coreless,

Medium capacity, with core,

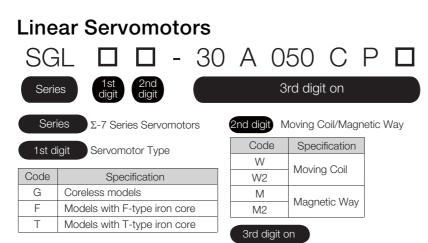
inner rotor

inner rotor

SGMCS



#### 1.4.2 Interpreting Servomotor Model Numbers



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

1.5.1 Combinations of Rotary Servomotors and SERVOPACKs

## **1.5** Combinations of SERVOPACKs and Servomotors

## 1.5.1 Combinations of Rotary Servomotors and SERVOPACKs

Potony Sonyom	ator Model	Capacity	SERVOPACK Model
Rotary Servom		Capacity	SGD7S-
SGM7M	SGM7M-A1A	11 W	- R90A or R90F
(Low Inertia, Ultra- small Capacity),	SGM7M-A2A	22 W	
3000 min <sup>-1</sup>	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	
(Medium Inertia, Small Capacity),	SGM7J-02A	200 W	- 1R6A or 2R1F
3,000 min <sup>-1</sup>	SGM7J-04A	400 W	2R8A or 2R8F
,	SGM7J-06A	600 W	EDE A
	SGM7J-08A	750 W	- 5R5A
	SGM7A-A5A	50 W	R70A or R70F
	SGM7A-01A	100 W	R90A or R90F
	SGM7A-C2A	150 W	
	SGM7A-02A	200 W	- 1R6A or 2R1F
	SGM7A-04A	400 W	2R8A or 2R8F
	SGM7A-06A	600 W	
SGM7A	SGM7A-08A	750 W	- 5R5A
(Low Inertia, Small Capacity),	SGM7A-10A	1.0 kW	1004
3,000 min <sup>-1</sup>	SGM7A-15A	1.5 kW	– 120A
- ,	SGM7A-20A	2.0 kW	180A
	SGM7A-25A	2.5 kW	0000
	SGM7A-30A	3.0 kW	200A
	SGM7A-40A	4.0 kW	0004
	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 <sup>-1</sup>	SGM7P-08A	750 W	5R5A
- ,	SGM7P-15A	1.5 kW	120A
	SGM7G-03A	300 W	0004
	SGM7G-05A	450 W	- 3R8A
	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 <sup>*1</sup>	2204
$1,500 \text{ min}^{-1}$	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 <sup>*2</sup>	SGMMV-A1A	10 W	
(Low Inertia, Ultra-	SGMMV-A2A	20 W	– R90A or R90F
small Capacity), 3,000 min <sup>-1</sup>	SGMMV-A3A	30 W	1R6A or 2R1F

#### 1.5.2 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.

## 1.5.2 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		
Inner Rotor)	SGM7E-08D	8	24	- 2R8A or 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	2R8A or 2R8F	
	SGM7F-04B	4	12		
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, Inner	SGM7F-1AM	110	330	180A	
Rotor)	SGM7F-1EN	150	450	0004	
	SGM7F-2ZN	200	600	- 200A	
	SGMCV-04B	4	12		
	SGMCV-10B	10	30	- 2R8A or 2R8F	
SOMOV	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	

1.5.3 Combinations of Linear Servomotors and SERVOPACKs

Continued from previous page				
		Rated Torque	Instantaneous	SERVOPACK Model
Direct Drive Servomotor 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	288A or 288F
Inner Rotor)	SGMCS-08D	8	24	ZROA UI ZROF
	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  $\Sigma$ -7 Series (Manual No.: KAEP S800001 23)

## 1.5.3 Combinations of Linear Servomotors and SERVOPACKs

		Rated Force	Instantaneous	SERVOPACK Model
Linear Servomotor Model		[N]	Maximum Force [N]	SGD7S-
	SGLGW-30A050C	12.5	40	R70A or R70F
	SGLGW-30A080C	25	80	R90A or R90F
	SGLGW-40A140C	47	140	- N90A UL N90F
SGLG	SGLGW-40A253C	93	280	1R6A or 2R1F
(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

Continued on next page.

#### 1.5.3 Combinations of Linear Servomotors and SERVOPACKs

		Rated Force	Instantaneous	SERVOPACK Mode
Linear Se	ervomotor Model	[N]	Maximum Force [N]	SGD7S-
	SGLFW-20A090A	25	86	
	SGLFW-20A120A	40	125	1R6A or 2R1F
	SGLFW-35A120A	80	220	
	SGLFW-35A230A	160	440	3R8A
	SGLFW-50A200B	280	600	5R5A
	SGLFW-50A380B	FCO	1000	1004
	SGLFW-1ZA200B	- 560	1200	120A
	SGLFW-1ZA380B	1120	2400	200A
	SGLFW2-30A070A	45	135	10040015
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
		560	1680	180A
	SGLFW2-45A380A*		1500	120A
	SGLFW2-90A200A□1	560	1680	1004
	SGLFW2-90A200A□L	896	1680	– 120A
	SGLFW2-90A380A	1120	3360	200A
	SGLFW2-90A560A	1680	5040	330A
	SGLFW2-1DA380A	1680	5040	200A
	SGLFW2-1DA560A	2520	7560	330A
	SGLTW-20A170A	130	380	3R8A
	SGLTW-20A320A	250	760	7R6A
	SGLTW-20A460A	380	1140	120A
	SGLTW-35A170A	220	660	
	SGLTW-35A170H	300	600	- 5R5A
	SGLTW-35A320A	440	1320	1004
SGLT	SGLTW-35A320H	600	1200	– 120A
(With T-type Iron Cores)	SGLTW-35A460A	670	2000	1004
00100,	SGLTW-40A400B	670	2600	- 180A
	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

Continued from previous page.

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

## 1.6 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
Power Supply Type Settings for the Main Circuit and Control Circuit	page 5-14
Automatic Detection of Connected Motor	page 5-16
Motor Direction Setting	page 5-17
Linear Encoder Pitch Setting	page 5-18
Writing Linear Servomotor Parameters	page 5-19
Selecting the Phase Sequence for a Linear Servomotor	page 5-23
Polarity Sensor Setting	page 5-25
Polarity Detection	page 5-26
Overtravel Function and Settings	page 5-29
Holding Brake	page 5-34
Motor Stopping Methods for Servo OFF and Alarms	page 5-39
Resetting the Absolute Encoder	page 5-50
Setting the Origin of the Absolute Encoder	page 5-53
Setting the Regenerative Resistor Capacity	page 5-56
Operation for Momentary Power Interruptions	page 6-16
SEMI F47 Function	page 6-17
Setting the Motor Maximum Speed	page 6-19
Software Limits and Settings	page 6-27
Multiturn Limit Setting	page 6-39
Adjustment of Motor Current Detection Signal Offset	page 6-55
Forcing the Motor to Stop	page 6-59
Overheat Protection	page 6-62
Speed Ripple Compensation	page 8-60
Current Control Mode Selection	page 8-73
Current Gain Level Setting	page 8-74
Speed Detection Method Selection	page 8-74
Fully-Closed Loop Control	page 10-1
Safety Functions	page 11-1
External Latches	_

#### · Functions Related to the Host Controller

Function	Reference
Electronic Gear Settings	page 5-44
I/O Signal Allocations	page 6-4
Σ-V Compatible Function	page 5-57
ALM (Servo Alarm) Signal	page 6-8
/WARN (Warning Output) Signal	page 6-8
/TGON (Rotation Detection) Signal	page 6-9
/S-RDY (Servo Ready) Signal	page 6-10
/V-CMP (Speed Coincidence Detection) Signal	page 6-11
/COIN (Positioning Completion) Signal	page 6-12
/NEAR (Near) Signal	page 6-13
Speed Limit during Torque Control	page 6-14
/VLT (Speed Limit Detection) Signal	page 6-14

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Function	Reference
Encoder Divided Pulse Output	page 6-20
Selecting Torque Limits	page 6-28
Vibration Detection Level Initialization	page 6-51
Alarm Reset	page 12-42
Replacing the Battery	page 12-3
Setting the Position Deviation Overflow Alarm Level	page 8-8

#### Functions to Achieve Optimum Motions

Function	Reference
Tuning-less Function	page 8-12
Autotuning without a Host Reference	page 8-24
Autotuning with a Host Reference	page 8-35
Custom Tuning	page 8-42
Anti-Resonance Control Adjustment	page 8-51
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Gain Selection	page 8-66
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Gravity Compensation	page 8-72
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Model Following Control	page 8-88
Compatible Adjustment Functions	page 8-91
Mechanical Analysis	page 8-95
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#### Functions for Trial Operation during Setup

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Software Reset	page 6-48
Trial Operation for the Servomotor without a Load	page 7-7
Program Jogging	page 7-14
Origin Search	page 7-19
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Monitoring Machine Operation Status and Signal Waveforms	page 9-7

#### • Functions for Inspection and Maintenance

Function	Reference
Write Prohibition Setting for Parameters	page 5-8
Initializing Parameter Settings	page 5-11
Automatic Detection of Connected Motor	page 5-16
Monitoring Product Information	page 9-2
Monitoring Product Life	page 9-2
Alarm History Display	page 12-43
Alarm Tracing	page 9-18

# 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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	2.1.3	Characteristics
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	2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.2.6 2.2.7 2.2.8 2.2.9 2.2.10	SGD7S-R70A, -R90A, and -1R6A       2-9         SGD7S-2R8A       2-9         SGD7S-3R8A, -5R5A, and -7R6A       2-10         SGD7S-120A       2-10         SGD7S-180A and -200A       2-12         SGD7S-330A       2-13         SGD7S-470A and -550A       2-14         SGD7S-590A and -780A       2-15         SGD7S-R70F, -R90F, and -2R1F       2-15         SGD7S-2R8F       2-16
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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

Μ	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	
Continu rent [Ar	uous Outp ms]	out Cur-	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
Main	Power S	Supply			200 VA	C to 24	0 VAC,	-15% t	0 +10%	, 50 Hz	z/60 Hz		
Circuit	Input Cu [Arms]*	ırrent	0.4	0.8	1.3	2.5	3.0	4.1	5.7	7.3	10	15	25
Con-	Power S	Supply			200 VA	C to 24	0 VAC,	-15% t	0 +10%	, 50 Hz	z/60 Hz		
trol	Input Curr	ent [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 C	apacity	0.2	0.3	0.5	1.0	1.3	1.6	2.3	3.2	4.0	5.9	7.5
	Main Circuit Power Loss [W]		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 Po [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
Rogon	Built-In Regen-	Resis- tance $[\Omega]$	-	-	_	-	40	40	40	20	12	12	8
Regen era- tive Resis- tor	erative Resis- tor	Capacity [W]	-	-	-	-	40	40	40	60	60	60	180
	Minimum Allow- able External Resistance [Ω]		40	40	40	40	40	40	40	20	12	12	8
Overvo	Itage Cat	egory											

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

	Model SGD7S-	470A	550A	590A	780A		
Maximum Appli	cable Motor Capacity [kW]	6.0	7.5	11	15		
Continuous Out	put Current [Arms]	46.9	54.7	58.6	78.0		
Instantaneous Maximum Output Current [Arms] 110 130 140					170		
Main Cinquit	Power Supply	200 VAC to 240 VAC, -15% to +10%, 50 Hz/60					
Main Circuit	Input Current [Arms] <sup>*1</sup>	29	37	54	73		
Control	Power Supply	200 VAC to	240 VAC, -15	% to +10%, 5	0 Hz/60 Hz		
Control	Input Current [Arms] <sup>*1</sup>	0.3	0.3	0.4	0.4		
Power Supply C	Capacity [kVA] <sup>*1</sup>	10.7	14.6	21.7	29.6		

Continued on next page.

2.1.1 Ratings

Continued from previous page

			00		nonouo pugo.
	Model SGD7S-	470A	550A	590A	780A
	Main Circuit Power Loss [W]	271.7	326.9	365.3	501.4
	Control Circuit Power Loss [W]	21	21	28	28
Power Loss <sup>*1</sup>	External Regenerative Resistor Power Loss [W]	180 <sup>*2</sup>	350 <sup>*3</sup>	350 <sup>*3</sup>	350 <sup>*3</sup>
	Total Power Loss [W]	292.7	347.9	393.3	529.4
	Resistance [Ω]	6.25 <sup>*2</sup>	3.13 <sup>*3</sup>	3.13 <sup>*3</sup>	3.13 <sup>*3</sup>
External Regen- erative Resistor	Capacity [W]	880 <sup>*2</sup>	1760 <sup>*3</sup>	1760 <sup>*3</sup>	1760 <sup>*3</sup>
Unit	Minimum Allowable External Resistance $[\Omega]$	5.8	2.9	2.9	2.9
Overvoltage Cate	egory		l	1	

\*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-				R90A	1R6A	2R8A	5R5A	120A
Maximum App	Maximum Applicable Motor Capacity [kW]			0.1	0.2	0.4	0.75	1.5
Continuous O	utput Current [Arms	6]	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
Main Circuit	Power Supply		200 VA	AC to 240	VAC, -15	% to +10	%, 50 Hz/	/60 Hz
Main Circuit	Input Current [Arn	าร]*	0.8	1.6	2.4	5.0	8.7	16
Control	Power Supply		200 VA	AC to 240	VAC, -15	% to +10	%, 50 Hz/	/60 Hz
Control	Input Current [Arms]*		0.2	0.2	0.2	0.2	0.2	0.25
Power Supply	Capacity [kVA]*		0.2	0.3	0.6	1.2	1.9	4.0
	Main Circuit Powe	5.0	7.1	12.1	23.7	39.2	71.8	
	Control Circuit Po	12	12	12	12	14	16	
Power Loss*	Built-in Regenerat Power Loss [W]	-	-	-	-	8	12	
	Total Power Loss	[W]	17.0	19.1	24.1	35.7	61.2	103.8
	Built-In Regener-	Resistance $[\Omega]$	-	-	-	_	40	12
Regenerative	ative Resistor	Capacity [W]	-	-	-	_	40	60
Resistor	Minimum Allowab tance $[\Omega]$	40	40	40	40	40	12	
Overvoltage C	Overvoltage Category				l	1		·

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

#### 2.1.1 Ratings

### 270 VDC

	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 Ou	tput Current [Arms]	0.66	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
Main Circuit	Power Supply		270	O VDC to	5 324 VI	DC, -15	% to +1	0%	
	Input Current [Arms] <sup>*1</sup>	0.5	1.0	1.5	3.0	3.8	4.9	6.9	11
Control	Power Supply	270 VDC to 324 VDC, -15% to +10%							
Control	Input Current [Arms] <sup>*1</sup>	0.2	0.2	0.2	0.2	0.2	0.2	0.2	$0.2^{*2}$
Power Supply (	Capacity [kVA]] <sup>*1</sup>	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] <sup>*1</sup>	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 Category					I				

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

\*2. The value is 0.25 Arms for the SGD7S-120A30A008.

	180A	200A	330A	470A	550A	590A	780A	
Maximum Appl	kimum Applicable Motor Capacity [kW]			5.0	6.0	7.5	11.0	15.0
Continuous Ou	tput Current [Arms]	18.5	19.6	32.9	46.9	54.7	58.6	78.0
Instantaneous [Arms]	Maximum Output Current	42.0	56.0	84.0	110	130	140	170
Main Circuit	Power Supply		270 \	/DC to 32	24 VDC, -	-15% to -	+10%	
	Input Current [Arms]*	14	20	34	36	48	68	92
Control	Power Supply	270 VDC to 324 VDC, -15% to +10%						
Control	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 Ca							·	

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

## Single-Phase, 100 VAC

	Model	SGD7S-	R70F	R90F	2R1F	2R8F	
Maximum App	licable N	Notor Capacity [kW]	0.05	0.1	0.2	0.4	
Continuous O	utput Cu	rrent [Arms]	0.66	0.91	2.1	2.8	
Instantaneous [Arms]	Maximu	m Output Current	2.1	3.2	6.5	9.3	
Main Circuit	Power	Supply	100 VAC t	to 120 VAC, -15	% to +10%, 50	Hz/60 Hz	
Main Circuit	Input C	Current [Arms]*	1.5	2.5	5	10	
Control	Power	Supply	100 VAC to 120 VAC, -15% to +10%, 50 Hz/60 Hz				
Control	Input C	Current [Arms]*	0.38	0.38	0.38	0.38	
Power Supply	Capacit	y [kVA]*	0.2	0.3	0.6	1.4	
	Main Circuit Power Loss [W]		5.3	7.8	14.2	26.2	
Power Loss*	Contro	I Circuit Power Loss [W]	12	12	12	12	
	Total Power Loss [W]		17.3	19.8	26.2	38.2	
Regenerative Resistor Minimum Allowable Resistance [Ω]		40	40	40	40		
Overvoltage Category					l	·	

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

#### 2.1.2 SERVOPACK Overload Protection Characteristics

## 2.1.2 SERVOPACK Overload Protection Characteristics

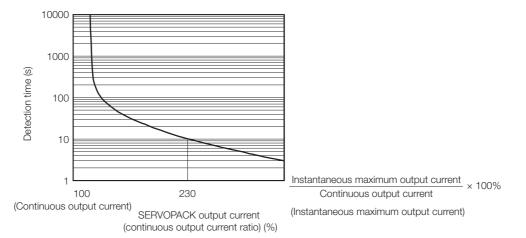
The overload detection level is set for hot start conditions with a SERVOPACK surrounding air temperature of 55°C.

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.

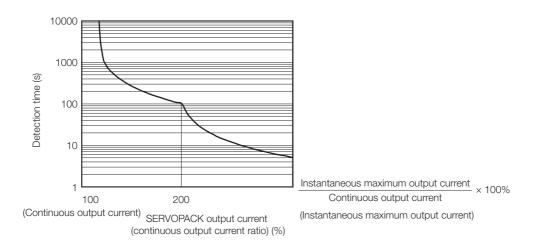
#### • SGD7S-R70A, -R90A, -1R6A, -2R8A, -R70F, -R90F, -2R1F, and -2R8F



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.

2.1.3 Specifications

## 2.1.3 Specifications

Item		Specification			
Drive 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	<ul> <li>Absolute linear encoder (The signal resolution depends on the absolute linear encoder.)</li> <li>Incremental linear encoder (The signal resolution depends on the incremental linear encoder or Serial Converter Unit.)</li> </ul>			
	Surrounding Air Temperature <sup>*1</sup>	-5°C to 55°C (With derating, usage is possible between 55°C and 60°C.) Refer to the following section for derating specifications. 3.6 Derating Specifications on page 3-8			
	Storage Temperature	-20°C to 85°C			
	Surrounding Air Humidity	95% relative humidity max. (with no freezing or condensation)			
	Storage Humidity	95% relative humidity max. (with no freezing or condensation)			
	Vibration Resistance	4.9 m/s <sup>2</sup>			
	Shock Resistance	19.6 m/s <sup>2</sup>			
		Degree SERVOPACK Model: SGD7S-			
Environ- mental Conditions	Degree of Protection	IP20	R70A, R90A, <sup>-</sup> R70F, R90F, 2	IR6A, 2R8A, 3R8A, 5R5A, 7R6A, 120A, R1F, 2R8F	
		IP10	120A30A008, 780A	180A, 200A, 330A, 470A, 550A, 590A,	
	Pollution Degree	<ul> <li>2</li> <li>Must be no corrosive or flammable gases.</li> <li>Must be no exposure to water, oil, or chemicals.</li> <li>Must be no dust, salts, or iron dust.</li> </ul>			
	Altitude <sup>*1</sup>	1,000 m or less. (With derating, usage is possible between 1,000 m and 2,000 m.) Refer to the following section for derating specifications.			
	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, and Other Safety Stan- dards on page xxvi			
Mounting			Nounting	SERVOPACK Model: SGD7S-	
		Base-m	-	All Models	
		Rack-m		R70A, R90A, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A, 120A, 180A, 200A, 330A, R70F, R90F, 2R1F, 2R8F	

Continued on next page.

2.1.3 Specifications

Continued from previous page.

Item			Specification		
	Speed Control Range		1:5000 (At the rated torque, the lower limit of the speed control range must not cause the Servomotor to stop.)		
	Coofficient	of Spood	$\pm 0.01\%$ of rated speed max. (for a load fluctuation of 0% to 100%)		
Perfor-	Coefficient of Speed Fluctuation <sup>*2</sup>		0% of rated speed max. (for a voltage fluctuation of $\pm 10\%$ )		
mance			$\pm 0.1\%$ of rated speed max. (for a temperature fluctuation of 25°C $\pm 25°$ C		
	Torque Control Preci- sion (Repeatability)		±1%		
	Soft Start Time Setting		0 s to 10 s (Can be set separately for acceleration and deceleration.)		
	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		
	Sequence Input Signals	Input Signals That Can Be Allo- cated	Allowable voltage range: 24 VDC ±20% Number of input points: 7 (Input method: Sink inputs or source inputs)		
			Input Signals <ul> <li>P-OT (Forward Drive Prohibit) and N-OT (Reverse Drive Prohibit) signals</li> <li>(D. CL (Forward External Targue Limit) and (NL CL (Reverse External))</li> </ul>		
			<ul> <li>/P-CL (Forward External Torque Limit) and /N-CL (Reverse External Torque Limit) signals</li> <li>/DEC (Origin Return Deceleration Switch) signal</li> </ul>		
			• /EXT1 to /EXT3 (External Latch Input 1 to 3) signals		
			FSTP (Forced Stop Input) signal		
			A signal can be allocated and the positive and negative logic can be changed.		
I/O Signals	Sequence Output Signals	Fixed	Allowable voltage range: 5 VDC to 30 VDC Number of output points: 1		
		Output	(A photocoupler output (isolated) is used.)		
		Output	Output signal: ALM (Servo Alarm) signal		
			Allowable voltage range: 5 VDC to 30 VDC Number of output points: 3		
			(A photocoupler output (isolated) is used.)		
			Output Signals		
			/COIN (Positioning Completion) signal		
			<ul> <li>/V-CMP (Speed Coincidence Detection) signal</li> <li>/TGON (Rotation Detection) signal</li> </ul>		
		Signals That Can	//GON (Rotation Detection) signal     //S-RDY (Servo Ready) signal		
		Be Allo- cated	/CLT (Torque Limit Detection) signal		
			/VLT (Speed Limit Detection) signal		
			/BK (Brake) signal		
			<ul> <li>/WARN (Warning) signal</li> <li>/NEAR (Near) signal</li> </ul>		
			A signal can be allocated and the positive and negative logic can be		
			changed.		
Communi- cations	RS-422A Communi- cations (CN502)	Inter- faces	Digital Operator (JUSP-OP05A-1-E) A JUSP-JC001 Communications Unit is required to connect to a Digital Operator.		
		1:N Commu- nications	Up to N = 15 stations possible for RS-422A port		
		Axis Address Setting	03h to EFh (maximum number of slaves: 62) The rotary switches (S1 and S2) are used to set the station address.		
	USB	Interface	Personal computer (with SigmaWin+)		
	Communi- cations (CN7)	Commu- nications Standard	Conforms to USB2.0 standard (12 Mbps).		

2

Continued on next page.

#### 2.1.3 Specifications

Continued from previous page.

Item		Specification		
Displays/Indicators		CHARGE, PWR, CN, L1, and L2 indicators, and one-digit seven-segment display		
MECHATR OLINK-III Communi- cations	Communications Protocol	MECHATROLINK-III		
	Station Address Settings	03h to EFh (maximum number of slaves: 62) The rotary switches (S1 and S2) are used to set the station address.		
	Baud Rate	100 Mbps		
	Transmission Cycle	125 μs, 250 μs, 500 μs, 750 μs, 1.0 ms to 4.0 ms (multiples of 0.5 ms)		
	Number of Transmission Bytes	32 or 48 bytes per station A DIP switch (S3) is used to select the baud rate.		
Reference Method	Performance	Position, speed, or torque control with MECHATROLINK-III communica- tions		
	Reference Input	MECHATROLINK-III commands (sequence, motion, data setting, data access, monitoring, adjustment, etc.)		
	Profile	MECHATROLINK-III standard servo profile		
MECHATRO		Rotary switch (S1 and S2) positions: 16		
Communica	ations Setting Switches	Number of DIP switch (S3) pins: 4		
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 Brake (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		<ul> <li>Built-in (An external resistor must be connected to the SGD7S-470A to -780A.)</li> <li>Refer to the following manual for information on selecting External Regenerative Resistors.</li> <li>Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)</li> </ul>		
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 Functions		Overcurrent, overvoltage, low voltage, overload, regeneration error, etc.		
Utility Functions		Gain adjustment, alarm history, jogging, origin search, etc.		
Safety Functions	Inputs	/HWBB1 and /HWBB2: Base block signals for Power Modules		
	Output	EDM1: Monitors the status of built-in safety circuit (fixed output).		
	Compliant Standards <sup>*3</sup>	ISO13849-1 PLe (Category 3), IEC61508 SIL3		
Applicable Option Modules		Fully-Closed Module and Safety Module Note: You cannot use a Fully-Closed Module and a Safety Module together.		

\*1. If you combine a  $\Sigma$ -7-Series SERVOPACK with a  $\Sigma$ -V-Series Option Module, the following  $\Sigma$ -V-Series SERVO-PACKs specifications must be used: a surrounding air temperature of 0°C to 55°C and an altitude of 1,000 m max. Also, the applicable surrounding range cannot be increased by derating.

\*2. The coefficient of speed fluctuation for load fluctuation is defined as follows:

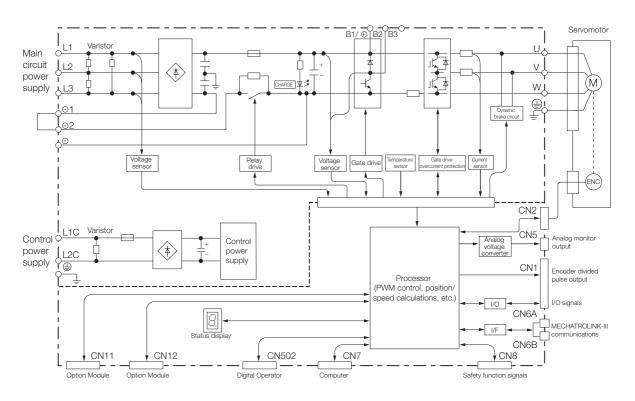
Coefficient of speed fluctuation =  $\frac{\text{No-load motor speed} - \text{Total-load motor speed}}{\text{Rated motor speed}} \times 100\%$ 

\*3. Always perform risk assessment for the system and confirm that the safety requirements are met.

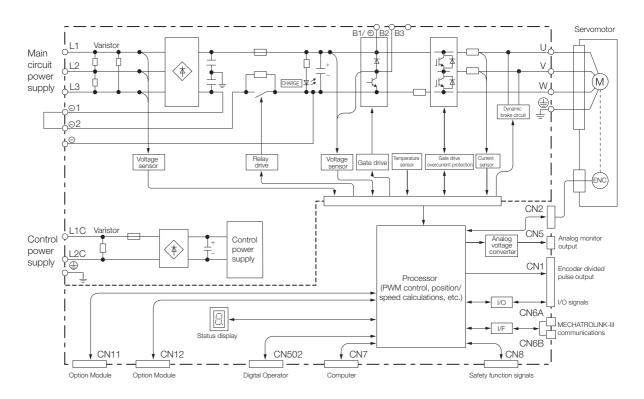
2.2.1 SGD7S-R70A, -R90A, and -1R6A

## 2.2 Block Diagrams

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

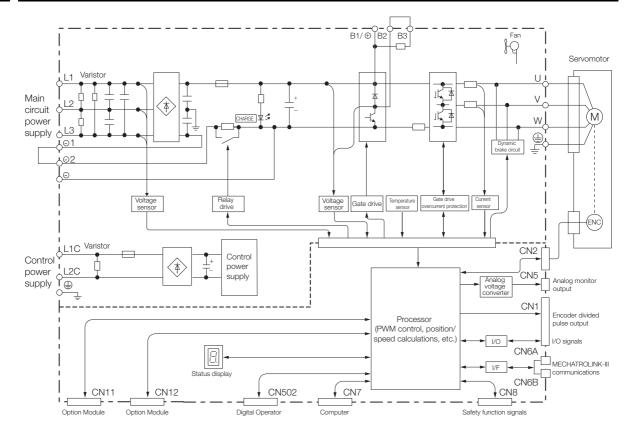


## 2.2.2 SGD7S-2R8A



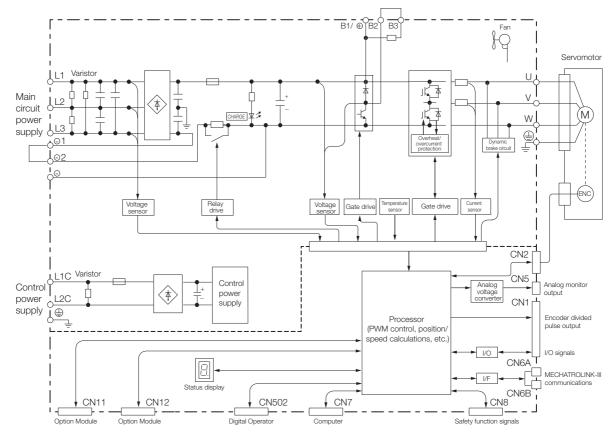
2.2.3 SGD7S-3R8A, -5R5A, and -7R6A

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

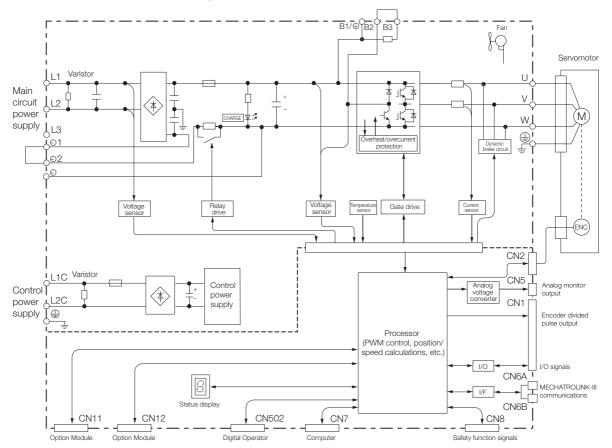


### 2.2.4 SGD7S-120A

#### • Standard Specifications: Three-Phase, 200-VAC Power Supply Input



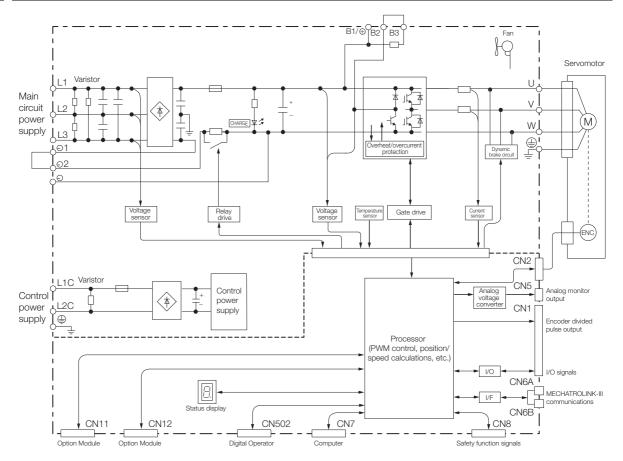
2.2.4 SGD7S-120A



 Optional Specifications: Single-Phase, 200-VAC Power Supply Input (SERVOPACK Model: SGD7S-120A30A008)

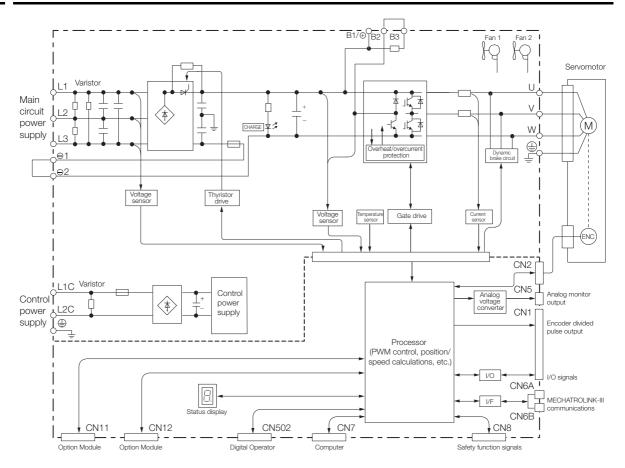
2.2.5 SGD7S-180A and -200A

## 2.2.5 SGD7S-180A and -200A

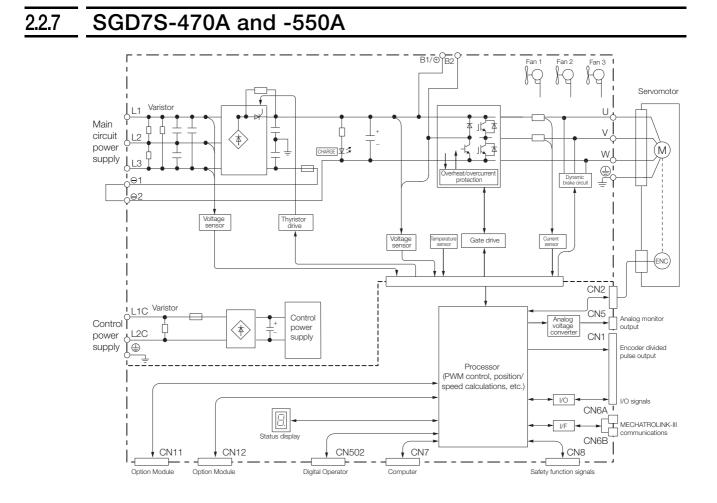


2.2.6 SGD7S-330A

2.2.6 SGD7S-330A

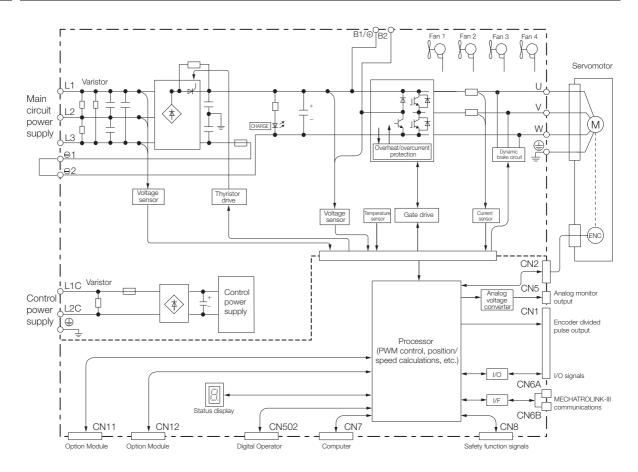


2.2.7 SGD7S-470A and -550A

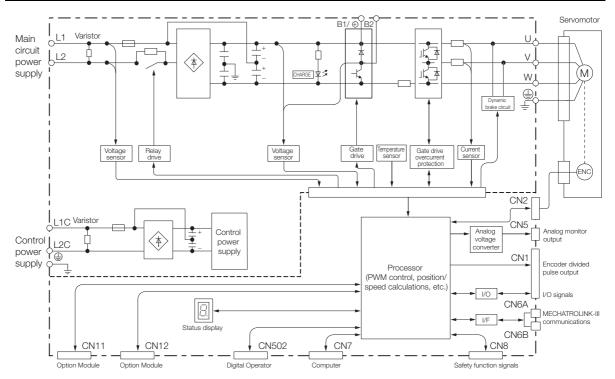


2.2.8 SGD7S-590A and -780A

## 2.2.8 SGD7S-590A and -780A

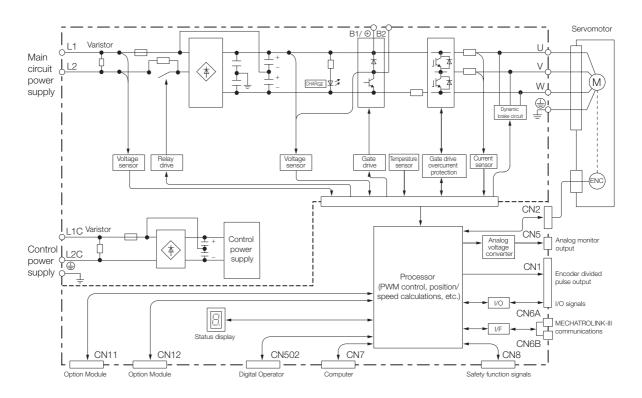


## 2.2.9 SGD7S-R70F, -R90F, and -2R1F



2.2.10 SGD7S-2R8F

## 2.2.10 SGD7S-2R8F



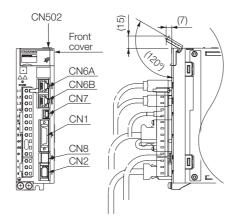
2.3.1 Front Cover Dimensions and Connector Specifications

## 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

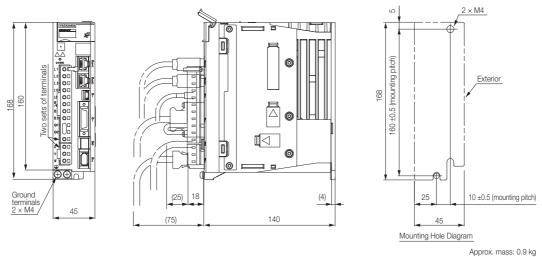
Connec- tor No.	Model	Number of Pins	Manufacturer
CN1	10226-59A3MB	26	3M Japan Limited
CN2	3E106-0220KV	6	3M Japan Limited
CN502	S8B-ZR-SM4A-TF (LF)(SN)	8	J.S.T. Mfg. Co., Ltd.
CN6A, CN6B	1-1734579-4	8	Tyco Electronics Japan G.K.
CN7	2172034-1	5	Tyco Electronics Japan G.K.
CN8	1981080-1	8	Tyco Electronics Japan G.K.

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

## 2.3.2 SERVOPACK External Dimensions

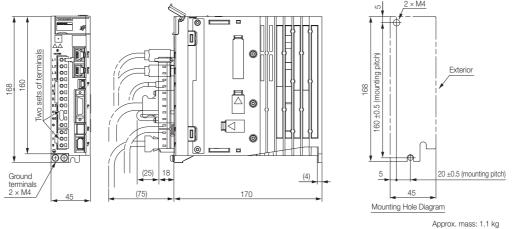
## **Base-mounted SERVOPACKs**

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



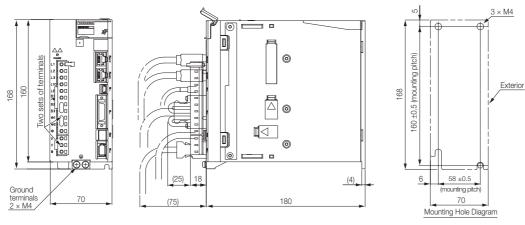
prox. mass: 0.9 kg Unit: mm

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



oprox. mass: 1.1 kg Unit: mm

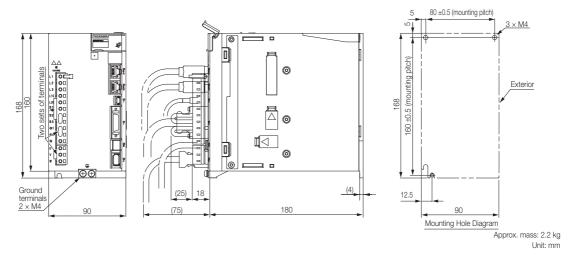
• Three-phase, 200 VAC: SGD7S-3R8A, -5R5A, and -7R6A; Single-phase, 100 VAC: SGD7S-2R8F



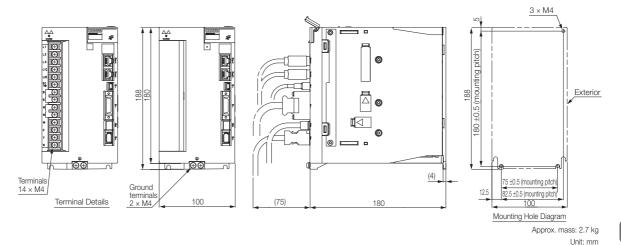
Approx. mass: SGD7S-3R8A, -5R5A, -7R6A: 1.6 kg SGD7S-2R8F: 1.5 kg Unit: mm

#### 2-18

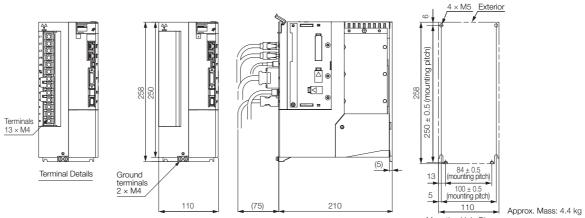
• Three-phase, 200 VAC: SGD7S-120A



#### Three-phase, 200 VAC: SGD7S-180A and -200A; Single-phase, 200 VAC: SGD7S-120A30A008



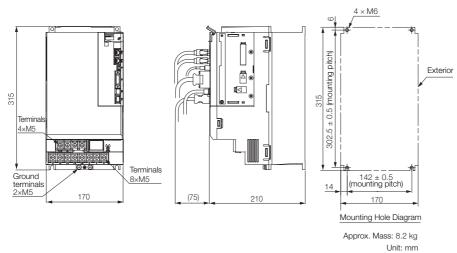
#### • Three-phase, 200 VAC: SGD7S-330A



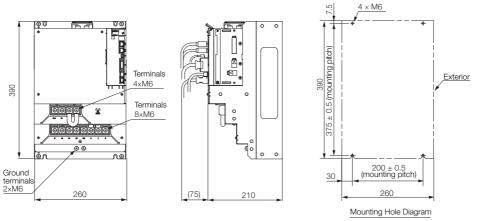
Mounting Hole Diagram Unit: mm

× M5

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



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

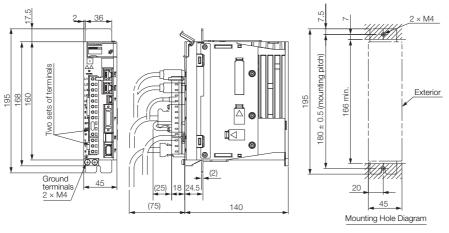


#### Approx. Mass: 15.5 kg Unit: mm

## **Rack-mounted SERVOPACKs**

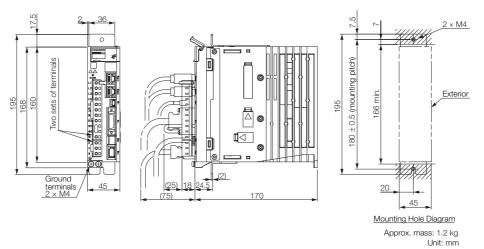
Hardware Option Code: 001

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

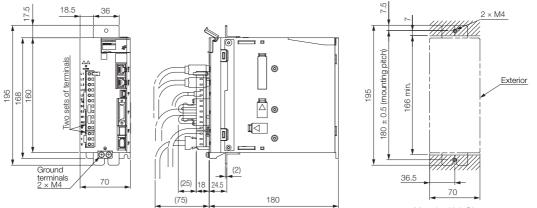


Approx. mass: 1.0 kg Unit: mm

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

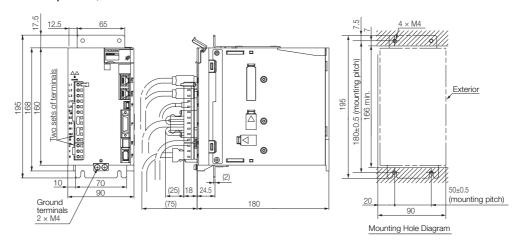


 Three-phase, 200 VAC: SGD7S-3R8A, -5R5A, and -7R6A; Single-phase, 100 VAC: SGD7S-2R8F



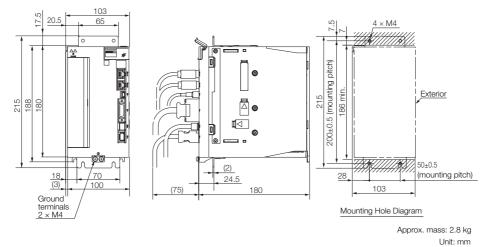
Mounting Hole Diagram Approx. mass: SGD7S-3R8A, -5R5A, -7R6A: 1.7 kg SGD7S-2R8F: 1.6 kg Unit: mm

• Three-phase, 200 VAC: SGD7S-120A

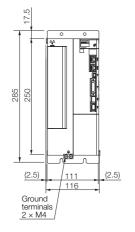


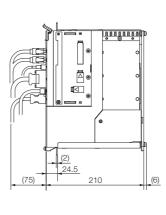
Approx. mass: 2.3 kg Unit: mm

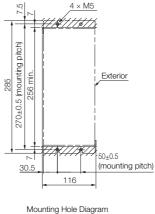
Three-phase, 200 VAC: SGD7S-180A and -200A



Three-phase, 200 VAC: SGD7S-330A







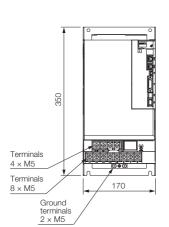
nting Hole Diagram

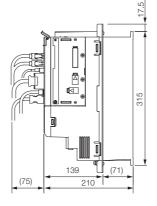
Approx. mass: 4.9 kg Unit: mm

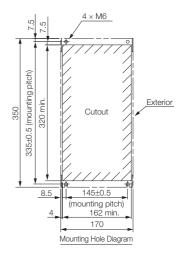
## **Duct-ventilated SERVOPACK**

Hardware Option Code: 001

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



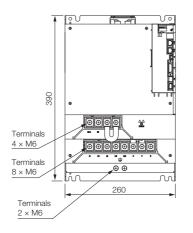


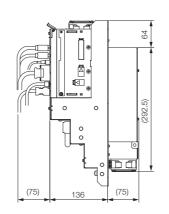


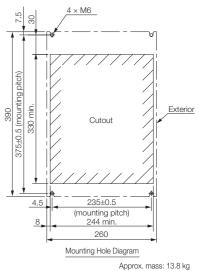
Approx. mass: 8.4 kg Unit: mm

2.3.2 SERVOPACK External Dimensions

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



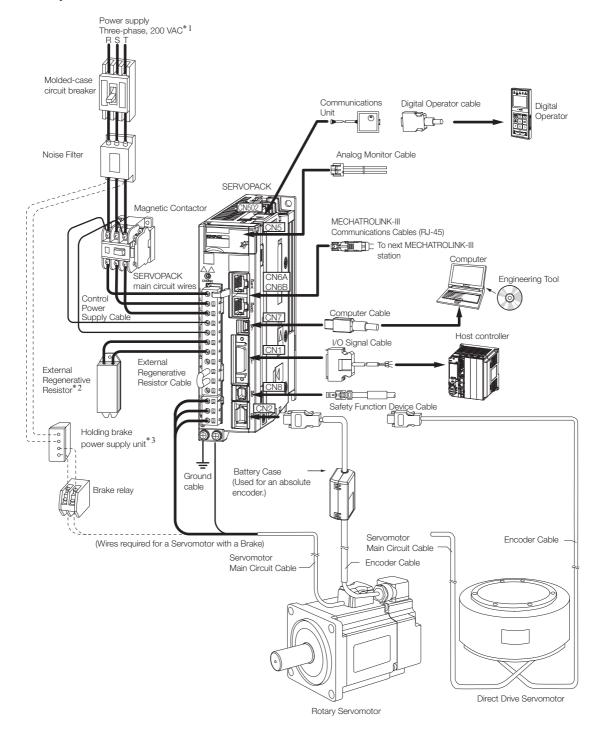




DX. mass: 13.8 kg Unit: mm

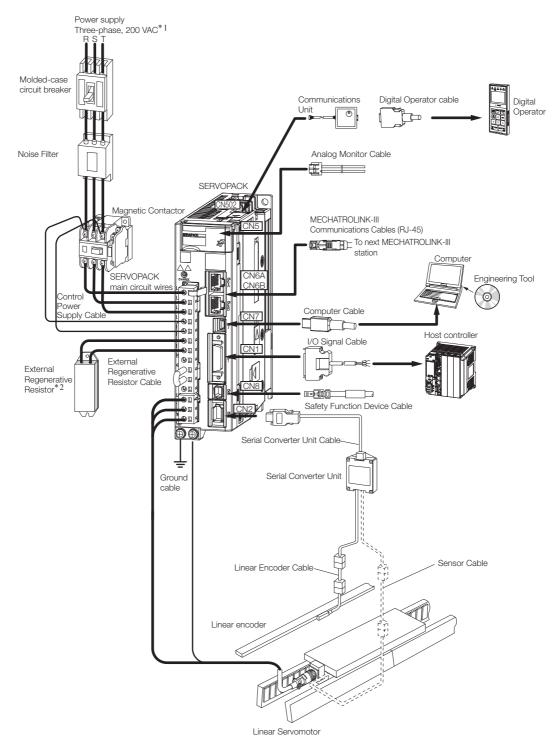
## 2.4 Examples of Standard Connections between SERVOPACKs and Peripheral Devices

#### · 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. If the power supply is shared, the I/O signals may malfunction.

#### · 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.

# SERVOPACK Installation

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

3.1	Installation Precautions						
3.2	Mour	nting Types and Orientation					
3.3	Mour	nting Hole Dimensions					
3.4	Mour	nting Interval					
	3.4.1 3.4.2	Installing One SERVOPACK in a Control Panel3-6 Installing More Than One SERVOPACK in a Control Panel					
3.5	Moni	toring the Installation Environment 3-7					
3.6	Derat	ting Specifications					
3.7	EMC	Installation Conditions3-9					

## 3.1 Installation Precautions

Refer to the following section for the ambient installation conditions. 2.1.3 Specifications on page 2-6

### 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.

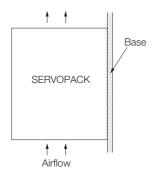
## 3.2 Mounting Types and Orientation

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.

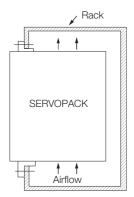
Also, mount the SERVOPACK so that the front panel is facing toward the operator.

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.)

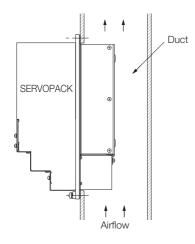
Base-mounted SERVOPACK



Rack-mounted SERVOPACK



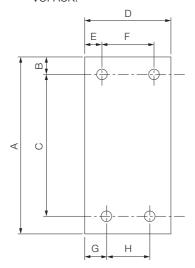
• Duct-ventilated SERVOPACK



## 3.3 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			Dimensions (mm)							Screw	Number
		А	В	С	D	Е	F	G	н	Size	of Screws
	R70A, R90A, 1R6A	168	5	160 ±0.5	45	35	-	25	-	M4	2
	2R8A, R70F, R90F, 2R1F	168	5	160 ±0.5	45	5	-	25	-	M4	2
SGD7S-	3R8A, 5R5A, 7R6A, 2R8F	168	5	160 ±0.5	70	6	58 ±0.5	64	-	M4	3
	120A	168	5	160 ±0.5	90	5	80 ±0.5	12.5	_	M4	3
	180A, 200A, 120A□□□008	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  $\Sigma$ -V-Series SERVOPACK with a  $\Sigma$ -7-Series SERVOPACK, you can also use the mounting holes that were used for the  $\Sigma$ -V-Series SERVOPACK. Refer to the following table.

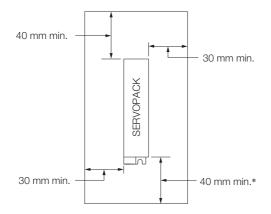
		Dimensions (mm)								Screw	Number
SERVO	SERVOPACK Model		В	с	D	Е	F	G	н	Size	of Screws
	R70A, R90A, 1R6A	168	5	150 ±0.5	45	35	-	35	-	M4	2
	2R8A, R70F, R90F, 2R1F	168	5	150 ±0.5	45	5	-	35	-	M4	2
	3R8A, 5R5A, 7R6A, 2R8F	168	5	150 ±0.5	70	6	58 ±0.5	6	-	M4	3
SGD7S-	120A	168	5	150 ±0.5	90	5	80 ±0.5	5	-	M4	3
	180A, 200A, 120A□□□008	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	A sp detai		ttachment is	requii	red. Co	ontact you	r Yask	awa repre	sentative	for

3.4.1 Installing One SERVOPACK in a Control Panel

## 3.4 Mounting Interval

### 3.4.1 Installing One SERVOPACK in a Control Panel

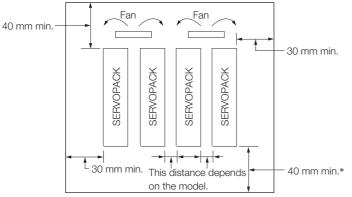
Provide the following spaces around the SERVOPACK.



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

# 3.4.2 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.

## 3.5 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
- Panel Operator or 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.

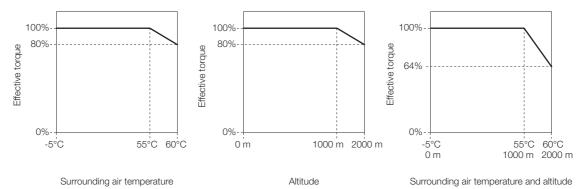


Always observe the surrounding air temperature given in the SERVOPACK environment conditions. Even if the monitor value is 100% or lower, you cannot use a SERVOPACK in a location that exceeds the specified surrounding air temperature.

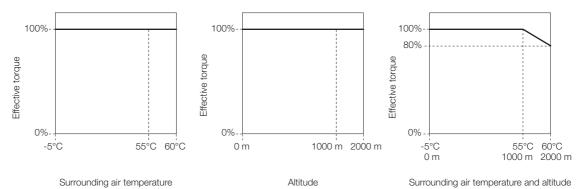
## 3.6 Derating Specifications

If you use the SERVOPACK at a surrounding air temperature of 55°C to 60°C or at an altitude of 1,000 m to 2,000 m, you must apply the derating rates given in the following graphs.

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



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



## 3.7 EMC Installation Conditions

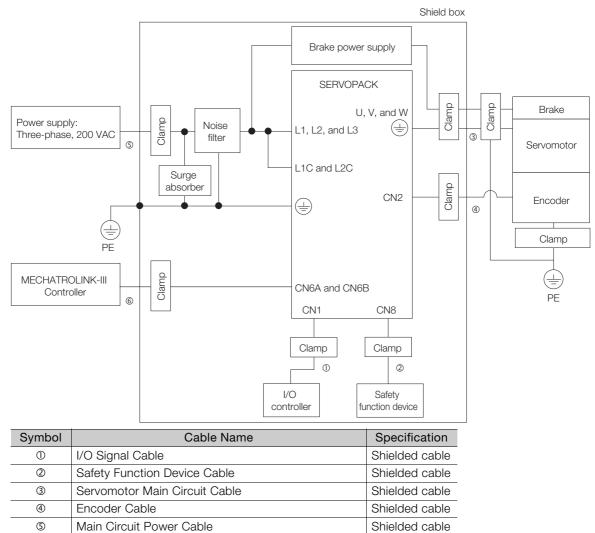
This section gives the recommended installation conditions that were used for EMC certification testing.

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).

- WARNING
   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

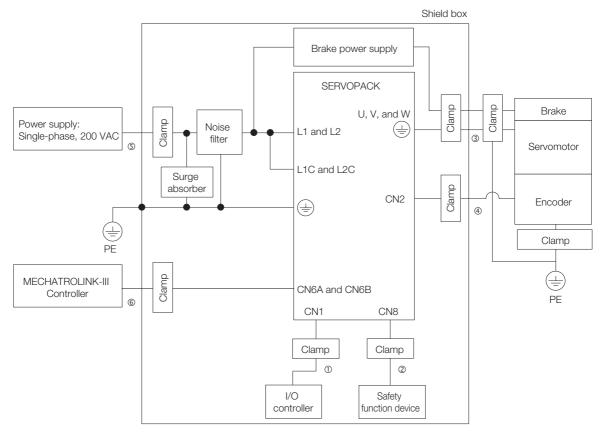
6



Shielded cable

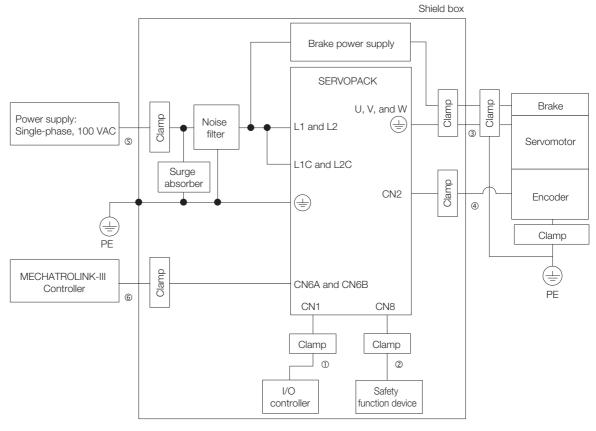
MECHATROLINK-III Communications Cable (RJ-45)

### • Single-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	MECHATROLINK-III Communications Cable (RJ-45) Shielded cab				

### • Single-Phase, 100 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	MECHATROLINK-III Communications Cable (RJ-45)	Shielded cable

# Wiring and Connecting SERVOPACKs

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

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### 4.6

#### 

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  4.8.2 Computer Connector (CN7) .....4-45

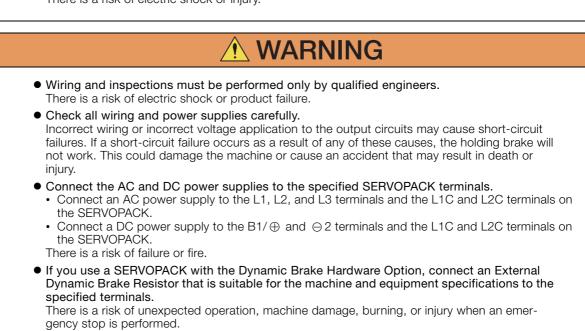
4.1.1 General Precautions

## 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.	
<ul> <li>Observe the precautions and instructions for wiring and trial operation precisely as described in this document.</li> <li>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.</li> </ul>	
<ul> <li>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.</li> </ul>	
• 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.	
<ul> <li>Use shielded twisted-pair cables or screened unshielded multi-twisted-pair cables for I/O Signal Cables and Encoder Cables.</li> </ul>	
<ul> <li>The maximum wiring length is 3 m for I/O Signal Cables, and 50 m for Encoder Cables or Servomotor Main Circuit Cables.</li> </ul>	
<ul> <li>Observe the following precautions when wiring the SERVOPACK's main circuit terminals.</li> <li>Turn ON the power supply to the SERVOPACK only after all wiring, including the main circuit is minals, has been completed.</li> <li>If a connector is used for the main circuit terminals, remove the main circuit connector from the SERVOPACK before you wire it.</li> <li>Insert only one wire per insertion hole in the main circuit terminals.</li> <li>When you insert a wire, make sure that the conductor wire (e.g., whiskers) does not come int contact with adjacent wires.</li> </ul>	he
<ul> <li>Install molded-case circuit breakers and other safety measures to provide protection against short circuits in external wiring.</li> <li>There is a risk of fire or failure.</li> </ul>	
NOTICE	
<ul> <li>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.</li> <li>Securely tighten cable connector screws and lock mechanisms. Insufficient tightening may result in cable connectors falling off during operation.</li> <li>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</li> </ul>	

- 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.

#### 4.1.2 Countermeasures against Noise



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 SERVORACK for applications that require the power supply of the
  - 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  $\Sigma$ -7 Series (Catalog No.: KAEP S800001 23)
- $\,\prod\,$   $\Sigma$ -7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)
- The signal cable conductors are as thin as 0.2 mm<sup>2</sup> or 0.3 mm<sup>2</sup>. Do not subject them to excessive bending stress or tension.

### 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.

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

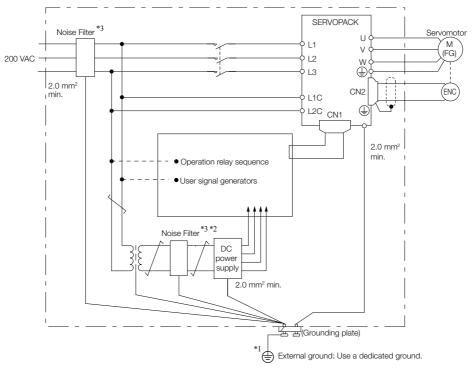
- •Main Circuit Cables and Encoder Cables
- Do not share the power supply with an electric welder or electrical discharge machine. If the SERVOPACK is placed near a high-frequency generator, install Noise Filters on the input side on the Main Circuit Power Supply Cable and Control Power Supply Cable 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 4-6
- Implement suitable grounding measures. Refer to the following section for information on grounding measures.

Jacobia 4.1.3 Grounding on page 4-8

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.



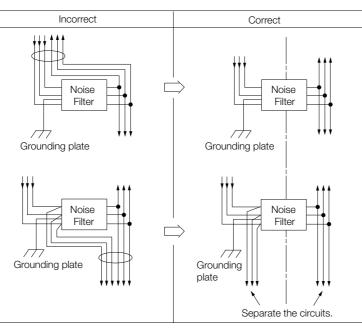
- \*1. For the ground wire, use a wire with a thickness of at least 2.0 mm<sup>2</sup> (preferably, flat braided copper wire).
- \*2. Whenever possible, use twisted-pair wires to wire all connections marked with <u>\_\_\_\_\_</u>.
- \*3. Refer to the following section for precautions when using Noise Filters. *Noise Filter Wiring and Connection Precautions* on page 4-7

4.1.2 Countermeasures against Noise

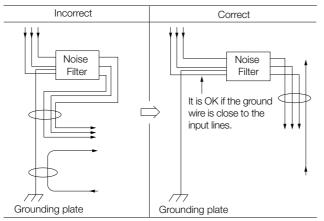
### **Noise Filter Wiring and Connection Precautions**

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

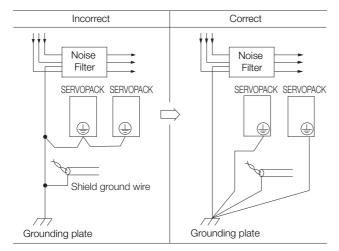
• Separate input lines from output lines. Do not place input lines and output lines in the same duct or bundle them together.



• 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.

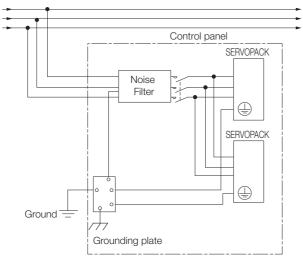


• Connect the Noise Filter ground wire directly to the grounding plate. Do not connect the Noise Filter ground wire to other ground wires.



#### 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  $\boldsymbol{\Omega}$  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).

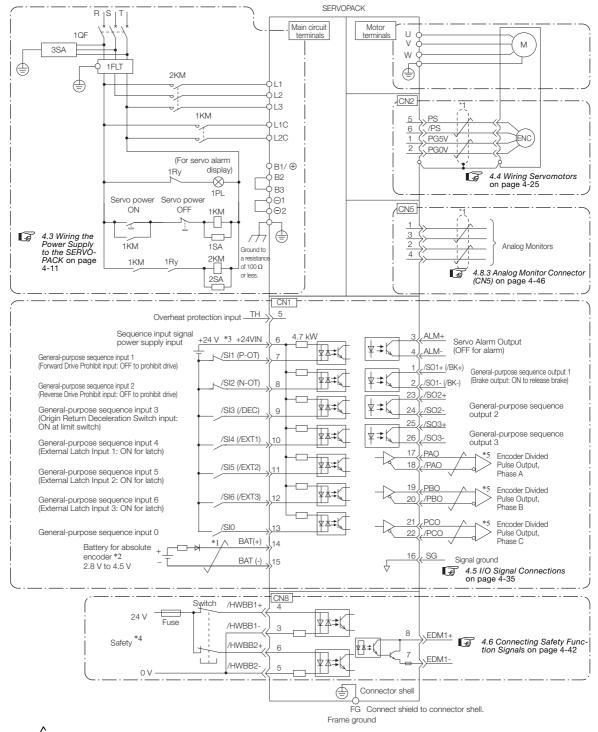
Ground both the Moving Coil and Magnetic Way of a Linear Servomotor.

### 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.  $\checkmark$  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. You can use parameters to change the functions allocated to the /DEC, P-OT, N-OT, /EXT1, /EXT2, and / EXT3 input signals and the /SO1, /SO2, and /SO3 output signals. Refer to the following section for details.
  - 2. 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.
  - 3. Default settings are given in parentheses.

4.3.1 Terminal Symbols and Terminal Names

## 4.3 Wiring the Power Supply to the SERVOPACK

### 4.3.1 Terminal Symbols and Terminal Names

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

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



• 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.

- Information 1. For the single-phase, 100 VAC power supply input specification, only a single-phase AC power supply can be connected to the control power supply terminals.
  - 2. For the other main circuit power supply input specifications, excluding the single-phase, 100 VAC power supply input specification, a single-phase AC power supply or a DC power supply can be connected to the control power supply terminals.

#### Three-Phase, 200-VAC Power Supply Input

Terminal Symbols	Terminal Name	Specifications and Reference			
L1, L2, L3	Main circuit power supply input terminals for AC power supply input	Three-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz			
	Control power supply	AC power supply	Single-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz		
L1C, L2C	Control power supply terminals	DC power supply	L1C: 270 VDC to 324 VDC, -15% to +10%, L2C: 0 VDC or L2C: 270 VDC to 324 VDC, -15% to +10%, L1C: 0 VDC		
		🕼 4.3.5 W	Viring Regenerative Resistors on page 4-22		
B1/⊕, B2, B3	Regenerative Resistor terminals	If the rege Regenera The Exter rately. • For SGD7 -330A If the inte or short b erative Re	<ul> <li>7S-R70A, -R90A, -1R6A, and -2R8A</li> <li>enerative capacity is insufficient, connect an External ative Resistor between B1/⊕ and B2.</li> <li>rnal Regenerative Resistor is not included. Obtain it sepa-</li> <li>7S-3R8A,- 5R5A, -7R6A, -120A, -180A, -200A, and</li> <li>rnal regenerative resistor is insufficient, remove the lead bar between B2 and B3 and connect an External Regenerative resistor between B1/⊕ and B2.</li> <li>rnal Regenerative Resistor is not included. Obtain it sepa-</li> </ul>		
		<ul> <li>For SGD7S-470A, -550A, -590A, and -780A</li> <li>Connect a Regenerative Resistor Unit between B1/⊕ and B2.</li> <li>Obtain a Regenerative Resistor Unit separately. These models do not have a B3 terminal.</li> </ul>			
	DC Reactor terminals	🕼 4.3.6 W	Viring Reactors for Harmonic Suppression on page 4-24		
⊖1, ⊖2	for power supply har- monic suppression	These terminals are used to connect a DC Reactor for power supply harmonic suppression.			
$\ominus$	-	None. (Do I	not connect anything to this terminal.)		

#### 4.3.1 Terminal Symbols and Terminal Names

Terminal Symbols	Terminal Name		Specifications and Reference				
L1, L2	Main circuit power supply input terminals for AC power supply input	Single-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz					
		AC power supply	Single-phase, 200 VAC to 240 VAC, -15% to +10%, 50 Hz/60 Hz				
L1C, L2C	Control power supply terminals	DC power supply	L1C: 270 VDC to 324 VDC, -15% to +10%, L2C: 0 VDC or L2C: 270 VDC to 324 VDC, -15% to +10%, L1C: 0 VDC				
	Regenerative Resistor terminals	🕞 4.3.5 V	3.3.5 Wiring Regenerative Resistors on page 4-22				
B1/⊕, B2, B3		■ For SGD7S-R70A, -R90A, -1R6A, and -2R8A If the regenerative capacity is insufficient, connect an External Regenerative Resistor between B1/⊕ and B2. The External Regenerative Resistor is not included. Obtain it sepa- rately.					
517⊕, 62, 63		If the inte or short k erative Re	7S-5R5A and 120A $\Box$ 0A008 rnal regenerative resistor is insufficient, remove the lead par between B2 and B3 and connect an External Regen- esistor between B1/ $\oplus$ and B2. rnal Regenerative Resistor is not included. Obtain it sepa-				
	DC Reactor terminals	€£ 4.3.6 V	Viring Reactors for Harmonic Suppression on page 4-24				
⊖1, ⊝2	for power supply har- monic suppression	These terminals are used to connect a DC Reactor for power supply harmonic 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. 11 (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. **D**1**D** (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-120A**DD**008).

#### • DC Power Supply Input

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

If you use a DC power supply input to the SERVOPACK, make sure to set parameter Pn00E to n. DDD1 (DC power supply input supported) before inputting the power supply. Refer to the following section for details.

5.3.1 AC Power Supply Input/DC Power Supply Input Setting on page 5-14

#### 4.3.2 Wiring Procedure for Main Circuit Connector

Terminal Symbols	Terminal Name	Specifications and Reference
L1, L2	Main circuit power supply input terminals for AC power supply input	Single-phase, 100 VAC to 120 VAC, -15% to +10%, 50 Hz/60 Hz
L1C, L2C	Control power supply termi- nals	Single-phase, 100 VAC to 120 VAC, -15% to +10%, 50 Hz/60 Hz
		4.3.5 Wiring Regenerative Resistors on page 4-22
B1, B2	Regenerative Resistor termi- nals	If the regenerative capacity is insufficient, connect an External Regenerative Resistor between B1/⊕ and B2. The External Regenerative Resistor is not included. Obtain it separately.

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

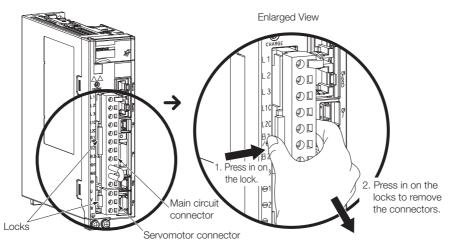
You can use a single-phase, 100-VAC power supply input with the following models. • SGD7S-R70F, -R90F, -2R1F, and -2R8F

### 4.3.2 Wiring Procedure for Main Circuit Connector

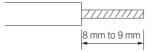
#### Required Items

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

#### 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.

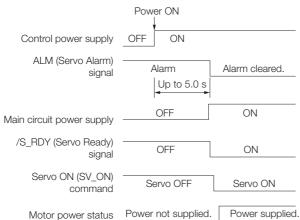
OUsing a Spring Opener	<sup>2</sup> Using a Flat-blade Screwdriver
Open the insertion hole with the Spring Opener as shown in the figure.	Firmly insert a flat-blade screwdriver into the screwdriver insertion hole to open the wire insertion hole.
Spring Opener Wire	

- 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).

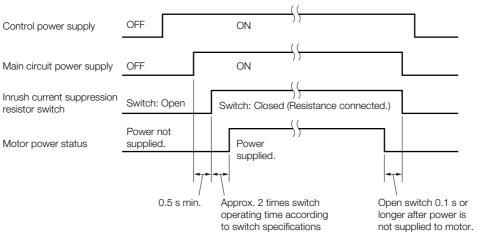


Information If the servo ON state cannot be achieved by inputting the SV\_ON command, the /S\_RDY signal is not ON. Check the status of the /S\_RDY signal. Refer to the following section for details.

6.1.6 /S-RDY (Servo Ready) Signal on page 6-10

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.



Turn ON the control power supply before the main circuit power supply or turn ON the control power supply and the main circuit power supply at the same time.

Turn OFF the main circuit power supply first, and then turn OFF the control power supply.

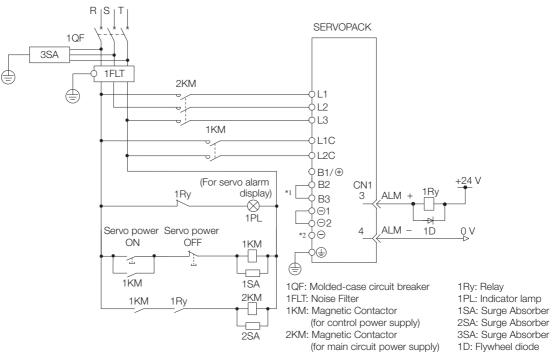
## 

• 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**

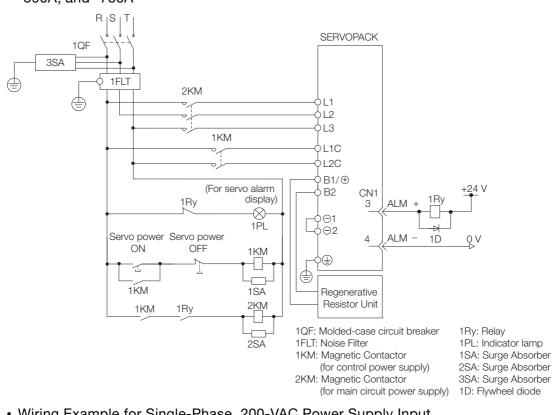
### Using Only One SERVOPACK

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



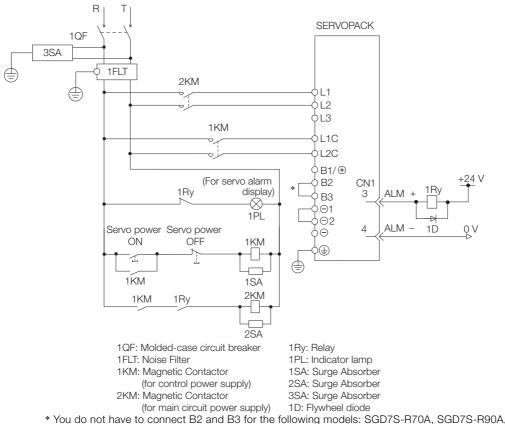
\*1. You do not have to connect B2 and B3 for the following models: SGD7S-R70A, SGD7S-R90A, SGD7S-1R6A, and SGD7S-2R8A. Do not connect them.

\*2. A 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

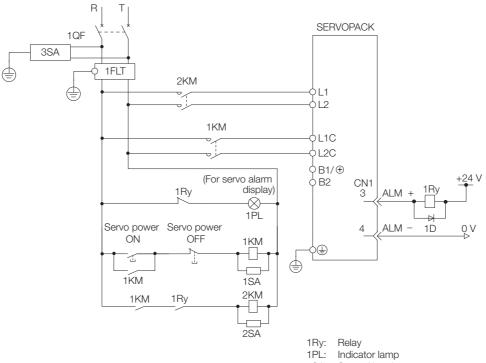


\* You do not have to connect B2 and B3 for the following models: SGD7S-R70A, SGD7S-R90A, SGD7S-1R6A, and SGD7S-2R8A. Do not connect them.

- 1QF SERVOPACK 3SA  $( \textcircled)$ δ 1FLT ٢ 2KM 1FU B1/⊕ AC/DC 2FU ¢⊝2 1KM 5L1C AC/DC L2C +24 V CN1 1Ry 3 AI M (For servo alarm ¢ L1 ¢L2 1Ry display) 1D  $\otimes$ ¢L3 4 ٥V ALM -1PL B2 Servo power Servo power B3 ON OFF 1KM ¢Θ1 ⊕ 1 φΘ ------₽₽ 1KM 1SA 2KM ٢ 1KM 1Ry ⊕ -1FU: Fuse 2SA 2FU: Fuse 1QF: Molded-case circuit breaker 1Ry: Relay 1FLT: Noise Filter 1PL: Indicator lamp 1SA: Surge Absorber 1KM: Magnetic Contactor (for control power supply) 2SA: Surge Absorber 2KM: Magnetic Contactor 3SA: Surge Absorber (for main circuit power supply) 1D: Flywheel diode \* 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

- S 1QF 3SA SERVOPACK ٢ δ 1FLT 1FU 2KM B1/⊕ F AC/DC 1R Θ2 2FU 1TRy 2Ry ------4SA 1KM L1C AC/DC ↓L2C <u>+24</u> ∨ CN1 1R۱ З ALM (For servo alarm 1Ry display) фLЗ  $-\otimes$ 4 οv ALM 1D 1PL ¢ в2 Servo power Servo power ¢Θ1 ÓN OFF 1KM þ⊕ ------1 7 ٢ +24 V 1KM 2Rv 1TRy 0 V 2<u>KM</u> 1KM 1Ry ⊳ -\_\_\_-T \_ ٦-2SA 5SA 1QF: Molded-case circuit breaker 1FLT: Noise Filter 1KM: Magnetic Contactor (for control power supply) 2KM: Magnetic Contactor (for main circuit power supply, auxiliary contact) 1SA: Surge Absorber 1FU: Fuse, positive side 2SA: Surge Absorber 2FU: Fuse, negative side 3SA: Surge Absorber 1Ry: Relay 4SA: Surge Absorber 2Ry: Relay (for inrush current 5SA: Surge Absorber suppression resistor switch) 1D: Flywheel diode 1TRy: Timer relay 1R: External inrush current 1PL: Indicator lamp suppression resistor
- 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



- 1QF: Molded-case circuit breaker
- 1FLT: Noise Filter
- 1KM: Magnetic Contactor (for control power supply)
- 2KM: Magnetic Contactor (for main circuit power supply)

1SA: Surge Absorber2SA: Surge Absorber3SA: Surge Absorber

1D: Flywheel diode

4-20

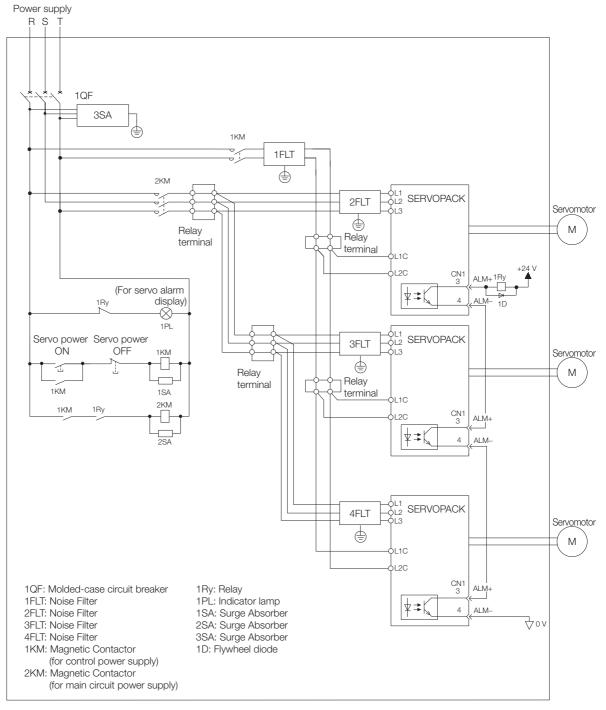
### Using More Than One SERVOPACK

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.

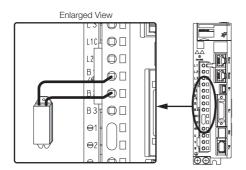
Refer to the following manual to select the capacity of a Regenerative Resistor.

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



### **Connecting Regenerative Resistors**

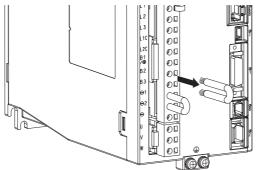
- SERVOPACK Models SGD7S-R70A, -R90A, -1R6A, -2R8A, -R70F, -R90F, -2R1F, and -2R8F
- 1. Connect the External Regenerative Resistor between the B1/⊕ and B2 terminals on the SERVOPACK.



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

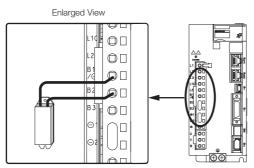
Refer to the following section for details on the settings. 5.18 Setting the Regenerative Resistor Capacity on page 5-56

- 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

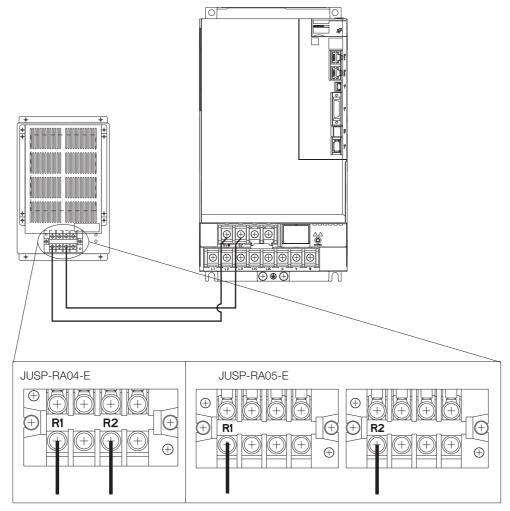
2. Connect the External Regenerative Resistor between the B1/ $\oplus$  and B2 terminals.



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

Refer to the following section for details on the settings. 5.18 Setting the Regenerative Resistor Capacity on page 5-56

- 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.



- 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.

 $\boxed{3}$  5.18 Setting the Regenerative Resistor Capacity on page 5-56

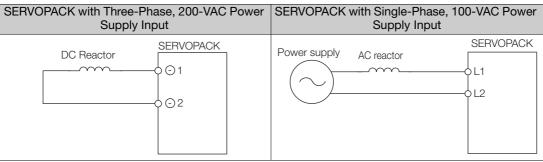
4.3.6 Wiring Reactors for Harmonic Suppression

### 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

# Wiring Servomotors

#### **Terminal Symbols and Terminal Names** 4.4.1

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

Terminal/Connector Symbols	Terminal/Connector Name	Remarks
U, V, and W	Servomotor terminals	<ul> <li>Refer to the following section for the wiring procedure.</li> <li>4.3.2 Wiring Procedure for Main Circuit Connector on page 4-13</li> </ul>
	Ground terminal	-
CN2	Encoder connector	-

#### Pin Arrangement of Encoder Connector (CN2) 4.4.2

•	When Using a Rotary Servomotor								
	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

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

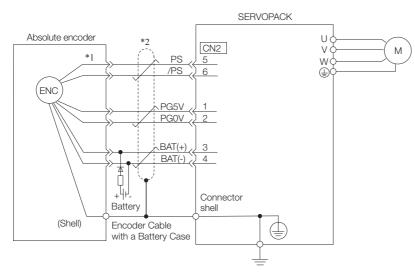
#### When Using an Absolute Encoder

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.

(3) 12.1.3 Replacing the Battery on page 12-3

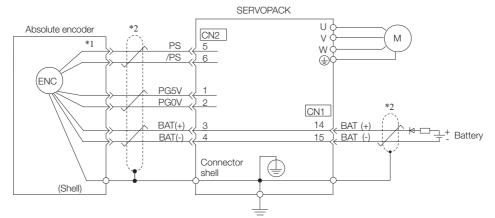
• Wiring Example When Using an Encoder Cable with a Battery Case



\*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

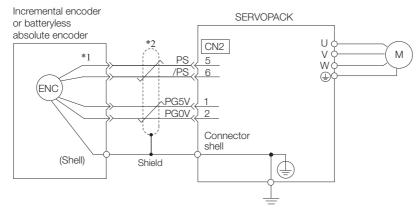


\*1. The absolute encoder pin numbers for wiring the connector depend on the Servomotor that you use.

. represents a shielded twisted-pair cable.

Use the Encoder Cable with Refer to the following manu	<ul> <li>When Installing a Battery on the Encoder Cable Use the Encoder Cable with a Battery Case that is specified by Yaskawa. Refer to the following manual for details.</li> <li>Σ-7-Series Peripheral Device Selection Manual (Manual No.: SIEP S800001 32)</li> </ul>						
	<ul> <li>When Installing a Battery on the Host Controller Insert a diode near the battery to prevent reverse current flow.</li> </ul>						
Circuit Example							
+ Battery	<ul> <li>Schottky Diode Reverse Voltage: Vr ≥ 40 V Forward Voltage: Vf ≤ 0.37 V Reverse current: Ir ≤ 5 μA Junction temperature: Tj ≥ 125°C</li> </ul>	• Resistor Resistance: 22 $\Omega$ Tolerance: $\pm 5\%$ max. Rated power: 0.25 W min.					

# When Using an Incremental Encoder or Batteryless Absolute Encoder



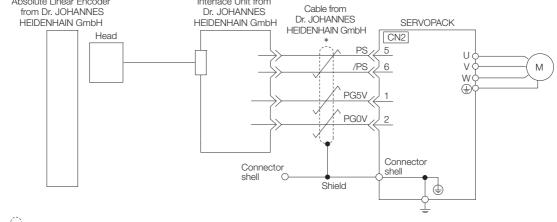
- \*1. The encoder pin numbers for wiring the connector depend on the Servomotor that you use.
- \*2. represents a shielded twisted-pair cable.

#### 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

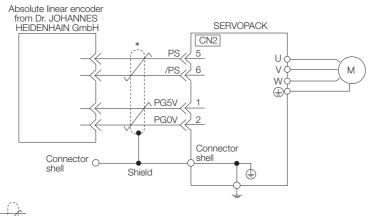
# LIC4100 Series, LIC2100 Series, LC115, and LC415



 $\frac{2}{1}$  represents a shielded twisted-pair cable.

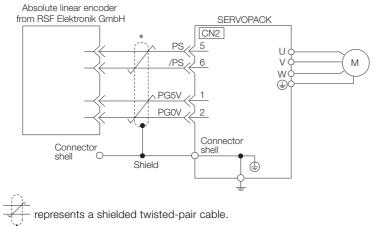
Information Sales of the interface unit EIB3391Y with the LIC4100 and LIC2100 series have ended due to the release of the LIC4190, LIC3190, and LIC2190 series.

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

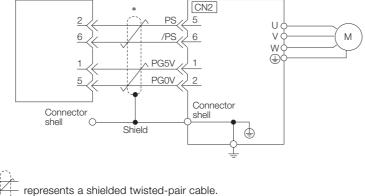


represents a shielded twisted-pair cable.

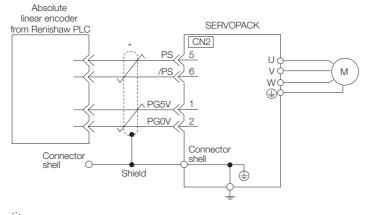
Connections to Linear Encoder from RSF Elektronik GmbH



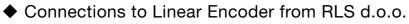
Connections to Absolute Linear Encoder from Mitutoyo Corporation Absolute linear encoder from Mitutoyo Corporation SERVOPACK \*
CN2

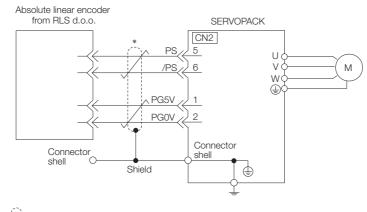


Connections to Absolute Linear Encoder from Renishaw PLC

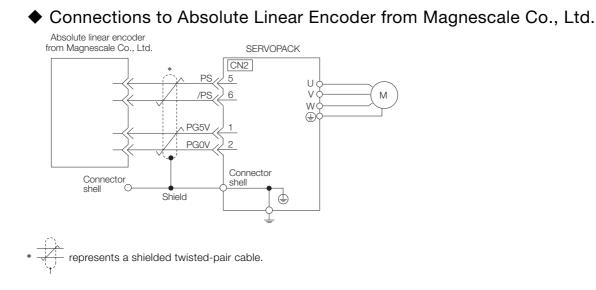


represents a shielded twisted-pair cable.

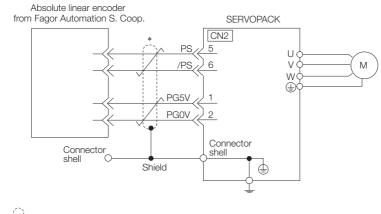




\* tepresents a shielded twisted-pair cable.

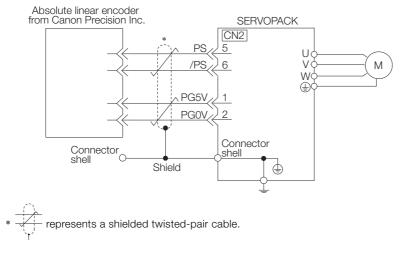


#### Connections to Absolute Linear Encoder from Fagor Automation S. Coop.



represents a shielded twisted-pair cable.

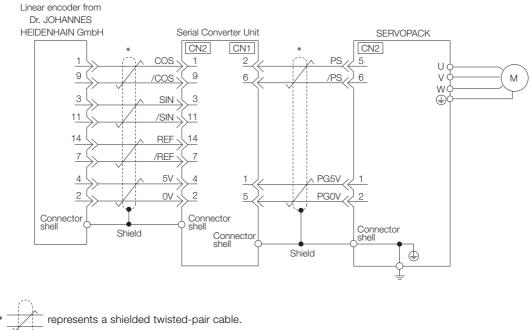
#### Connections to Absolute Linear Encoder from Canon Precision Inc.



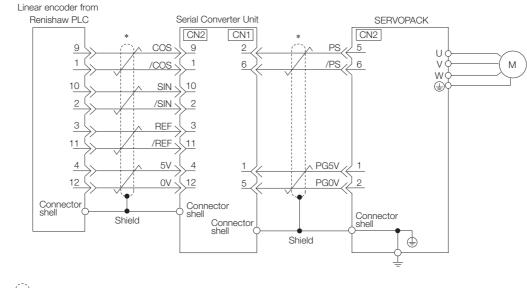
#### When Using an Incremental Linear Encoder

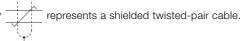
The wiring depends on the manufacturer of the linear encoder.

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



#### Connections to Linear Encoder from Renishaw PLC

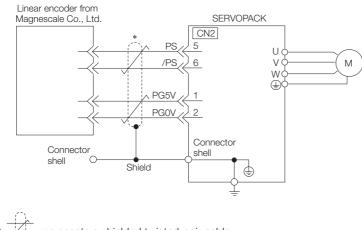




#### Connections to Linear Encoder from Magnescale Co., Ltd.

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.

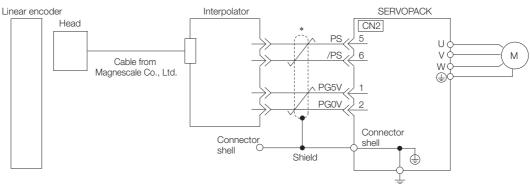
# SL700, SL710, SL720, SL730, and SQ10 PL101-RY, MQ10-FLA, or MQ10-GLA Interpolator

The following table gives the Linear Encoder and Interpolator combinations.

Linear Encoder Model	Interpolator
SL700, SL710, SL720, or SL730	PL101-RY*1
SQ10	MQ10-FLA <sup>*2</sup>
3010	MQ10-GLA <sup>*2</sup>

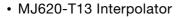
\*1. This is the model of the Head with Interpolator.

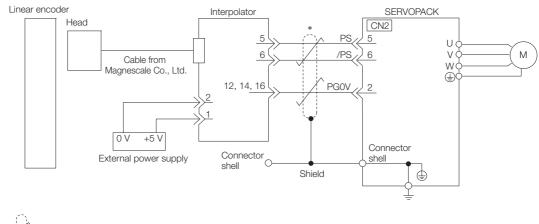
\*2. This is the model of the Interpolator.



\* Trepresents a shielded twisted-pair cable.

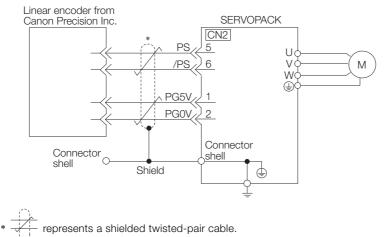
■ SL700, SL710, SL720, and SL730





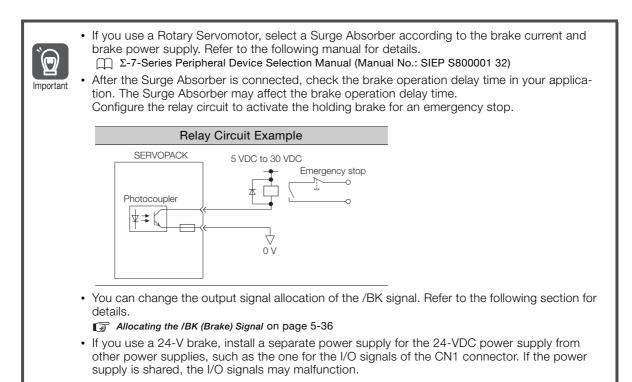
represents a shielded twisted-pair cable.

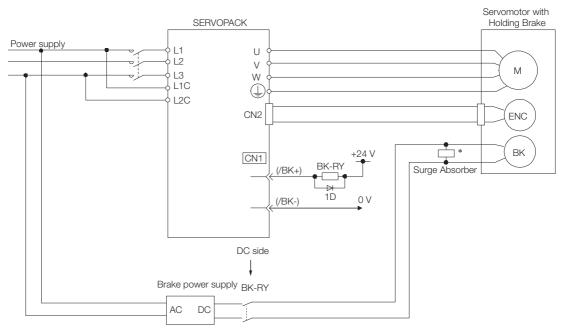
• Connections to Linear Encoder from Canon Precision Inc.



4.4.4 Wiring the SERVOPACK to the Holding Brake

### 4.4.4 Wiring the SERVOPACK to the Holding Brake





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

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

4.5.1 I/O Signal Connector (CN1) Names and Functions

# 4.5 I/O Signal Connections

# 4.5.1 I/O Signal Connector (CN1) Names and Functions

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

### **Input Signals**

Default settings are given in parentheses.

Signal	Pin No.	Name	Function	Reference
/SI1* (P-OT)	7	General-purpose Sequence Input 1 (For- ward Drive Prohibit Input)	You can allocate the input signal to use with a parameter. (Stops Servomotor drive (to prevent over-	
/SI2* (N-OT)	8	General-purpose Sequence Input 2 (Reverse Drive Prohibit Input)	travel) when the moving part of the machine exceeds the range of move- ment.)	page 5-29
/SI3* (/DEC)	9	General-purpose Sequence Input 3 (Ori- gin Return Deceleration Switch Input)	You can allocate the input signal to use with a parameter. (Connects the deceleration limit switch for origin return.)	_
/SI4* (/EXT1)	10	General-purpose Sequence Input 4 (Exter- nal Latch Input 1)		
/SI5* (/EXT2)	11	General-purpose Sequence Input 5 (Exter- nal Latch Input 2)	You can allocate the input signals to use with parameters. (Connect the external signals that latch the current feedback pulse counter.)	-
/SI6* (/EXT3)	12	General-purpose Sequence Input 6 (Exter- nal Latch Input 3)		
/SI0*	13	General-purpose Sequence Input 0	You can allocate the input signal to use with a parameter. (Used for general-purpose input. You can monitor this signal in the I/O monitor field of MECHATROLINK.)	_
+24VIN	6	Sequence Input Signal Power Supply Input	Inputs the sequence input signal power supply. Allowable voltage range: 24 VDC ±20% The 24-VDC power supply is not provided by Yaskawa.	_
BAT+	14	Battery for Absolute Encoder (+)	These are the pins to connect the abso- lute encoder backup battery.	
BAT-	15	Battery for Absolute Encoder (-)	Do not connect these pins if you use the Encoder Cable with a Battery Case.	_
ТН	5	Overheat Protection Input	Inputs the overheat protection signal from a Linear Servomotor or from a sensor attached to the machine.	page 6-62

\* You can change the allocations. Refer to the following section for details.

6.1.1 Input Signal Allocations on page 6-4

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.

4.5.1 I/O Signal Connector (CN1) Names and Functions

## **Output Signals**

Default settings are given in parentheses.

Signal	Pin No.	Name	Function	Reference	
ALM+	3	Servo Alarm Output	Turne OFE (apope) when an error is detected		
ALM-	4	- Servo Alarm Output	Turns OFF (opens) when an error is detected.	page 6-8	
/SO1+* (/BK+)	1	General-purpose - Sequence Output 1	You can allocate the output signal to use with a parameter.	page 5-24	
/SO1-* (/BK-)	2	(Brake Output)	(Controls the brake. The brake is released when the signal turns ON (closes).)	page 5-34	
/SO2+*	23	General-purpose			
/SO2-*	24	Sequence Output 2	Used for general-purpose outputs.	-	
/SO3+*	25	General-purpose	Set the parameters to allocate functions.		
/SO3-*	26	Sequence Output 3			
PAO	17	Encoder Divided Pulse		page 6-33 page 6-43	
/PAO	18	Output, Phase A	Output the encoder divided pulse output sig-		
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.	_	

\* You can change the allocations. Refer to the following section for details.

(3) 6.1.2 Output Signal Allocations on page 6-5

4.5.2 I/O Signal Connector (CN1) Pin Arrangement

# 4.5.2 I/O Signal Connector (CN1) Pin Arrangement

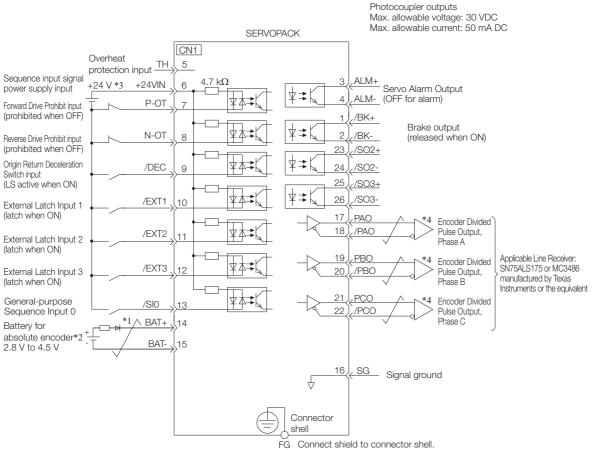
The following figure gives the pin arrangement of the of the I/O signal connector (CN1) for the default settings.

	2	/SO1-	General- purpose	1	/SO1+ (/BK+)	General- purpose Sequence Output 1	15	BAT-	Battery for Absolute	14	BAT+	Battery for Absolute Encoder (+)
		(/BK-)	Sequence Output 1	3	ALM+	Servo Alarm Out-			Encoder (-)	16	SG	Signal Ground
Pin 1 Pin 2 Pin 2 Pin 14 Pin 14 Pin 15	4	ALM-	Servo Alarm Output	5	ТН	put Overheat Protection	17	PAO	Divided Pulse Out- put, Phase A	18	/PAO	Encoder Divided Pulse Out-
Pin 12			Sequence Input Sig-			Input			Encoder Divided	-		put, Phase A
Pin 12 Pin 13 Pin 25 Pin 26	6			/SI1 (P-OT)	General- purpose Sequence	19	I9 PBO	Pulse Out- put, Phase B	20	/PBO	Encoder Divided Pulse Out-	
The above view is from the direction		/SI2	General- purpose		(1 01)	Input 1			Encoder Divided			put, Phase B
of the following arrow without the connector shell	8	(N-OT)	Sequence Input 2	9	/SI3 (/DEC)	General- purpose Sequence	21	PCO	Pulse Out- put, Phase C	22	/PCO	Encoder Divided Pulse Out-
attached.	10	/SI4	General- purpose		Input 3		23	/SO2+	General- purpose			put, Phase C
	10	(/EXT1)	Sequence Input 4	11	/SI5	General- purpose	20	/002+	Sequence Output 2	24	/SO2-	General- purpose
	12	/SI6	General- purpose		(/EXT2)	T2) Sequence Input 5	25	/SO3+	General- purpose		7002	Sequence Output 2
	12	(/EXT3)	Sequence Input 6	13	/SI0	General- purpose Sequence Input 0	20	/300+	Sequence Output 3	26	/SO3-	General- purpose Sequence Output 3

4.5.3 I/O Signal Wiring Examples

## 4.5.3 I/O Signal Wiring Examples

#### Using a Rotary Servomotor

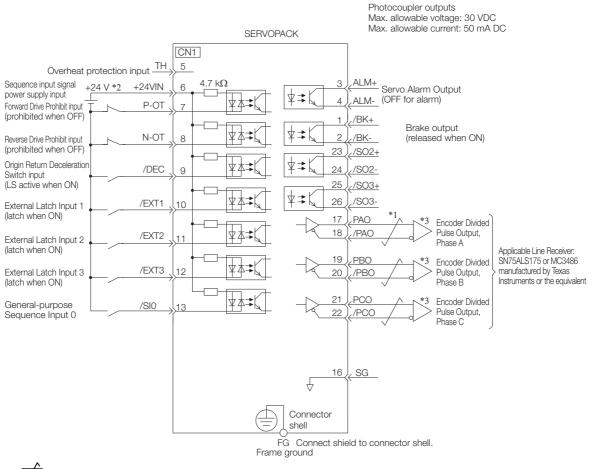


Frame ground

- \*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: 1. You can use parameters to change the functions allocated to the /DEC, P-OT, N-OT, /EXT1, /EXT2, and /EXT3 input signals and the /SO1, /SO2, and /SO3 output signals. Refer to the following section for details.
  - 2. 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.

#### 4.5.3 I/O Signal Wiring Examples

## Using a Linear Servomotor



- \*1. / represents twisted-pair wires.
- \*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: 1. You can use parameters to change the functions allocated to the /DEC, P-OT, N-OT, /EXT1, /EXT2, and /EXT3 input signals and the /SO1, /SO2, and /SO3 output signals. Refer to the following section for details.
  - 2. 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.

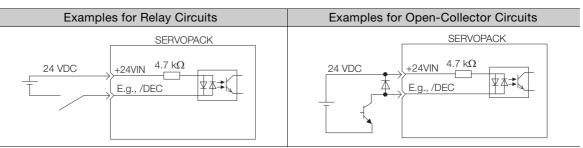
4.5.4 I/O Circuits

# 4.5.4 I/O Circuits

#### **Sequence Input Circuits**

#### Photocoupler Input Circuits

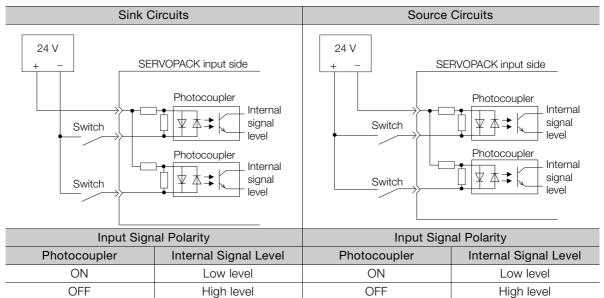
This section describes CN1 connector terminals 6 to 13.



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 4.5.3 I/O Signal Wiring Examples on page 4-38 are for sink circuit connections.



4.5.4 I/O Circuits

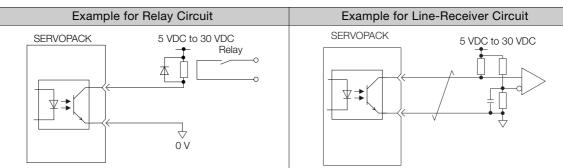
## **Sequence Output Circuits**

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 a photocoupler output circuit to a relay or line-receiver circuit.



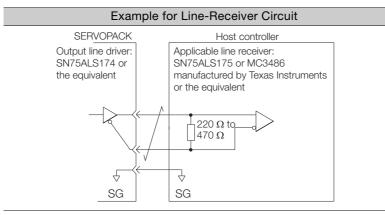
Note: The maximum allowable voltage and current range for photocoupler output circuits are as follows:

- 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 Pin Arrangement of Safety Function Signals (CN8)

# 4.6 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* 

# 4.6.1 Pin Arrangement of Safety Function Signals (CN8)

Pin No.	Signal	Name	Function		
1	-	- (Do not use these pins because they a	are connected to internal circuite )		
2	-	- (Do not use these pins because they a	are connected to internal circuits.)		
3	/HWBB1-	Hard Wire Base Block Input 1			
4	/HWBB1+	Hard whe base block input i	For a hard wire base block input. The base block (motor power turned OFF) is in effect when the signal is OFF.		
5	/HWBB2-	Hard Wire Roop Plack Input 2			
6	/HWBB2+	Hard Wire 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.		

### 4.6.2 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.

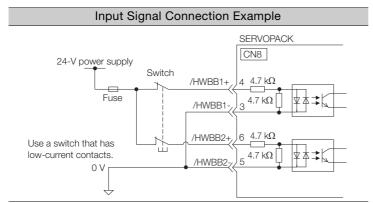
To avoid confusion, the ON and OFF status of signals for the safety function are defined as follows:

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.



4.6.2 I/O Circuits

Туре	Signal	Connector Pin No.	Status	Meaning
		CN8-4	ON (closed)	Does not activate the HWBB (normal operation).
	/HWBB1	CN8-3	OFF (open)	Activates the HWBB (motor current shut-OFF request).
mputs	hputs /HWBB2	CN8-6	ON (closed)	Does not activate the HWBB (normal operation).
		WBB2 CN8-5 OFF (		Activates the HWBB (motor current shut-OFF request).

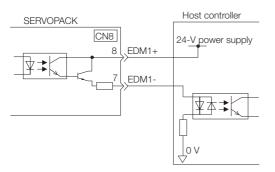
#### ◆ Input (HWBB) Signal Specifications

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

Item	Characteristics	Remarks
Internal Impedance	4.7 kΩ	-
Operating Voltage Range	+24 V ±20%	-
Maximum Delay 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

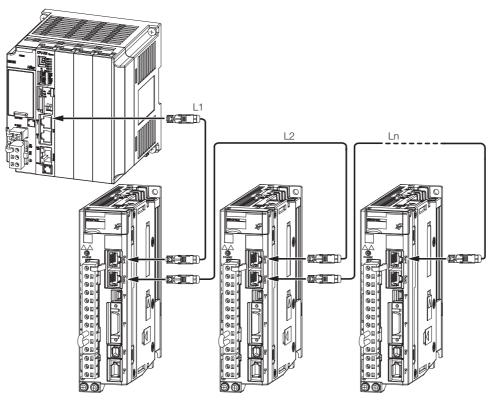
Туре	Signal	Pin No.	Output Sta- tus	Meaning
Output	EDM1	CN8-8 CN8-7	ON	Both the /HWBB1 and /HWBB2 signals are operat- ing normally.
			OFF	The /HWBB1 signal, the /HWBB2 signal, or both are not operating.

The electrical characteristics of the EDM1 signal are as follows:

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

# 4.7 Connecting MECHATROLINK-III Communications Cables (RJ-45)

Connect the MECHATROLINK-III Communications Cables (RJ-45) to the CN6A and CN6B connectors.



Note: The length of the cable between stations (L1, L2, ... Ln) must be 50 m or less.

Use the cables specified in the selection table for the MECHATROLINK-III Communications Cables (RJ-45). The maximum cable lengths are as follows:

- Cables with Connectors on Both Ends and No Ferrite Cores: 30 m
- Cables with Connectors on Both Ends and Ferrite Cores: 50 m

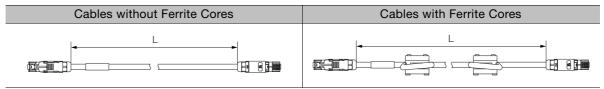
#### **Selection Table**

Contact your Yaskawa representative for details.

Туре	Length (L)	Order Number*
Cables with Connectors on Both Ends and No Ferrite Cores	0.2 m, 0.5 m, 1 m, 2 m, 3 m, 4 m, 5 m, 10 m, 20 m, and 30 m	JZSP-CM3RR00-□□-E (□□: 00P2/00P5/01/02/03/04/ 05/10/20/30)
Cables with Connectors on Both Ends and Ferrite Cores	10 m, 20 m, 30 m, and 50 m	JZSP-CM3RR01-□□-E (□□: 10/20/30/50)

\* Replace the boxes ( $\Box\Box$ ) in the order number with the code for the cable length.

## **External Dimensions**



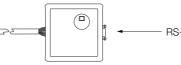
4.8.1 Serial Communications Connector (CN502)

# 4.8 Connecting the Other Connectors

# 4.8.1 Serial Communications Connector (CN502)

To use an RS-422 cable to connect a Digital Operator, connect it to CN502 on the SERVO-PACK. A JUSP-JC001-1 Communications Unit is required to make the connection.

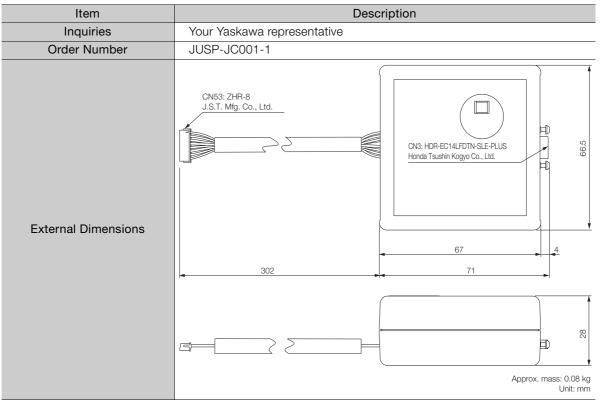




Communications Unit

RS-422 cable

# **Communications Unit**



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.



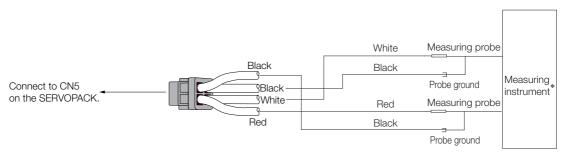
Use the Yaskawa-specified cables. Operation will not be dependable due to low noise resistance with any other cable.

4.8.3 Analog Monitor Connector (CN5)

# 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.

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5.1.1 Parameter Classification

# 5.1 Manipulating Parameters (Pn

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.

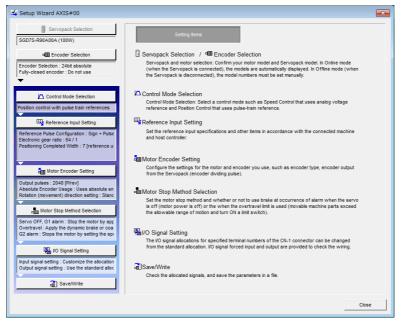
Important	When you edit parameters with the SigmaWin+, setup parameters and tuning parameters are displayed. When you edit parameters with a Digital Operator, only setup parameters are displayed by default. To edit tuning parameters, set Pn00B to n.□□□1 (Display all parameters).							
	Parameter Meaning When Enabled							
	Pn00B	n.□□□0 (default setting)	Display only setup parameters.	After restart	Setup			
		n.0001	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.



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.

- 8.6 Autotuning without Host Reference on page 8-24
- *[ 8.7 Autotuning with a Host Reference* on page 8-35

😰 8.8 Custom Tuning on page 8-42

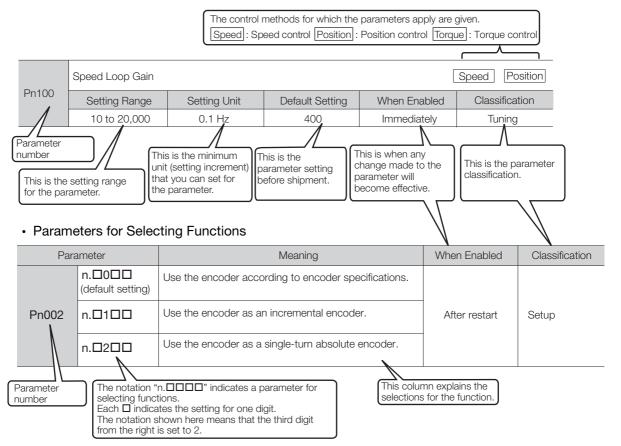
You can also set the tuning parameters individually to make adjustments. Refer to the following section for details.

🕞 8.13 Manual Tuning on page 8-81

## 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

### 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 🔺 or 💌 Button to display the parameter to edit.

<b>A</b>			YASKAWA SigmaWin+ Ver.	7		- @ ×			
	Edit Parameters	_				- 0 ×			
	Category	SERVOPACK	SERVOPACK						
001-SGD75 -R90A00A H88 P-0T R90WER ESTP N-0T	All constant number Function Selection(Pn0xx-) Gain(Pn1xx-) Position(Pn2xx-) Speed(Pn3xx-)	Edited Parameters F	arameters parameters parameters		Export Project Project Com				
POWER ESTP N-OT	Torque(Pn4xx-)	Read from	Servo Write to Servo	File	Project Function	Display			
	Sequence(Pn5xx-) I/O Sign	No.	Name	Unit	001-SGD75-R90				
	Display Settings	Pn000.0	Direction Selection	-	Axis A				
	Hierarchy:	Pn000.1	Control Method Selection	-	1 : Position contr···				
	Descriptions: 0	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 II	-	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…				
0= m-	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.

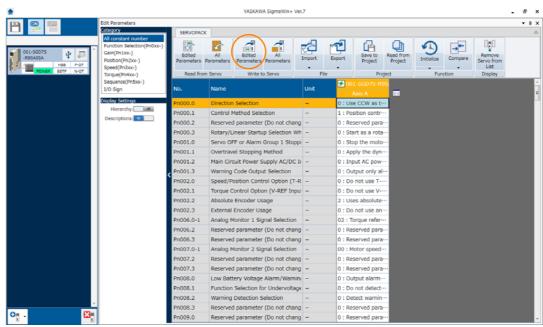
Information

- 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.

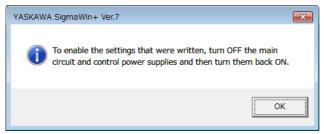
The background of the edited parameter cell will change to green.

5.1.3 Parameter Setting Methods



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.



**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

5-7

5.1.4 Write Prohibition Setting for Parameters

## 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	Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Others - Write Prohibited Setting	Gerating Procedure on page 5-8

### **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.
- Press the ▼ or ▲ for the rightmost digit and set one of the following. 0000: Writing is permitted (default setting). 0001: Writing is prohibited.



4. Click the Setting Button.



#### 5. Click the OK Button.

The setting will be written to the SERVOPACK.



5.1.4 Write Prohibition Setting for Parameters

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	Mhon Mrit		
SigmaWin+ Function Name	Fn No.	Utility Function Name	ing Is Pro- hibited	Reference	
Initialize <sup>*1</sup>	Fn005	Initializing Parameters	Cannot be executed.	page 5-11	
Software Reset	Fn030	Software Reset	Can be executed.	page 6-48	
	Fn011	Display Servomotor Model	Can be executed.		
Draduat Information	Fn012	Display Software Version	Can be executed.	2222 0 0	
Product information	Fn01E	Display SERVOPACK and Servomotor IDs	Can be executed.	page 9-2	
	Fn01F	Display Servomotor ID from Feedback Option Module	Can be executed.		
Reset Absolute Encoder	Fn008	Reset Absolute Encoder	Cannot be executed.	page 5-51	
Multi-turn Limit Setup	Fn013	Multiturn Limit Setting after Multiturn Limit Disagreement Alarm	Cannot be executed.	page 6-40	
Search Origin <sup>*2</sup>	Fn003	Origin Search	Cannot be executed.	page 7-19	
Zero Point Position Setting	Fn020	Set Absolute Linear Encoder Origin	Cannot be executed.	page 5-53	
Polarity Detection	Fn080	Polarity Detection	Cannot be executed.	page 5-28	
	Fn000	Display Alarm History	Can be executed.	page 12-43	
Display Alarm	Fn006	Clear Alarm History	Cannot be executed.	page 12-44	
	Fn014	Reset Option Module Config- uration Error	Cannot be executed.	page 12-45	
Reset Motor Type Alarm	Fn021	Reset Motor Type Alarm	Cannot be executed.	page 12-47	
Jog	Fn002	Jog	Cannot be executed.	page 7-7	
Program JOG Operation	Fn004	Jog Program	Cannot be executed.	page 7-14	
	SigmaWin+ Function Name Initialize*1 Software Reset Software Reset Product Information Reset Absolute Encoder Multi-turn Limit Setup Search Origin*2 Zero Point Position Setting Polarity Detection Display Alarm Display Alarm Jog	SigmaWin+ Function NameFn No.Initialize*1Fn005Software ResetFn030Software ResetFn011Fn012Fn012Fn012Fn012Fn014Fn015Raset Absolute EncoderFn008Multi-turn Limit SetupFn013Search Origin*2Fn003Zero Point Position SettingFn020Polarity DetectionFn080Display AlarmFn006Fn014Fn014Reset Motor Type AlarmFn021JogFn002	SigmaWin+ Function NameFn No.Utility Function NameInitialize*1Fn005Initializing ParametersSoftware ResetFn030Software ResetProduct InformationFn011Display Servomotor ModelFn012Display SetWork VersionFn014Display SetWOPACK and Servomotor IDsFn015Display SERVOPACK and Servomotor IDsReset Absolute EncoderFn016Multi-turn Limit SetupFn013Search Origin*2Fn030Zero Point Position Setting Polarity DetectionFn020Set Absolute Linear EncoderSet Absolute Linear EncoderPisplay AlarmFn000Display AlarmFn014Reset Motor Type AlarmFn021JogFn021Reset Motor Type AlarmFn021JogFn022JogFn024	SigmaWin+Function NameFn No.Utility Function NameWhen Writ- ing Is Pro- hibitedInitialize*1Fn005Initializing ParametersCannot be executed.Software ResetFn030Software ResetCan be executed.Product InformationFn011Display Servomotor ModelCan be executed.Fn012Display Software VersionCan be executed.Fn011Display Servomotor IDsCan be executed.Fn011Display Servomotor ID from Feedback Option ModuleCan be 	

Continued on next page.

5.1.4 Write Prohibition Setting for Parameters

	SigmaWin+		Digital Operator	inued from pr	
Button in Menu Dialog Box	SigmaWin+ Function Name	Fn No.	Utility Function Name	When Writ- ing Is Pro- hibited	Reference
	Tuning - Autotuning without Host Reference	Fn201	Advanced Autotuning with- out Reference	Cannot be executed.	page 8-24
	Tuning - Autotuning with Host Ref- erence	Fn202	Advanced Autotuning with Reference	Cannot be executed.	page 8-35
	Tuning - Custom Tuning	Fn203	One-Parameter Tuning	Cannot be executed.	page 8-42
Tuning	Tuning - Custom Tuning - Adjust Anti-resonance Control	Fn204	Adjust Anti-resonance Con- trol	Cannot be executed.	page 8-51
	Tuning - Custom Tuning - Vibration Suppression		Vibration Suppression	Cannot be executed.	page 8-56
	Response Level Setting	Fn200	Tuning-less Level Setting	Cannot be executed.	page 8-16
Diagnostic	Easy FFT	Fn206	Easy FFT	Cannot be executed.	page 8-97
	Adjust the Analog Monitor	Fn00C	Adjust Analog Monitor Output Offset	Cannot be executed.	page 9-9
	Output	Fn00D	Adjust Analog Monitor Output Gain	Cannot be executed.	page 9-9
Others	Adjust the Motor Current	Fn00E	Autotune Motor Current Detection Signal Offset	Cannot be executed.	page 6-55
	Detection Offsets	Fn00F	Manually Adjust Motor Cur- rent Detection Signal Offset	Cannot be executed.	page 0-00
	Initialize Vibration Detection Level	Fn01B	Initialize Vibration Detection Level	Cannot be executed.	page 6-51
	Write Prohibited Setting	Fn010	Write Prohibition Setting	Can be executed.	page 5-8

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

# 5.1.5 Initializing Parameter Settings

You can return the parameters to their default settings.

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



To enable the new settings, turn the power supply to the SERVOPACK OFF and ON again after you complete the operation.

### Preparations

Always check the following before you initialize the parameter settings.

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

#### **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	Fn005	Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Basic Functions - Edit Parameters	Gerating Procedure on page 5-12

5.1.5 Initializing Parameter Settings

#### **Operating Procedure**

Use the following procedure to initialize the parameter settings.

- 1. Click the <u>I</u> 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.
- 4. Click the Initialize Button in the Function Group.

<b>a</b>			YASKAWA SigmaWin+ Ver.7			-	5 x
	Edit Parameters						• • ×
	Category	SERVOPACK					۵
Gein(Philos-) Commerce State Pro- Specify Philos-) Signer Commerce State Pro- Signer Commerce State Pro- Signer Commerce State Pro- Signer Commerce State Pro- Signer Commerce State Pro- Common Parameters (Pi Boolay Schrings	Function Selection(Pn0xx-) Gain(Pn1xx-) Position(Pn2xx-) Speed(Pn3xx-)	Edited Parameters Pa Read from S	rameters parameters parameters	mport Exp	Dort Project Project	Function	Display
	Sequence(Pn5xx-) I/O Sign	NO.	Name	Unit			<b>^</b>
		Pn000.0	Direction Selection	-	0 : Use CCW as t…		
	Display Settings	Pn000.1	Reserved parameter (Do not chang	-	0 : Reserved para…		
		n000.2	Reserved parameter (Do not chang	-	0 : Reserved para…		
	Descriptions: D	Pn000.3	Rotary/Linear Startup Selection Wh	-	0 : Start as a rota…		
	P	Pn001.0	Servo OFF or Alarm Group 1 Stoppi	-	0 : Stop the moto…		
	< P	Pn001.1	Overtravel Stopping Method	-	1 : Decelerate the…		
	P	n001.2	Main Circuit Power Supply AC/DC Ir	-	0 : Input AC pow…		
	P	Pn001.3	Reserved parameter (Do not chang	-	0 : Reserved para…		
	P	Pn002.0	MECHATROLINK Command Position	-	1 : Use TLIM as t…		
	P	n002.1	Torque Control Option	-	1 : Use the speed…		
	P	n002.2	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…		
	P	Pn006.3	Reserved parameter (Do not chang	-	0 : Reserved para…		
	P	Pn007.0-1	Analog Monitor 2 Signal Selection	-	00 : Motor speed…		
	P	n007.2	Reserved parameter (Do not chang	-	0 : Reserved para…		
• <u></u> •	P	Pn007.3	Reserved parameter (Do not chang	-	0 : Reserved para…		-

5. Click the OK Button.



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

6. Click the OK Button.

YASKAWA SigmaWin+ Ver.7	
Cautior	
Turn OFF the power supply. The settings will be applied the next time the power supply is turned ON.	
ОК	2

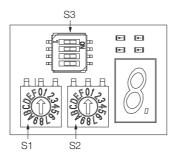
7. Turn the power supply to the SERVOPACK OFF and ON again after the parameter settings have been initialized.

This concludes the procedure to initialize the parameter settings.

5.2.1 Communications Settings

# 5.2 MECHATROLINK-III Communications Settings

The settings for MECHATROLINK-III communications are made with the DIP switch (S3). The station address is set using the rotary switches (S1 and S2).



# 5.2.1 Communications Settings

Use the DIP switch (S3) to make the communications settings.

Din No.	Eurotion	Setting			Default
FIII NO.	Pin No. Function		2	Description	Setting
		OFF	OFF	Reserved. (Do not change.)	
1.0	Sets the number of transmission bytes.	ON	OFF	32 bytes	1: OFF 2: ON
1, 2		OFF	ON	48 bytes	
		ON	ON	Reserved. (Do not change.)	
3	Reserved. (Do not cha	nge.)			OFF
4	Reserved. (Do not cha	nge.)			OFF



• If you will use the MECHATROLINK-III standard servo profile, set the number of transmission bytes to either 32 or 48.

 To enable the new setting, turn the power supply to the SERVOPACK OFF and ON again after you change the communications switches (S1, S2, and S3).

# 5.2.2 Setting the Station Address

Use the rotary switches (S1 and S2) to set the station address.

Station Address	S1	S2
00h to 02h: Disabled (Do not set.)	0	0 to 2
03h (default setting)	0	3
04h	0	4
:	:	:
EFh	E	F
F0h to FFh: Disabled (Do not set.)	F	0 to F

5.3.1 AC Power Supply Input/DC Power Supply Input Setting

# 5.3 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.

# 5.3.1 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□□ (default setting)	Use an AC power supply input.	After restart	Setup				
	n.0100	Use a DC power supply input.	-					
<ul> <li>Canth</li> <li>Canth</li> <li>Canth</li> <li>Canth</li> <li>The</li> <li>Alway the</li> <li>If you n. In equivily</li> <li>With suppowe</li> <li>Inst</li> <li>The with tive</li> <li>If you necommer the Reference</li> </ul>	onnect an AC power e SERVOPACK. onnect a DC power e SERVOPACK. re is a risk of failure of ays specify a DC po main circuit power wi 1 III), the SERVOP, ipment. n a DC power supply ply is turned OFF. A ver supply is turned all fuses on the power a DC power supply energy at the power of use a DC power supply energy at the power of use a DC power supply tan inrush current I nded by Yaskawa: S re is a risk of equipm	ower supply input (Pn001 = $n.\Box 1 \Box \Box$ ) be supply. thout specifying a DC power supply input ACK's internal elements may burn and ma y input, time is required to discharge ele- high residual voltage may remain in the OFF. Be careful not to get an electric sh ver supply line if you use DC power. s regenerative energy to the power supply y input, regenerative energy is not proce- r supply. supply input with any of the following SI imiting circuit and use the power ON an GD7S-330A, -470A, -550A, -590A, or -7 nent damage. ction for the power ON and OFF sequence	nd the L1C and L2 and the L1C and L2 afore you input D0 (i.e., without settin ay cause fire or dat ectricity after the n e SERVOPACK aft nock. My. If you use a SI essed. Process th ERVOPACKs, exte d OFF sequences 780A.	C terminals on C power for ng Pn001 to mage to the main power ter the ERVOPACK e regenera- ernally con-				

Refer to the following section for information on wiring the SERVOPACK. *4.3.4 Power Supply Wiring Diagrams* on page 4-16 5.3.2 Single-phase AC Power Supply Input/Three-phase AC Power Supply Input Setting

# 5.3.2 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 input as a single-phase power supply input) for a SERVOPACK with a single-phase 200-VAC power supply input (model numbers: SGD7S-120A  $\Box \Box \Box$  008) or for a SERVOPACK with a single-phase 100-VAC power supply input.

	Parameter	Meaning	When Enabled	Classification
Pn00B	n.0000 (default setting)	Use a three-phase power supply input.	Aftor rostart	Setup
THOOD	n.0100	Use a three-phase power supply input and as a single-phase power supply input.	- After restart	Setup
Important	<ul> <li>ply (Pn00B = n.E</li> <li>2. Not all SERVOPA single-phase AC power, an A.F10</li> <li>3. If you use a single</li> </ul>	e-phase power supply input without specifyir 11DD), an A.F10 alarm (Power Supply Line ( CKs can be run on a single-phase AC powe power supply input to a SERVOPACK that d alarm (Power Supply Line Open Phase) will c e-phase 200-VAC power supply input, the to pr will not be the same as for a three-phase A	Dpen Phase) will c r supply input. If y oes not support s occur. rque-motor speed	occur. ou connect a ingle-phase characteristic

acteristics given in the Servomotor manual or catalog.

whether to use a single-phase or three-phase AC power supply input after checking the char-

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 4-17

# 5.4 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□□□ (default setting)	When an encoder is not connected, start as SERVOPACK for Rotary Servo- motor.	After restart	Setup
FIIUUU	n.1000	When an encoder is not connected, start as SERVOPACK for Linear Servo- motor.	Aller residit	Serup

# 5.5 Motor Direction Setting

You can reverse the direction of Servomotor rotation by changing the setting of  $Pn000 = n.\Box\Box\BoxX$  (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 6-20

#### Rotary Servomotors

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

Parameter		Forward/Reverse Reference	Motor Direction and Encoder Divided Pulse Outputs	Applicable Overtravel Signal (OT)
	n.□□□0 Use CCW as	Forward reference	CCW Hotor speed Ho	P-OT (For- ward Drive Prohibit) sig- nal
Pn000	the forward direction. (default setting)	Reverse reference	Torque reference Encoder Divided Pulse Outputs	N-OT (Reverse Drive Pro- hibit) signal
1 11000	n.□□□1 Use CW as the forward direc-	Forward reference	+ Torque reference Encoder Divided Pulse Outputs	P-OT (For- ward Drive Prohibit) sig- nal
	tion. (Reverse Rota- tion Mode)	Reverse reference	Torque reference Encoder Divided Pulse Outputs CCW HAT Time PAO PASE-A lead Motor speed PBO PBO	N-OT (Reverse Drive Pro- 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 Reference	Motor Moving Direction and Encoder Divided Pulse Outputs	Applicable Overtravel Signal (OT)
	n.□□□0 Use the direc- tion in which the linear	Forward reference	Horizon       Force reference       Encoder Divided Pulse Outputs         Moves in the count-up direction.       Time       PAO         Motor speed       PBO       PBO	P-OT (For- ward Drive Prohibit) signal
	encoder counts up as the for- ward direction. (default setting)	Reverse reference	Moves in the count-down direction. Hore and the second sec	N-OT (Reverse Drive Prohibit) signal
Pn000	n.□□□1 Use the direc- tion in which the linear	Forward reference	+       Force reference       Encoder Divided Pulse Outputs         Moves in the count-down direction.       Motor speed       PAO	P-OT (For- ward Drive Prohibit)signal
	encoder counts down as the forward direc- tion.	Reverse reference	Force reference       Encoder Divided Pulse Outputs         Moves in the count-up direction.       Motor speed	N-OT (Reverse Drive 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

# 5.6 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			Speed Po	osition Force	
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 Encoder	Manufacturer	Model	Serial Converter Unit Model	Linear Encoder Pitch [µm]	
	emental	LIDA480	JZDP-H003-DDD-E	20	
		LIDA40	JZDP-J003-DD-E	20	
Incremental		HEIDENHAIN GmbH	LIF480	JZDP-H003-DD-E	1
Incremental		LIF40	JZDP-J003-DD-E	4	
		RGH22B	JZDP-H005-DDD-E	20	
			JZDP-J005-DDD-E	20	

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

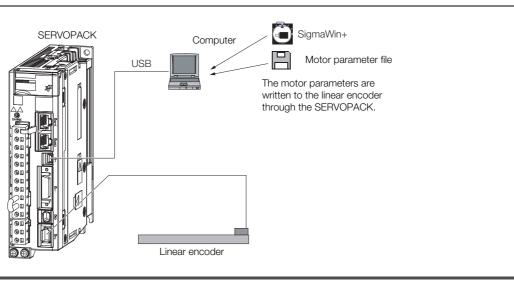
If you do not use a Serial Converter Unit, the linear encoder pitch is automatically set and the setting of the Pn282 is disabled. Refer to the following section for details. Feedback Resolution of Linear Encoder on page 5-47

# 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.



ters If you do not write the correct motor parameters, the Servomotor may run out of control or burning may occur, possibly resulting in equipment damage or fire.



Important

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 Scale Write	Operating Procedure on page 5-20		

### **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. If the data which does not suit the connected motor is rewritten, the motor may not work normally, resulting in motor overrun, etc., and it is very dangerous. 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.

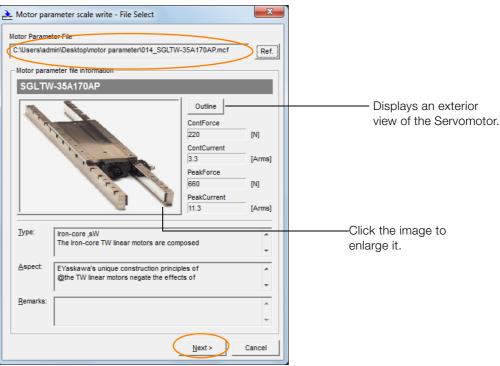
5. Click the Ref. Button.

otor Parameter File	
	Ref.
Motor parameter file information	
-1	

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

Open		- 2
Organize  New folder	jii • 🛄	4
Favorites	Date modified Type	
Desktop	f 5/13/2015 7:39 PM MCF File	
Ubraries Ubraries Ubraries  Music  Pictures Videos		
P Computer		
Win7_JPN (D:)		
File game: 014_SGLTW-35A170AP.mcf	• Motor parameter file(*.mcf) Open Cancel	•

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

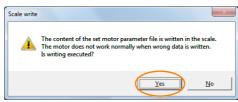


Click the **Cancel** Button to cancel writing the motor parameters to the linear encoder. The Main Window will return.

8. Click the Write Button.

🚵 Motor par	ameter scale write - Sca	le write		×			
The motor parameter is written in the scale. Please confirm the motor which connects is corresponding to the following information.							
- Motor para	meter file information						
SGLTV	/-35A170AP						
Recer	Outline           ContForce           220         [N]           ContCurrent         3.3           [Arms]           PeakForce           660         [N]           PeakCurrent           11.3         [Arms]						
<u>T</u> ype:	Iron-core ,sW The Iron-core TW linear	motors are cor	nposed	^ +			
Aspect:	EYaskawa's unique cor @the TW linear motors			* •			
<u>R</u> emarks:				*			
		< <u>B</u> ack	Complete	Cancel			

9. Click the Yes Button.



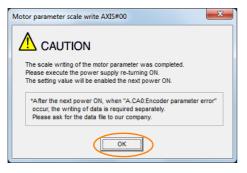
Click the No Button to cancel writing the motor parameters to the linear encoder.

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

#### 10. Click the Complete Button.

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

#### 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.

3.1 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□ (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.		

### Setting Procedure

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

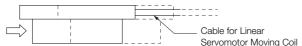
- **1.** Set Pn000 to  $n.\Box\Box\Box\Box$  (Set a phase-A lead as a phase sequence of U, V, and W). This setting is to make following confirmation work easier to understand.
- 2. Select Monitor in the Menu Dialog Box. The Operation Pane will be displayed so that you can check the feedback pulse counter.

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.

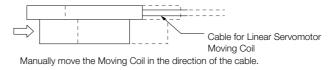
Example

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 Pane 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.

# 5.9 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.  $\Box\Box\Box$  1 (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 (default setting)	Use polarity sensor.	After restart	Setup	
	n.0001	Do not use polarity sensor.			

5.10.1 Restrictions

# 5.10 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
	Each time the control power supply to the SERVOPACK is turned ON	Use the SV_ON (Servo ON) com- mand.
Incremental encoder	(Even after you execute polarity detec- tion, the position of the polarity will be lost the next time the control power supply to the SERVOPACK is turned OFF.)	<ul> <li>Use the polarity detection function of the SigmaWin+.</li> <li>Execute the Fn080 (Polarity Detection) utility function from the Digital Opera- tor.</li> </ul>
	Only for initial setup, or after the SER- VOPACK, linear encoder, or Servomotor has been replaced	<ul> <li>Use the polarity detection function of the SigmaWin+.</li> <li>Execute the Fn080 (Polarity Detection)</li> </ul>
Absolute encoder	(The results of polarity detection is stored in the absolute encoder, so the polarity position is not lost when the control power supply is turned OFF.)	utility function from the Digital Opera- tor. • Use Pn587 (Absolute Linear Encoder Polarity Detection Selection).

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.

# 5.10.1 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.

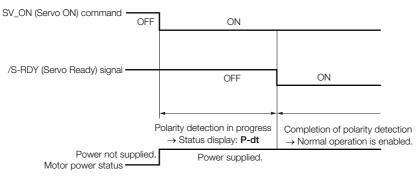
Polarity detection is affected by many factors.
 For example, polarity detection may fail if the mass ratio or friction is too large or the cable tension is too strong.

## 5.10.2 Using the SV\_ON (Servo ON) Command to Perform Polarity Detection

You can use the SV\_ON (Servo ON) command 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 send the SV\_ON (Servo ON) command. As soon as polarity detection is completed, the /S-RDY (Servo Ready) signal will turn ON.

Polarity detection will start simultaneously with execution of the SV\_ON (Servo ON) command. As soon as polarity detection is completed, the /S-RDY will turn ON and the servo will remain ON.



5.10.3 Using a Tool Function to Perform Polarity Detection

# 5.10.3 Using a Tool Function to Perform Polarity Detection

### **Applicable Tools**

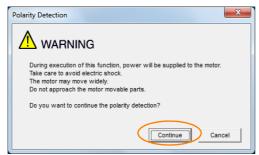
The following table lists the tools that you can use to perform polarity detection.

Tool	Fn No./Function Name	Reference
Digital Operator	Fn080	Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Encoder Setting - Polarity Detection	Jean Operating Procedure on page 5-28

### **Operating Procedure**

Use the following procedure to perform polarity detection.

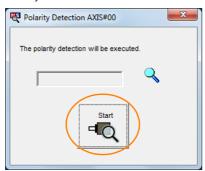
- 1. Click the 🔎 Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- **2.** Select Polarity Detection in the Menu Dialog Box. The Polarity Detection Dialog Box will be displayed.
- 3. Click the Continue Button.



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.

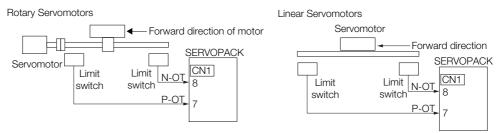
# 5.11 Overtravel and Related Settings

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.

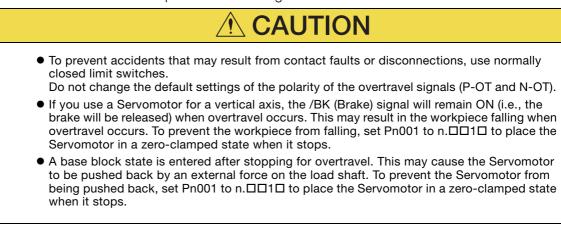
You use the P-OT and N-OT signals to stop the machine by installing limit switches at the positions where you want to stop the machine that is operated by the Servomotor.

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.



5.11.1 Overtravel Signals

# 5.11.1 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			ON	Forward drive is enabled (actual operation).
	P-OT			Forward drive is prohibited (forward overtravel).
			ON	Reverse drive is enabled (actual operation).
	N-OT	CN1-8	OFF	Reverse drive is prohibited (reverse overtravel).

You can operate the Servomotor in the opposite direction during overtravel by inputting a reference.

# 5.11.2 Setting to Enable/Disable Overtravel

You can use  $Pn50A = n.X \square \square \square$  (P-OT (Forward Drive Prohibit) Signal Allocation) and  $Pn50B = n.\square \square \square X$  (N-OT (Reverse Drive Prohibit) Signal Allocation) to enable and disable the overtravel function.

You do not need to wire the overtravel input signals if you are not going to use the overtravel function.

Parameter		Meaning	When Enabled	Classification
Pn50A	n.1□□□ (default setting)	The forward overtravel function is enabled and the P-OT (Forward Drive Prohibit) signal is input from CN1-7.		Octors
	n.8000	The reverse overtravel function is disabled. Forward drive is always enabled.	After restart	
Pn50B	n.□□□2 (default setting)	The reverse overtravel function is enabled and the N-OT (Reverse Drive Prohibit) signal is input from CN1-8.	After restart	Setup
	n.0008	The reverse overtravel function is disabled. Reverse drive is always enabled.		

You can allocate the P-OT and N-OT signals to other connector pins. Refer to the following section for details.

6.1.1 Input Signal Allocations on page 6-4

#### 5.11.3 Motor Stopping Method for Overtravel

# 5.11.3 Motor Stopping Method for Overtravel

You can set the stopping method of the Servomotor when overtravel occurs in  $Pn001 = n.\Box \Box XX$  (Servo OFF or Alarm Group 1 Stopping Method and Overtravel Stopping Method).

Pa	arameter	Motor Stopping Method*	Status after Stopping	When Enabled	Classification
	n.□□00 (default setting)	Dynamic brake			Setup
	n.□□01	5	Coasting	p After restart	
	n.□□02 Coasting	Coasting			
Pn001	n.0010	Deceleration	Zero clamp		
	n.□□2□	according to setting of Pn406	Coasting		
	n.🗆 🗆 3 🗆	Deceleration	Zero clamp		
	n.□□4□ according to setting of Pn30A	Coasting			

\* You cannot decelerate a Servomotor to a stop during torque control. For torque control, the Servomotor will be stopped with the dynamic braking or coast to a stop (according to the setting of Pn001 = n.□□□X (Servo OFF or Alarm Group 1 Stopping Method)), and then the Servomotor will enter a coasting state.

Refer to the following section for information on stopping methods other than those for overtravel.

5.13.1 Stopping Method for Servo OFF on page 5-40

# Stopping the Servomotor by Setting Emergency Stop Torque

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

If  $Pn001 = n.\Box\BoxX\Box$  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			Speed Position		
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.

### Stopping the Servomotor by Setting the Deceleration Time

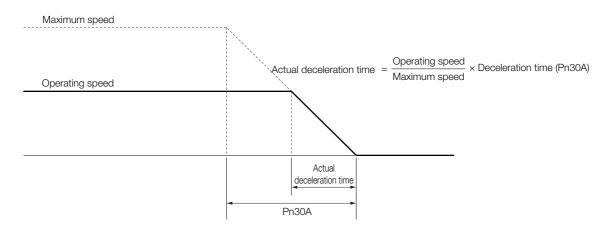
To specify the Servomotor deceleration time and use it to stop the Servomotor, set Pn30A (Deceleration Time for Servo OFF and Forced Stops).

	Deceleration Time f	or Servo OFF and Fo	Speed Position	١	
Pn30A	Setting Range	Setting Unit Default Setting		When Enabled	Classification
	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.

#### 5.11.4 Overtravel Warnings



# 5.11.4 Overtravel Warnings

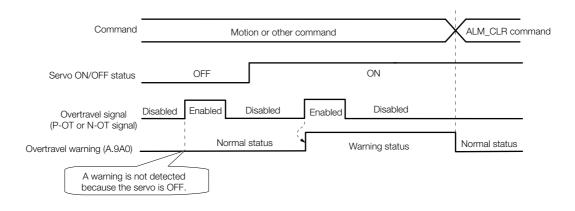
You can set the system to detect an A.9A0 warning (Overtravel) if overtravel occurs while the servo is ON. This allows the SERVOPACK to notify the host controller with a warning even when the overtravel signal is input only momentarily. An alarm occurs only if overtravel occurs while the servo is ON.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

Important	<ol> <li>The occurrence of an A.9A0 warning will not stop the motor or have any affect on host controller motion operations. The next step (e.g., the next motion or command) can be executed even if an overtravel warning exists. However, depending on the processing specifications and programming for warnings in the host controller, operation may be affected when an overtravel warning occurs (e.g., motion may stop or not stop). Confirm the specifications and programming in the host controller.</li> <li>When overtravel occurs, the SERVOPACK will perform stop processing for overtravel. Therefore, when an A.9A0 warning occurs, the Servomotor may not reach the target position specified by the host controller. Check the feedback position to make sure that the axis is stopped at a safe position.</li> </ol>
-----------	---

The following parameter is set for this function.

Parameter		Meaning	When Enabled	Classification
Pn00D	n.0□□□ (default setting)	Do not detect overtravel warnings.	Immediately	Setup
	n.1000	Detect overtravel warnings.		

A timing chart for warning detection is provided below.



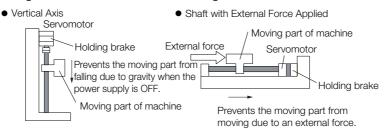
- Information 1. Warnings are detected for overtravel in the same direction as the reference.
  - 2. Warnings are not detected for overtravel in the opposite direction from the reference. Example: A warning will not be output for a forward reference even if the N-OT signal turns ON.
  - 3. A warning 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. You can use the ALM\_CLR (Clear Alarms and Warnings) command to clear the warning regardless of the servo ON/OFF status and overtravel signal status.
  - 6. If you clear the warning with the ALM\_CLR (Clear Alarms and Warnings) command during overtravel status, a warning will not be detected again until the overtravel status is left.
  - 7. An overtravel warning will be detected even when the software limit has been detected.

5.12.1 Brake Operating Sequence

# 5.12 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.

# 5.12.1 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.

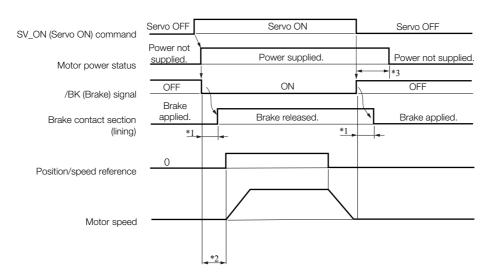


#### Brake Release Delay Time

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.

#### 5.12.2 /BK (Brake) Signal

Model	Voltage	Brake Release Delay Time [ms]	Brake Operation 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	80
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	90
SGM7G-1E		250	80

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.

## 5.12.2 /BK (Brake) Signal

The following settings are for the output signal that controls the brake. You can change the connector pin that is allocated. For details, refer to *Allocating the /BK (Brake) Signal.* 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	/ВК (	CN1-1, CN1-2	ON (closed)	Releases the brake.
			OFF (open)	Activates the brake.

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

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

# Allocating the /BK (Brake) Signal

Set the allocation for the /BK signal in Pn50F =  $n.\Box X \Box \Box$  (/BK (Brake Output) Signal Allocation).

Parameter		Connector Pin No.		Meaning	When	Classification
		+ Pin	- Pin	Meaning	Enabled	Classification
	n.□0□□	-	-	The /BK signal is not used.		
Pn50F	n.□1□□ (default set- ting)	CN1-1	CN1-2	The /BK signal is output from CN1-1 and CN1-2.	After restart	Setup
	n.0200	CN1-23	CN1-24	The /BK signal is output from CN1-23 and CN1-24.		Octup
	n.¤3¤¤	CN1-25	CN1-26	The /BK signal is output from CN1-25 and CN1-26.		



If you allocate more than one signal to the same output connector pin, a logical OR of the signals is output. Allocate the /BK signal to its own output connector pin, i.e., do not use the same output terminal for another signal.

For example, never allocate the /TGON (Rotation Detection) signal and /BK signal to the same output connector pin. If you did so, the /TGON signal would be turned ON by the falling speed on a vertical axis, and the brake would not operate.

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

When the Servomotor is stopped, the /BK signal turns OFF as soon as the SV\_OFF (Servo OFF) command is received. Use the servo OFF delay time (Pn506) to change the timing to turn OFF power supply to the motor after the SV\_OFF command is input.

	Brake Reference-Servo OFF Delay Time			Speed Position	on Torque
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.

SV_OFF (Servo OFF) command input	Servo ON	Servo OFF
/BK signal	ON (Brake released.)	OFF (Brake applied.)
Motor power status	Power supplied.	Power not
		Pn506

 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.

### 5.12.4 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

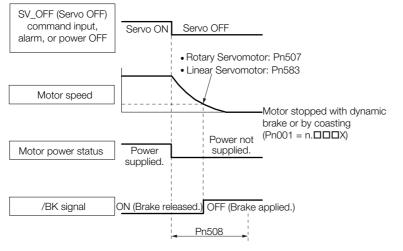
	Brake Reference Ou	utput Speed Level	Speed Positi	on Torque	
Pn507	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min⁻¹	100	Immediately	Setup
	Servo OFF-Brake Reference Waiting Time			Speed Positi	on Torque
Pn508	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 100	10 ms	50	Immediately	Setup

Linear Servomotors

	Brake Reference Ou	utput Speed Level		Speed Positi	on Force
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			Speed Positi	on Force
Pn508	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 100	10 ms	50	Immediately	Setup

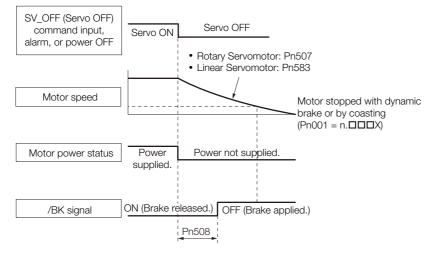
The brake operates when either of the following conditions is satisfied:

• 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



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

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





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.

#### Motor Stopping Methods for Servo OFF and Alarms 5.13

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 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 Important 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 St	Servomotor Stopping Method			
Condition	SGD7S-R70A, -1R6A, -2R8A, -3R8A, -5R5A, -7R6A, -120A, -180A, -200A, -R70F, -R90F, -2R1F, or -2R8F	SGD7S-330A, -470A, -550A, -590A, or -780A			
Main circuit power supply turned OFF before turning OFF the servo	Stopping with	dynamic brake			
Control power supply turned OFF before turning 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.

5.13.1 Stopping Method for Servo OFF

# 5.13.1 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 Stop- ping Method	Status after Servo- motor Stops	When Enabled	Classifi- cation
D-001	n.ロロロ0 (default setting)	Dynamic brake*	Dynamic brake*	A (t	Setup
Pn001	n.0001		Coasting	After restart	
	n.0002	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.

# 5.13.2 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. (2) 12.2.1 List of Alarms on page 12-5

### 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.

5.13.1 Stopping Method for Servo OFF on page 5-40

### 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)

However, during torque control, the group 1 stopping method is always used.

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.

#### 5.13.2 Servomotor Stopping Method for Alarms

	Parameter		Servomotor	Status after	When	
Pn00B	Pn00A	Pn001	Stopping Method	Servomotor Stops	Enabled	Classification
n.□□0□		n.□□□0 (default setting)	Zero-speed stop-	Dynamic brake		
(default setting)	-	n.0001	ping	Coasting		
ootting)		n.0002		Obasting		
~ 0010		n.□□□0 (default setting)	Dynamic brake	Dynamic brake		
n.0010	-	n.0001		Coasting		
		n.□□□2	Coasting		-	
	n.□□□0	n.□□□0 (default setting)	Dynamic brake	Dynamic brake	- After restart	Setup
		n.□□□1		Coasting		
		n.□□□2	Coasting	oodatiing		
	n.□□□1 (default setting)	n.□□□0 (default setting)		Dynamic brake		
		n.0001	Motor is deceler- ated using the torque set in	Coasting		
		n.0002				
n.0020	n.0002	n.□□□0 (default setting)	Pn406 as the maximum torque.			
11.0020		n.□□□1		Coasting		
		n.□□□2			-	
		n.□□□0 (default setting)		Dynamic brake		
	n.□□□3	n.0001		Coasting		
		n.🗆 🗆 🗠 2	Motor is deceler- ated according to	Coasting	_	
	~ 0004	n.□□□0 (default setting)	setting of Pn30A.	Consting		
	n.□□□4	n.0001	-	Coasting		
		n.0002				

Note: 1. The setting of Pn00A is ignored if Pn00B is set to n. DDD or n. DD1.

2. The setting of Pn00A = n. TITX is enabled for position control and speed control. During torque control, the setting of Pn00A = n. TITX will be ignored and only the setting of Pn001 = n. TITX will be used.

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

Stopping the Servomotor by Setting Emergency Stop Torque on page 5-31

4. 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 5-31

5.14.1 Detection Timing for Overload Warnings (A.910)

# 5.14 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.

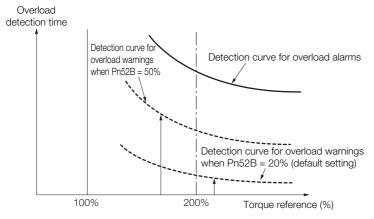
It is designed to prevent Servomotor overheating.

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).

# 5.14.1 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 L	evel	Speed Position Torque		
Pn52B	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 100	1%	20	Immediately	Setup

5.14.2 Detection Timing for Overload Alarms (A.720)

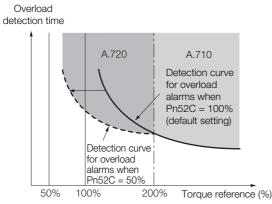
# 5.14.2 Detection Timing for Overload Alarms (A.720)

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 Derati	ng at Motor Overloa	Speed Position Torque		
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)

# 5.15 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.

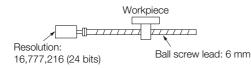
With the electronic gear, one reference unit is equal to the workpiece travel distance per reference pulse input to the SERVOPACK. In other words, if you use the SERVOPACK's electronic gear, pulses can be read as reference units.

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

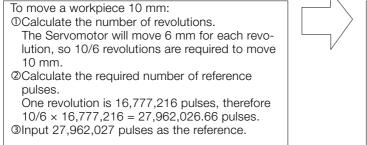
The difference between using and not using the electronic gear is shown below.

#### Rotary Servomotors

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



When the Electronic Gear Is Not Used



Calculating the number of reference pulses for each reference is troublesome.

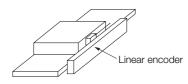
When the Electronic Gear Is Used

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 resolution of the Serial Converter Unit is 256 and that the linear encoder pitch is 20  $\mu$ m.



When the Electronic Gear Is Not Used

To move the load 10 mm:  $10 \times 1000 \div 20 \times 256 = 128,000$ pulses, so 128,000 pulses are input as the reference.



Calculating the number of reference pulses for each reference is troublesome. 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.

5.15.1 Electronic Gear Ratio Settings

# 5.15.1 Electronic Gear Ratio Settings

Set the electronic gear ratio using Pn20E and Pn210.

Pn20E	Electronic Gear Rati	o (Numerator)	Position		
	Setting Range Setting Unit Default Setting		Default Setting	When Enabled	Classification
	1 to 1,073,741,824 1 16		16	After restart	Setup
	Electronic Gear Rati	o (Denominator)	Position		
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

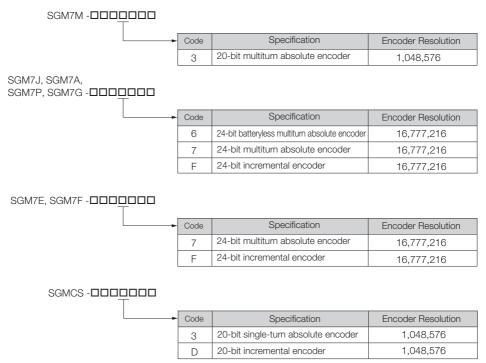
If the gear ratio between the Servomotor shaft and the load is given as n/m, where n is the number of load rotations for m Servomotor shaft rotations, the settings for the electronic gear ratio can be calculated as follows:

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

#### 5.15.1 Electronic Gear Ratio Settings

#### Encoder Resolution

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



SGMCV - DDDDDDD

 Code	Specification	Encoder Resolution	
E	22-bit single-turn absolute encoder	4,194,304	
	22-bit multiturn absolute encoder	4,194,304	

#### 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.

Electronic gear ratio  $\frac{B}{A} = \frac{Pn20E}{Pn210} = \frac{Travel distance per reference unit (reference units) × Linear encoder resolution Linear encoder pitch (the value from the following table)$ 

#### When Using a Serial Converter Unit

Electronic gear ratio  $\frac{B}{A} = \frac{Pn20E}{Pn210} = \frac{Travel distance per reference unit (reference units) \times Resolution of the Serial Converter Unit Linear encoder pitch (setting of Pn282)$ 

#### ■ 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 Linear Encoder	Manufacturer	Linear Encoder Model	Linear Encoder Pitch [µm] <sup>*1</sup>	Relay Device Model between SERVOPACK and Linear Encoder	Resolution	Resolution	
	Dr. JOHANNES		20 -	JZDP-H003- <b>DD</b> -E <sup>*2</sup>	256	0.078 μm	
		LIDA48		JZDP-J003- <b>DDD</b> -E <sup>*2</sup>	4,096	0.0049 μm	
	HEIDENHAIN			JZDP-H003- <b>DDD</b> -E <sup>*2</sup>	256	0.016 µm	
	GmbH	LIF480	4	JZDP-J003- <b>DDD</b> -E*2	4,096	0.00098 µm	
	Renishaw	5.0110.05		JZDP-H005- <b>DDD</b> -E <sup>*2</sup>	256	0.078 μm	
	PLC	RGH22B	20	JZDP-J005- <b>DDD</b> -E <sup>*2</sup>	4,096	0.0049 μm	
		SR75-0000LF*3	80	_	8,192	0.0098 µm	
Incre-		SR75-DDDDDMF	80	_	1,024	0.078 μm	
mental		SR85-0000LF*3	80	_	8,192	0.0098 μm	
	Magnescale	SR85-DDDDDMF	80	_	1,024	0.078 μm	
	Co., Ltd.	SL700 <sup>*3</sup> , SL710 <sup>*3</sup> ,		PL101-RY*4			
		SL720 <sup>*3,</sup> SL730 <sup>*3</sup>	800	MJ620-T13*5	8,192	0.0977 μm	
				MQ10-FLA <sup>*5</sup>		0.0488 µm	
		SQ10	400	MQ10-GLA <sup>*5</sup>	8,192		
	Canon	PH03-36110	128	-	2,048	0.0625 µm	
	Precision Inc.	PH03-36120	128	_	2,048	0.0625 μm	
	Dr. JOHANNES HEIDENHAIN GmbH	LIC4100 Series <sup>*6</sup>	20.48	EIB3391Y*7	4,096	0.005 μm	
		LIC2100 Series <sup>*6</sup>	204.8	EIB3391Y*7	4,096	0.05 μm	
			409.6	EIB3391Y*7	4,096	0.1 μm	
		S LIC4190 Series	40.96	_	4,096	0.01 µm	
			20.48	_	4,096	0.005 μm	
			4.096	_	4,096	0.001 µm	
		LIC3190 Series	40.96	_	4,096	0.01 µm	
		LIC2190 Series	409.6	_	4,096	0.1 µm	
			LIOZ 130 Denes	204.8	-	4,096	0.05 µm
		LC115	40.96	EIB3391Y*7	4,096	0.01 µm	
		LC415	40.96	EIB3391Y*7	4,096	0.01 µm	
Absolute	RSF Elektronik	MC15Y Series	409.6	_	4,096	0.1 µm	
	GmbH		204.8	-	4,096	0.05 µm	
	Mitutoyo	ST781A/ST781AL	256	_	512	0.5 µm	
	Corporation	ST782A/ST782AL	256	_	512	0.5 µm	
		ST783/ST783AL	51.2	_	512	0.1 µm	
			12.8	_	256	0.05 μm	
	Renishaw		25.6	-	256	0.1 μm	
	PLC	EL36Y <b>D</b> 500F <b>DD</b> RL36Y <b>D</b> 050 <b>DDD</b>	128 12.8	-	256 256	0.5 μm 0.05 μm	
		RL36Y00001000	0.256		256 256	0.05 μm 0.001 μm	
			2,000		2,048	0.001 μm	
	RLS d.o.o.	LA11YA Series	2,000		4,096	0.9703 μm 0.4882 μm	
			2,000	_	4,090 8,192	0.4882 μm 0.2441 μm	
			2,000		Continued o	•	

Continued on next page.

#### 5.15.1 Electronic Gear Ratio Settings

Continued from previous page.

Type of Linear Encoder	Manufacturer	Linear Encoder Model	Linear Encoder Pitch [µm] <sup>*1</sup>	Relay Device Model between SERVOPACK and Linear Encoder	Resolution	Resolution
		SR77-0000LF*3	80	_	8,192	0.0098 µm
		SR77-DDDDDMF	80	_	1,024	0.078 μm
		SR87-0000LF*3	80	_	8,192	0.0098 µm
		SR87-DDDDDMF	80	-	1,024	0.078 µm
	Magnescale Co., Ltd.	SQ47/SQ57- SF SQ47/SQ57- TF	20.48	_	4,096	0.005 μm
		SQ47/SQ57- AF SQ47/SQ57- FF	40.96	_	4,096	0.01 µm
Absolute	Fagor Automation S. Coop.	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
		S2AK208	20	-	256	0.078 µm
		SV2AK208	20	-	256	0.078 µm
		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 Precision Inc.	PH03-36E00	128	_	2,048	0.0625 μm

\*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. 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 6-25

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

\*5. This is the model of the Interpolator.

\*6. 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.

\*7. This is the model of the Interface Unit.

#### 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.

Linear encoder pitch

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

5.15.2 Electronic Gear Ratio Setting Examples

## 5.15.2 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 Load shaft Incoder: Ball screw lead: 24 bits 6 mm	Reference unit: 0.01° Gear ratio: 1/100 Load shaft Encoder: 24 bits	Reference unit: 0.005 mm Load shaft Gear ratio: Pulley dia.: 1/50 Pulley dia.: 100 mm Encoder: 24 bits	
1	Machine 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 (Pulley circumference: 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 Load Shaft Revolution (Reference Units)	6 mm/0.001 mm = 6,000	360°/0.01° = 36,000	314 mm/0.005 mm = 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	
Description	Reference unit: 0.02 mm (20 µm) Forward direction	
Linear encoder pitch	0.02 mm (20 μm)	
Reference Unit	0.001 mm (1 μm)	
Electronic Gear Ratio	$\frac{B}{A} = \frac{1 (\mu m)}{20 (\mu m)} \times 256$	
Setting Parameters	Pn20E: 256 Pn210: 20	
	Linear encoder pitch Reference Unit Electronic Gear Ratio	

5.16.1 Precautions on Resetting

## 5.16 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.

## 5.16.1 Precautions on Resetting

- You cannot use the ALM\_CLR (Clear Alarm) command from the SERVOPACK to clear the A.810 alarm (Encoder Backup Alarm) or the A.820 alarm (Encoder Checksum Alarm). Always use 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.

### 5.16.2 Preparations

Always check the following before you reset an absolute encoder.

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

5.16.3 Applicable Tools

## 5.16.3 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 Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Encoder Setting – Reset Absolute Encoder	5.16.4 Operating Procedure on page 5-51

Information You can reset the absolute encoder using the MEM\_WR (Write Memory) command. Refer to the following manual for information on the MEM\_WR (Write Memory) command.

Ω-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

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

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

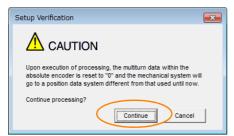
5. Click the Execute setting Button.

Absolute encoder - Setup AXIS#00	×	
Perform absolute encoder setup under the following circumstances: 1. At first start-up of the machine 2. When an "encoder backup alarm" has been generated 3. After the Servopack power has been turned OFF and the encoder cable removed		
Absolute encoder setup can only be performed with the Restart power after setup processing is complete.		
Alarm name A.810 : Encoder Backup Alarm		
Execute setting		

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

#### 5.16.4 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. Tum the Servo UFF 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 Multiturn amount in the absolute encoder has been to "0". Be sure to reset the mechanical system to "0" after restarting 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.

5.17.1 Absolute Encoder Origin Offset

## 5.17 Setting the Origin of the Absolute Encoder

## 5.17.1 Absolute Encoder Origin Offset

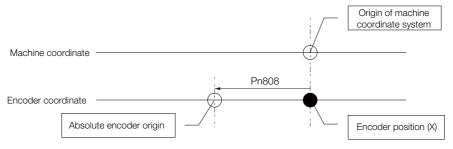
The origin offset of the absolute encoder is a correction that is used to set the origin of the machine coordinate system in addition to the origin of the absolute encoder. Set the offset between the absolute encoder origin and the machine coordinate system origin in Pn808 (Absolute Encoder Origin Offset).

After the SENS\_ON (Absolute Data Request) command is received, the position in the machine coordinate system (APOS) is set based on the absolute encoder position data and the setting of Pn808.

	Absolute Encoder Origin Offset			Position	
Pn808	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
1 11000	-1,073,741,823 to 1,073,741,823	1 reference unit	0	Immediately	Setup



If the encoder position (X) is at the origin of the machine coordinate system (0), then Pn808 would be set to -X.



## 5.17.2 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



 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.

 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.

5.17.2 Setting the Origin of the Absolute Linear Encoder

### 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.

### **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 Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Encoder Setting - Zero Point Position Setting	Operating Procedure on page 5-54

### **Operating Procedure**

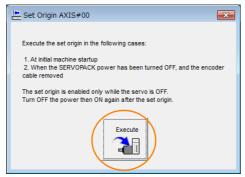
Use the following procedure to set the origin of an absolute linear encoder.

- 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.

Set Origin
The set origin sets the current position to the connected absolute linear scale as the zero-point position. Always refer to the user's manual before executing this function. 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 defined mechanical system will change to a different coordinate system. Operating the machine in this state is extremely dangerous. Failure to observe this warning may result in personal injury and/or damage to the machine. 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: a. Servo OFF b. The polarity detection has been completed. 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. Always turn OFF the SERVOPACK power then ON again after the set origin.
Do you want to continue the set origin?
Continue

#### 5.17.2 Setting the Origin of the Absolute Linear Encoder

4. Click the Execute Button.



5. Click the Continue Button.

Set Origin	×
Executing the set origin will clear the ab absolute linear scale to 0 and the previo change to a different coordinate system	usly defined mechanical system will
Do you want to continue the set origin?	
	Continue

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

6. Click the OK Button.

Set Origin
Zero-point position setting has been executed. The movement amount saved in the encoder has been reset to 0 (zero). Always turn the power to the Servopack off and then on again after execution of this function.
When using a linear motor without a hall sensor, execute polarity detection after turning the power off and then on again
ОК

- 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.
   3.10 Polarity Detection on page 5-26

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

## 5.18 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.

	Regenerative Resiste	or Capacity		Speed Pos	sition Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
Pn600	0 to SERVOPACK's maximum applica- ble motor capacity	10 W	0	Immediately	Setup
	Regenerative Resiste	or Resistance		Speed Pos	sition Torque
Pn603	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	10 mΩ	0	Immediately	Setup

There is a risk of personal injury or fire.

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.

5.19.1 Setting the Communications Interface Compatibility Selection

## 5.19 Σ-V Compatible Function and Settings

The  $\Sigma$ -V compatible function allows you to easily replace a  $\Sigma$ -V-Series SERVOPACK with a  $\Sigma$ -7-Series SERVOPACK in an existing servo system.

As long as MECHATROLINK communications are used to communicate with the SERVOPACK from the host controller, the  $\Sigma$ -7-Series SERVOPACK can be used in the same way as the replaced  $\Sigma$ -V-Series SERVOPACK.

**Ìmportant** 

Important

If you replace a  $\Sigma$ -V-Series SERVOPACK with a  $\Sigma$ -7-Series SERVOPACK, you must also replace the previous Servomotor with a Servomotor that is compatible with the  $\Sigma$ -7-Series SERVOPACK. You cannot use a  $\Sigma$ -V-Series Servomotor even if you use the  $\Sigma$ -V compatible function.

# 5.19.1 Setting the Communications Interface Compatibility Selection

If you use MECHATROLINK communications to communicate with a  $\Sigma$ -7-Series SERVOPACK as if it were a  $\Sigma$ -V-Series SERVOPACK, set Pn040 to n. $\Box\Box\Box$ 1.

- 1. When you set Pn040 to n.□□□1, you cannot use the following functions from the SigmaWin+.
  - Mechanical Analysis
  - Moment of Inertia Estimation
  - Tracing function when connecting through a controller
  - If you set Pn040 to n. DDD1, Pn040 will no longer be displayed on the SigmaWin+, so you will not be able to change the setting. To change the setting of Pn040, use a Digital Operator or initialize the parameters.
     Before to the following section for information on initializing parameters.
    - Refer to the following section for information on initializing parameters.
    - 5.1.5 Initializing Parameter Settings on page 5-11

Parameter		Description	When Enabled	Classification
n.□□□0 Pn040 (default setting)		Perform $\Sigma$ -7 communications.	After restart Setup	
	n.□□□1	Perform $\Sigma$ -V communications.		

If Pn040 is set to n. DDD1, the information read by the ID\_RD command will be as follows:

- Device code: 0220000h
- Device version: 00FF
- Minimum communications cycle: 250000 (250 µs) [unit: 0.01 µs]
- Main device name for a Rotary Servomotor: SGDV-DDD21A
- Main device name for a Linear Servomotor: SGDV-DDD25A

Refer to the following manual for IR\_RD command details.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

5.19.2 Setting the Encoder Resolution Compatibility Selection

## 5.19.2 Setting the Encoder Resolution Compatibility Selection

If an SGM7J, SGM7A, SGM7P, or SGM7G, SGM7E, or SGM7F Servomotor is connected to a  $\Sigma$ -7-Series SERVOPACK and the encoder is set to operate at a resolution of 20 bits, set Pn040 to n. $\Box\Box$ 1 $\Box$ .

Parameter		Description	When Enabled	Classification
	n.□□0□ (default setting)	Use the encoder resolution of the Servomotor.		
Pn040	n.0010	Use a resolution of 20 bits when con- nected to an SGM7J, SGM7A, SGM7P, SGM7G, SGM7E, or SGM7F Servomotor.	After restart	Setup

# 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 Signal Allocations

## 6.1 I/O Signal Allocations

Functions are allocated to the pins on the I/O signal connector (CN1) in advance. You can change the allocations and the polarity for some of the connector pins. Function allocations and polarity settings are made with parameters.

This section describes the I/O signal allocations.

## 6.1.1 Input Signal Allocations



 If you change the default polarity settings for the P-OT (Forward Drive Prohibit) or N-OT (Reverse Drive Prohibit) signal, the overtravel function will not operate if there are signal line disconnections or other problems. If you must change the polarity of one of these signals, verify operation and make sure that no safety problems will exist.

 If you allocate two or more signals to the same input circuit, a logical OR of the inputs will be used and all of the allocated signals will operate accordingly. This may result in unexpected operation.

The input signals that you can allocate to the pins on the I/O signal connector (CN1) and the related parameters are given in the following table.

Input Signal	Input Signal Name	Parameter
P-OT	Forward Drive Prohibit	Pn50A = n.X□□□
N-OT	Reverse Drive Prohibit	Pn50B = n.□□□X
/P-CL	Forward External Torque Limit	Pn50B = n.□X□□
/N-CL	Reverse External Torque Limit	Pn50B = n.X□□□
/DEC	Origin Return Deceleration Switch Input	Pn511 = n.□□□X
/EXT1	External Latch Input 1	Pn511 = n.□□X□
/EXT2	External Latch Input 2	Pn511 = n.□X□□
/EXT3	External Latch Input 3	Pn511 = n.X□□□
FSTP	Forced Stop	Pn516 = n.□□□X

### Relationship between Parameter Settings, Allocated Pins, and Polarities

The following table shows the relationship between the input signal parameter settings, the pins on the I/O signal connector (CN1), and polarities.

Parameter Setting	Pin No.	Description	
0	13		
1	7	+24 V	
2	8		
3	9	A reverse signal (a signal with "/" before the signal abbreviation, such as the /	
4	10	P-CL signal) is active when the contacts are ON (closed).	
5	11	A signal that does not have "/" before the signal abbreviation (such as the P- OT signal) is active when the contacts are OFF (open).	
6	12		
7	_	The input signal is not allocated to a connector pin and it is always active. If the signal is processed on a signal edge, then it is always inactive.	
8	_	The input signal is not allocated to a connector pin and it is always inactive. Set the parameter to 8 if the signal is not used.	

Continued on next page.

6.1.2 Output Signal Allocations

Continued from previous page.

Parameter Setting	Pin No.	Description
9	13	
A	7	+24 V
В	8	
С	9	A reverse signal (a signal with "/" before the signal abbreviation, such as the /
D	10	P-CL signal) is active when the contacts are OFF (open).
E	11	A signal that does not have "/" before the signal abbreviation (such as the P- OT signal) is active when the contacts are ON (closed).
F	12	

Note: 1. You cannot allocate the /EXT1 to /EXT3 (External Latch Inputs 1 to 3) signals to pins 10 to 12 on the I/O signal connector (CN1).

2. Refer to the following section for details on input signal parameter settings.

13.1.2 List of Servo Parameters on page 13-3

### Example of Changing Input Signal Allocations

The following example shows reversing the P-OT (Forward Drive Prohibit) signal allocated to CN1-7 and the /DEC (Origin Return Deceleration Switch) signal allocated to CN1-9.

 $Pn50A = n.1 \square \square 1$  $Pn511 = n.\Box\Box\Box$  Before change ↓  $\downarrow$  $Pn50A = n.3\Box\Box1$  $Pn511 = n.\Box\Box\Box1$  After change

Refer to the following section for the parameter setting procedure. 5.1.3 Parameter Setting Methods on page 5-6

## Confirming the Allocation Status of Input Signals

You can confirm the allocation status of input signals with the I/O Signal Allocations Window of the SigmaWin+. Refer to the following section for details. 9.2.3 I/O Signals Status Monitor on page 9-5

#### 6.1.2 **Output Signal Allocations**

You can allocate the desired output signals to pins 1, 2, and 23 to 26 on the I/O signal connector (CN1). You set the allocations in the following parameters: Pn50E, Pn50F, Pn510, and Pn514.

However, you can also force outputs on the servo command I/O signal (SVCMD IO) command.

Information is provided here for when signals are allocated with Pn50E, Pn50F, Pn510, and Pn514.

Refer to the following section for details on forcing outputs with the SVCMD\_IO command. 6.1.2 Output Signal Allocations - Forcing Outputs with MECHATROLINK-III Commands on page 6-7



- The signals that are not detected are considered to be OFF. For example, the /COIN (Positioning Completion) signal is considered to be OFF during speed control.
- Reversing the polarity of the /BK (Brake) signal, i.e., changing it to positive logic, will prevent the holding brake from operating if its signal line is disconnected. If you must change the polarity of this signal, verify operation and make sure that no safety problems will exist.
  - If you allocate more than one signal to the same output circuit, a logical OR of the signals will be output.

#### 6.1.2 Output Signal Allocations

Output Signals	Output Signal Name	Parameter
/COIN	Positioning Completion	Pn50E = n.□□□X
/V-CMP	Speed Coincidence Detection	Pn50E = n.□□X□
/TGON	Rotation Detection	Pn50E = n.□X□□
/S-RDY	Servo Ready	Pn50E = n.X <b>DDD</b>
/CLT	Torque Limit Detection	Pn50F = n.□□□X
/VLT	Speed Limit Detection	Pn50F = n.□□X□
/BK	Brake	Pn50F = n.□X□□
/WARN	Warning	Pn50F = n.X□□□
/NEAR	Near	Pn510 = n.□□□X
/PM	Preventative Maintenance	Pn514 = n.□X□□

The following table shows the relationship between the parameters and the output signals that can be allocated to the pins on the I/O signal connector (CN1).

### Relationship between Parameter Settings and Allocated Pin Numbers

The following table shows the relationship between the output signal parameter settings and the pin numbers on the I/O signal connector (CN1).

Parameter Setting	Pin No.	Description
0	_	Disable (signal output is not used)
1	1 or 2	Output the allocated signal from the CN1-1 or CN1-2 output terminal.
2	23 or 24	Output the allocated signal from the CN1-23 or CN1-24 output terminal.
3	25 or 26	Output the allocated signal from the CN1-25 or CN1-26 output terminal.
4 to 6	_	Reserved parameter (Do not change.)

### ♦ Output Signal Polarity Switching

The polarity of the output signal is switched using Pn512.

Parameter				
Parameter No.		Setting Value	Pin No.	Description
	n.🗆🗆 X	0	1 or 2	The signal is not inverted.
		1	T OF Z	The signal is inverted.
Pn512	n.¤¤X¤	0	23 or 24	The signal is not inverted.
Photz		1		The signal is inverted.
		0	25 or 26	The signal is not inverted.
	n.¤X¤¤	1	25 or 26	The signal is inverted.

### **Example of Changing Output Signal Allocations**

The following example shows disabling the /COIN (Positioning Completion) signal allocated to CN1-25 and CN1-26 and allocating the /SRDY (Servo Ready) signal.

 $Pn50E = n.0 \square \square 3$  Before change

 $\downarrow$ 

 $Pn50E = n.3 \square \square 0$  After change

Refer to the following section for the parameter setting procedure. *5.1.3 Parameter Setting Methods* on page 5-6

6.1.2 Output Signal Allocations

## Confirming the Allocation Status of Output Signals

You can confirm the allocation status of output signals with the I/O Signal Allocations Window of the SigmaWin+. Refer to the following section for details.

## Forcing Outputs with MECHATROLINK-III Commands

You can use the servo command I/O signal (SVCMD\_IO) command through MECHATROLINK-III communications to force outputs on general-purpose sequence output 1 (SO1) to general-purpose sequence output 3 (SO3).

Use Pn56A =  $n.\Box XXX$  to set the output signal reference method for SO1 to SO3.

Refer to the following manual for detailed information on the servo command I/O signal (SVCM-D\_IO) command.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

Par	ameter	Description	When Enabled	Classification
Pn56A	n.□□□0 (default set- ting)	Output parameter-assigned SO1 signal.	signal.	
	n.0001	Output OR of parameter-assigned SO1 signal and signal set by SVCMD_IO.	After restart	Setup
	n.□□0□ (default set- ting)	Output parameter-assigned SO2 signal.		
	n.0010	Output OR of parameter-assigned SO2 signal and signal set by SVCMD_IO.		
	n.□0□□ (default set- ting)	Output parameter-assigned SO3 signal.		
	n.□1□□ Output OR of parameter-assigned SO3 signal and signal set by SVCMD_IO.			

Example

If you change the setting of Pn56A from the default setting to n. DDD1, an OR of the /BK signal and the signal that is set with the servo command I/O signal (SVCMD\_IO) command will be output.



To output only the signal that is set with the servo command I/O signal (SVCMD\_IO) command on SO1 to SO3, disable the signal that is allocated with the parameter (i.e., set it to not use the signal).

6.1.3 ALM (Servo Alarm) Signal

## 6.1.3 ALM (Servo Alarm) Signal

This signal is output when the SERVOPACK detects an error.

W 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	
	ALIVI	CINT-S and CINT-4	OFF (open)	SERVOPACK alarm

### Alarm Reset Methods

Refer to the following section for information on the alarm reset methods. *12.2.3 Resetting Alarms* on page 12-42

## 6.1.4 /WARN (Warning) Signal

Both alarms and warnings are generated by the SERVOPACK. Alarms indicate errors in the SERVOPACK for which operation must be stopped immediately. Warnings indicate situations that may results in alarms but for which stopping operation is not yet necessary.

The /WARN (Warning) signal indicates that a condition exists that may result in an alarm.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output		Must be allocated.	ON (closed)	Warning
	/ / / / / / / / / / / /		OFF (open)	Normal status

Note: You must allocate the /WARN signal to use it. Use Pn50F = n.XDDD (/WARN (Warning Output) Signal Allocation) to allocate the signal to a connector pin. Refer to the following section for details.

6.1.2 Output Signal Allocations on page 6-5

## 6.1.5 /TGON (Rotation Detection) Signal

The /TGON signal indicates that the Servomotor is operating.

This signal is output when the shaft of the Servomotor rotates at the setting of Pn502 (Rotation Detection Level) or faster or the setting of Pn581 (Zero Speed Level) or faster.

Туре	Signal	Connector Pin No.	Signal Status	Servomotor	Meaning
Output	/TGON	Must be allocated.		Rotary Servomotors	The Servomotor is operating at the setting of Pn502 or faster.
			ON (closed)	Linear Servomotors	The Servomotor is operating at the setting of Pn581 or faster.
			OFF (open)	Rotary Servomotors	The Servomotor is operating at a speed that is slower than the setting of Pn502.
				Linear Servomotors	The Servomotor is operating at a speed that is slower than the setting of Pn581.

## Setting the Rotation Detection Level

Use the following parameter to set the speed detection level at which to output the /TGON signal.

• Rotary Servomotors

	Rotation Detection I	_evel	Speed Position	Torque	
Pn502	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 10,000	1 min <sup>-1</sup>	20	Immediately	Setup

#### Linear Servomotors

	Zero Speed Level		Speed Position	n Force	
Pn581	Setting Range	Setting Unit Default Setting		When Enabled	Classification
	1 to 10,000	1 mm/s	20	Immediately	Setup

6.1.6 /S-RDY (Servo Ready) Signal

## 6.1.6 /S-RDY (Servo Ready) Signal

The /S-RDY (Servo Ready) signal turns ON when the SERVOPACK is ready to accept the SV\_ON (Servo ON) command.

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.
- There is no forced stop state (FSTP).
- If an absolute encoder is used, the SENS\_ON (Turn ON Sensor) command has been input.
- If a Servomotor without a polarity sensor is used, polarity detection has been completed. \*
- If an absolute encoder is used, the output of the position data from the absolute encoder to the host controller must have been completed if the SENS\_ON (Turn ON Sensor) command is being input.

<sup>\*</sup> Do not include this condition if the SV\_ON (Servo ON) command is input for the first time after the control power supply was turned ON. In that case, when the first SV\_ON command is input, polarity detection is started immediately and the /S-RDY signal turns ON at the completion of polarity detection.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output	/S-RDY	Must be allocated.	ON (closed)	Ready to receive the SV_ON (Servo ON) com- mand.
	73-nD1		OFF (open)	Not ready to receive the SV_ON (Servo ON) command.

Note: 1. You must allocate the /S-RDY signal to use it. Use Pn50E = n.X□□□ (/S-RDY (Servo Ready) Signal Allocation) to allocate the signal to a connector pin. Refer to the following section for details.

*G* 6.1.2 Output Signal Allocations on page 6-5

2. Refer to the following section for information on the hard wire base block and the /S-RDY signal.

6.1.7 /V-CMP (Speed Coincidence Detection) Signal

## 6.1.7 /V-CMP (Speed Coincidence Detection) Signal

The /V-CMP (Speed Coincidence Output) signal is output when the Servomotor speed is the same as the reference speed. This signal is used, for example, to interlock the SERVOPACK and the host controller. You can use this output signal only during speed control.

The /V-CMP signal is described in the following table.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output		P Must be allocated.	ON (closed)	The speed coincides.
Output /V-CMP			OFF (open)	The speed does not coincide.

Note: You must allocate the /V-CMP signal to use it. Use Pn50E = n.  $\Box \Box X \Box$  (/V-CMP (Speed Coincidence Detection Output) Signal Allocation) to allocate the signal to connector pins.

- Refer to the following section for details on allocations.
- 6.1.2 Output Signal Allocations on page 6-5

You can set the speed detection width for the /V-CMP signal in Pn503 (Speed Coincidence Detection Signal Output Width) for a Rotary Servomotor or in Pn582 (Speed Coincidence Detection Signal Output Width) for a Linear Servomotor.

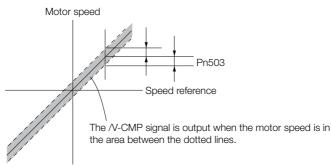
Rotary Servomotors

	Speed Coincidence	Detection Signal Ou	Speed		
Pn503	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1 min <sup>-1</sup>	10	Immediately	Setup

The signal is output when the difference between the reference speed and motor speed is equal or less than the setting.



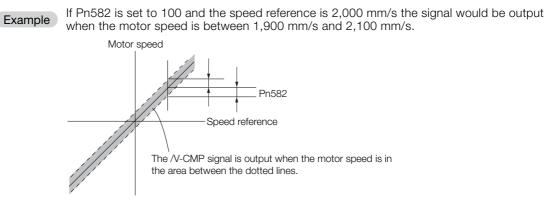
If Pn503 is set to 100 and the speed reference is 2,000 min<sup>-1</sup>, the signal would be output when the motor speed is between 1,900 min<sup>-1</sup> and 2,100 min<sup>-1</sup>.



• Linear Servomotors

	Speed Coincidence	Detection Signal Ou	Speed		
Pn582	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1 mm/s	10	Immediately	Setup

The signal is output when the difference between the reference speed and motor speed is equal or less than the setting.



6.1.8 /COIN (Positioning Completion) Signal

## 6.1.8 /COIN (Positioning Completion) Signal

The /COIN (Positioning Completion) signal indicates that Servomotor positioning has been completed during position control.

The /COIN signal is output when the difference between the reference position output by the host controller and the current position of the Servomotor (i.e., the position deviation as given by the value of the deviation counter) is equal to or less than the setting of the positioning completed width (Pn522).

Use this signal to check the completion of positioning from the host controller.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output /COIN	Must be allocated	ON (closed)	Positioning has been completed.	
		Must be allocated.	OFF (open)	Positioning has not been completed.

Note: You must allocate the /COIN signal to use it. Use Pn50E = n. DDDX (/COIN (Positioning Completion Output) Signal Allocation) to allocate the signal to connector pins. Refer to the following section for details on allocations.

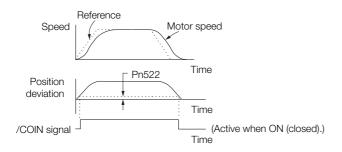
6.1.2 Output Signal Allocations on page 6-5

## Setting the Positioning Completed Width

The /COIN signal is output when the difference between the reference position and the current position (i.e., the position deviation as given by the value of the deviation counter) is equal to or less than the setting of the positioning completed width (Pn522).

	Positioning Complet	ed Width	Position		
Pn522	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,073,741,824	1 reference unit	7	Immediately	Setup

The setting of the positioning completed width has no effect on final positioning accuracy.



Note: If the parameter is set to a value that is too large, the /COIN signal may be output when the position deviation is low during a low-speed operation. If that occurs, reduce the setting until the signal is no longer output.

6.1.9 /NEAR (Near) Signal

# Setting the Output Timing of the /COIN (Positioning Completion Output) Signal

You can add a reference input condition to the output conditions for the /COIN signal to change the signal output timing.

If the position deviation is always low and a narrow positioning completed width is used, change the setting of  $Pn207 = n.X \square \square \square$  (/COIN (Positioning Completion Output) Signal Output Timing) to change output timing for the /COIN signal.

Parameter		Description	When Enabled	Classification
Pn207	n.0□□□ (default setting)	Output the /COIN signal when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width).		
	n. 1000	Output the /COIN signal when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width) and the reference after the position reference filter is 0.	After restart	Setup
	n. 2000	Output the /COIN signal when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width) and the reference input is 0.		

## 6.1.9 /NEAR (Near) Signal

The /NEAR (Near) signal indicates when positioning completion is being approached.

The host controller receives the NEAR signal before it receives the /COIN (Positioning Completion) signal, it can start preparations for the operating sequence to use after positioning has been completed. This allows you to reduce the time required for operation when positioning is completed.

The NEAR signal is generally used in combination with the /COIN signal.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output	/NEAR	Must be allocated.	ON (closed)	The Servomotor has reached a point near to positioning completion.
			OFF (open)	The Servomotor has not reached a point near to positioning completion.

Note: You must allocate the /NEAR signal to use it. Use Pn510 = n.  $\square$  (/NEAR (Near) Signal Allocation) to allocate the signal to a connector pin. Refer to the following section for details.

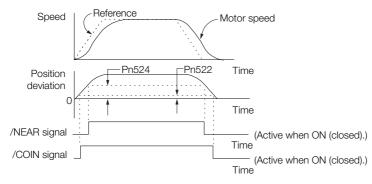
3 6.1.2 Output Signal Allocations on page 6-5

## /NEAR (Near) Signal Setting

You set the condition for outputting the /NEAR (Near) signal (i.e., the near signal width) in Pn524 (Near Signal Width). The /NEAR signal is output when the difference between the reference position and the current position (i.e., the position deviation as given by the value of the deviation counter) is equal to or less than the setting of the near signal width (Pn524).

	Near Signal Width			Position	
Pn524	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,824	1 reference unit	1,073,741,824	Immediately	Setup

#### 6.1.10 Speed Limit during Torque Control



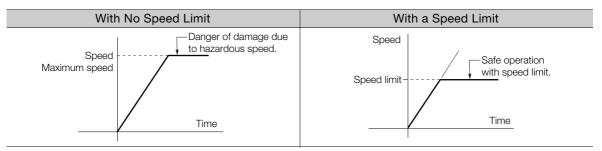
Note: Normally, set Pn524 to a value that is larger than the setting of Pn522 (Positioning Completed Width).

## 6.1.10 Speed Limit during Torque Control

You can limit the speed of the Servomotor to protect the machine.

When you use a Servomotor for torque control, the Servomotor is controlled to output the specified torque, but the motor speed is not controlled. Therefore, if a reference torque is input that is larger than the machine torque, the speed of the Servomotor may increase greatly. If that may occur, use this function to limit the speed.

Note: The actual limit of Servomotor speed depends on the load conditions on the Servomotor.



### /VLT (Speed Limit Detection) Signal

The signal that is output when the motor speed is being limited by the speed limit is described in the following table.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
			ON (closed)	The Servomotor speed is being limited.
Output	/VLT	Must be allocated.	OFF (open)	The Servomotor speed is not being lim- ited.

Note: You must allocate the /VLT signal to use it. Use Pn50F = n.□□X□ (/VLT (Speed Limit Detection) Signal Allocation) to allocate the signal to a connector pin. Refer to the following section for details.

3 6.1.2 Output Signal Allocations on page 6-5

### Selecting the Speed Limit

The smaller of the external speed limit and internal speed limit will be used.

Parameter		Meaning	When Enabled	Classification
	n.🗆 🗆 🛛 🗆	Reserved parameter (Do not change.)		
Pn002	n.ロロ1ロ (default setting)	Use the speed limit from the VLIM (Limit Speed for Torque Control) command as the speed limit. (Use external speed limiting.)	After restart	Setup

### ◆ Internal Speed Limiting

Set the speed limit for the motor in Pn407 (Speed Limit during Torque Control) or Pn480 (Speed Limit during Force Control).

Also set  $Pn408 = n.\square\squareX\square$  (Speed Limit Selection) to specify using the maximum motor speed or the overspeed alarm detection speed as the speed limit. Select the overspeed alarm detection speed to limit the speed to the equivalent of the maximum motor speed.

Parameter		Meaning	When Enabled	Classification
Pn408	n.□□0□ (default setting)	Use the smaller of the maximum motor speed and the setting of Pn407 or Pn480 as the speed limit.	After restart	Cotup
	n.0010	Use the smaller of the overspeed alarm detec- tion speed and the setting of Pn407 or Pn480 as the speed limit.	Aller restart	Setup

Note: If you are using a Rotary Servomotor, set Pn407 (Speed Limit during Torque Control). If you are using a Linear Servomotor, set Pn480 (Speed Limit during Force Control).

Rotary Servomotors

	Speed Limit during	Torque			
Pn407	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min <sup>-1</sup>	10000	Immediately	Setup

### Linear Servomotors

	Speed Limit during I	Force			
Pn480	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	10000	Immediately	Setup

Note: If the parameter setting exceeds the maximum speed of the Servomotor, the Servomotor's maximum speed or the overspeed alarm detection speed will be used.

### External Speed Limiting

The motor speed will be limited by VLIM (Limit Speed for Torque Control). Refer to the following manual for details.

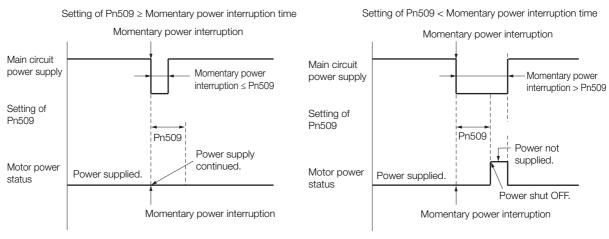
Ω Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

## 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 In	terruption Hold Time	Speed Position	n Torque	
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  $Pn008 = n.\Box\Box X\Box$  (Function Selection for Undervoltage) to specify whether the function is executed by the host controller or by the SERVOPACK.

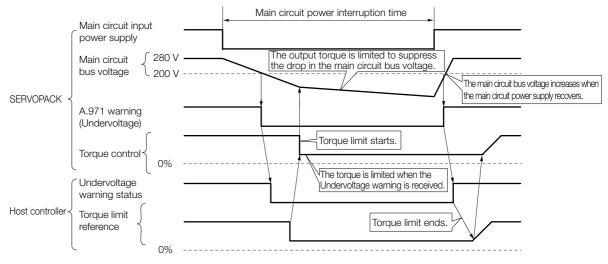
The default setting (Pn008 =  $n.\Box\Box0\Box$ ) disables detection of an A.971 warning (Undervoltage).

F	Parameter	Meaning	When Enabled	Classification
	n.□□0□ (default setting)	Do not detect undervoltage warning.		
Pn008	n.0010	Detect undervoltage warning and limit torque at host controller.		Setup
	n.0020	Detect undervoltage warning and limit torque with Pn424 and Pn425 (i.e., only in SERVOPACK).		·

### • Execution with the Host Controller (Pn008 = $n.\Box\Box1\Box$ )

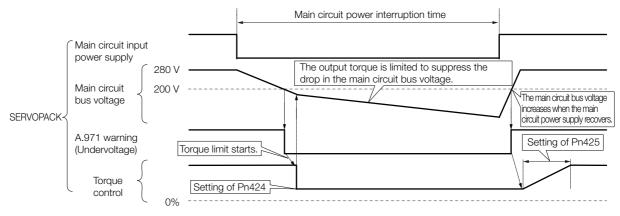
The host controller limits the torque in response to an A.971 warning (Undervoltage).

The host controller removes the torque limit after the Undervoltage warning is cleared.



### ◆ Execution with the SERVOPACK (Pn008 = n.□□2□)

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.



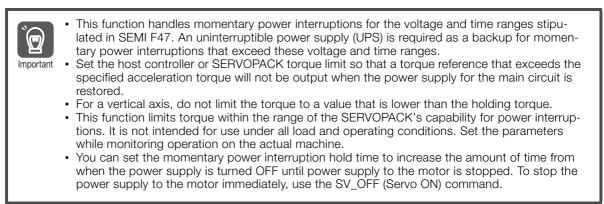
### **Related Parameters**

The following parameters are related to the SEMI F47 function.

	Torque Limit at Mair	n Circuit Voltage Dro	Speed Position Torque		
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			Speed Position Torque	
Pn425	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 1,000	1 ms	100	Immediately	Setup
	Momentary Power Interruption Hold Time			Speed Position	Torque
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.



## 6.4 Setting the Motor Maximum Speed

You can set the maximum speed of the Servomotor with the following parameter. • Rotary Servomotors

	Maximum Motor Sp	eed	Speed Posit	ion Torque	
Pn316	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	1 min <sup>-1</sup>	10,000	After restart	Setup

Linear Servomotors

	Maximum Motor Sp	beed	Speed Position Force		
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 6-20

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)
  - Ω Σ-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 following table describes the signals and output phase forms.

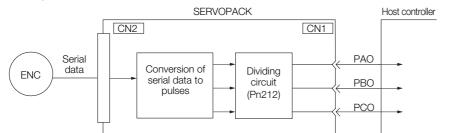
## 6.5.1 Encoder Divided Pulse Output Signals

Туре	Signal	Connector Pin No.	Name	Remarks		
Output	PAO	CN1-17	Encoder Divided Pulse Output,	Rotary Servomotors     These encoder divided pulse     output pins output the number		
	/PAO	CN1-18	Phase A	of pulses per Servomotor reso- lution that is set in Pn212 (Number of Encoder Output		
	РВО	CN1-19		<ul> <li>Pulses). The phase difference between phase A and phase B is an electric angle of 90°.</li> <li>Linear Servomotors These encoder divided pulse output pins output pulses at the resolution that is set in Pn281 (Encoder Output Resolution). The phase difference between phase A and phase B is an electric angle of 90°.</li> <li>These pins output one pulse every Servomotor rotation.</li> </ul>		
	/PBO	CN1-20	Encoder Divided Pulse Output, Phase B			
	PCO	CN1-21	Encoder Divided Pulse Output,			
	/PCO	CN1-22	Phase C*			

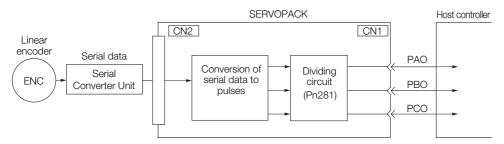
\* Refer to the following section for information on the origin within one encoder rotation.

If the relation between Renishaw PLC Incremental Linear Encoders and Encoder Output Pulse Signal from the SERVOPACK When Using a RGS20 Scale and RGH22B Sensor Head on page 6-21

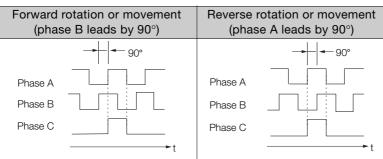
• Rotary Servomotor



· 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 =  $n.\square\square\square$ ), the output phase form is the same as shown above.



If you use the SERVOPACK's phase-C pulse output for an origin return, rotate the Servomotor two or more rotations before you start an origin return. If the Servomotor cannot be rotated two or more times, perform an origin return operation 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.

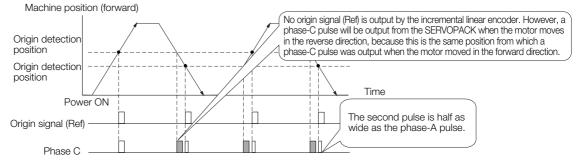
### Relation between Renishaw PLC Incremental Linear Encoders and Encoder Output Pulse Signal from the SERVOPACK When Using a RGS20 Scale and RGH22B Sensor Head

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.

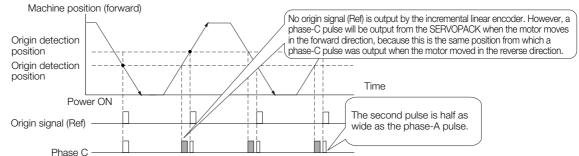
In that case, the phase-C pulse of the SERVOPACK is output at two positions.

For detailed specifications on the origin, 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

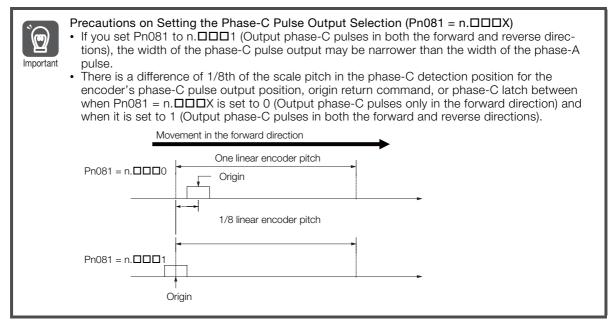


### Precautions When Using an Incremental Linear Encoder from Magnescale Co., Ltd.

### 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.

Parameter		Meaning	When Enabled	Classification
Pn081		Output phase-C pulses only in the forward direction.	After restart	Setup
1 11001	n.0001	Output phase-C pulses in both the forward and reverse directions.		Gerup



Observe the following precaution if you set Pn081 to n.  $\Box\Box\Box$  (Output phase-C pulses only in the forward direction).

When an incremental linear 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.

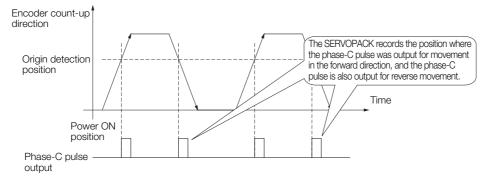
		6	
Encoder Model	Interpolator	Linear Encoder Pitch [µm]	
SL710		800	
SL720	PL101-RY MJ620-T13	800	
SL730		800	
	SR75	80	
	SR85	80	
SQ10	MQ10-FLA	400	
3010	MQ10-GLA	- 400	

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 =  $n.\square\square\square$ ).

#### 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.

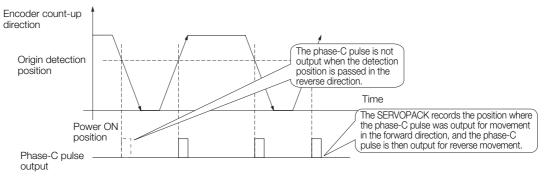
After that, the phase-C pulse is output whenever the origin detection position is passed in the forward or reverse direction.



#### When First Passing the Origin Signal in the Reverse Direction and Returning after Turning ON the Power Supply

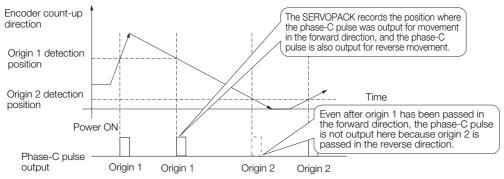
The encoder's phase-C pulse (CN1-19 and CN1-20) is not output when the origin detection position is passed for the first time in the reverse direction after the power supply is turned ON.

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

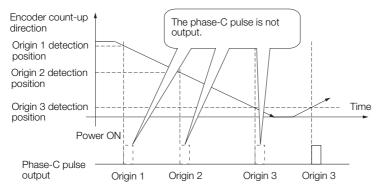
The encoder's phase-C pulse is output when the origin detection position is passed for the first time in the forward direction after the power supply is turned ON. After that, the phase-C pulse is output whenever the origin detection position is passed in the forward or reverse direction.



## 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 C	utput Pulses	Speed Positic	on Torque	
Pn212	12 Setting Range Setting Unit Default Setting When Enabled C		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		En	coder Resoluti	Upper Limit of Servo-	
of Encoder Output Pulses [P/Rev]	Setting Increment	20 bits (1,048,576 pulses)	22 bits (4,194,304 pulses)	24 bits (16,777,216 pulses)	motor Speed for Set Number of Encoder 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

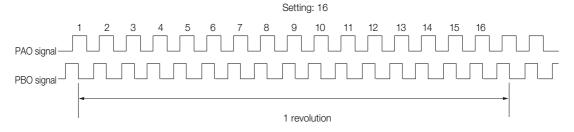
\* Available only for incremental encoder

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 Re	solution	Speed Posit	ion Force	
Pn281	Setting Range Setting Unit Default Setting		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 5-47.

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.

Lleing a Soria	al Converter Unit	Setting of Pn282	
Not Using a Serial Converter Unit (when the lin- ear encoder and SERVOPACK are connected directly or when a linear encoder that does not require a Serial Converter Unit is used)		The linear encoder pitch is automatically detected by the SERVO- PACK, so the setting of Pn282 is disabled.	
Information	because of the maximum resp If the setting is out of range or (Encoder Output Pulse Setting limit for the set encoder output will be output.	is 4 μm, the maximum motor speed is limited to 1 m/s onse frequency of the Serial Converter Unit. does not satisfy the setting conditions, an A.041 alarm Error) will be output. If the motor speed exceeds the upper resolution, an A.511 alarm (Encoder Output Pulse Overspeed) output resolution is restricted by the dividing specifications of	
Example	(Pn385 = 50): Pn281 = 28 (edg	oder pitch of 20 μm and a maximum motor speed of 5 m/s ges/pitch) (edges/pitch) (An A.041 alarm would be output.)	
Example	Pulse Output Example When Pn281 = 20 (20-edge or Phase A Phase B	utput (5-pulse output) per linear encoder pitch)	
	Linear en	coder pitch	

6.6.1 Setting to Enable/Disable Software Limits

# 6.6 Software Limits

You can set limits in the software for machine movement that do not use the overtravel signals (P-OT and N-OT). If a software limit is exceeded, an emergency stop will be executed in the same way as it is for overtravel.

You must make the following settings to use the software limits.

- You must enable the software limit function.
- You must set the software limits.

### 6.6.1 Setting to Enable/Disable Software Limits

You can use  $Pn801 = n.\square\square\squareX$  (Software Limit Selection) to enable and disable the software limit function. One of following commands must be executed to define the origin of the machine coordinate system before the software limits will operate. Otherwise, the software limit function will not operate even if a software limit is exceeded.

- The ZRET command has been executed.
- The POS\_SET command has been executed with REFE set to 1.
- If an absolute encoder is used, the SENS\_ON (Turn ON Sensor) command must have been completed.

Parameter		Meaning	When Enabled	Classification
Pn801	n.0000	Enable both forward and reverse soft- ware limits.		
	n.0001	n. Disable forward software limit.		Catura
	n.🗆 🗆 🗆 2	Disable reverse software limit.	Immediately	Setup
	n.□□□3 Disable both forward and reverse so (default setting) ware limits.			

## 6.6.2 Setting the Software Limits

Software limits are set in both the forward and reverse directions.

The reverse software limit must be less than the forward software limit to set a limit in each direction.

	Forward Software Limit			Position		
Pn804	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	-1,073,741,823 to 1,073,741,823	1 reference unit	1,073,741,823	Immediately	Setup	
	Reverse Software Limit			Position		
Pn806	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	-1,073,741,823 to 1,073,741,823	1 reference unit	-1,073,741,823	Immediately	Setup	

### 6.6.3 Software Limit Check for References

You can enable or disable software limit checks for commands that have target position references, such as POSING or INTERPOLATE. If the target position exceeds a software limit, a deceleration stop will be performed from the position set as the software limit.

Parameter		Meaning	When Enabled	Classification
Pn801 -	n.□0□□ (default setting)	Do not perform software limit checks for references.	Immediately	Setup
	n.0100	Perform software limit checks for refer- ences.	Intinediatery	

6.7.1 Internal Torque Limits

# 6.7 Selecting Torque Limits

You can limit the torque that is output by the Servomotor.

There are four different ways to limit the torque. These are described in the following table.

Limit Method	Outline	Control Method	Reference
Internal Torque Limits	The torque is always limited with the setting of a parameter.	Speed control, position control, or	6.7.1
External Torque Limits	The torque is limited with an input signal from the host computer.	torque control	6.7.2
Limiting Torque with TLIM Data in Commands*	The TLIM data in a command is used to set the required torque limits.	Speed control or position control	_
Torque Limiting with P_CL and N_CL in the Servo Command Output Signals (SVCMD_IO)*	The P_CL and N_CL signals in the servo command output signals (SVCMD_IO) are used to set the required limits.	Speed control or position control	_

\* Refer to the following manual for details.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

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.

### 6.7.1 Internal Torque Limits

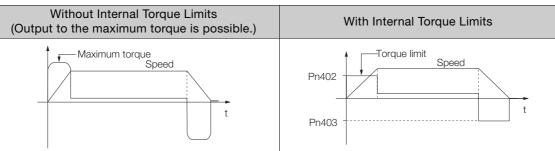
If you use internal torque limits, the maximum output torque will always be limited to the specified forward torque limit (Pn402) and reverse torque limit (Pn403).

#### Rotary Servomotors

	Forward Torque Limit			Speed Position Torque		
Pn402	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	800	Immediately	Setup	
	Reverse Torque Limit			Speed Positio	on Torque	
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.



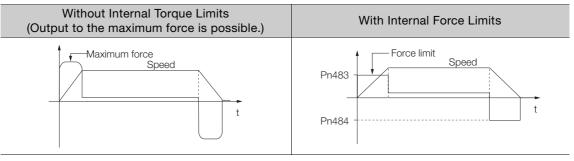
• Linear Servomotors

	Forward Force Limit			Speed Position Force		
Pn483	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	30	Immediately	Setup	
	Reverse Force Limit			Speed Positic	n Force	
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.

6.7.2 External Torque Limits

Note: If the setting of Pn483 or Pn484 is too low, the force may be insufficient for acceleration or deceleration of the Servomotor.



### 6.7.2 External Torque Limits

You can limit the torque only when required by the operating conditions of the machine by turning a signal ON and OFF.

You can use this for applications such as stopping on physical contact, or holding a workpiece with a robot.

#### **External Torque Limit Reference Signals**

The /P-CL (Forward External Torque Limit) and /N-CL (Reverse External Torque Limit) signals are used as the external torque limit reference signals. The /P-CL signal is used for the forward torque limit and the /N-CL signal is used for the reverse torque limit.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Input	/P-CL	Must be allocated.	ON (closed)	Applies the forward external torque limit. The torque is limited to the smaller of the set- tings of Pn402 <sup>*1</sup> and Pn404.
			OFF (open)	Cancels the forward external torque limit. The torque is limited to the setting of Pn402 <sup>*1</sup> .
Input	/N-CL	Must be allocated.	ON (closed)	Applies the reverse external torque limit. The torque is limited to the smaller of the set- tings of Pn403 <sup>*2</sup> and Pn404.
			OFF (open)	Cancels the reverse external torque limit. The torque is limited to the setting of Pn403 <sup>*2</sup> .

\*1. Pn483 is used for a Linear Servomotor.

\*2. Pn484 is used for a Linear Servomotor.

Note: You must allocate the /P-CL and /N-CL signals to use them. You can use the following parameters to allocate the signal to a terminal.

• Pn50B = n. IXIII (/P-CL (Forward External Torque Limit Input) Signal Allocation)

Pn50B = n.XDDD (/N-CL (Reverse External Torque Limit Input) Signal Allocation)
 for to the following paction for details

Refer to the following section for details.

6.1.1 Input Signal Allocations on page 6-4

6.7.2 External Torque Limits

#### Setting the Torque Limits

The parameters that are related to setting the torque limits are given below.

Rotary Servomotors

If the setting of Pn402 (Forward Torque Limit), Pn403 (Reverse Torque Limit), Pn404 (Forward External Torque Limit), or Pn405 (Reverse External Torque Limit) is too low, the torque may be insufficient for acceleration or deceleration of the Servomotor.

	Forward Torque Limit			Speed Positio	Torque	
Pn402	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	800	Immediately	Setup	
	Reverse Torque Lim	it		Speed Positio	on Torque	
Pn403	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	800	Immediately	Setup	
	Forward External Torque Limit			Speed Position Torque		
Pn404	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	100	Immediately	Setup	
	Reverse External Torque Limit			Speed Positio	Torque	
Pn405	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	100	Immediately	Setup	

\* Set a percentage of the rated motor torque.

• Linear Servomotors

If the setting of Pn483 (Forward Force Limit), Pn484 (Reverse Force Limit), Pn404 (Forward External Force Limit), or Pn405 (Reverse External Force Limit) is too low, the force may be insufficient for acceleration or deceleration of the Servomotor.

	Forward Force Limit			Speed Positio	on Force	
Pn483	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	30	Immediately	Setup	
	Reverse Force Limit	:		Speed Positio	on Force	
Pn484	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	30	Immediately	Setup	
	Forward External Force Limit			Speed Position Force		
Pn404	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	100	Immediately	Setup	
	Reverse External Force Limit			Speed Positio	on Force	
Pn405	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 800	1%*	100	Immediately	Setup	

\* Set a percentage of the rated motor force.

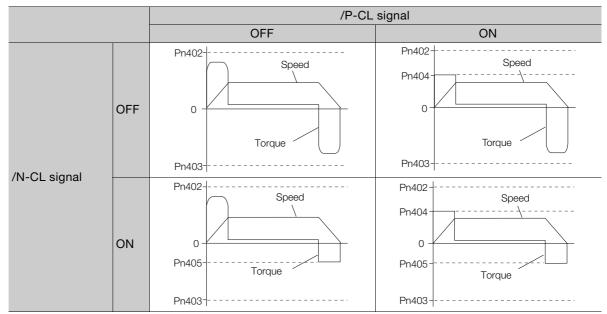
6.7.2 External Torque Limits

#### Changes in the Output Torque for External Torque Limits

The following table shows the changes in the output torque when the internal torque limit is set to 800%.

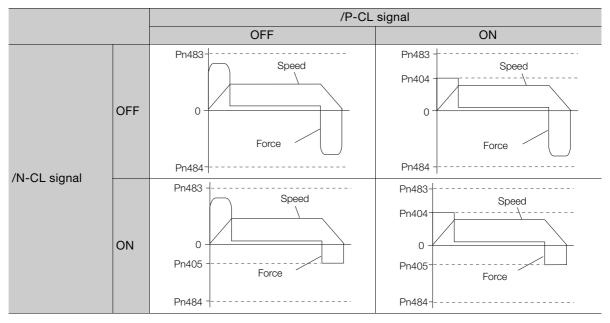
Rotary Servomotors

In this example, the Servomotor direction is set to  $Pn000 = n.\Box\Box\Box$  (Use CCW as the forward direction).



#### Linear Servomotors

In this example, the Servomotor direction is set to  $Pn000 = n.\Box\Box\Box\Box$  (Use the direction in which the linear encoder counts up as the forward direction).



6.7.3 /CLT (Torque Limit Detection) Signal

### 6.7.3 /CLT (Torque Limit Detection) Signal

This section describes the /CLT signal, which indicates the status of limiting the motor output torque.

Туре	Signal	Connector Pin No.	Signal Status	Meaning
Output /CLT		ON (closed)	The motor output torque is being limited.	
		Must be allocated.	OFF (open)	The motor output torque is not being limited.

Note: You must allocate the /CLT signal to use it. Use Pn50F = n. DDX (/CLT (Torque Limit Detection) Signal Allocation) to allocate the signal to a connector pin. Refer to the following section for details.

6.1.2 Output Signal Allocations on page 6-5

# 6.8 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 an origin return operation 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.

Image ■ Encoder Resolution on page 5-46

#### · Parameter Settings When Using an Incremental Encoder

Parameter		Meaning	When Enabled	Classification
	n.□0□□ (default setting)	Use the encoder as an incremental encoder. A battery is not required.		
Pn002	n.0100	Use the encoder as an incremental encoder. A battery is not required.	After restart	Setup
	n.0200	Use the encoder as a single-turn absolute encoder. A battery is not required.		

#### · Parameter Settings When Using a Single-Turn Absolute Encoder

Parameter		Meaning	When Enabled	Classification
n.□0□□ (default setting)		Use the encoder as a single-turn absolute encoder. A battery is not required.		
	n.0100	Use the encoder as an incremental encoder. A battery is not required.	After restart	Setup
	n.0200	Use the encoder as a single-turn absolute encoder. A battery is not required.		

#### • Parameter Settings When Using a Multiturn Absolute Encoder

Parameter		Meaning	When Enabled	Classification
	n.□0□□ (default setting)	Use the encoder as a multiturn absolute encoder. A battery is required.		
Pn002	n.0100	Use the encoder as an incremental encoder. A battery is not required.	After restart	Setup
	n.0200	Use the encoder as a single-turn absolute encoder. A battery is not required.		

#### Parameter Settings When Using a Batteryless Multiturn Absolute Encoder

Parameter		Meaning	When Enabled	Classification
	n.□0□□ (default setting)	Use the encoder as a batteryless multiturn absolute encoder. A battery is not required.		
Pn002	n.0100	Use the encoder as an incremental encoder. A battery is not required.	After restart	Setup
	n.□2□□	Use the encoder as a single-turn absolute encoder. 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.

6.8.1 Connecting an Absolute Encoder

### 6.8.1 Connecting an Absolute Encoder

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 4-26
 4.5.3 I/O Signal Wiring Examples on page 4-38

#### 6.8.2 Structure of the Position Data of the Absolute Encoder

The position data of the absolute encoder is the position coordinate from the origin of the absolute encoder.

The position data from the absolute encoder contains the following two items.

- The number of rotations from the origin of the encoder coordinate system (called the multiturn data)
- The position (number of pulses) within one rotation

The position data of the absolute encoder is as follows:

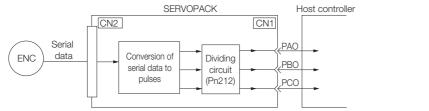
Position data of absolute encoder = Multiturn data  $\times$  Number of pulses within one encoder rotation (setting of Pn212) + Position (number of pulses) within one rotation.

For a single-turn absolute encoder, the multiturn data is 0.

#### 6.8.3 Output Ports for the Position Data from the Absolute Encoder

You can read the position data of the absolute encoder from the PAO, PBO, and PCO (Encoder Divided Pulse Output) signals.

The output method and timing for the position data of the absolute encoder are different in each case. A conceptual diagram of the connections of the PAO, PBO, and PCO (Encoder Divided Pulse Output) signals to the host controller is provided below.



Signal	Status	Signal Contents When Using an Absolute Encoder
PAO	First signal	Multiturn data position within one rotation (pulse train)
	During normal operation	Incremental pulses
PBO	First signal	Position within one rotation (pulse train)
FBO	During normal operation	Incremental pulses
PCO	Always	Origin pulse

The PAO (Encoder Divided Pulse Output) signal outputs the position data from the absolute encoder after the control power supply is turned ON. The SENS\_ON (Turn ON Sensor) command is used to output the position data from the absolute encoder.

The position data of the absolute encoder is the current stop position. The absolute encoder outputs the multiturn data with the specified protocol. The absolute encoder outputs the position within one rotation as a pulse train. It then outputs pulses as an incremental encoder (incremental operation status).

The host controller must have a reception circuit (e.g., UART) for the position data from the absolute encoder. The pulse counter at the host controller will not count pulses when the multiturn data (communications message) is input because only phase A is input. Counting starts from the position of the absolute encoder within one rotation.

The output circuits for the PAO, PBO, and PCO signals use line drivers. Refer to the following section for details on line drivers.

3 4.5.4 I/O Circuits on page 4-40

6.8.4 Reading the Position Data from the Absolute Encoder

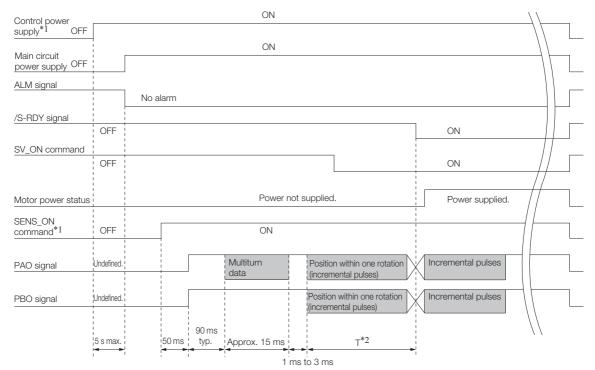
### 6.8.4 Reading the Position Data from the Absolute Encoder

The SENS\_ON (Turn ON Sensor) command is used to read the position data from the absolute encoder.

The sequence for using the SENS\_ON command to read the position data from the absolute encoder of a Rotary Servomotor is given below.

The multiturn data is sent according to the transmission specifications.

The position of the absolute encoder within one rotation is output as a pulse train.



\*1. When you turn OFF the control power supply, input the SENS\_OFF command.

\*2. The pulse output time T for the position of the absolute encoder within one rotation depends on the setting of Pn212 (Number of Encoder Output Pulses). Refer to the following table.

Setting of Pn212	Calculation of the Pulse Output Speed for the Position of the Absolute Encoder within One Rotation	Calculation of the Pulse Output Time T for the Position of the Absolute Encoder within One Rotation
16 to 16,384	680 × Pn212/16,384 [kpps]	25 ms max.
16,386 to 32,768	680 × Pn212/32,768 [kpps]	50 ms max.
32,722 to 65,536	680 × Pn212/65,536 [kpps]	100 ms max.
65,544 to 131,072	680 × Pn212/131,072 [kpps]	200 ms max.
131,088 to 262,144	680 × Pn212/262,144 [kpps]	400 ms max.
262,176 to 524,288	680 × Pn212/524,288 [kpps]	800 ms max.
524,352 to 1,048,576	680 × Pn212/1,048,576 [kpps]	1,600 ms max.

### 6.8.5 Transmission Specifications

The position data transmission specifications for the PAO (Encoder Divided Pulse Output) signal are given in the following table.

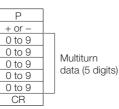
The PAO signal sends only the multiturn data.

Refer to the following section for the timing of sending the position data from the absolute encoder.  $\bigcirc$  6.8.4 Reading the Position Data from the Absolute Encoder on page 6-36

Item	PAO signal
Synchronization Method	Start-stop synchronization (ASYNC)
Baud Rate	9,600 bps
Start Bits	1 bit
Stop Bits	1 bit
Parity	Even
Character Code	ASCII, 7 bits
Data Format	Refer to Data Format of PAO Signal.
Data Output Period	Each time the SENS_ON command is input after the control power supply is turned ON

#### Data Format of PAO Signal

As shown below, the message format consists of eight characters: "P," the sign, the 5-digit multiturn data, and "CR" (which indicates the end of the message).



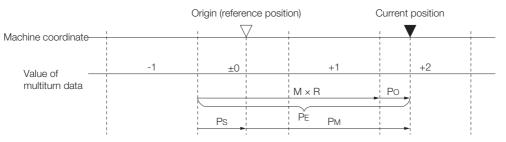
# 6.8.6 Calculating the Current Position in Machine Coordinates

When you reset the absolute encoder, the reset position becomes the reference position.

The host controller reads the coordinate Ps from the origin of the encoder coordinate system. The host controller must record the value of coordinate Ps.

This section describes the reference position in the machine coordinate system.

The method to calculate the coordinate value of the present position from the origin of the machine coordinate system is given below.



#### 6.8.7 Alarm Output from Output Ports for the Position Data from the Absolute Encoder

The current position  $\mathsf{P}_\mathsf{M}$  in the machine coordinate system is calculated as follows:

 $P_{M} = P_{E} - P_{S}$  $P_{E} = M \times R + P_{O}$  $P_{S} = M_{S} \times R + P_{S}'$ 

Symbol	Meaning
PE	Position data for the current position of the absolute encoder
М	Current position of the multiturn data of the absolute encoder
Po	Position of the current position within one rotation
P <sub>S</sub>	Position data of the absolute encoder when absolute encoder was reset
M <sub>S</sub>	Multiturn data of the absolute encoder when absolute encoder was reset
P <sub>S</sub> '	Position of the absolute encoder within one rotation when absolute encoder was reset
PM	Current position in machine coordinate system
R	Pulses output per encoder rotation (value after dividing; setting of Pn212)

Note: The following formulas apply in reverse rotation mode (Pn000 =  $n.\Box\Box\Box$ 1).

$$P_{M} = P_{E} - P_{S}$$
$$P_{E} = -M \times R + P_{O}$$
$$P_{S} = M_{S} \times R + P_{S}'$$

Information

- ation
   1. If you are using a Rotary Servomotor, you must reset the absolute encoder. Refer to the following section for information on resetting the absolute encoder.
   5.16 Resetting the Absolute Encoder on page 5-50
  - 2. You can set the origin to a different position from the reset position. Refer to the following section for information on the origin position offset.
    - 5.17 Setting the Origin of the Absolute Encoder on page 5-53

# 6.8.7 Alarm Output from Output Ports for the Position Data from the Absolute Encoder

Any alarm detected by the SERVOPACK is transmitted as alarm information to the host controller with the PAO (Encoder Divided Pulse Output) signal when the SENS\_ON (Turn ON Sensor) command turns OFF.

ALM signal		<□
Motor power status	Servo ON (Power supplied.)	Servo OFF (Power not supplied.)
Main circuit power supply	ON	OFF
Control power supply	ON	
SENS_ON command	ON	OFF
PAO signal		Alarm information

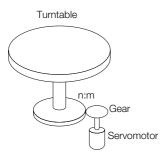
The data format of the alarm information is shown below.



6.8.8 Multiturn Limit Setting

#### **Multiturn Limit Setting** 6.8.8

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.



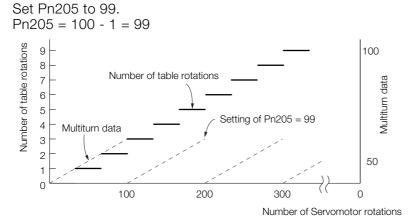
Because the turntable moves in only one direction, the upper limit to the number of rotations that can be counted by an absolute encoder will eventually be exceeded.

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			Speed Position Torque	
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.

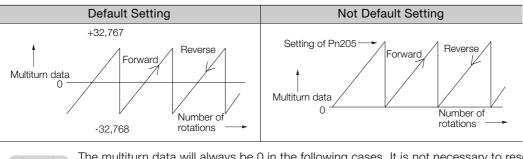
The data will change as shown below when this parameter is set to anything other than the default setting.

- 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.

#### 6.8.9 Multiturn Limit Disagreement Alarm (A.CC0)



Information The multiturn data will always be 0 in the following cases. It is not necessary to reset the absolute encoder in these cases.

- 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.

### 6.8.9 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	Meaning
A.CC0	Multiturn Limit Disagreement	Different multiturn limits are set in the encoder and SERVO- PACK.

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 (Manual No.: SIEP S800001 33)
SigmaWin+	Encoder Setting - Multi-turn Limit Setup	G Operating Procedure on page 6-40

This setting can be made with the MEM\_WR (Write Memory) command. Refer to the following manual for information on the MEM\_WR (Write Memory) command.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

#### **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.

6.8.9 Multiturn Limit Disagreement Alarm (A.CC0)

3. Click the Continue Button.

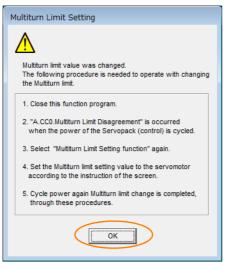
C Multiturn Limit Setting
The position data is cleared when this function is used. Since the Multiturn (multiple rotations) limit is changed, the position data of the machine system is changed and it is very dangerous.
Do you want to continue the process?
Continue

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 Setting Change					
Pn205:Multiturn	Limit				
65535	[Rev] 🕨 65535	[Rev]			
	(0-65535)				
	Writing into the Servopack				

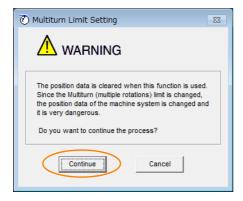
- 5. Click the Writing into the Servopack Button.
- 6. Click the OK Button.



- 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 Multi-turn Limit Setting in the Menu Dialog Box.

6.8.9 Multiturn Limit Disagreement Alarm (A.CC0)

9. Click the Continue Button.

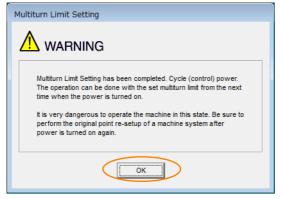


10. Click the Writing into the servomotor Button.

🕐 Multiturn	Limit Setting	×
Set the multiturn limit value to the servomotor.		
Pn205:Multitur	n Limit	
1555	[Rev]	Re-Change
(	Writing into the servomot	pr

Click the **Re-change** Button to change the setting.

11. Click the OK Button.



This concludes the procedure to set the multiturn limit.

6.9.1 Connecting an Absolute Linear Encoder

# 6.9 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 an origin return operation 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 5-47

#### · Parameter Settings When Using an Incremental Linear Encoder

Parameter		arameter	Meaning	When Enabled	Classification
	Pn002	n.□0□□ (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
Pn002	n.□0□□ (default setting)	Use the encoder as an absolute linear encoder.	After restart	Setup
	n.🗆 1 🗆 🗆	Use the encoder as an incremental linear encoder.		

#### 6.9.1 Connecting an Absolute Linear Encoder

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.

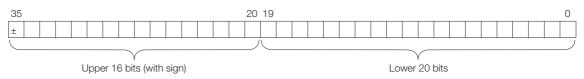
4.4.3 Wiring the SERVOPACK to the Encoder on page 4-26

(a) 4.5.3 I/O Signal Wiring Examples on page 4-38

# 6.9.2 Structure of the Position Data of the Absolute Linear Encoder

The position data of the absolute linear encoder is the distance (number of pulses) from the origin of the absolute linear encoder.

The position data is signed 36-bit data.



When the SERVOPACK sends the position data, it sends the upper 16-bit data (with sign) separately from the lower 20-bit data.

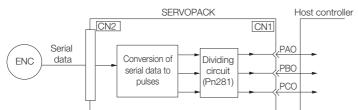
6.9.3 Output Ports for the Position Data from the Absolute Linear Encoder

# 6.9.3 Output Ports for the Position Data from the Absolute Linear Encoder

You can read the position data of the absolute linear encoder from the PAO, PBO, and PCO (Encoder Divided Pulse Output) signals.

The output method and timing for the position data of the absolute linear encoder are different in each case.

A conceptual diagram of the connections of the PAO, PBO, and PCO (Encoder Divided Pulse Output) ports to the host controller is provided below.



Signal Status		Signal Contents	
Signal	Status	When Using an Absolute Linear Encoder	
PAO	First signal	Upper 16-bit data (with sign) Lower 20-bit data (pulse train)	
	During normal operation	Incremental pulses	
PBO	First signal	Lower 20-bit data (pulse train)	
FDO	During normal operation	Incremental pulses	
PCO	Always	Origin pulse	

The PAO (Encoder Divided Pulse Output) signal outputs the position data from the absolute linear encoder after the control power supply is turned ON. The SENS\_ON (Turn ON Sensor) command is used to output the position data from the absolute linear encoder.

The position data of the absolute linear encoder is the current stop position. The absolute linear encoder outputs the upper 16-bit data (with sign) according to the specified protocol. The absolute encoder outputs the lower 20-bit data as a pulse train. It then outputs pulses as an incremental linear encoder (incremental operation status).

The host controller must have a reception circuit (e.g., UART) for the position data from the absolute linear encoder. The pulse counter at the host controller will not count pulses when the upper 16-bit data (with sign) (communications message) is input because only phase A is input.

The output circuits for the PAO, PBO, and PCO signals use line drivers. Refer to the following section for details on line drivers.

3 4.5.4 I/O Circuits on page 4-40

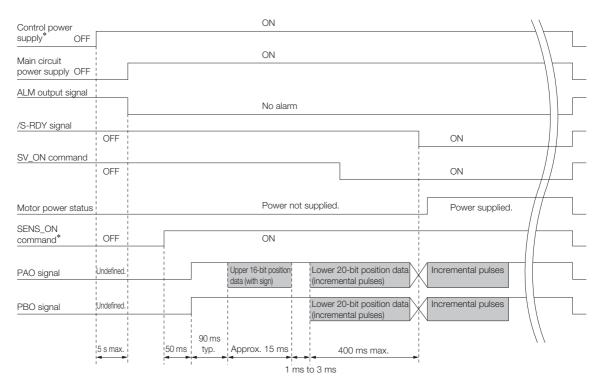
#### 6.9.4 Reading the Position Data from the Absolute Linear Encoder

The SENS\_ON (Turn ON Sensor) command is used to read the position data from the absolute linear encoder.

The sequence for using the SENS\_ON command to read the position data from the absolute linear encoder of a Linear Servomotor is given below.

The upper 16-bit position data (with sign) are sent according to the transmission specifications. The lower 20-bit data is output as a pulse train.

#### 6.9.5 Transmission Specifications



\* When you turn OFF the control power supply, input the SENS\_OFF command.

### 6.9.5 Transmission Specifications

The position data transmission specifications for the PAO (Encoder Divided Pulse Output) signal are given in the following table.

The PAO signal sends only the 16-bit data (with sign).

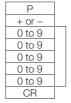
Refer to the following section for the timing of sending the position data from the absolute encoder.

Æ	6.9.4 Reading the Position Data from the Absolute Linear Encoder	on page 6-44
---	--	--------------

Item	PAO signal
Synchronization Method	Start-stop synchronization (ASYNC)
Baud Rate	9,600 bps
Start Bits	1 bit
Stop Bits	1 bit
Parity	Even
Character Code	ASCII, 7 bits
Data Format	Refer to Data Format of PAO Signal.
Data Output Period	Each time the SENS_ON command is input after the control power supply is turned ON

#### Data Format of PAO Signal

As shown below, the message format consists of eight characters: "P," the sign, the 5-digit upper 15bit position data, and "CR" (which indicates the end of the message).



Upper 15 bits of position data

6.9.6 Calculating the Current Position in Machine Coordinates

### 6.9.6 Calculating the Current Position in Machine Coordinates

With an absolute linear encoder, you must set the position of the origin (i.e., the origin of the machine coordinate system).

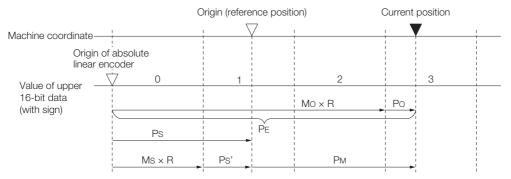
The host controller reads the coordinate from the origin of the encoder coordinate system. The host controller must record the value of this coordinate.

The method to calculate the coordinate value of the present position from the origin of the machine coordinate system is given below.

The position data from the absolute linear encoder is signed 36-bit data, but the upper 16 bits (with sign) and the lower 20 bits are output separately.

For the upper 16-bit data (with sign), the upper bits (16 bits, including the sign) of the current position after dividing by the setting of Pn281 are output with serial communications according to the transmission specifications.

For the lower 20-bit data, the lower bits (20 bits) of the current position after dividing by the setting of Pn281 are output as a pulse train.



The current position  $P_M$  in the machine coordinate system is calculated as follows:

 $P_{M} = P_{E} - P_{S}$  $P_{E} = M_{O} \times R + P_{O}$  $P_{S} = M_{S} \times R + P_{S}'$ 

Symbol	Meaning
P <sub>E</sub>	Position data for the current position of the absolute linear encoder
M <sub>O</sub>	Upper 16 bits (with sign) of the position data for the current position of the absolute linear encoder
Po	Lower 20 bits of the position data for the current position of the absolute linear encoder
P <sub>S</sub>	Position data of the origin
M <sub>S</sub>	Upper 16 bits (with sign) of the position data of the origin
P <sub>S</sub> '	Lower 20 bits of the position data of the origin
P <sub>M</sub>	Current position in machine coordinate system
R	1048576 (=2 <sup>20</sup> )

Note: The above formulas also apply in reverse movement mode (Pn000 =  $n.\Box\Box\Box$ 1).

Information If you are using a Linear Servomotor, you do not need to reset the absolute linear encoder to define the origin. (Some absolute linear encoders also allow you to set any position as the origin.)

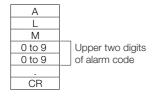
6.9.7 Alarm Output from the Output Ports for the Position Data from the Absolute Linear Encoder

# 6.9.7 Alarm Output from the Output Ports for the Position Data from the Absolute Linear Encoder

Any alarm detected by the SERVOPACK is transmitted as alarm information to the host controller with the PAO (Encoder Divided Pulse Output) signal when the SENS\_ON (Turn ON Sensor) command turns OFF.

ALM signal		]
Motor power status	Servo ON (Power supplied.)	Servo OFF (Power not supplied.)
Main circuit power supply	ON	OFF
Control power supply	ON	
SENS_ON comm	and ON	OFF
PAO signal		Alarm information

The data format of the alarm information is shown below.



6.10.1 Preparations

# 6.10 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. Al

- 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.

#### 6.10.1 Preparations

Always check the following before you perform a software reset.

- The servo must be OFF.
- The motor must be stopped.

#### 6.10.2 Applicable Tools

The following table lists the tools that you can use to perform a software reset and the applicable tool functions.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn030	Ω-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	<b>Basic Functions - Software Reset</b>	€ 6.10.3 Operating Procedure on page 6-48

### 6.10.3 Operating Procedure

There are the following two methods that you can use to perform a software reset.

- Direct connection to the SERVOPACK
- · Connection through a controller

The procedure for each method is given below.

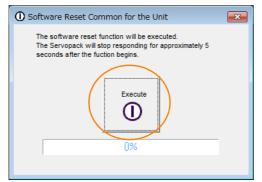
Direct Connection to the SERVOPACK

- 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.
- 3. Click the Execute Button.

Software Reset
The software reset function resets the Servopack by using software and re-calculates all settings including parameters. Be sure to carefully read the SigmaWin+ Operation Manual before executing this function. Special care must be taken for the following.
The Servopack will stop responding for approximately 5 seconds after the execution begins. Before executing this function, always check the Servopack and motor status to ensure safety.
Execute

Click the Cancel Button to cancel the software reset. The Main Window will return.

4. Click the Execute Button.



#### 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.

Software Reset
The software reset function has been completed. All settings including parameters were re-calculated. Always reconnect the SigmaWin+ to the Servopack after execution of this function.
ОК

This concludes the procedure to reset the software.

6.10.3 Operating Procedure

#### **Connection through a Controller**

- 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.
- 3. Click the Execute Button.

Software Reset
The software reset function resets the Servopack by using software and re-calculates all settings including parameters. Be sure to carefully read the SigmaWin+ Operation Manual before executing this function. Special care must be taken for the following.
The Servopack will stop responding for approximately 5 seconds after the execution begins. Before executing this function, always check the Servopack and motor status to ensure safety.
Execute

Click the Cancel Button to cancel the software reset. The Main Window will return.

4. Select the Reset MECHATROLINK communication Check Box.

Software Reset Common for the Unit		
The software reset function will be executed. The Servopack will stop responding for approximately 5 seconds after the fuction begins.		
Execute		
0%		
Reset MECHATROLINK communication After executing the software reset function, communication with the axis #5 will be reset.	ns	

5. Click the Execute Button.



If you perform a software reset without resetting MECHATROLINK communications, a communications error will occur between the controller and SERVOPACK, and communications will no longer be possible.

Always select the **Reset MECHATROLINK communication** Check Box and reset MECHATROLINK communications as well.

#### 6. Click the OK Button.

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.

Software Reset
The software reset function has been completed. All settings including parameters were re-calculated. Always reconnect the SigmaWin+ to the Servopack after execution of this function.
ОК

This concludes the procedure to reset the software.

# 6.11 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		Meaning	When Enabled	Classification
(de		n.□□□0 (default setting)	Do not detect vibration.		
	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 = <u>Vibration detection level (Pn312 [min-1]) × Vibration detection sensitivity (Pn311 [%])</u> 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			Speed Positi	on Torque
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.

#### 6.11.1 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 =  $n.\Box\Box\Box$ ).

6.11.2 Applicable Tools

## 6.11.2 Applicable Tools

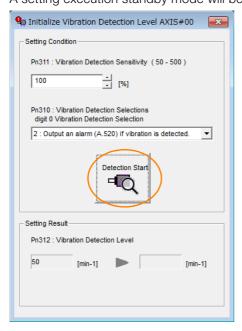
The following table lists the tools that you can use to initialize the vibration detection level.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn01B	Ω-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Others - Initialize Vibration Detection Level	6.11.3 Operating Procedure on page 6-52

### 6.11.3 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.



6.11.3 Operating Procedure

4. Click the Execute Button.

Initialize Vibration Detection Level AXIS#00
Setting Condition
Pn311 : Vibration Detection Sensitivity (50 - 500)
100 - [%]
Pn310 : Vibration Detection Selections 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 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], Alarm(A.520) is detected.		

This concludes the procedure to initialize the vibration detection level.

6.11.4 Related Parameters

#### 6.11.4 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 func tion 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 Changes
Pn311	Vibration Detection Sensitivity	Allowed	No
Pn312	Vibration Detection Level	Not allowed	Yes
Pn384	Vibration Detection Level	Not allowed	Yes

6.12.1 Automatic Adjustment

# 6.12 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.

### 6.12.1 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 (Manual No. SIEP S800001 33)
SigmaWin+	Others - Adjust the Motor Current Detection Offset	G Operating Procedure on page 6-55

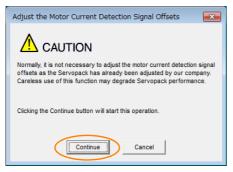
#### **Operating Procedure**

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.

#### 6.12.1 Automatic Adjustment

3. Click the Continue Button.



4. Click the Automatic Adjustment Tab in the Adjust the Motor Current Detection Signal Offsets Dialog Box.

Adjust the Motor Current Detection Signal O		
Automatic Adjustment Manual Adjustment		
Automatic Adjustment Manual Adjustment		
New		
U-phase Offset -73		
V-phase Offset		
Adjust		

5. Click the Adjust Button.

The values that result from automatic adjustment will be displayed in the New Boxes.

Search Adjust the Motor Current Detection Signal O		
Automatic Adjustment   Manual Adjustment		
New		
U-phase Offset -73 -74		
V-phase Offset -63		
Adjust		

This concludes the procedure to automatically adjust the motor current detection signal offset.

6.12.2 Manual Adjustment

## 6.12.2 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.

- 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 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

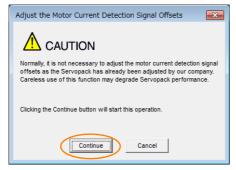
The following table lists the tools that you can use to manually adjust the offset.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn00F	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Others - Adjust the Motor Current Detection Offset	Operating Procedure on page 6-57

#### **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.



6.12.2 Manual Adjustment

5. Click the Manual Adjustment Tab in the Adjust the Motor Current Detection Signal Offsets Dialog Box.

2 Adjust the Motor Current Detection Signal O			
Automatic Adjustment			
Motor Current Detection Offset			
Channel U-phase 💌			
0 ffset -74 +1 ᠿ♠ -1 ᠿ♠			

- 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.

6.13.1 FSTP (Forced Stop Input) Signal

# 6.13 Forcing the Motor to Stop

You can force the Servomotor to stop for a signal from the host controller or an external device.

To force the motor to stop, you must allocate the FSTP (Forced Stop Input) signal in Pn516 =  $n.\square\square\squareX$ . You can specify one of the following stopping methods: dynamic brake (DB), coasting to a stop, or decelerating to a stop.

Note: Forcing the motor to stop is not designed to comply with any safety standard. In this respect, it is different from the hard wire base block (HWBB).

Information Panel Operator and Digital Operator Displays

When a forced stop is performed, the panel and the Digital Operator will display FSTP.



• To prevent accidents that may result from contact faults or disconnections, use a normally closed switch for the Forced Stop Input signal.

## 6.13.1 FSTP (Forced Stop Input) Signal

Classifica- tion	Signal	Connector Pin No.	Signal Status	Description
Input	FSTP	Must be allocated.	ON (closed)	Drive is enabled (normal operation).
			OFF (open)	The motor is stopped.

Note: You must allocate the FSTP signal to use it. Use Pn516 = n.□□□X (FSTP (Forced Stop Input) Signal Allocation) to allocate the FSTP signal to a connector pin. Refer to the following section for details.

(2) 6.1.1 Input Signal Allocations on page 6-4

# 6.13.2 Stopping Method Selection for Forced Stops

Use  $Pn00A = n.\square\squareX\square$  (Stopping Method for Forced Stops) to set the stopping method for forced stops.

Parameter		Description	When Enabled	Classifi- cation
Pn00A	n.🗆 🗆 🗆	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in $Pn001 = n.\Box\Box\BoxX$ ).		Setup
	n.□□1□ (default set- ting)	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque. Use the setting of Pn001 = $n.\Box\Box\BoxX$ for the status after stopping.		
	n.0020	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then let the motor coast.	After restart	
	n.0030	Decelerate the motor to a stop using the deceleration time set in Pn30A. Use the setting of Pn001 = $n.\Box\Box\BoxX$ for the status after stopping.		
	n.0040	Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.		

Note: You cannot decelerate a Servomotor to a stop during torque control. For torque control, the Servomotor will be stopped with the dynamic braking or coast to a stop according to the setting of Pn001 = n.  $\Box \Box \Box X$  (Servo OFF or Alarm Group 1 Stopping Method).

6.13.2 Stopping Method Selection for Forced Stops

#### Stopping the Servomotor by Setting Emergency Stop Torque (Pn406)

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

If  $Pn00A = n.\Box\BoxX\Box$  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			Speed Position		
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.

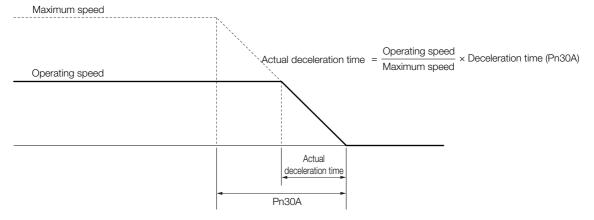
# Stopping the Servomotor by Setting the Deceleration Time for Servo OFF and Forced Stops (Pn30A)

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 f	Deceleration Time for Servo OFF and Forced Stops			Speed Position		
Pn30A	Setting Range	Setting Unit	Default Setting	When Enabled	Classification		
	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.



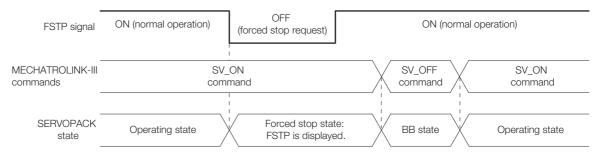
6.13.3 Resetting Method for Forced Stops

### 6.13.3 Resetting Method for Forced Stops

This section describes the reset methods that can be used after stopping operation for an FSTP (Forced Stop Input) signal.

If the FSTP (Forced Stop Input) signal is OFF and the SV\_ON (Servo ON) command is sent, the forced stop state will be maintained even after the FSTP signal is turned ON.

Send the SV\_OFF (Servo OFF) command to place the SERVOPACK in the base block (BB) state and then send the SV\_ON (Servo ON) command.



6.14.1 Connecting the Overheat Protection Input (TH) Signal

# 6.14 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 =  $n.\Box\Box\BoxX$ ).

#### 6.14.1 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

- If you use a Serial Converter Unit, connect the connector for the polarity sensor and thermostat cable of the Linear Servomotor to the Serial Converter Unit.
- If you do not use a Serial Converter Unit, connect the thermostat cable of the Linear Servomotor to CN1-5 on the SERVOPACK.

#### 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.

# 6.14.2 Overheat Protection Selection

The overheat protection function is selected with  $Pn61A = n.\Box\Box\BoxX$  (Overheat Protection Selections).

	Parameter	Meaning	When Enabled	Classification
	n.□□□0 (default setting)	Disable overheat protection.	_	Setup
Pn61A	n.0001	Use overheat protection in the Yaskawa Linear Servomotor.*		
	n.0002	Monitor a negative voltage input from a sensor attached to the machine and use overheat protection.	After restart	
	n.□□□3	Monitor a positive voltage input from a sensor attached to the machine and use overheat pro-tection.		

\* The SGLFW2 is the only Yaskawa Linear Servomotor that supports this function.

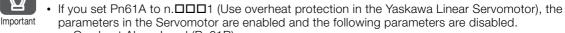
# Using Overheat Protection in the Yaskawa Linear Servomotor

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.



- Overheat Alarm Level (Pn61B)
   Overheat Warning Level (Pn61B)
- Overheat Warning Level (Pn61C)
   Overheat Alarm Filter Time (Pn61D)
- 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 Leve	) I		Speed Posit	ion Torque
Pn61B	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 500	0.01 V	250	Immediately	Setup
	Overheat Warning Le	evel		Speed Positi	ion Torque
Pn61C	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	100	Immediately	Setup
	Overheat Alarm Filte	r Time	-	Speed Positi	ion Torque
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 and Actual Operation

7

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 7.1.2	Flow of Trial Operation for Rotary Servomotors 7-2 Flow of Trial Operation for Linear Servomotors 7-3
7.2	Inspec	tions and Confirmations before Trial Operation 7-6
7.3	Trial O	peration for the Servomotor without a Load 7-7
	7.3.1 7.3.2 7.3.3	Preparations
7.4	Trial Op	peration with MECHATROLINK-III Communications7-10
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7.1.1 Flow of Trial Operation for Rotary Servomotors

# 7.1 Flow of Trial Operation

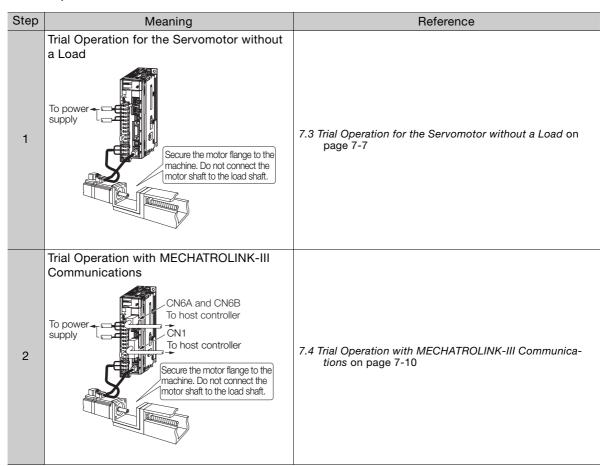
# 7.1.1 Flow of Trial Operation for Rotary Servomotors

The procedure for trial operation is given below.

#### Preparations for Trial Operation

Step	Meaning	Reference
1	Installation Install the Servomotor and SERVOPACK according to the installation conditions. First, operation is checked with no load. Do not connect the Servomotor to the machine.	Chapter 3 SERVOPACK Installation
2	Wiring and Connections Wire and connect the SERVOPACK. First, Servomotor operation is checked without a load. Do not connect the CN1 connector on the SERVOPACK.	Chapter 4 Wiring and Connecting SERVOPACKs
3	Confirmations before Trial Operation	7.2 Inspections and Confirmations before Trial Operation on page 7-6
4	Power ON	-
5	Resetting the Absolute Encoder This step is necessary only for a Servomotor with an Absolute Encoder.	5.16 Resetting the Absolute Encoder on page 5-50

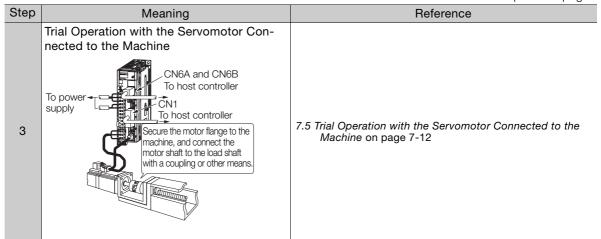
#### Trial Operation



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 Install the Servomotor and SERVOPACK according to the installation conditions. First, operation is checked with no load. Do not connect the Servomotor to the machine.	Chapter 3 SERVOPACK Installation
2	Wiring and Connections Wire and connect the SERVOPACK. First, Servomotor operation is checked without a load. Do not connect the CN1 connector on the SERVOPACK.	Chapter 4 Wiring and Connecting SERVOPACKs
3	Confirmations before Trial Operation	7.2 Inspections and Confirmations before Trial Operation on page 7-6
4	Power ON	-

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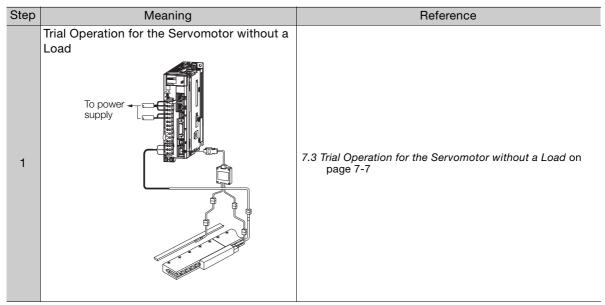
#### 7.1 Flow of Trial Operation

#### 7.1.2 Flow of Trial Operation for Linear Servomotors

Continued from previous page.

Step		Meaning			Reference		
	Setting Parameters in the SERVOPACK						
	Step	No. of Parameter to Set	Description		Remarks	Reference	
	5-1	Pn282	Linear Encoder Pitch		Set this parameter only if you are using a Serial Converter Unit.	page 5-18	
	5-2	-	Writing Parameters to the Linear Servo- motor		Set this parameter only if you are not using a Serial Converter Unit.	page 5-19	
5	5-3	Pn080 = n.□□X□	Polarity Sensor Selection		-	page 5-23	
	5-4	Pn080 = n.□□□X			_	page 5-25	
	5-5	_			This step is necessary only for a Linear Servomotor with a Polarity Sensor.	page 5-26	
	5-6	Pn50A = n.X□□□ and Pn50B = n.□□□X	Overtravel Signal Allocations		-	page 5-29	
	5-7	Pn483, Pn484	Force Control		_	page 6-28	
6	Setting Encode	the Origin of the Absolu r	ute Linear		Setting the Origin of the Absolut age 5-53	e Linear Encoder on	

#### Trial Operation



Continued on next page.

#### 7.1.2 Flow of Trial Operation for Linear Servomotors

Continued from previous page.

•		Continued from previous page.
Step	Meaning	Reference
2	Trial Operation with MECHATROLINK-III Communications	7.4 Trial Operation with MECHATROLINK-III Communica- tions on page 7-10
3	Trial Operation with the Servomotor Con- nected to the Machine CN6A and CN6B To host controller CN1 To host controller	7.5 Trial Operation with the Servomotor Connected to the Machine on page 7-12

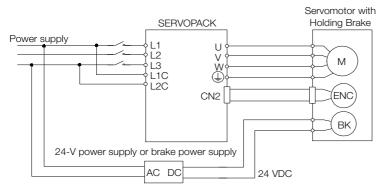
# 7.2 Inspections and Confirmations before Trial Operation

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

# 7.3 Trial Operation for the Servomotor without a Load

You use jogging for trial operation of the Servomotor without a load.

Jogging is used to check the operation of the Servomotor without connecting the SERVOPACK to the host controller. The Servomotor is moved at the preset jogging speed.



• During jogging, the overtravel function is disabled. Consider the range of motion of your machine when you jog the Servomotor.

Importa

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 jogging.

- 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 jogging speed must be set considering the operating range of the machine. The jogging speed is set with the following parameters.
  - Rotary Servomotors

	Jogging Speed			Speed Po	sition Torque
Pn304	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min⁻¹	500	Immediately	Setup
	Soft Start Acceler	ration Time		Speed	
Pn305	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup
	Soft Start Deceler	ration Time		Speed	
Pn306	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup

Direct Drive Servomotors

2					
	Jogging Speed			Speed Po	osition Torque
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	ration Time		Speed	
Pn305	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup
	Soft Start Deceler	ration Time		Speed	
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

	Jogging Speed			Speed Po	sition Force
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		Speed	
Pn305	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup
	Soft Start Deceleration Time Speed				
Pn306	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 ms	0	Immediately	Setup

# 7.3.2 Applicable Tools

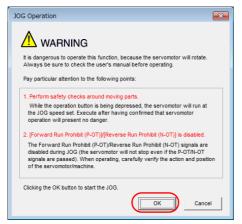
The following table lists the tools that you can use to perform jogging.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn002	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Operation - Jog	Derating Procedure on page 7-8

# 7.3.3 Operating Procedure

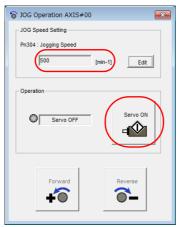
Use the following procedure to jog the motor.

- 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 jogging speed and then click the Servo ON Button.

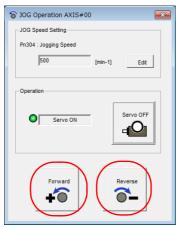


The display in the **Operation** Area will change to **Servo ON**.

Information To change the speed, click the Edit Button and enter the new speed.

5. Click the Forward Button or the Reverse Button.

Jogging will be performed only while you hold down the mouse button.



6. After you finish jogging, turn the power supply to the SERVOPACK OFF and ON again.

This concludes the jogging procedure.

# 7.4 Trial Operation with MECHATROLINK-III Communications

A trial operation example for MECHATROLINK-III communications is given below.

Refer to the following manual for command details.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

1. Confirm that the wiring is correct, and then connect the I/O signal connector (CN1 connector).

Refer to the following chapter for details on wiring. Chapter 4 Wiring and Connecting SERVOPACKs

2. Turn ON the power supplies to the SERVOPACK and host controller.

If control power is being supplied correctly, the PWR indicator on the SERVOPACK will light. If main circuit power is being supplied correctly, the CHARGE indicator on the SERVOPACK will light. If communications are established, the L1 or L2 indicators, whichever one corresponds to the CN6A or CN6B connector where the MECHATROLINK-III Communications Cable (RJ-45) is connected, will light. If the L1 or L2 indicator does not light, recheck the settings of MECHATROLINK-III setting switches (S1, S2, and S3) and then turn the power supply OFF and ON again.

#### 3. Send the CONNECT command from the host controller.

If the SERVOPACK correctly receives the CONNECT command, the CN indicator will light. If the CN indicator does not light, the settings of the CONNECT command are not correct. Correct the settings of the CONNECT command, and then send it from the host controller again.

#### 4. Confirm the product model with the ID\_RD command.

The SERVOPACK will return the product model (example: SGD7S-R90A30A).

5. Set the following items, which are necessary for trial operation.

Setting	Reference
Electronic Gear	5.15 Electronic Gear Settings on page 5-44
Motor Direction	5.5 Motor Direction Setting on page 5-17
Overtravel	5.11 Overtravel and Related Settings on page 5-29

#### 6. Save the settings that you made in step 5.

If the settings are saved in the host controller, use the SVPRM\_WR command with the mode set to RAM to save them.

If the settings are saved in the SERVOPACK, use the SVPRM\_WR command with the mode set to non-volatile memory to save them.

- 7. Send the CONFIG command to enable the settings.
- 8. Send the SENS\_ON command to obtain the position information (encoder ready).
- 9. Send the SV\_ON command.

Servomotor operation will be enabled and the SERVOPACK will return 1 for SVON (power supplied to motor) in the status.

#### **10.** Operate the Servomotor at low speed.

Operating Example for a Positioning Command Command: POSING Command settings: Positioning position = 10,000 (If you are using an absolute encoder, add 10,000 to the present position), rapid traverse speed = 400.

#### **11.** While operation is in progress for step 10, confirm the following items.

Confirmation Item	Reference
Confirm that the rotational direction of the Servomotor agrees with the forward or reverse reference. If they do not agree, cor- rect the rotation direction of the Servomo- tor.	
Confirm that no abnormal vibration, noise, or temperature rise occurs. If any abnor- malities are found, implement corrections.	12.5 Troubleshooting Based on the Operation and Condi- tions of the Servomotor on page 12-59

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

# \land 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. 34.4.4 Wiring the SERVOPACK to the Holding Brake on page 4-34 35.12 Holding Brake on page 5-34

1 Important

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

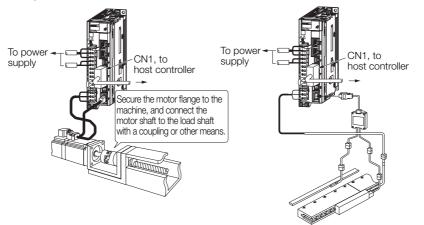
Always confirm the following before you perform the trial operation procedure for both the machine and Servomotor.

- Make sure that the procedure described in 7.4 Trial Operation with MECHATROLINK-III Communications on page 7-10 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.
  - 4.6 Connecting Safety Function Signals on page 4-42
  - 5.11 Overtravel and Related Settings on page 5-29
  - 3.12 Holding Brake on page 5-34
- **3.** Turn OFF the power supply 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 supply 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 MECHATROLINK-III Communications* on page 7-10 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 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 Jogging

You can use program jogging 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 jogging to move the Servomotor without connecting it to the host controller in order to check Servomotor operation and execute simple positioning operations.

## Preparations

Always check the following before you execute program jogging.

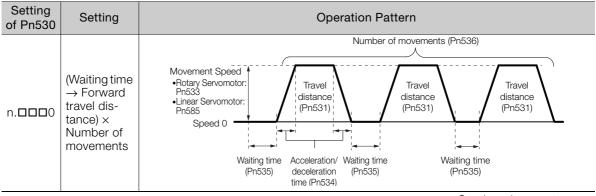
- The parameters must not be write prohibited.
- The main circuit power supply must be ON.
- There must be no alarms.
- There must be no hard wire base block (HWBB).
- The servo must be OFF.
- The range of machine motion and the safe movement speed of your machine must be considered when you set the travel distance and movement speed.
- There must be no overtravel.

## Additional Information

- You can use the functions that are applicable to position control. However, parameters related to motion control through MECHATROLINK communications (i.e., Pn800 and higher) are disabled.
- The overtravel function is enabled.

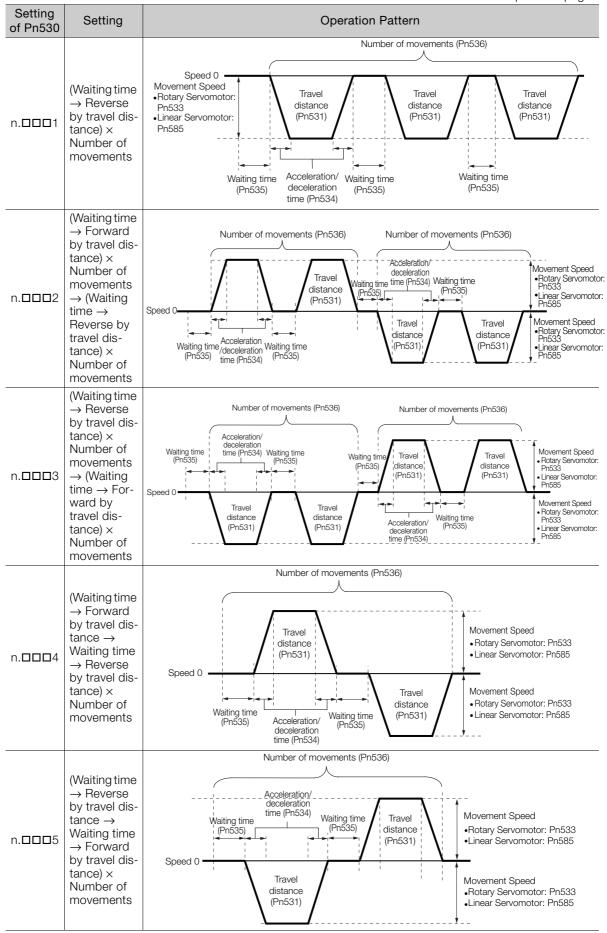
# **Program Jogging Operation Pattern**

An example of a program jogging 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).



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Information If Pn530 is set to n.  $\Box$   $\Box$   $\Box$ , n.  $\Box$   $\Box$   $\Box$ , n.  $\Box$   $\Box$   $\Box$ , or n.  $\Box$   $\Box$   $\Box$ , you can set Pn536 (Program Jogging Number of Movements) to 0 to perform infinite time operation. You cannot use infinite time operation if Pn530 is set to n.  $\Box$   $\Box$   $\Box$   $\Box$   $\Box$ . 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 jogging operation pattern. Do not change the settings while the program jogging operation is being executed.

• Rotary Servomotors

	Program Jogging-R	elated Selections		Speed Posit	ion Torque	
Pn530	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0000 to 0005	-	0000	Immediately	Setup	
	Program Jogging Tr	avel Distance		Speed Posit	ion Torque	
Pn531	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	1 to 1,073,741,824	1 reference unit	32,768	Immediately	Setup	
	Program Jogging M	ovement Speed		Speed Po	sition Torque	
Pn533	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	1 to 10,000	1 min⁻¹	500	Immediately	Setup	
	Program Jogging Acceleration/Deceleration Time			Speed Posit	Speed Position Torque	
Pn534	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	2 to 10,000	1 ms	100	Immediately	Setup	
	Program Jogging W	aiting Time		Speed Posit	ion Torque	
Pn535	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 10,000	1 ms	100	Immediately	Setup	
	Program Jogging N	umber of Movemer	nts	Speed Po	sition Torque	
Pn536	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 1,000	1	1	Immediately	Setup	

#### • Direct Drive Servomotors

	Program Jogging-R	elated Selections		Speed Po	sition Torque	
Pn530	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0000 to 0005	_	0000	Immediately	Setup	
	Program Jogging Tra	avel Distance		Speed Po	Speed Position Torque	
Pn531	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	1 to 1,073,741,824	1 reference unit	32,768	Immediately	Setup	
	Program Jogging M	ovement Speed		Speed Po	sition Torque	
Pn533	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	1 to 10,000	0.1 min <sup>-1</sup>	500	Immediately	Setup	
	Program Jogging Acceleration/Deceleration Time			Speed Po	Speed Position Torque	
Pn534	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	2 to 10,000	1 ms	100	Immediately	Setup	
	Program Jogging W	aiting Time		Speed Po	sition Torque	
Pn535	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 10,000	1 ms	100	Immediately	Setup	
	Program Jogging Number of Movements		Speed Po	sition Torque		
Pn536	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 1,000	1	1	Immediately	Setup	

• Linear Servomotors

	Program Jogging-R	elated Selections		Speed Pc	sition Force		
Pn530	Setting Range	Setting Unit	Default Setting	When Enabled	Classification		
	0000 to 0005	_	0000	Immediately	Setup		
	Program Jogging Tr	avel Distance		Speed Pc	Speed Position Force		
Pn531	Setting Range	Setting Unit	Default Setting	When Enabled	Classification		
	1 to 1,073,741,824	1 reference unit	32,768	Immediately	Setup		
	Program Jogging Movement Speed		Speed Pc	sition Force			
Pn585	Setting Range	Setting Unit	Default Setting	When Enabled	Classification		
	1 to 10,000	1 mm/s	50	Immediately	Setup		
	Program Jogging Acceleration/Deceleration Time			Speed Pc	Speed Position Force		
Pn534	Setting Range	Setting Unit	Default Setting	When Enabled	Classification		
	2 to 10,000	1 ms	100	Immediately	Setup		
	Program Jogging W	aiting Time		Speed Pc	sition Force		
Pn535	Setting Range	Setting Unit	Default Setting	When Enabled	Classification		
	0 to 10,000	1 ms	100	Immediately	Setup		
	Program Jogging N	umber of Movemer	nts	Speed Pc	sition Force		
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 jogging.

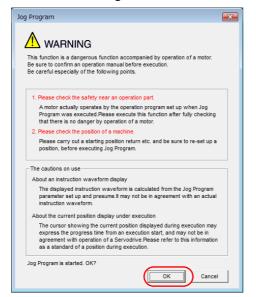
Tool	Fn No./Function Name	Reference
Digital Operator	Fn004	Ω-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	<b>Operation - Program JOG Operation</b>	Gervice Operating Procedure on page 7-17

## **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.

AUTO V [min-1/div]	Running Condition Pn531:Program Jogging Travel Distance
	3276800 [reference units] (1-1073741824
700 т	
600	Pn533:Program Jogging Movement Speed
500	500 [min-1] (1-10000)
	Pn534:Program Jogging Acceleration/Deceleration
400	26 [ms] (2-10000)
300	
200	Pn535:Program Jogging Waiting Time
100-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0	100 [ms] (0-10000)
	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. (Waiting time in PhSSS -> Por ward by travel d
0 976 1952 2928 3904 4880	
•	
<u>۱</u>	
FULL 💌 [ms/div]	Apply
Running Information	
fotal Time 4880[ms]	

7.6.2 Origin Search

5. Click the Servo ON Button and then the Execute Button. The program jogging operation will be executed.

	Servo ON/OFF operation
AUTO  [min-1/div]	$\frown$
•	Servo ON
700	Servo OFF
600	
500	
400	
300	- Bun
200	Run
100	
	Stopping Execute
0	
-100	
-200	
-300	Progress time
	-[sec]
	The number of forward movements
	O/3[times]
FULL V [ms/div]	The number of reverse movements
Running Information	0/0[times]
Total Time 4880[ms]	
The total amount of movements +9830400[reference units]	
	Running condition re-setting

• Be aware of the following points if you cancel the program jogging operation while the Servomotor is operating.

**CAUTION** 

- 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 jogging procedure.

## 7.6.2 Origin Search

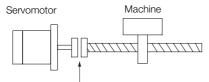
The origin search operation positions the motor to the origin within one rotation and then clamps it there.



• 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



To align the origin within one rotation with the machine origin

7.6.2 Origin Search

#### 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**

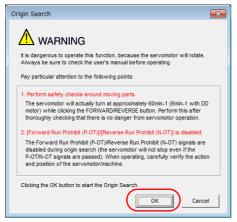
The following table lists the tools that you can use to perform an origin search.

Tool	Fn No./Function Name	Reference
Digital Operator	Fn003	Ω-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Encoder Setting - Search Origin	Gervariant Operating Procedure on page 7-20

## **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.



4. Click the Servo ON Button.

Origin Search AXIS#00
Status Origin Search Not Executed
Operation Servo OFF
Forward Reverse

#### 5. Click the Forward Button or the Reverse Button.

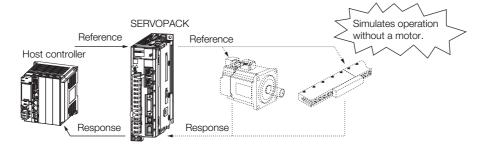
An origin search will be performed only while you hold down the mouse button. The motor will stop when the origin search has been completed.

Search AXIS#00
Status
Origin Search Not Executed
Operation
Servo ON
Forward Reverse

This concludes the origin search procedure.

## 7.6.3 Test without a Motor

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  $PnOOC = n.\square\square\squareX$  to enable or disable the test without a motor.

P	arameter	Meaning	When Enabled	Classification
Pn00C	n.□□□0 (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 Status	Information That Is Used	Source of Information
	Motor information <ul> <li>Rated motor speed</li> <li>Maximum motor speed</li> </ul>	Information in the Servomotor that is connected
Connected	Encoder information <ul> <li>Encoder resolution</li> <li>Encoder type</li> </ul>	
Not connected	Motor information • Rated motor speed • 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 monitor 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□ (Encoder Resolution for Tests without a Motor)</li> <li>Encoder type: Setting of Pn00C = n.□X□□ (Encoder 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 Status	Information That Is Used	Source of Information
Connected	External encoder infor- mation	Information in the external encoder that is con- 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 Status	Information That Is Used	That Is Used Source of Information	
	Motor information	Information in the motor that is connected	
Connected	Linear encoder informa- tion • Resolution • Encoder pitch • Encoder type	Information in the linear encoder that is connected	
Not connected	Motor information	Setting of Pn000 = n.XDDD (Rotary/Linear Startup Selection When Encoder Is Not Connected)	
	Linear encoder informa- tion • Resolution • Encoder pitch • 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□□□ (default setting)	When an encoder is not connected, start as SERVOPACK for Rotary Servomotor.			- After restart		Setup	
1 11000	n.1000	When an encoder is not connected, start as SERVOPACK for Linear Servomotor.						
	Linear Encoder F	Pitch			Speed	Posi	tion Force	
Pn282	Setting Range	Setting Unit	Default Setting	Whe	en Enabled	0	Classification	
	0 to 6,553,600	0.01 µm	0	Aft	ter restart		Setup	
F	Parameter	Meaning		When Enabled		Classification		
	n.□□0□ (default setting)	Use 13 bits as enco without a motor.	Use 13 bits as encoder resolution for tests without a motor.					
	n.0010	Use 20 bits as encod without a motor.	Use 20 bits as encoder resolution for tests without a motor.					
Pn00C	n.🗆 🗆 2 🗆	Use 22 bits as encoder resolution for tests without a motor.			After restart		Setup	
FILLOU	n.🗆 🗆 3 🗆	Use 24 bits as encod without a motor.	Use 24 bits as encoder resolution for tests without a motor.			Alter lestart		
	n.0000 (default setting)	Use an incremental e a motor.	encoder for tests wi	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.

7

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## Restrictions

The following functions cannot be used during the test without a motor.

- Regeneration and dynamic brake operation
- Brake output signal
- Items marked with "x" in the following utility function table

Manu Bar Button         SigmaWin+Function Name         Fn No.         Utility Function Name         Motor Not Connected         Motor Connected Connected         Reference           Basic Functions         Initialize <sup>11</sup> Software Reset         Fn005         Initializing Parameters         O         O         page 5-11           Basic Functions         Fn011         Display Servomotor Model         O         O         page 6-48           Basic Functions         Fn011         Display Servomotor IDS Software Vor- Soft         O         O         O           Product Information         Fn012         Display Servomotor IDS Servomotor IDS         O         O         Page 9-2           Encoder         Fn016         Display Servomotor IDS Module         O         O         Page 9-2           Multi-turn Limit Settip Secting         Fn016         Reset Absolute Encoder Origin         X         O         page 6-40           Search Origin <sup>2</sup> Fn008         Reset Absolute Encoder Origin         X         O         page 5-51           Multi-turn Limit Setting Seating         Fn008         Origin Search         O         O         page 5-53           Polarity Detection         Fn008         Polarity Detection         X         X         page 5-54           Seatrch Origin <sup>2</sup>	SigmaWin+			Digital Operator	Execu	table?	
Software Reset         Fn030         Software Reset         O         O         page 6-48           Functions         Fn011         Display Servomotor Model         O         O         O         O           Product Information         Fn012         Display Servomotor IDs from Feedback Option         O         O         O         Page 9-2           Reset Absolute Encoder         Fn012         Display Servomotor ID from Feedback Option         O         O         Page 6-51           Multi-turn Limit Setup Encoder         Fn018         Multiturn Limit Setting atter Multimum Limit Disgreement Alarm         X         O         page 6-40           Search Origin <sup>12</sup> Fn000         Origin Search         O         O         page 5-53           Polarity Detection         Fn000         Display Alarm History         O         O         page 12-43           Trouble shooting         Fn001         Fn002         Reset Motor Type Alarm         O         page 12-43           Aleat Motor Type Aleat Motor Type         Fn002         Display Alarm History         O         O         page 7-19           Jog         Fn002         Display Alarm         Go         O         page 12-43           Aleat Motor Type Aleat Mitor Type         Fn002         O         page 7-			Fn No.	Utility Function Name			Reference
Basic Functions         Fn011         Display Servomotor Model         O         O         O           Product Information         Fn012         Display Servomotor ID Signary Servomotor ID front Fosplay Servomotor ID front Feedback Option Module         O         O         O         Page 9-2           Reset Absolute Encoder         Fn011         Display Servomotor ID front Feedback Option Module         O         O         O         Page 5-51           Multi-turn Limit Setup Setting         Fn013         Multiturn Limit Setting after Multituru Limit Setting after Autan History         O         page 5-26           Troubles         Fin028         Set Absolute Linear Encoder Origin         ×         O         page 5-26           Polarity Detection         Fn020         Set Absolute Linear Encoder Origin         ×         O         page 5-26           Troubles         Display Alarm         Fn024         Reset Motor Type Alarm         Fn024         Reset Motor Type Alarm         O         O         page 7-14		Initialize <sup>*1</sup>	Fn005	Initializing Parameters	0	0	page 5-11
Basic FunctionsProduct InformationInitial ModelModelOOProduct InformationFn012Display Software Ver- sionOOOFn011Display SERVOPACK and Sarvomotor IDsOOOFn011Display Servomotor IDs mometedback Option ModuleOOOFn012Display Servomotor IDs mometedback Option ModuleOOOFn014Display Servomotor IDs mometedback Option ModuleOOPage 5-51Fn004Fn018After Multifurn Limit Setting after Multifurn Limit Setting Disagreement AlarmXOpage 5-53Search Origin*2Fn003Origin SearchOOPage 5-53SettingFn020Set Absolute Linear EncoderXOpage 5-54Polarity DetectionFn020Set Absolute Linear Encoder OriginXDpage 5-53Polarity DetectionFn020Set Absolute Linear Encoder OriginXOpage 5-26Polarity DetectionFn020Set Absolute Linear Encoder OriginXDpage 5-23Polarity DetectionFn020Display Alarm HistoryOOpage 12-43AdarmFn021Reset Motor Type AlarmOOpage 12-44PoperationFn021Reset Motor Type AlarmOOpage 7-7PoperationFn020Jog ProgramOOpage 8-24Tuning - turbTuning - fuotFn201Advanced Aut		Software Reset	Fn030	Software Reset	0	0	page 6-48
Functions Product InformationProduct InformationPro12sionOOF01EDisplay SERVOPACK and Servomotor IDs ModuleOOOF01EDisplay Servomotor ID fn01EOOOF01EDisplay Servomotor ID moduleOOPage 5-51F00EFn008Preset Absolute Encoder×Opage 5-51Multi-turn Limit SetupFn013Multiturn Limit Setting after Multiturn Limit Disagreement Alarm×Opage 6-40Search Origin*2Fn003Origin SearchOOpage 5-53SettingFn016Fn020Set Absolute Linear Encoder Origin×Opage 5-26Polarity DetectionFn020Display Alarm HistoryOOpage 12-43Polarity DetectionFn020Display Alarm HistoryOOpage 12-44PoperationFn020Display Alarm HistoryOOpage 7-7PogerationFn021Reset Motor Type AlarmOOpage 7-7PoperationFn021Reset Motor Type AlarmOOpage 7-7PoperationFn020Fn022JogOOpage 7-7PogerationFn021Advanced Autotuning without Reference××page 8-24Tuning * Autotuning without Host ReferenceFn202Advanced Autotuning with Reference××page 8-35Tuning * Custom Tuning * Custom Tuning * Custom Tuning * Custom Tuning * C			Fn011		0	0	
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EncoderFn008Encoder×Opage 5-51Multi-turn Limit SetungMulti-turn Limit SetungMulti-turn Limit Setung×Opage 6-40Search Origin*2Fn003Origin SearchOOpage 7-19Zero Point Position SettingFn020Encoder Origin×Opage 5-53Polarity DetectionFn080Polarity Detection××page 5-26Polarity DetectionFn020Est Absolute Linear Encoder Origin×Opage 5-26Polarity DetectionFn080Polarity Detection××page 5-26Polarity DetectionFn020Est Absolute Linear Encoder Origin×Opage 12-43Fn006Clear Alarm HistoryOOpage 12-43Fn014Reset Option Module Configuration ErrorOOpage 12-47JogFn021Reset Motor Type AlarmOOpage 7-7JogFn021Reset Motor Type AlarmOOpage 7-7JogFn021Reset Motor Type AlarmOOpage 7-7JogFn021Advanced Autotuning without Reference××page 8-24Tuning - Autotuning without Host ReferenceFn201Advanced Autotuning with Reference××page 8-35Tuning - Custom Tuning			Fn01F	from Feedback Option	0	0	
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SettingFN020Encoder OriginXOpage 3-33Polarity DetectionFn080Polarity Detection××page 5-26Trouble- shootingDisplay AlarmFn000Display Alarm HistoryOOpage 12-43Trouble- shootingDisplay AlarmFn006Clear Alarm HistoryOOpage 12-43Fn014Reset Option Module Configuration ErrorOOpage 12-47OperationJogFn021Reset Motor Type AlarmOOpage 12-47JopJogFn022JogOOpage 7-7Program JOG Opera- tionFn004Jog ProgramOOpage 8-24Tuning - Autotuning without Host ReferenceFn201Advanced Autotuning without Reference××page 8-35Tuning - Custom Tuning - Autotuning - Adjust Anti-resonance Custom Tuning - Custom Tuning - Nance ControlFn202Adjust Anti-resonance Control××page 8-51Tuning - Custom Tuning - Vibration Suppres- sionFn205Vibration Suppression××page 8-56DiagnosticEasy FFTFn206Easy FFT××page 8-16	Setting	Search Origin <sup>*2</sup>	Fn003	Origin Search	0	0	page 7-19
Trouble- shootingDisplay AlarmFn000Display Alarm HistoryOOpage 12-43Image: Page AlarmFn014Reset Option Module Configuration ErrorOOpage 12-44Reset Motor Type AlarmFn014Reset Option Module Configuration ErrorOOpage 12-45OperationJogFn021Reset Motor Type AlarmOOpage 12-47JogFn021Reset Motor Type AlarmOOpage 7-7OperationProgram JOG Opera- tionFn004Jog ProgramOOpage 7-7Iming - Autotuning without Host ReferenceFn201Advanced Autotuning without Reference××page 8-24Tuning - Autotuning with Host ReferenceFn202Advanced Autotuning with Reference××page 8-35Tuning - Custom Tuning - Custom Tuning - Vibration SuppressionFn203One-Parameter Tuning Control××page 8-51Tuning - Custom Tuning - Vibration SuppressionFn205Vibration Suppression××page 8-56Image SconeFn204Tuning-less Level Set- tingYibration Suppression×××page 8-56DiagnosticEasy FFTFn206Easy FFT×××page 8-16			Fn020		×	0	page 5-53
Trouble- shootingDisplay AlarmFn006Clear Alarm HistoryOOpage 12-44Reset Motor Type AlarmFn014Reset Option Module Configuration ErrorOOpage 12-45Reset Motor Type AlarmFn021Reset Motor Type AlarmOOpage 12-47JogFn021Reset Motor Type AlarmOOpage 7-7OperationProgram JOG Opera- tionFn004Jog ProgramOOpage 7-14Tuning - Autotuning without Host ReferenceFn201Advanced Autotuning without Reference××page 8-24Tuning - Autotuning with Host ReferenceFn202Advanced Autotuning with Reference××page 8-35Tuning - Custom Tuning - Custom Tuning - Custom Tuning - Custom Tuning - Nance ControlFn204Adjust Anti-resonance Control××page 8-51Tuning - Custom Tuning - Custom Tuning - Response Level Set- tingFn205Vibration Suppression××page 8-56DiagnosticEasy FFTFn206Tuning-less Level Set- ting××page 8-16		Polarity Detection	Fn080	Polarity Detection	×	×	page 5-26
Trouble- shootingDisplay AlarmFn014Reset Option Module Configuration ErrorOOpage 12-45Reset Motor Type AlarmFn021Reset Motor Type AlarmOOpage 12-47JogFn022JogOOpage 7-7Program JOG Opera- tionFn004Jog ProgramOOpage 7-14Tuning - Autotuning without Host ReferenceFn201Advanced Autotuning without Reference××page 8-24Tuning - Autotuning with Host ReferenceFn202Advanced Autotuning with Reference××page 8-35Tuning - Custom Tuning - Custom Tuning - Vibration SuppressionFn203One-Parameter Tuning Custom Tuning - Adjust Anti-resonance Control××page 8-51Tuning - Custom Tuning - Vibration SuppressionFn205Vibration Suppression××page 8-56DiagnosticEasy FFTFn206Easy FFT××page 8-16			Fn000	Display Alarm History	0	0	page 12-43
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tionFn004Jog ProgramOOPage 7-14Image: Tuning - Autotuning without Host ReferenceFn201Advanced Autotuning without Reference××page 8-24Tuning - Autotuning with Host ReferenceFn202Advanced Autotuning with Reference××page 8-35Tuning - Autotuning with Host ReferenceFn203One-Parameter Tuning××page 8-42Tuning - Custom Tuning - Adjust Anti-reso- nance ControlFn204Adjust Anti-resonance Control××page 8-51Tuning - Custom Tuning - Vibration SuppressionFn205Vibration Suppression××page 8-56DiagnosticEasy FFTFn200Tuning-less Level Set- ting×××page 8-16		Jog	Fn002	Jog	0	0	page 7-7
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		ting	Fn200	ting	×	×	page 8-16
	Diagnostic	Easy FFT	Fn206	Easy FFT			

Continued on next page.

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	Continued norr previous page.						
SigmaWin+			Digital Operator	Execu			
Menu Bar Button	SigmaWin+ Function Name	Fn No.	Utility Function Name	Motor Not Connected	Motor Connected	Reference	
Adjust the Analog		Fn00C	Adjust Analog Monitor Output Offset	0	0	page 9-9	
Others Adjust rent Du	Monitor Output	Fn00D	Adjust Analog Monitor Output Gain	0	0	page 9-9	
	Adjust the Motor Cur- rent Detection Offsets	Fn00E	Autotune Motor Cur- rent Detection Signal Offset	×	0	page 6-55	
		Fn00F	Manually Adjust Motor Current Detection Sig- nal Offset	×	0	page 0-00	
	Initialize Vibration Detection Level	Fn01B	Initialize Vibration Detection Level	×	×	page 6-51	
	Write Prohibited Set- ting	Fn010	Write Prohibition Set- ting	0	0	page 5-8	

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

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

# 7.7 Operation Using MECHATROLINK-III Commands

Refer to the following manual for information on MECHATROLINK-III commands.  $\bigcap_{N=0}^{\infty} \Sigma^{-7}\text{-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP $800001 31)}$ 

Information	The SERVOPACK's device code is as follows:	

ID Code	Description	Data Size	Data Type	Support	
	Device Code	4 bytes	Binary data	Yes	
02h	02250002h (Σ-7S-series SERVOPACK with RJ-45 Connector (SGD7S-□□□□30□)) There is a specific code for each device.				

# Tuning

This chapter provides information on the flow of tuning, details on tuning functions, and related operating procedures.

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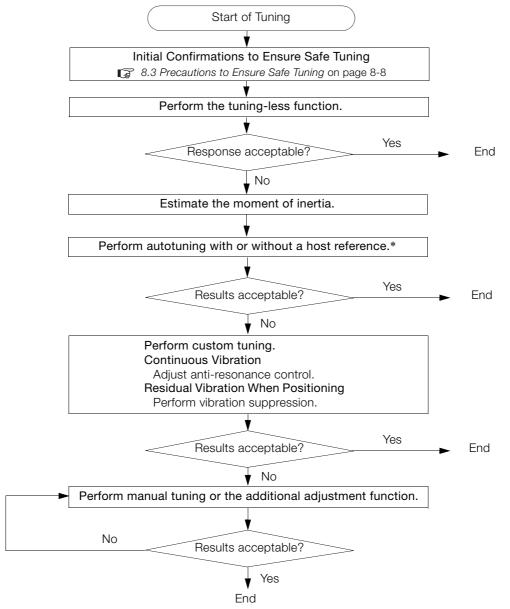
# 8.1 Overview and Flow of Tuning

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 while performing program jogging.

8.1.1 Tuning Functions

# 8.1.1 Tuning Functions

Tuning Function	Outline	Applicable Con- trol Methods	Reference
Tuning-less Function	This automatic adjustment function is designed to enable stable operation without servo tuning. This function can be used to obtain a stable response regardless of the type of machine or changes in the load. You can use it with the default settings.	Speed control or position control	page 8-12
Moment of Inertia Estimation	The moment of inertia ratio is calculated by operat- ing the Servomotor a few times. The moment of inertia ratio that is calculated here is used in other tuning functions.	Speed control, position control, or torque control	page 8-16
Autotuning without Host Reference	<ul> <li>The following parameters are automatically adjusted in the internal references in the SERVO- PACK 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>	Speed control or position control	page 8-24
Autotuning with Host 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>	Position control	page 8-35
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>	Speed control or position control	page 8-42
Anti-resonance Control Adjustment	This function effectively suppresses continuous vibration.	Speed control or position control	page 8-51
Vibration Suppression	This function effectively suppresses residual vibra- tion if it occurs when positioning.	Position control	page 8-56
Speed Ripple Com- pensation	This function reduces the ripple in the motor speed.	Speed control, position control, or torque control	page 8-60
Additional Adjustment Function	This function combines autotuning with custom tuning. You can use it to improve adjustment results.	Depends on the functions that you use.	page 8-66
Manual Tuning	You can manually adjust the servo gains to adjust the response.	Speed control, position control, or torque control	page 8-81

The following table provides an overview of the tuning functions.

8.1.2 Diagnostic Tool

# 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	Applicable Control Methods	Reference
Mechanical Analysis	The machine is subjected to vibration to detect resonance frequencies. The measurement results are displayed as waveforms or numeric data.	Speed control, position control, or torque control	page 8-95
Easy FFT	The machine is subjected to vibration to detect resonance frequencies. The measurement results are displayed only as numeric data.	Speed control, position control, or torque control	page 8-97

# 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.

• Position Control

Item	Unit		
	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		

#### • Speed Control

Item	Unit		
nem	Rotary Servomotor	Linear Servomotor	
Torque reference	%		
Feedback speed	min <sup>-1</sup>	mm/s	
Reference speed	min⁻¹	mm/s	

#### Torque Control

ltem	Unit		
	Rotary Servomotor	Linear Servomotor	
Torque reference	%		
Feedback speed	min <sup>-1</sup>	mm/s	

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.

5.11 Overtravel and Related Settings on page 5-29

# 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. 6.7 Selecting Torque Limits on page 6-28

# 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

 $Position \text{ deviation [reference units]} = \frac{Motor \text{ speed [mm/s]}}{Pn102 [0.1/s]/10^{*2,*3}} \times \frac{Resolution}{Linear \text{ encoder pitch } [\mum]/1,000} \times \frac{Pn210}{Pn20E}$ 

#### 8.3.3 Setting the Position Deviation Overflow Alarm Level

Position Deviation Overflow Alarm Level (Pn520) [setting unit: reference units]

#### Rotary Servomotors

 $Pn520 > \frac{\text{Maximum motor speed [min^{-1}]}}{60} \times \frac{\text{Encoder resolution}^{*1}}{Pn102 [0.1/s]/10^{*2, *3}} \times \frac{Pn210}{Pn20E} \times \frac{(1.2 \text{ to } 2)^{*4}}{Pn20E}$ 

#### · Linear Servomotors

D- 500	Maximum motor speed [mm/s]	Resolution	$\times \frac{\text{Pn210}}{\text{max}} \times (1.2 \text{ to } 2)^{*4}$	
Pn520 >	Pn102 [0.1/s]/10 <sup>*2, *3</sup>	Linear encoder pitch [µm]/1,000	Pn20E (1.2 to 2)	

\*1. Refer to the following section for details.

5.15 Electronic Gear Settings on page 5-44

- \*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.  $\frac{Pn210}{Pn20E} = \frac{1}{16}$ 

$$Pn520 = \frac{6,000}{60} \times \frac{16,777,216}{400/10} \times \frac{1}{16} \times 2$$
$$= 2,621,440 \times 2$$

= 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		Position		
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			Position	
Pn51E	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 100	1%	100	Immediately	Setup

## **Related Alarms**

Alarm Number	Alarm Name	Alarm Meaning
A.d00	Position Deviation Overflow Alarm	This alarm is displayed when the position deviation exceeds the set- ting of Pn520 (Position Deviation Overflow Alarm Level).

8.3.4 Vibration Detection Level Setting

### **Related Warnings**

Warning Number	Warning Name	Warning Meaning
A.900	Position Deviation Overflow Warning	This warning occurs if the position deviation exceeds the specified percentage (Pn520 $\times$ Pn51E/100).

## 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.

@ 6.11 Initializing the Vibration Detection Level on page 6-51

# 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			Position	
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			Posit	ion
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			Position	
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			Position	
Pn584	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	10,000	Immediately	Setup

#### 8.3.5 Setting the Position Deviation Overflow Alarm Level at Servo ON

# **Related Alarms**

Alarm Number	Alarm Name	Alarm Meaning
A.d01	Position Deviation Overflow Alarm at Servo ON	This alarm occurs if the servo is turned ON after the position devia- tion exceeded the setting of Pn526 (Excessive Position Deviation Alarm Level at Servo ON) while the servo was OFF.
A.d02	Position Deviation Overflow Alarm for Speed Limit at Servo ON	If position deviation remains in the deviation counter, the setting of Pn529 or Pn584 (Speed Limit Level at Servo ON) will limit the speed when the servo is turned ON. This alarm occurs if a position refer- ence is input and the setting of Pn520 (Excessive Position Deviation Alarm Level) is exceeded.

Refer to the following section for information on troubleshooting alarms. *12.2.3 Resetting Alarms* on page 12-42

# **Related Warnings**

Warning Number	Warning Name	Warning Meaning
A.901	Position Deviation Overflow Warning 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 tuning-less function is disabled during torque control.
- 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.

Function	Executable?	Remarks
Vibration Detection Level 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 Reference	×	Disable the tuning-less function (Pn170 = $n.\Box\Box\Box$ 0) before you execute autotuning without a host reference.
Autotuning with Host Reference	×	-
Custom Tuning	×	-
Anti-Resonance Control Adjustment	×	_
Vibration Suppression	×	-
Easy FFT	0	The tuning-less function is disabled while you execute Easy FFT and then it is enabled when Easy FFT has been 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 mechan- ical analysis has been completed.

\* O: Yes ×: No

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.		
n.□□□1 (default setting)	Enable tuning-less function.			
Pn170	n.□□0□ (default setting)	Use for speed control.	After restart	Setup
	n.0010	Use for speed control and use host controller for position control.		

When you enable the tuning-less function, you can select the tuning-less type. Normally, set Pn14F to  $n.\square\square2\square$  (Use tuning-less type 3) (default setting). If compatibility with previous models is required, set Pn14F to  $n.\square\square0\square$  (Use tuning-less type 1) or  $n.\square\square1\square$  (Use tuning-less type 2).

Parameter		Meaning	When Enabled	Classification
	n.🗆 🗆 🗆	Use tuning-less type 1.		
Pn14F n.DD1D		Use tuning-less type 2. (The noise level is improved more than with tuning-less type 1.)	After restart	Tuning
	n.□□2□ (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>Servo</u> 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

# 3. 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.□□0□ or n.□□1□) is used.
5		
4 (default setting)		
3		
2		]-
1		
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  $n.\square7\square\square$ ).

Parameter		Description	When 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□□ (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
	n.0000	Tuning-less load level 0		
Pn170	n.1□□□ (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 =  $n.X\square\square\square$  or the setting of Pn170 =  $n.\squareX\square\square$ .

- Excessive Vibration during Position Control
- Increase the setting of  $Pn170 = n.X\square\square\square$  or decrease the setting of  $Pn170 = n.\squareX\square\square$ .

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 =  $n.\Box\Box\Box$ 1) (default setting), the parameters in the following table are disabled.

Item	Parameter Name	Parameter Number
	Speed Loop Gain Second Speed Loop Gain	Pn100 Pn104
Gain-Related Parameters	Speed Loop Integral Time Constant Second Speed Loop Integral Time Constant	Pn101 Pn105
	Position Loop Gain Second Position Loop Gain	Pn102 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 torque control, Easy FFT, and mechanical analysis for a vertical axis. The gain-related parameters in the above table are enabled for torque control, Easy FFT, and mechanical analysis. Of these, Pn100, Pn103, and Pn104 are enabled for torque control.

# 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	Do not adjust the second stage notch filter automatically when the tuning-less function is enabled or during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		Immediately	Tuning	
	n.□1□□ (default setting)	Adjust the second stage notch filter automati- cally when the tuning-less function is enabled or during execution of autotuning without a host reference, autotuning with a host refer- ence, and custom tuning.	initiculately	Turning	

### 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 Constan		
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 8-26

### 8.5.1 Outline

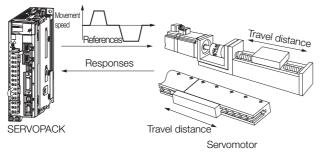
The moment of inertia during operation is automatically calculated by the SERVOPACK for round-trip (forward and reverse) operation. A reference from the host controller is not used.

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 jogging to a position that ensures a suitable range of motion.

## 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

8.5.3 Applicable Tools

# 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 proportional control is used

Note: If you specify calculating the moment of inertia, an error will occur if V\_PPI in the servo command output signals (SVCMD\_IO) changes to specify the proportional action during moment of inertia estimation.

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 speed feedforward or torque feedforward is input

### 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 control method must not be set to torque control.
- The gain selection switch must be set to manual gain selection (Pn139 =  $n.\Box\Box\Box$ ).
- 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 =  $n.\Box\Box\Box$ ).

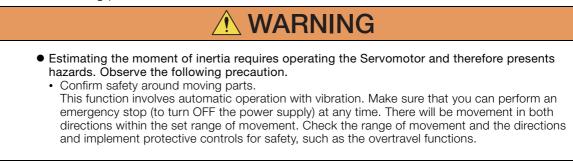
# 8.5.3 Applicable Tools

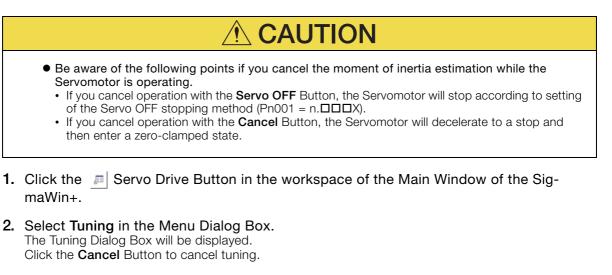
The following table lists the tools that you can use to estimate the moment of inertia.

Tool	Fn No./Function Name	Operating Procedure Reference	
Digital Operator	You cannot estimate the moment of inertia from the Digital Operator.		
SigmaWin+ Tuning - Tuning		8.5.4 Operating Procedure on page 8-17	

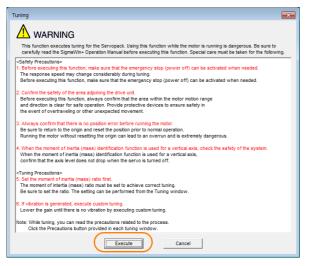
## 8.5.4 Operating Procedure

Use the following procedure to set the moment of inertia ratio.





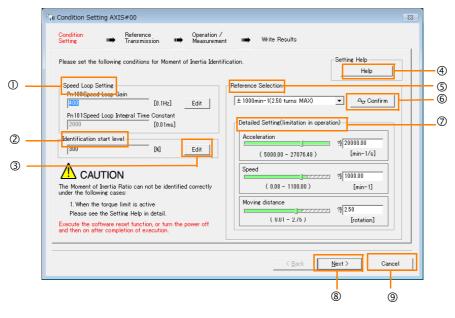
3. Click the Execute Button.



4. Click the Execute Button.

Tuning AXIS#00
Set the moment of inertia (mass) ratio before Precautions executing autotuning.
Moment of inertia (mass) ratio identification
Pol (03 - Memoria of Partia Ratio
Autotuning Reference input from host controller © Postion Reference Input No Reference Input U
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.

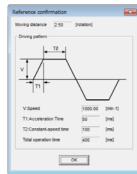
#### **S** Reference Selection Area

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.



#### ⑦ Detailed Setting Area

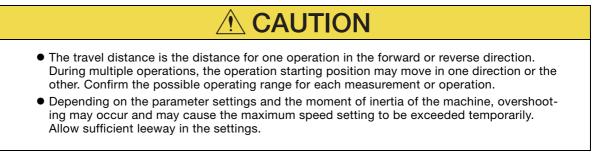
You can change the settings by moving the bars or directly inputting the settings to create the required reference pattern.

® Next Button

Click this button to display the Reference Transmission Dialog Box.

③ Cancel Button

Click this button to return to the Tuning Dialog Box.



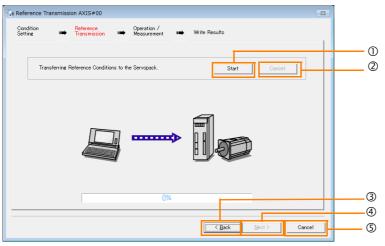
#### Information When Measurement Is Not Correct

Estimating the moment of inertia ratio cannot be performed correctly if the torque limit is 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.

#### 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

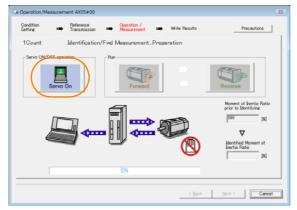
This button appeals press

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.



#### 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.

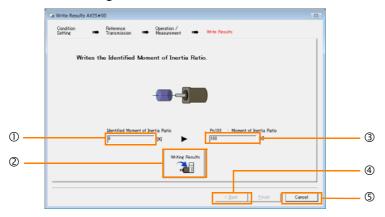
#### 14. Click the Next Button.

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.



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.

2 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.

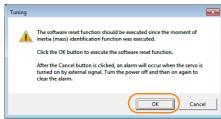
④ Back Button

This button is disabled.

S 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.



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.

<ul> <li>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 vibration is eliminated.</li> <li>You cannot execute autotuning without a host reference if the tuning-less function is enabled (Pn170 = n.□□□1 (default setting)). Disable the tuning-less function (Pn170 = n.□□□0) before you execute autotuning without a host reference.</li> <li>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.</li> <li>Pn140 = n.□□□0 (Do not use model following control.)</li> <li>Pn160 = n.□□□0 (Do not use anti-resonance control.)</li> <li>Pn408 = n.00□0 (Disable friction compensation, first stage notch filter, and second stage notch filter.)</li> <li>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.□□□1) and then turn the power supply OFF and ON again.</li> </ul>
--

# 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.

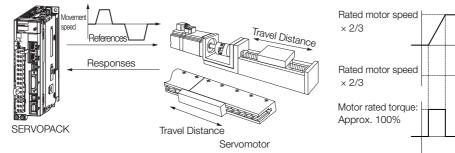
- Moment of inertia ratio
- · Gains (e.g., speed loop gain and position loop gain)
- Filters (torque reference filter and notch filters)
- Friction compensation
- Anti-resonance control
- Vibration suppression (only for mode 2 or 3)

Refer to the following section for details on the parameters that are adjusted. **8.6.7** *Related Parameters* on page 8-34

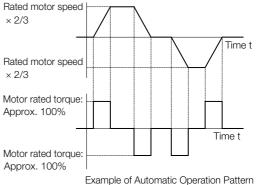
The Servomotor is operated with the following specifications.

Maximum speed	Rated motor speed × $\frac{2}{3}$	
Acceleration Torque	Rated motor torque: Approx. 100% Note: The acceleration torque depends on the setting of the moment of inertia ratio (Pn103), and the influences of machine friction and external disturbance.	
	Rotary Servomotors	You can set the desired travel distance. The default setting is for a value equivalent to 3 Servomotor shaft rotations.
Travel Distance	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.)

8.6.2 Restrictions



Note: Execute autotuning without a host reference after jogging to a position that ensures a suitable range of motion.



- 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 outcomption

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.  $\boxed{3}$  8.7 Autotuning with a Host Reference on page 8-35

3.8 Custom Tuning on page 8-42

### 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 proportional control is used

Note: If you specify calculating the moment of inertia, an error will occur if V\_PPI in the servo command output signals (SVCMD\_IO) changes to specify the proportional action during moment of inertia estimation.

• 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 speed feedforward or torque feedforward is input
- 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 control method must not be set to torque control.
- The gain selection switch must be set to manual gain selection (Pn139 =  $n.\square\square\square$ ).
- 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.
  - 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.

### 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	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Tuning - Tuning	S.6.4 Operating Procedure on page 8-26

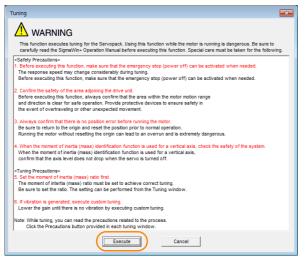
## 8.6.4 Operating Procedure

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.
- If you are using an MP3000-series Controller for phase control, set the mode selection to 1. If 2 or 3 is selected for the mode, correct phase control may not be possible.
- 1. Confirm that the moment of inertia ratio (Pn103) is set correctly.
- 2. 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 No Reference Input Option in the Autotuning Area and then click the Autotuning 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
0 % Edit
Autotuning -
Reference input from host controller
C Postion Reference Input
Advanced adjustment

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 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.

Set conditions. Switching the load moment of intertia (load mass) identification 1:A moment of inertia is not presumed.  Mode selection 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.	•	0: A moment of ind 1: A moment of ind Mode selection E Set the mode.	-
Mechanism selection		Mode Selection	Description
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.	1	1: Standard	Standard gain adjustment is per- formed. In addition to gain adjust- ment, notch filters and anti-resonance control are automatically adjusted.
Distance The moving range from the current value is specified. 786000 [reference units] (-99990 - 99990) (Setting invalid range : -131 - 131) 3.0 [Rotation]		2: For positioning	Tuning is performed for positioning applications. In addition to gain adjustment, model following control, notch filters, anti-resonance control, and vibration suppression are auto- matically adjusted.
Start tuning using the default settings.		3: For positioning especially to pre- vent overshooting	Tuning is performed for positioning applications with emphasis on elimi- nating overshooting. In addition to gain adjustment, notch filters, anti- resonance control, and vibration sup- pression are automatically adjusted.
<b>Distance</b> Box Set the travel distance. Movement range: -99,990,000 to +99,990,000 [reference units] Minimum setting increment for travel dis- tance: 1,000 [reference units] Negative values are for reverse operation and positive values are for forward opera-		drive. If there is noise or results may be obt	etion Box cording to the machine element to if the gain does not increase, better tained by changing the rigidity type. cording to the following guidelines.
tion from the current position.		Mechanism Selection	Description
Default settings: Rotary Servomotors: Approx. 3 rotations Direct Drive Servomotors: Approx. 0.3 rotations Linear Servomotors: Approx 90 mm Set the distance to the following values or higher. To ensure tuning precision, we rec- pommend that you use approximately the default distance acting		1: Belt mechanism	Tuning is performed for a mecha- nism with relatively low rigidity, e.g., a belt.
		2: Ball screw mech anism or linear motor	Tuning is performed for a mecha- nism with relatively high rigidity, e.g., a ball screw or Linear Servomotor. Use this setting if there is no other appropriate setting.
default distance setting. Rotary Servomotors: 0.5 rotations Direct Drive Servomotors: 0.05 rotations		3: Rigid model	Tuning is performed for a mecha- nism with high rigidity, e.g., a rigid body system.

Specify the parameters to use for tuning. If you select the **Start tuning using the default settings** Check Box, the tuning parameters will be returned to the default settings before tuning is started.

7. Click the Servo ON Button.

Autotuning - Automatic s	setting AXIS#00	×
Waiting for execution Oscillation level measurement	Servo ON/OFF oper	vo OFF
Gain search behaviour evaluation	Mode selection 2:For positioning	Start tuning
	Mechanism selection 2:Ball screw me	ction chanism or linear motor
Notch filter Anti-res Adj Vib Suppress	Distance 786000 3.0	[reference units] [Rotation]
Precautions	< <u>B</u> ack	Finish Cancel

8. Click the Start tuning Button.

T Autotuning - Automatic setting AXIS#00			
Waiting for execution	Servo ON/OFF operation Servo OFF		
Gain search behaviour evaluation	Tuning Start tuning		
	2:For positioning Mechanism selection 2:Ball screw mechanism or linear motor Distance		
Notch filter Anti-res Adj Vib Suppress	786000         [reference units]           3.0         [Rotation]		
Precautions	< Back Finish Cancel		

8.6.5 Troubleshooting Problems in Autotuning without a Host Reference

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.

Autotuning - Automatic s	setting AXIS#00
Waiting for execution	Servo ON/OFF operation Servo OFF Servo OFF
Oscillation level measurement	
Gain search 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 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- 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>

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 were not successfully completed.	Machine vibration occurs or the posi- tioning completion signal is not stable 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 trouble	eshooting information. Iation of Moment of Inertia on page 8-31
Positioning was not completed within approximately 10 sec- onds after position adjustment was com- pleted.	The positioning completed width is too narrow or proportional control is being used.	<ul> <li>Increase the setting of the positioning completed width (Pn522).</li> <li>Set V_PPI to 0 in the servo command output signals (SVCMD_IO).</li> </ul>

### 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>
The speed control section changed to proportional control during calculation of the moment of inertia, e.g., V_PPI in the servo command output signals (SVCMD_IO) was set to 1.	Use PI control when calculating the moment of inertia.

### ◆ 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		Speed Posit	ion Torque	
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.

F	Parameter	Function	When Enabled	Classification
Pn460	n.□□□0	Do not adjust the first stage notch filter auto- matically during execution of autotuning with- out a host reference, autotuning with a host reference, and custom tuning.	Immediately	Tuning
	n.□□□1 (default setting)	Adjust the first stage notch filter automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		
	n.0000	Do not adjust the second stage notch filter automatically when the tuning-less function is enabled or during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.		
	n.□1□□ (default setting)	Adjust the second stage notch filter automati- cally when the tuning-less function is enabled or during execution of autotuning without a host reference, autotuning with a host refer- 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
Pn160	ically during execution of autotuning without	Do not adjust anti-resonance control automat- ically during execution of autotuning without a host reference, autotuning with a host refer- ence, and custom tuning.	Immediately	Tuning
FIII00	n.□□1□ (default setting)	Adjust anti-resonance control automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	inineciately	Turning

### 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.

#### 8.6.6 Automatically Adjusted Function Settings

P	arameter	Function	When Enabled	Classification
Pn140	n.0000	Do not adjust vibration suppression automati- cally during execution of autotuning without a host reference, autotuning with a host refer- ence, and custom tuning.	Immediately	Tuning
11140	n.⊡1□□ (default setting)	Adjust vibration suppression automatically during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.	inineulately	Turning

### 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.X□□□ (Friction Compensation Function Selection)*	
2: For position control	Adjusted with friction componention	
3: For position control (emphasis on overshooting)	Adjusted with friction compensation.	

Parameter		Function	When Enabled	Classification
Pn408	n.0□□□ (default setting)	Disable friction compensation.	Immediately	Setup
	n.1000	Enable friction compensation.		

\* Refer to the following section for details.

Required Parameter Settings on page 8-70

### Feedforward

If Pn140 is set to n.0 [1] (Do not use model following control and speed/torque feedforward together (default setting)) and tuning is performed with the mode selection set to 2 or 3, feed-forward (Pn109), the speed feedforward input (VFF), and the torque feedforward input (TFF) will be disabled.

To use the speed feedforward input (VFF), the torque feedforward input (TFF), and model following control from the host controller in the system, set Pn140 to n.1 []] (Use model following control and speed/torque feedforward together).

Parameter		Function	When Enabled	Classification
Pn140	n.0□□□ (default setting)	Do not use model following control and speed/torque feedforward together.	Immediately	Tuning
11140	n.1000	Use model following control and speed/torque feedforward together.	inineclately	rannig

Refer to the following manual for information on the torque feedforward input (TFF) and the speed feedforward input (VFF).

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)



When model following control is used with the feedforward function, it is used to make optimum feedforward settings in the SERVOPACK. Therefore, model following control is not normally used together with either the speed feedforward input (VFF) or torque feedforward input (TFF) from the host controller. However, model following control can be used with the speed feedforward input (VFF) or torque feedforward input (TFF) if required. An unsuitable feedforward input may result in overshooting.

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 Jogging Travel Distance	No
Pn533	Program Jogging Movement Speed for Rotary Servomotor	No
Pn585	Program Jogging Movement Speed for Linear Servomotor	No
Pn534	Program Jogging Acceleration/Deceleration Time	No
Pn535	Program Jogging Waiting Time	No
Pn536	Program Jogging Number of Movements	No

Yes: The parameter is automatically set.

No: The parameter is not automatically set, but the setting is read during execution.

8.7.1 Outline

# 8.7 Autotuning with a Host Reference

This section describes autotuning with a host reference.



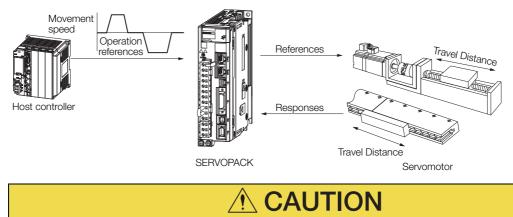
Autotuning with a host reference makes adjustments based on the set speed loop gain (Pn100). Therefore, precise adjustments cannot be made if there is vibration when adjustments are started. Make adjustments after lowering the speed loop gain (Pn100) until vibration is eliminated.

# 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



• 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 proportional control 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.

3.8 Custom Tuning on page 8-42

### 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.
- Position control must be selected if power is supplied to the motor (i.e., when the servo is ON).
- The gain selection switch must be set to manual gain selection (Pn139 =  $n.\Box\Box\Box$ ).
- 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

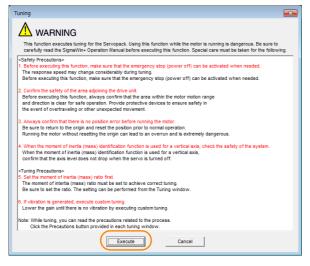
The following table lists the tools that you can use to perform autotuning with a host reference.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn202	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Tuning - Tuning	8.7.4 Operating Procedure on page 8-37

Use the following procedure to perform autotuning with a host reference.



- If you are using an MP3000-Series Controller for phase control, set the mode selection to 1. If 2 or 3 is selected for the mode, correct phase control may not be possible.
- 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.
- 4. Click the Execute Button.



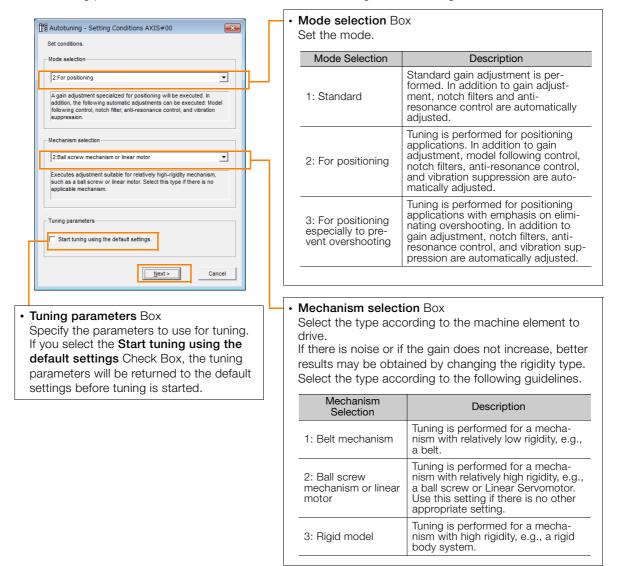
5. Select the **Position reference input** Option in the **Autotuning** Area and then click the **Autotuning** Button.

	Tuning AXIS#00
	Set the moment of inertia (mass) ratio before Precautions
	Moment of inertia (mass) ratio identification
i	Pn103 : Moment of Inertia Ratio
	Execute
	202 % Edit
	₽ 
	Autotuning
	Reference input from host controller
	Position Reference Input
	C No Reference input
	Advanced adjustment Finish

**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.



7. Click the Yes Button.

Autotuning 💽
Tuning will be executed after resetting the tuning parameters to their default values. When tuning starts, the current tuning results will be lost. Do you want to execute tuning?

8. Input the correct moment of inertia ratio and click the Next Button.

📲 Autotuning - Moment of Inertia Ratio Setting AXI 🔜			
If 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.** First confirm safety around moving parts. Turn ON the servo, enter a reference from the host controller, and then click the **Start tuning** Button.

Autotuning - Automatic s	etting AXIS#00	<b>X</b>
Waiting for execution	Tuning Turn the servo on, input the reference from the host controller, and then click the Start button.	
Tuning completed	Mode selection 2:For positioning	
Notch filter Anti-res Adj Vib Suppress	Mechanism selection 2:Ball screw mechanism or linear motor	-
Precautions	< Back Finish Cance	

**10.** Click the **Yes** Button.

Autotuning		
Please check the safety near an operation part. Execute?		
Ves No		

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.

8.7.5 Troubleshooting Problems in Autotuning with a Host Reference

E Autotuning - Automatic s	setting AXIS#00	X
Waiting for execution	Tuning Executing tuning (Input the reference.)	
Oscillation level measurement	Cancel	
Gain search behaviour evaluation	4	
Tuning completed	Mode selection	
	2:For positioning	
Notch filter	Mechanism selection	
OAnti-res Adj Vib Suppress	2:Ball screw mechanism or linear motor	
Precautions	< Back Finish Cancel	

#### **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 occurs or positioning completion is not stable 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>
Positioning was not completed within approximately 10 seconds after posi- tion adjustment was completed.	The positioning com- pleted width is too nar- row or proportional control is being used.	<ul> <li>Increase the setting of the positioning completed width (Pn522).</li> <li>Set V_PPI to 0 in the servo command output signals (SVCMD_IO).</li> </ul>

8.7.6 Automatically Adjusted Function Settings

### ◆ 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		Speed Position Torque		
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 8-32

### 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.

8.8.1 Outline

# 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 speed or position 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 8-50

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.

# **A CAUTION**

• 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).
- If speed control is used, tuning mode 0 or 1 must be set.
- The parameters must not be write prohibited.

8.8.3 Applicable Tools

# 8.8.3 Applicable Tools

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 Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Tuning – Tuning	8.8.4 Operating Procedure on page 8-43

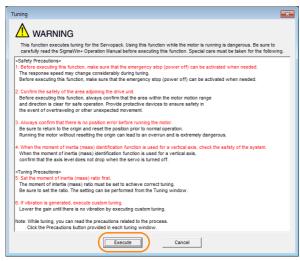
## 8.8.4 Operating Procedure

Use the following procedure to perform custom tuning.

: ( •	<ul> <li>Before you execute custom tuning, check the information provided in the SigmaWin+ oper- ting manual.</li> <li>Dbserve the following precautions.</li> <li>Make sure that you can perform an emergency stop at any time.</li> <li>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.</li> <li>Set the moment of inertia correctly before you execute custom tuning.</li> <li>If the setting greatly differs from the actual moment of inertia, vibration may occur.</li> <li>If you change the feedforward level, the new setting will not be used immediately. It will be used after positioning is completed.</li> </ul>
	f you are using an MP3000-series Controller for phase control, set the tuning mode to 0 or I. If 2 or 3 is selected for the tuning mode, correct phase control may not be possible.

- 1. Confirm that the moment of inertia ratio (Pn103) is set correctly.
- 2. Click the *P* 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. Click the Advanced adjustment Button.

Tuning AXIS#00	
Set the moment of inertia (mass) ratio before 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	
Advanced adjustment Finish	

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 seting. Set a correct moment of inertia (mass) ratio in the Moment of Inertia (Mass) Setting window before starting tuning. If an incorrect moment of Inertia (mass) ratio is set, vibration may be generated during tuning. Do you want to continue tuning?
Cancel

6. Click the Custom tuning Button.

Tuning	
Click the button of the function to be execute	d.
Manually adjust gain and vibration.	
Suppress vibration by decreasing gain whe	en stopped.

7. Set the Tuning mode Box and Mechanism selection Box, and then click the Next Button.

	Tuning mode Box	
Custom Tuning - Mode selection AXIS#00	Mode Selection	Description
2:Set serve gains for positioning application.  2:Set serve gains with priority given to stability. Overshoot will rarely occur since priority is given to stability. In addition to gain adjustments, the notch filter and anti-resonance control (except for torque (force) control) can be adjusted.  1:Set serve gains with priority given to response.	0: Set servo gains with priority given to stability.	This setting gives priority to stability and preventing overshooting. In addi- tion to gain adjustment, notch filters and anti-resonance control (except during torque control) are automatically adjusted.
Overshoot may occur since priority is given to responsiveness. In addition to gain adjustments, the notch filter and anti-resonance control (except for torque (force) control) can be adjusted.         Mechanism selection         2:Ball screw mechanism or linear motor	1: Set servo gains with priority given to response.	Overshooting may occur because pri- ority is given to response. In addition to gain adjustment, notch filters and anti- resonance control (except during torque control) are automatically adjusted.
Executes adjustment suitable for relatively high-rigidity mechanism, such     as a ball screw or linear motor. Select this type if there is no applicable     Option     Friction compensation         C Enable         C Disable	2: Set servo gains for positioning application.	Tuning is performed for positioning applications. In addition to gain adjust- ment, notch filters, anti-resonance control, and vibration suppression are adjusted.
Next > Cancel	3: Set servo gains especially to pre- vent overshooting during positioning application.	Tuning is performed for positioning applications with emphasis on elimi- nating overshooting. In addition to gain adjustment, notch filters, anti-reso- nance control, and vibration suppres- 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 Cancel	

8.8.4 Operating Procedure

**9.** Turn ON the servo, enter a reference from the host controller, and then click the **Start tuning** Button.

Tuning Mode 0 or 1

Tuning mode	0 : Set servo gains with priority given to stability.		Tu
Mechanism selection	2 : Ball screw mechanism or linear motor		Me
Friction compensation	Enable		Fri
Gain status	1 gain		Ga
Tuning level adjustmen Setting the tuning level too high can cause vibration or abnormal noise. Finish		Start tuning	In ov
	Auto-setting Notch fiter 1 step inactive Cancel	Vib Detect	
	Anti-res Ctrl Adj Anti-res Adj inactive Cancel	Anti-res Ctrl Adj	No

#### Tuning Mode 2 or 3

Tuning mode	2 : Set servo gains for positioning application.	
Mechanism selection	2 : Ball screw mechanism or linear motor	
Friction compensation	Enable	
Gain status	1 gain	
	Tuning level	
FF level adjustment	Set the tuning level and start the tuning. Feed forward level (FF)	Start tuning
Increase until		
overshooting occurs.	(1 - 2000)	
<del>\</del>	Feedback level (FB)	
FB level adjustment	88839	
Increase until	(1 - 2000)	
Increase until overshooting disappears		
		Vik Detect
	S. Auto-setting Notch filter 1 step inactive	Vib Detect
	5. Auto-setting Notch filter	Vib Detect
Response level OK?	Auto-setting Notch filter 1 step	Vib Detect
Response level OK?	Auto-setting Notch filter 1 step inactive Cancel 2 step inactive Cancel	
Response level OK?	Auto-setting Notch filter 1 step	Vib Detect
Response level OK?	Auto-setting Notch filter 1 step inactive Cancel 2 step inactive 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.

	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	
Gain status Tuning level adjustment Setting the tuning level too high can cause vibration or shormal noise. Finish	Tuning level. Set the tuning level. Tuning level	Back
	Auto-asting Notch filter Vibration not detected 1 step inactive 2 step inactive Anti-res Ctrl Adj Vibration not detected Anti-res Add inactive	Vib Detect

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.

Custom Tuning - Ad	lust AXIS#00	×
Tuning mode	2 : Set servo gains for positioning application.	
Mechanism selection	2 : Ball screw mechanism or linear motor	
Friction compensation	Enable	
Gain status	1 gain	
	Tuning level Set the tuning level. Feed forward level (FF)	
FF level adjustment		Back
Increase until overshooting occurs.		-
overshooting occurs.	(1 - 2000)	
↓	Feedback level (FB)	
FB level adjustment		
Increase until	(1 - 2000)	
overshooting disappears	Auto-setting	
↓ ↓	Notch filter Vibration not detected	Vib Detect
	1 step inactive Cancel	
Response level OK?	2 step inactive	-4
I Yes	Anti-res Ctrl Adj Vibration not detected	
<u> </u>	Anti-res Adj inactive Cancel	Anti-res Ctrl Adj
Finish	Vib Suppression	
	Frequency 1 inactive Cancel	Vib Suppress
Precautions	< Back To Autotuning Completed.	Cancel

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 8-47

8.8.4 Operating Procedure

**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.

	0 : Set servo gain	is with pri	ority given to	stability.		
Mechanism selection	2 : Ball screw me	chanism o	r linear moto	r		
Friction compensation	Enable					
Gain status	1 gain					
Tuning level adjustmen Setting the tuning level too high can cause vibration or abnormal noise.	Tuning level Set the tuning Tuning level	level.	ł	2000)		Back
Finish						
Finish	Auto-setting					
Finish	Auto-setting Notch filter	Vibratio	n not detecte	ed		Vib Detect
Finish		Vibratio	inactive	cancel	۹	Vib Detect
Finish	Notch filter	Vibratio	inactive		۹	Vib Detect
Finish	Notch filter 1 step		inactive inactive	Cancel	٩	Vib Detect

This concludes the procedure to set up custom tuning.

## **Vibration Suppression Functions**

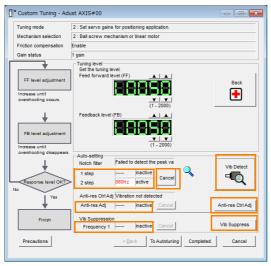
#### Notch Filters and Automatic Anti-resonance Control Setting

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.



8.8.5 Automatically Adjusted Function Settings

#### • 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 8-51

#### • 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 8-56

### 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 8-35

## 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. **8.6.6** Automatically Adjusted Function Settings on page 8-32

8.8.6 Tuning Example for Tuning Mode 2 or 3

# 8.8.6 Tuning Example for Tuning Mode 2 or 3

Step	Measurement Display Examples	Operation
1	Position deviation Reference speed Positioning completion signal	The positioning time is measured after the moment of inertia ratio (Pn103) is set correctly. Tuning is completed if the specifications are met. The tuning results are saved in the SERVOPACK.
2		The positioning time will be reduced if the feedforward level is increased. Tuning is completed if the specifications are met. The tuning results are saved in the SERVOPACK. If overshooting occurs before the specifications are met, pro- ceed to step 3.
3		Overshooting will be reduced if the feedback level is increased. If the overshooting is eliminated, proceed to step 4.
4		The graph shows overshooting that occurred when the feed- forward level was increased even more after step 3. In this state, overshooting occurs, but the positioning settling time is shorter. Tuning is completed if the specifications are met. The tuning results are saved in the SERVOPACK. If over- shooting occurs before the specifications are met, repeat steps 3 and 4. If vibration occurs before the overshooting is eliminated, the vibration is suppressed with the notch filters and anti-reso- nance control.
5	_	The tuning results are saved in the SERVOPACK.

8.8.7 Related Parameters

## 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.

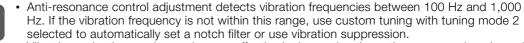
Anti-resonance control is effective for suppression of continuous vibration frequencies from 100 to 1,000 Hz that occur when the control gain is increased. Vibration can be eliminated by setting vibration frequencies through automatic detection or by manually setting them to adjust the damping gain. 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 =  $n.\Box\Box\Box$ ).
- The test without a motor function must be disabled (Pn00C =  $n.\Box\Box\Box$ ).
- The control method must not be set to torque control.
- The parameters must not be write prohibited.

Tuning

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	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Tuning - Tuning	🕼 8.9.4 Operating Procedure on page 8-52

## 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.

•	Before you execute anti-resonance control adjustment, 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.
	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.
	• 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.
	<ul> <li>If you have already performed anti-resonance control adjustment and then you change the fre- quency, the current anti-resonance control effect may be lost. Caution is particularly required when automatically detecting the vibration frequency.</li> </ul>
	<ul> <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 a custom tuning.</li> </ul>
	<ul> <li>Perform custom tuning separately if required to increase the response after performing anti-res nance control adjustment.</li> </ul>
	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.

# 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 8-43

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.

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 adjustmen Setting the tuning level too high can cause vibration or abnormal noise.	Start tuning Tuning level
Finish	
Finish	Auto-setting Notch filter 1 step 2 step 860Hz sactive 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 - Frequency Setting Me	ethods	Anti-res Adj: Inactive
Disk the Auto Detect button to sutomatically set the frequency.	Auto Detect	Manual Set	
Set frequency	)	Before adjustment 760 [Hz]	Start adjustment
Tick the Start adjustment button.	<< Frequency >>		
Adjust damping gain	)	(1-2000)	«Caution» If a frequency significantly different from the value before
norease (Damping Gain).	< <damping gain="">&gt;</damping>	888888 ×	may be lost. Once the vibration
Finish		(0-300)	problem is solved, do not increase damping gain.

Determine frequency lisk the Auto Detect button to utomatically set the frequency.	Adjustment Frequency Setting M Auto Detect		Anti-res	Adj Inactive
Set frequency It is the Start adjustment button. Adjust damping gain nosaaa (Damping Gain) Finan	<< Frequency >> < <demping gen="">&gt;</demping>	Detore adjustment [PC]	Cautions If a frequency sig different from the adjustment is set anti-resonance or may be lost. Onco- may be lost. Onco- problem is solved increase damping	inificantly value before the current ontrol effect a the vibration , do not
	Precautions		Finish	Cancel

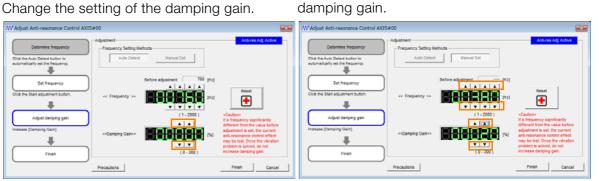
To Manually Set the Vibration Frequency

#### 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.



#### 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 automatically set the frequency.	Auto Detect	Manual Set	
Set frequency	)	Before adjustment 760 pig	
Click the Start adjustment button.	<< Frequency >>		z] Reset
		<b>T T T</b>	
Adjust damping gain		(1-2000)	«Caution» If a frequency significantly
Increase (Damping Gain).			different from the value before adjustment is set, the current
	< <damping gain="">&gt;</damping>		anti-resonance control effect
<b>+</b>		* *	may be lost. Once the vibration problem is solved, do not
Einiah	1	(9-309)	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:  $1 < (fb/fa) \le 3$  to 4

## **Required Parameter Settings**

The following parameter settings are required to use anti-resonance control for more than one vibration frequency.

	Parameter	Description			Wher Enable	
Pn160	n.□□□0 (default setting) Do not use anti-resonance control.			After restar	Setun	
	n.🗆 🗆 🗆 1	Use anti-resonance co	ontrol.		Testal	L
	Anti-Resonance Fr	equency		Speed	Positic	n Torque
Pn161	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	10 to 20,000	0.1 Hz	1000	Immedia	ately	Tuning
	Anti-Resonance Ga	ain Correction		Speed	Positic	n Torque
Pn162	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	1 to 1,000	1%	100	Immedia	ately	Tuning
	Anti-Resonance Da	amping Gain		Speed	Positic	n Torque
Pn163	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	0 to 300	1%	0	Immedia	ately	Tuning
	Anti-Resonance Fi	ter Time Constant 1 C	orrection	Speed	Positic	n Torque
Pn164	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	-1,000 to 1,000	0.01 ms	0	Immedia	ately	Tuning
	Anti-Resonance Fi	ter Time Constant 2 C	orrection	Speed	Positic	n Torque
Pn165	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	-1,000 to 1,000	0.01 ms	0	Immedia	ately	Tuning
	Anti-Resonance Da	amping Gain 2		Speed	Positic	n Torque
Pn166	Setting Range	Setting Unit	Default Setting	When Ena	abled	Classification
	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. Refer to the following section for details. 3.9.4 Operating Procedure on page 8-52
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. 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. However, if the vibration does not disappear even when you adjust Pn166 (Anti-Resonance Damping Gain 2), reduce the tuning level or feedback level until vibration does not occur.

8.10.1 Outline

# 8.10 Vibration Suppression

This section describes vibration suppression.

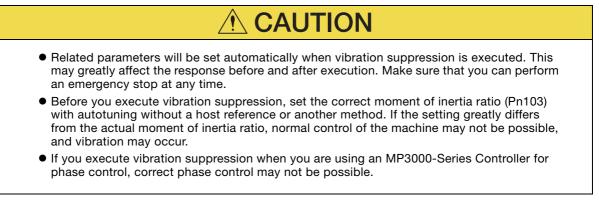
## 8.10.1 Outline

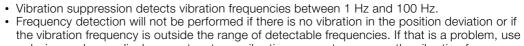
Important

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.





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		Positi	on	
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 operation. 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.

- Position control must be used.
- 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-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Tuning - Tuning	S.10.4 Operating Procedure on page 8-57

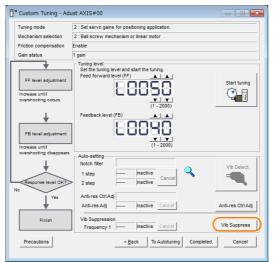
## 8.10.4 Operating Procedure

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 8-43

2. Click the Vib Suppress Button.



**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.)

#### 8.10.4 Operating Procedure



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.

Vibration Suppression AXIS	#00	×
Determine the frequency for setting. Click the Import battor Menual setting a site possible. The the frequency. Click the frequency. Click the Set battor bas battor finely adjust the frequency and the click adjust the frequency and the set battor again.	Adjustment Residual Vibration Frequency Set frequency ( 1.0 - 100.0 )	Vb Suppression: Inactive
	Precautions	Finish Cancel

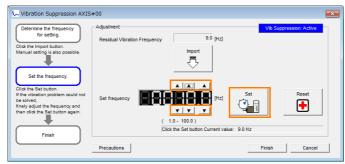
#### 4. Click the Set Button.



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 for setting. Click the Import button. Manual setting is also possible. Set the frequency.	Adjustment Vib Suppression Active Residual Vibration Frequency 9:0 [Hz]	
Click the Set button. If the vibration problem could not be solved. finely adjust the frequency and then click the Set button again.	Set frequency	
	Precautions Finish Cancel	1

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.



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 Setting Combined Functions

## 8.10.5 Setting Combined Functions

You can also use the feedforward function when you execute vibration suppression.

In the default settings, feedforward (Pn109), the speed feedforward input (VFF), and the torque feedforward input (TFF) are disabled.

To use the speed feedforward input (VFF), the torque feedforward input (TFF), and model following control from the host controller in the system, set Pn140 to n.1DDD (Use model following control and speed/torque feedforward together).

Parameter		Function	When Enabled	Classification
Pn140	n.0□□□ (defaultsetting)	Do not use model following control and speed/torque feedforward together.	Immediately	Tuning
11140	n.1000	Use model following control and speed/ torque feedforward together.	Infinediately	runnig

Refer to the following manual for information on the torque feedforward input (TFF) and the speed feedforward input (VFF).

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

When model following control is used with the feedforward function, it is used to make optimum feedforward settings in the SERVOPACK. Therefore, model following control is not normally used together with either the speed feedforward input (VFF) or torque feedforward input (TFF) from the host controller. However, model following control can be used with the speed feedforward input (VFF) or torque feedforward input (TFF) if required. An unsuitable feedforward input may result in overshooting.

## 8.10.6 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 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.

8.11.1 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 precaution.

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 jogging 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**

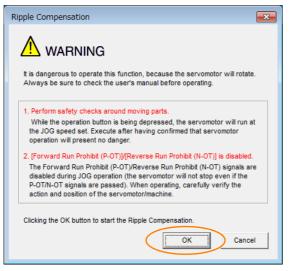
The following table lists the tools that you can use to set up speed ripple compensation.

Tool	Fn No./Function Name	Reference	
Digital Operator	You cannot set up speed ripple compensation from the Digital Operator.		
SigmaWin+	Diagnostic – Ripple Compensation	G Operating Procedure on page 8-61	

### **Operating Procedure**

Use the following procedure to set up speed ripple compensation.

- 1. Click the <u>I</u> Servo 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.



Information 1. Click the **Cancel** Button to cancel ripple compensation. The Main Window will return.



Click the **OK** Button to cancel write prohibition.

8.11.2 Setting Up Speed Ripple Compensation

4. Click the Edit Button.

<u>h</u> Ripple Compensation AXIS#00  Measure → Writing Results → Verification → Confirm	<b>2</b>
	Measurement PC04 : Jogong Speed poo Pesse execute by 100me-11 or less. Perse execute by 100me-11 or less. Serve ON Forward Forward Forward Forward Forward Forward Forward Forward Forward Forward Forward Forward Forward
4         4           y         0.0         60.0         120.0         100.0         240.0         240.0         40.0         40.0         y         y           4         Trac(res)         7         Trac(res)         3         7         1           F         Seture adjustment         T         Adjustment         T         964	Contra

5. Enter the jogging speed in the Input Value Box and click the OK Button.

Edit AXIS#00	<b>×</b>
Pn304 Jogging Speed	
Input value 500 min 1	
	OK Cancel

6. Click the Servo ON Button.

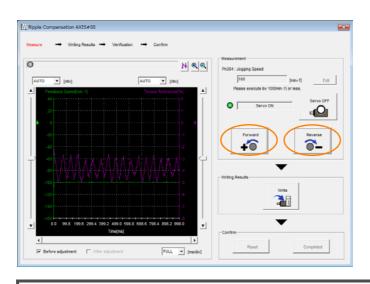
✓         µbb)         ✓         µbb)         ✓         Philo	leasure	😁 Writing Results 😁	Verification 0	Confirm	
Image: state	0			<u>₩</u> € €	
0         5         5         5         5         5         5         5         5         6         5         5         6         5         6         5         7         6         5         7         6         5         7         6         7	A .	v [klw]			part frank d
2 4 3 4 4 4 4 4 4 4 4 4 4 4 4 4		5		\$	Serve OFF
0 -3 -3 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4		3			Forward Reverse
V 0.0 60.0 120 0 100 240 300 300 420 450 640 540 600 V		1		1	+6
3 		4		-1	Writing Results
					Write
Reset Completed	*			×	Confirm

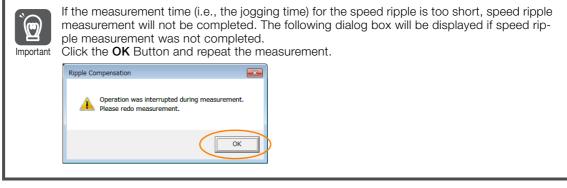
7. Click the Forward Button or the Reverse Button. Measurement operation is started.

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.

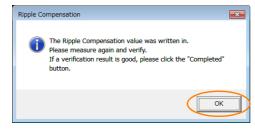
The feedback speed and torque reference graph will be displayed in the Ripple Compensation Dialog Box during jogging.

8.11.2 Setting Up Speed Ripple Compensation





- 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.



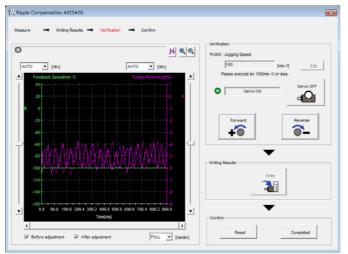
#### 8.11.3 Setting Parameters

#### 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 **Completed** 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 8-61. To cancel speed ripple compensation, use  $Pn423 = n.\square\square\square$  (Disable speed ripple compensation) to disable it.

Pa	rameter	Description	When Enabled	Classifi- cation
Pn423	n.□□□0 (default setting)	Disable speed ripple compensation.	Immedi- 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 Enable Condition Selection) and Pn427 or Pn49F (Speed Ripple Compensation Enable Speed).

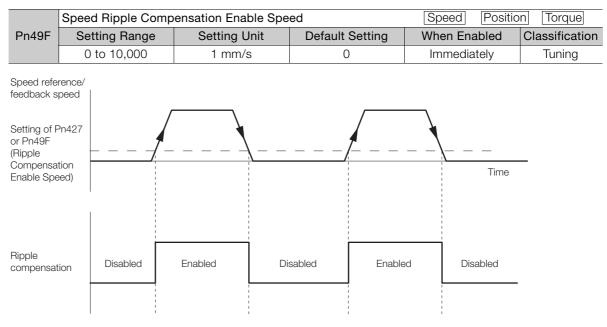
Parameter		Description		Classifi- cation
Pn423	n.0000 (default setting)	Speed reference	After restart	Setup
	n.0100	Motor Speed	restart	

For Rotary Servomotors

	Speed Ripple Comp	ensation Enable Spe	Speed Position	on Torque	
Pn427	Setting Range Setting Unit		Default Setting	When Enabled	Classification
	0 to 10,000	1 min <sup>-1</sup>	0	Immediately	Tuning

8.11.3 Setting Parameters

• For Linear Servomotors



## **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- cation
Pn423	n.□□0□ (default setting)	Detect A.942 alarms.	After restart	Setup
	n.0010	Do not detect A.942 alarms.	restart	

# 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	Applicable Control Methods	Reference
Gain Switching	Position control, speed control, or torque control*	page 8-66
Friction Compensation	Position control or speed control	page 8-70
Current Control Mode Selection	Position control, speed control, or torque control	page 8-73
Current Gain Level Setting	Position control or speed control	page 8-74
Speed Detection Method Selection	Position control, speed control, or torque control	page 8-74
Backlash Compensation	Position Control	page 8-75

\* Automatic gain switching is enabled only for position control.

## 8.12.1 Gain Switching

Two gain switching functions are available, manual selection and automatic switching. The manual switching function uses an external input signal to select the gains, and the automatic switching function changes the gains automatically.

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	
	n.□□□0 (default setting)	Use manual gain switching.	Immediately	Tuning	
	n.□□□2	Use automatic gain switching pattern 1.	† 		

Note:  $Pn139 = n.\square\square\square1$  is a reserved parameter. Do not change.

Refer to the following section for gain switching combinations.

Gain Switching Combinations on page 8-66

Refer to the following sections for information on manual and automatic gain switching. *Manual Gain Switching* on page 8-67 and *Automatic Gain Switching* on page 8-67

## **Gain Switching Combinations**

Selected Gains	Speed Loop Gain	Speed Loop Integral Time Constant	Position Loop Gain	Torque Refer- ence Filter	Model Fol- lowing Con- trol Gain	Model Follow- ing Control Correction	Friction Compensa- tion Gain
Gain Set- tings 1	Speed Loop Gain (Pn100)	Speed Loop Integral Time Constant (Pn101)	Position Loop Gain (Pn102)	First Stage First Torque Reference Fil- ter Time Con- stant (Pn401)	Model Fol- lowing Con- trol Gain* (Pn141)	Model Follow- ing Control Correction* (Pn142)	Friction Compensa- tion Gain (Pn121)
Gain Set- tings 2	Second Speed Loop Gain (Pn104)	Second Speed Loop Integral Time Constant (Pn105)	Second Position Loop Gain (Pn106)	First Stage Second Torque Refer- ence Filter Time Con- stant (Pn412)	Second Model Fol- lowing Con- trol Gain* (Pn148)	Second Model Following Control Cor- rection* (Pn149)	Second Friction Compensa- tion Gain (Pn122)

\* Gain switching for the model following control gain and the model following control gain correction is applicable only to manual gain switching.

To enable gain switching with these parameters, a gain switching input signal must be used and the following conditions must be met. If the conditions are not met, these parameters will not be changed even if the other parameters in the above table are changed.

There must be no reference.

• The motor must be stopped.

## Manual Gain Switching

With manual gain switching, you use G-SEL in the servo command output signals (SVCMD\_IO) to change between gain settings 1 and gain settings 2.

Туре	Command Name	Value	Meaning
Input	G-SEL in the servo command output sig-	0	Changes the gain settings to gain settings 1.
	nals (SVCMD_IO)	1	Changes the gain settings to gain settings 2.

## Automatic Gain Switching

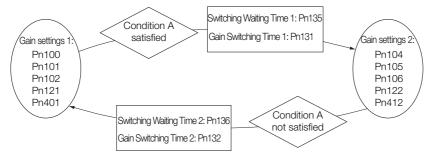
Automatic gain switching is enabled only for position control. The switching conditions are specified by using the following settings.

Parameter		Switching Condition	Selected Gains	Switching Waiting Time	Switching Time
Pn139		Condition A satisfied	Gain settings 1 to gain set- tings 2	Gain Switching Waiting Time 1 Pn135	Gain Switching Time 1 Pn131
	n.0002	Condition A not satisfied	Gain settings 2 to gain set- tings 1	Gain Switching Waiting Time 2 Pn136	Gain Switching Time 2 Pn132

Select one of the following settings for switching condition A.

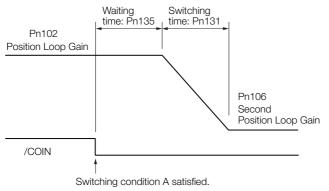
P	Parameter	Position Control Gain Switching Condition A	For Control Methods Other Than Position Control (No Switching)	When Enabled	Classification
	n.□□0□ (default setting)	/COIN (Positioning Com- pletion) signal ON	Gain settings 1 used.		
	n.0010	/COIN (Positioning Com- pletion) signal OFF	Gain settings 2 used.	_	
	n.🗆 🗆 2 🗆	/NEAR (Near) signal ON	Gain settings 1 used.		
Pn139	n.🗆 🗆 3 🗆	/NEAR (Near) signal OFF	Gain settings 2 used.	Immediately	Tuning
	n.0040	Position reference filter output is 0 and position reference input is OFF.	Gain settings 1 used.		
	n.0050	Position reference input is ON.	Gain settings 2 used.		

Automatic Switching Pattern 1 (Pn139 = n.



#### 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).





Ation You can use gain switching for either PI control or I-P control (Pn10B =  $n.\Box\Box\Box\Box$  or  $\Box\Box$ 1 $\Box$ ).

## **Related Parameters**

	Speed Loop Gain			Speed Posit	ion	
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		Speed Posit	ion	
Pn101	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	15 to 51,200	0.01 ms	2,000	Immediately	Tuning	
	Position Loop Gain			Posit	ion	
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	Speed Posit	ion Torque	
Pn401	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 65,535	0.01 ms	100	Immediately	Tuning	
	Model Following Control Gain			Position		
Pn141	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	10 to 20,000	0.1/s	500	Immediately	Tuning	
	Model Following Co	ntrol Correction	Posit	ion		
Pn142	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	500 to 2,000	0.1%	1,000	Immediately	Tuning	
	Friction Compensat	ion Gain		Speed Posit	ion	
Pn121	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	10 to 1,000	1%	100	Immediately	Tuning	
	Second Speed Loop	o Gain		Speed Position		
Pn104	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	10 to 20,000	0.1 Hz	400	Immediately	Tuning	
	Second Speed Loop	o Integral Time Cons	tant	Speed Posit	ion	
Pn105	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	15 to 51,200	0.01 ms	2,000	Immediately	Tuning	

Continued from previous page.

					i previeue pugei	
	Second Position Lo	op Gain		Posit	ion	
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	Iter Time Constant	Speed Posit	ion Torque	
Pn412	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 65,535	0.01 ms	100	Immediately	Tuning	
	Second Model Following Control Gain			Position		
Pn148	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	10 to 20,000	0.1/s	500	Immediately	Tuning	
	Second Model Following Control Correction			Position		
Pn149	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	500 to 2,000	0.1%	1,000	Immediately	Tuning	
	Second Friction Co	mpensation Gain		Speed Posit	ion	
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	e 1		Position		
Pn131	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 65,535	1 ms	0	Immediately	Tuning	
	Gain Switching Time	e 2		Posit	ion	
Pn132	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 65,535	1 ms	0	Immediately	Tuning	
	Gain Switching Waiting Time 1			Position		
Pn135	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 65,535	1 ms	0	Immediately	Tuning	
	Gain Switching Wait	ting Time 2		Position		
Pn136	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 65,535	1 ms	0	Immediately	Tuning	

## **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		Active Gain Monitor	1 V	Gain settings 1 are enabled.
Pn007	n. <b>□□</b> 0B	Active Gain Monitor	2 V	Gain settings 2 are enabled.

8.12.2 Friction Compensation

## 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.

F	Parameter	Func	tion	When Enabled	Classification		
Pn408	n.0□□□ (default setting)	Disable friction comper	Disable friction compensation.		Setup		
	n.1000	Enable friction compen	sation.				
	Friction Compensation Gain				tion		
Pn121	Setting Range	Setting Unit	Default Setting	When Enabled	Classification		
	10 to 1,000	1%	100	Immediately	Tuning		
	Second Friction Compensation Gain			Speed Posit	tion		
Pn122	Setting Range	Setting Unit	Default Setting	When Enabled	Classification		
	10 to 1,000	1%	100	Immediately	Tuning		
	Friction Compensation Coefficient			Speed Posit	Speed Position		
Pn123	Setting Range	Setting Unit	Default Setting	When Enabled	Classification		
	0 to 100	1%	0	Immediately	Tuning		
	Friction Compension	sation Frequency Corre	ction	Speed Posit	tion		
Pn124	Setting Range	Setting Unit	Default Setting	When Enabled	Classification		
	-10,000 to 10,00	0 0.1 Hz	0	Immediately	Tuning		
	Friction Compension	sation Gain Correction		Speed Posit	tion		
Pn125	Setting Range	Setting Unit	Default Setting	When Enabled	Classification		
	1 to 1,000	1%	100	Immediately	Tuning		

8.12.2 Friction Compensation

## **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.

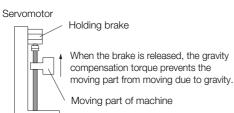
Step	Operation					
1	Set the following parameters related to friction compensation to their default settings. Friction compensation gain (Pn121): 100 Second friction compensation gain (Pn122): 100 Friction compensation coefficient (Pn123): 0 Friction compensation frequency correction (Pn124): 0 Friction compensation gain correction (Pn125): 100 Note: Always use the default settings for the friction compensation frequency correction (Pn124) and friction com- pensation gain correction (Pn125).					
2	<ul> <li>Gradually increase the friction compensation coefficient (Pn123) to check the effect of friction compensation.</li> <li>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.         Image: Poor response because of friction Low friction Low friction deviation High friction deviation High friction Position reference speed         Image: Position reference speed Before Friction Compensation         Image: Position Compensation         After Friction Compensation					

8.12.3 Gravity Compensation

## 8.12.3 Gravity Compensation

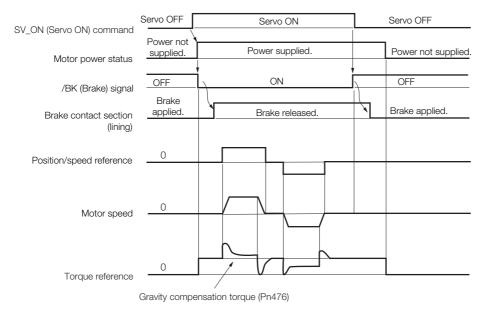
When the Servomotor is used with a vertical axis, gravity compensation prevents the moving part from falling due to the machine's own weight when the brake is released.

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.

#### 5.12.1 Brake Operating Sequence on page 5-34



## **Required Parameter Settings**

The following parameter settings are required to use gravity compensation.

Parameter		Description		When Enabled	Classification	
Pn475	n475 n.□□□0 (default setting)		After restart	Setup		
	n.0001	Enable gravity comper	nsation.			
	Gravity Compensation Torque Speed Position 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

Parameter		Meaning	When Enabled	Classification
	n. 🗆 🗆 🗆			Tuning
Pn009	n. DD1D (default setting)	Use current control mode 1.	After restart	
	n. 🗆 🗆 2 🗆	Use current control mode 2 (low noise).		l

• SERVOPACK Models SGD7S-120A, -180A, -200A, -330A, -470A, -550A, -590A, and -780A

Parameter		Meaning	When Enabled	Classification
n. 🗆 🗆 🗆		Use current control mode 1.		
Pn009	n. 🗆 🗆 1 🗆 (default setting)	Use current control mode 2 (low noise).	After restart	Tuning
	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

## 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			Speed Position	
Pn13D	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	100 to 2,000	1%	2,000	Immediately	Tuning



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. □0□□ (default setting)	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.

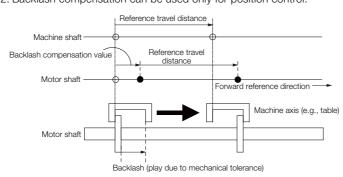
	Speed Feedback Filter Time Constant		Speed Position		
Pn308	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535 (0.00 ms to 655.35 ms)	0.01 ms	0 (0.00 ms)	Immediately	Setup

## 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: 1. Backlash compensation can be used only with a Rotary Servomotor. 2. Backlash compensation can be used only for position control.



## **Related Parameters**

Set the following parameters to use backlash compensation.

### Backlash Compensation Direction

Set the direction in which to apply backlash compensation.

Parameter		Meaning	When Enabled	Classification	
	n. □□□0 (default setting)	Compensate forward references.	After restart	Setup	
	n. 🗆 🗆 🗆 1	Compensate reverse references.			

### Backlash Compensation Value

Set the amount of backlash compensation to add to the position reference. The amount is set in increments of 0.1 reference unit. However, when the amount is converted to encoder pulses, it is rounded off at the decimal point.

**Example** When Pn231 = 6,553.6 [reference units] and electronic gear ratio (Pn20E/Pn210) = 4/1:  $6,553.6 \times 4 = 26,214.4$  [pulses]

 $\Rightarrow$  The backlash compensation will be 26,214 encoder pulses.

	Backlash Compensatio	n	Position		
Pn231	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
111201	-500,000 to 500,000	0.1 reference units	0	Immediately	Setup

<u>ک</u>	• The backlash compensation value is restricted by the following formula. Backlash compensa- tion is not performed if this condition is not met.
Important	$Pn231 \leq \frac{Pn210}{Pn20E} \times \frac{Maximum motor speed [min-1]}{60} \times Encoder resolution* \times 0.00025$
	*Refer to the following section for the encoder resolution.
	With fully-closed loop control, substitute the number of external encoder pulses per motor rotation for the encoder resolution in the above formula.
	Example 1: Pn20E = 4, Pn210 = 1, Maximum motor speed = 6,000 [min <sup>-1</sup> ], and Encoder resolution = $16,777,216$ (24 bits) $1/4 \times 6,000/60 \times 16,777,216 \times 0.00025 = 104,857.6$ [reference units]
	$\Rightarrow$ The backlash compensation will be limited to 104,857.6 reference units.
	Example 2: Pn20E = 4, Pn210 = 1, Maximum motor speed = 6,000 [min <sup>-1</sup> ], Number of External Encoder Pitches (Pn20A) = 500, and Use of the JZDP-H00 $\square$ -000 (signal resolution: 1/256): 1/4 × 6,000/60 × (500 × 256) × 0.00025 = 800.0 [reference units] $\Rightarrow$ The backlash compensation will be limited to 800.0 reference units.
	<ul> <li>Do not exceed the upper limit of the backlash compensation value. You can check the upper limit on the operation monitor of the SigmaWin+.</li> </ul>

### Backlash Compensation Time Constant

You can set a time constant for a first order lag filter for the backlash compensation value (Pn231) that is added to the position reference.

If you set Pn233 (Backlash Compensation Time Constant) to 0, the first order lag filter is disabled.

	Backlash Compensation	n Time Constant	Position		
Pn233	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	0.01 ms	0	Immediately	Setup

Note: Changes to the settings are applied when there is no reference pulse input and the Servomotor is stopped. The current operation is not affected if the setting is changed during Servomotor operation.

## **Related Monitoring**

You can monitor the following values on the operation monitor of the SigmaWin+.

Displayed Value	Setting Unit
Current Backlash Compensation Value	0.1 reference units
Backlash Compensation Value Setting Limit	0.1 reference units

## **Compensation Operation**

This section describes the operation that is performed for backlash compensation.

Note: The following figures are for when backlash compensation is applied to references in the forward direction (Pn230 = n.  $\Box\Box\Box$ ). The following monitor information is provided in the figures: TPOS (target position in the reference coordinate system), POS (reference position in the reference coordinate system), and APOS (feed-back position in the machine coordinate system). The monitor information includes the feedback position in machine coordinate system (APOS) and other feedback information.

The backlash compensation value is subtracted from the feedback positions in the monitor information, so it is not necessary for the host controller to consider the backlash compensation value.

# 

• The encoder divided pulse output will output the number of encoder pulses for which driving was actually performed, including the backlash compensation value. If you use the encoder output pulses for position feedback at the host controller, you must consider the backlash compensation value.

### Operation When the Servo Is ON

The backlash compensation value (Pn231) is added in the backlash compensation direction when the servo is ON (i.e., while power is supplied to the motor) and a reference is input in the same direction as the backlash compensation direction (Pn230 =  $n.\square\square\squareX$ ).

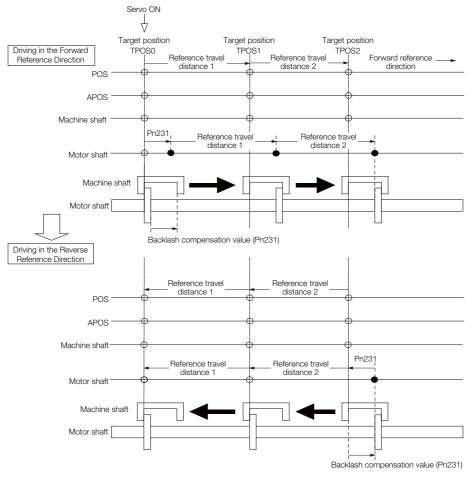
When there is a reference input in the direction opposite to the backlash compensation direction, the backlash compensation value is not added (i.e., backlash compensation is not performed).

The relationship between APOS and the motor shaft position is as follows:

- If a reference is input in the compensation direction: APOS = Motor shaft position Pn231
- If a reference is input in the direction opposite to the compensation direction: APOS = Motor shaft position

The following figure shows driving the Servomotor in the forward direction from target position TPOS0 to TPOS1 and then to TPOS2, and then returning from TPOS2 to TPOS1 and then to TPOS0.

Backlash compensation is applied when moving from TPOS0 to TPOS1, but not when moving from TPOS2 to TPOS1.



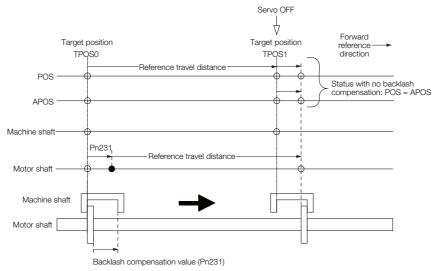
### Operation When the Servo Is OFF

Backlash compensation is not applied when the servo is OFF (i.e., when power is not supplied to motor). Therefore, the reference position POS is moved by only the backlash compensation value.

The relationship between APOS and the motor shaft position is as follows:

• When servo is OFF: APOS = Servomotor shaft position

The following figure shows what happens when the servo is turned OFF after driving the Servomotor in the forward direction from target position TPOS0 to TPOS1. Backlash compensation is not applied when the servo is OFF. (The SERVOPACK manages the position data so that APOS and POS are the same.)



### Operation When There Is Overtravel

When there is overtravel (i.e., when driving is prohibited due to an overtravel signal or software limit), the operation is the same as for when the servo is OFF ( $\blacklozenge$  Operation When the Servo Is OFF on page 8-78), i.e., backlash compensation is not applied.

### Operation When Control Is Changed

Backlash compensation is performed only for position control.

Backlash compensation is not applied when position control is changed to any other control method.

Backlash compensation is applied in the same way as when the servo is ON ( Poperation When the Servo Is ON on page 8-77) if any other control method is changed to position control.

## **Related Monitoring**

You can monitor the following values on the operation monitor of the SigmaWin+.

Displayed Value Unit		Specification		
Input Reference Pulse Speed	min <sup>-1</sup>	Displays the input reference pulse speed before backlash compensation.		
		Displays the position deviation for the position reference after backlash compensation.		
Input Reference Pulse Counter Reference units		Displays the input reference pulse counter before back- lash compensation.		
Feedback Pulse Counter	Encoder pulses	Displays the number of pulses from the actually driven motor encoder.		
Fully-Closed Feedback PulseExternal encoderCounterresolution		Displays the number of pulses of the actually driven exter- nal encoder.		
Feedback Pulse Counter Reference units		Displays the number of pulses from the actually driven encoder in reference units.		

## **MECHATROLINK Monitor Information**

This section describes the information that is set for the MECHATROLINK monitor information (monitor 1, monitor 2, monitor 3, and monitor 4) and the backlash compensation operation.

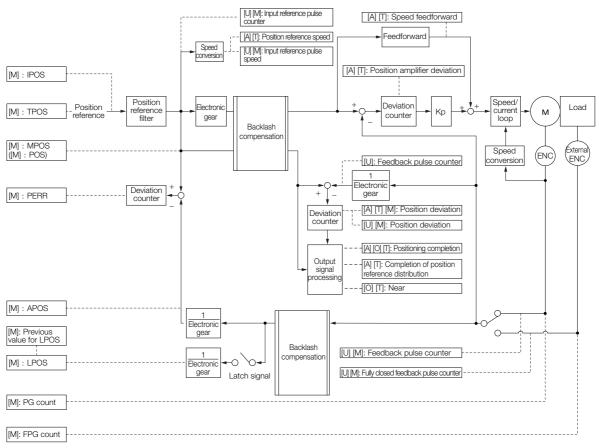
Monitor Code	Abbreviation	Description	Unit	Remarks
0	POS	Reference position in the reference coordi- nate system (after the position reference filter)	Reference units	-
1	MPOS	Reference position	Reference units	_
2	PERR	Position deviation	Reference units	-
3	APOS	Feedback position in machine coordinate system	Reference units	Feedback position with the backlash com- pensation subtracted
4	LPOS	Feedback latch posi- tion in the machine coordinate system	Reference units	Feedback position with the backlash compensation subtracted
5	IPOS	Reference position in the reference coordi- nate system (before the position reference filter)	Reference units	-
6	TPOS	Target position in the reference coordinate system	Reference units	_
E	OMN1	Option monitor 1 (selected with Pn824)	_	-
F	OMN2	Option monitor 2 (selected with Pn825)	-	_
Par	ameter	Monitor Information	Output Unit	Remarks
	0003h	Position deviation	Reference	_

Parameter		Monitor Information	Output Unit	Remarks
Pn824 Pn825	0003h	Position deviation (lower 32 bits)	Reference units	-
	0004h	Position deviation (upper 32 bits)	Reference units	-
	000Ah	PG count (lower 32 bits)	Reference units	Count value of the actually driven motor
	000Bh	PG count (upper 32 bits)	Reference units	encoder
	000Ch	FPG count (lower 32 bits)	Reference units	Count value of the actually driven external
	000Dh	FPG count (upper 32 bits)	Reference units	encoder
	0017h	Input reference pulse speed	min <sup>-1</sup>	-
	0018h	Position deviation	Reference units	_
	001Ch	Input reference pulse counter	Reference units	-
	001Dh	Feedback pulse counter	Encoder pulses	-
	001Eh	Fully-closed feedback pulse counter	External encoder resolution	_
	0080h	Previous value of latched feedback posi- tion (LPOS)	Encoder pulses	Feedback position with the backlash compensation subtracted

### Related Monitoring Diagrams

The following symbols are used in the related monitoring diagrams.

- [A]: Analog monitor
- [U]: Monitor mode (Un monitor)
- [O]: Output signal
- [T]: Trace data
- [M]: MECHATROLINK monitor information



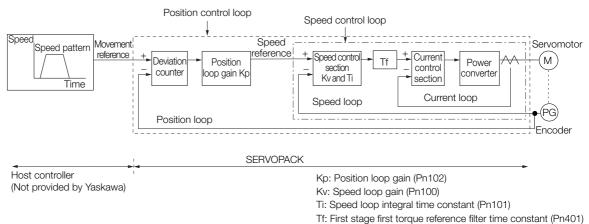
8.13.1 Tuning the Servo Gains

# 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. For example, you can reduce the positioning time for position control.

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.

## **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.

6.11 Initializing the Vibration Detection Level on page 6-51

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 (for Position Control or Speed Control)

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	For position control, 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			Position	
Pn102	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	10 to 20,000	0.1/s	400	Immediately	Tuning

Information For machines for which a high position loop gain (Pn102) cannot be set, overflow alarms can 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.

 $Pn520 \ge \frac{Maximum feed speed [reference units/s]}{Pn102 \div 10 (1/s)} \times 2.0$ 

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.

Pn520	Position Deviation	Overflow Alarm	Position		
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,823	1 reference 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		Speed Positi	on Torque	
Pn100	Setting Range	Setting Unit	Default Setting	When Enabled	Classifica- 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 R	atio	Speed Positi	on Torque	
Pn103	Setting Range	Setting Unit	Default Setting	When Enabled	Classifica- tion
	0 to 20,000	1%	100	Immediately	Tuning

## Speed Loop Integral Time Constant

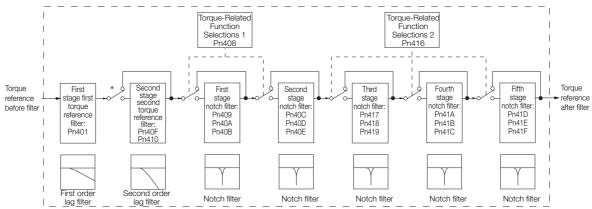
To enable response to even small inputs, the speed loop has an integral element. The integral element becomes a delay factor in the servo system. If the time constant is set too high, over-shooting will occur, positioning settling time will increase, and the response characteristic will suffer.

	Speed Loop Integral Time Constant			Speed Positi	on
Pn101	Setting Range	Setting Unit	Default Setting	When Enabled	Classifica- tion
	15 to 51,200	0.01 ms	2,000	Immediately	Tuning

## ◆ 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			Speed Posit	ion Torque
Pn401	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 65,535	0.01 ms	100	Immediately	Tuning
	Second Stage Seco	nd Torque Reference	e Filter Frequency	Speed Posit	ion Torque
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			Speed Posit	ion Torque
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.

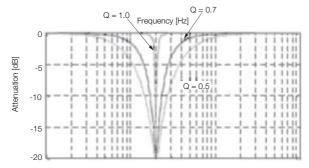
The notch filter puts a notch in the gain curve at the specific vibration frequency (called the notch frequency). The frequency components near the notch frequency can be reduced or removed with a notch filter.

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.

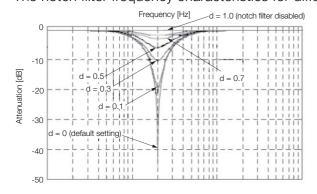


Note: The above notch filter frequency characteristics are based on calculated values and may be different from actual characteristics.

### • 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 (default setting)	Disable first stage notch filter.		
Dn/09	n.0001	Enable first stage notch filter.		
Pn408	n.□0□□ (default setting)	Disable second stage notch filter.	Immediately	Setup
	n.0100	Enable second stage notch filter.		
	n.□□□0 (default setting)	Disable third stage notch filter.		
	n.0001	Enable third stage notch filter.		
Pn416	n.□□0□ (default setting)	Disable fourth stage notch filter.		
	n.0010	Enable fourth stage notch filter.		
	n.□0□□ (default setting)	Disable fifth stage notch filter.		
	n.0100	Enable fifth stage notch filter.		

Set the machine vibration frequencies in the notch filter parameters.

Tuning

Pn409         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           50 to 5,000         1 Hz         5,000         Immediately         Tuning           Prixt Stage Notch Filter Q Value         Speed         [Position]         Torque]           Pn40A         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           First Stage Notch Filter Depth         Speed         [Position]         Torque]           Pn40B         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           Pn40C         Second Stage Notch Filter Prequency         Speed         [Position]         Torque]           Pn40D         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           So to 1,000         0.01         70         Immediately         Tuning           Pn40D         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           So to 1,000         0.01         70         Immediately         Tuning           Pn410         Setting Range         Setting Unit         Default Setting         When Enabled		First Stage Notch F	ilter Frequency		Speed Posit	tion Torque
50 to 5,000         1 Hz         5,000         Immediately         Tuning           First Stage Notch Filter Q Value         Speed         Postton         Torque           Setting Range         Setting Unit         Default Setting         When Enabled         Classification           50 to 1,000         0.01         70         Immediately         Tuning           First Stage Notch Filter Depth         Speed         Position         Torque           Pn408         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           0 to 1,000         0.001         0         Immediately         Tuning         Tuning           Second Stage Notch Filter Prequency         Speed         Position         Torque           Pn400         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           50 to 1,000         0.01         70         Immediately         Tuning         Torque           Pn401         Setting Range         Setting Unit         Default Setting         When Enabled         Classification           700         Immediately         Tuning         Torque         Speed         Position         Torque           Pn416	Pn409	-		Default Setting		
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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.

## ♦ 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/(2π × Pn100 [Hz] × 4)

Critical gain: Pn401 [ms]  $\leq$  1,000/(2 $\pi$  × Pn100 [Hz] × 4)

- 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, Panel 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].

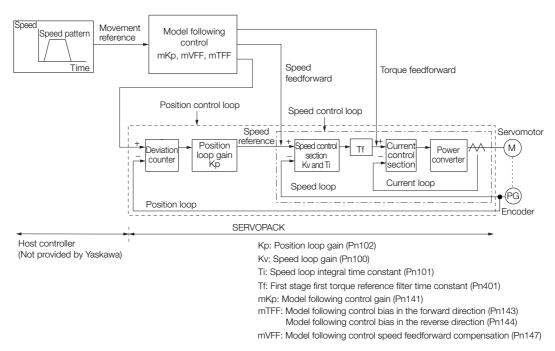
# **Model Following Control**

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	Note: 1. Set the moment of inertia ratio (Pn103) as accurately as possible. 2. Refer to the guidelines for manually tuning the servo gains and set a stable gain for the position loop gain (Pn102). <i>Guidelines for Manually Tuning Servo Gains</i> on page 8-87
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).

## 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 (default setting)	Do not use model following control.		Tuning
	n.0001	Use model following control.	Immediately	
Pn140	n.□□0□ (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			Position	
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.

 $Pn 520 \ge \frac{Maximum \text{ feed speed [reference units/s]}}{Pn 141/10 [1/s]} \times 2.0$ 

	Position Deviation Overflow Alarm Level			Positio	on
Pn520	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,823	1 reference 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			Posit	ion
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			Posit	ion
Pn144	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	0.1%	1,000	Immediately	Tuning

### 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			Posit	ion
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).

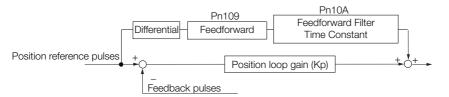
Parameter		Meaning	When Enabled	Classification
	n.🗆 🗆 🗆 0	Use model following control type 1.		
Pn14F	n.□□□1 (default setting)	Use model following control type 2.	After restart	Tuning

# 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.



	Feedforward			Posit	ion
Pn109	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	0	Immediately	Tuning
	Feedforward Filter Time Constant Position				ion
Pn10A	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 6,400	0.01 ms	0	Immediately	Tuning

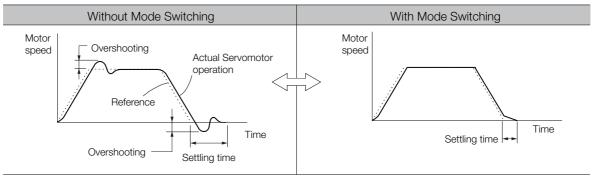
Note: If you set the feedforward value too high, the machine may vibrate. As a guideline, use a setting of 80% or less.

8.13.2 Compatible Adjustment Functions

# 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.



## Related Parameters

Select the switching condition for mode switching with  $Pn10B = n.\Box\Box\BoxX$ .

Parameter		Mode Switching	Parameter That Sets the Level		When	Classification
		Selection	Rotary Servomotor	Linear Servomotor	Enabled	Classification
	n.□□□0 (default setting)	Use the internal torque reference as the condition.	Pn1	10C		
	n.0001	Use the speed ref- erence as the con- dition.	Pn10D	Pn181		
Pn10B	n.0002	Use the accelera- tion reference as the condition.	Pn10E	Pn182	Immediately	Setup
	n.0003	Use the position deviation as the condition.	Pn	10F		
	n.0004	Do not use mode switching.	-	-		

### Parameters That Set the Switching Levels

Rotary Servomotors

	Mode Switching L	evel for Torque Ref	erence	Speed	Position
Pn10C	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%	200	Immediately	Tuning
	Mode Switching Level for Speed Reference		Speed F	Position	
Pn10D	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 min <sup>-1</sup>	0	Immediately	Tuning
	Mode Switching L	evel for Acceleration	on	Speed	Position
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 L	evel for Position De	eviation	F	Position
Pn10F	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 reference unit	0	Immediately	Tuning

8.13.2 Compatible Adjustment Functions

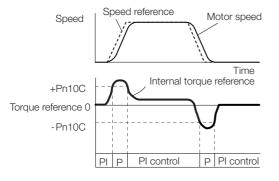
• Linear Servomotors

	Mode Switching L	evel for Force Refe	rence	Speed	Position
Pn10C	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 800	1%	200	Immediately	Tuning
	Mode Switching Level for Speed Reference		Speed	Position	
Pn181	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 mm/s	0	Immediately	Tuning
	Mode Switching L	evel for Acceleration	on	Speed	Position
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 L	evel for Position De	eviation	F	Position
Pn10F	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 10,000	1 reference unit	0	Immediately	Tuning

 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.

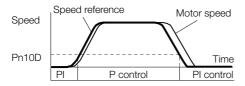
The default setting for the torque reference level is 200%.



### Using the Speed Reference as the Mode Switching Condition

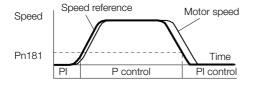
Rotary Servomotors

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

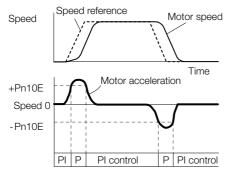
When the speed reference equals or exceeds the speed set for the mode switching level for a speed reference (Pn181), the speed loop is changed to P control.



8.13.2 Compatible Adjustment Functions

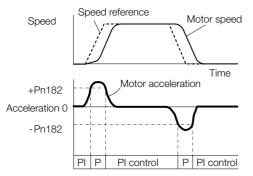
- Using the Acceleration as the Mode Switching Condition
- Rotary Servomotors

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

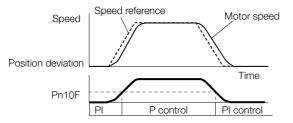
When the speed reference equals or exceeds the acceleration rate set for the mode switching level for acceleration (Pn182), the speed loop is changed to P control.



### 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 Tin	ne Constant		Posit	ion
Pn11F	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 50,000	0.1 ms	0	Immediately	Tuning

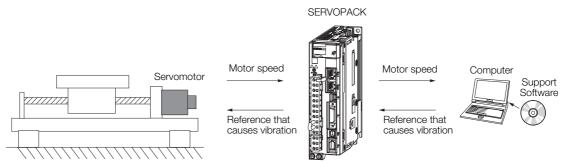
8.14.1 Mechanical Analysis

# 8.14 Diagnostic Tools

# 8.14.1 Mechanical Analysis

## Overview

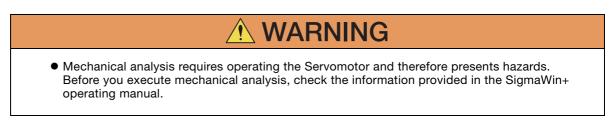
You can connect the SERVOPACK to a computer to measure the frequency characteristics of the machine. This allows you to measure the frequency characteristics of the machine without using a measuring instrument.



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.

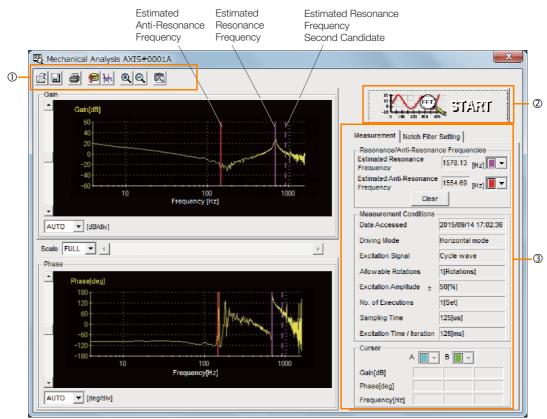


8.14.1 Mechanical Analysis

## **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.

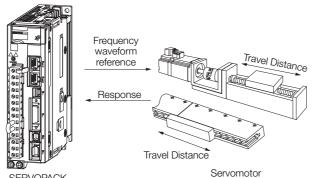
#### 8.14.2 Easy FFT

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 highfrequency noise and vibration.

- WARNING • Never touch the Servomotor or machine during execution of Easy FFT. Doing so may result in injury.
  - CAUTION
- 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**

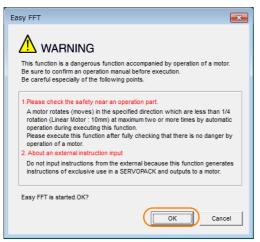
The following table lists the tools that you can use to perform EasyFFT.

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn206	Ω Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Diagnostic – Easy FFT	Gerating Procedure on page 8-98

# **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+.
- 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 ON/OFF operation	
Servo OFF	Servo ON
Measurement start / Stopping operation	
Measurement condition	
Stimulus signal Frequency	Start
Instruction amplitude [15 - [%] (1 - 800)	
Rotation (moving) Forward V	~
Measurement result	
Detected resonance frequency	[Hz]
Optimal notch filter frequency	[Hz]
Notch filter selection	1
	Measurement complete

 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	X
Servo ON/OFF operation	
Servo ON	Servo OFF
- Measurement start / Stopping operation -	
Measurement condition	
Stimulus signal Frequency	Start
Instruction amplitude 15	[%]
(1 - 800)	Q
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	<b></b>
- Servo ON/OFF operation	
Servo ON	
Measurement start / Stopping operation	
Measurement condition	
Stimulus signal Frequency	Start I
Instruction amplitude 15 . [%]	
(1 - 800) Rotation (moving) direction	<b>A</b>
Measurement result	
Detected resonance frequency 502	[Hz]
Optimal notch filter frequency 502	[Hz]
Notch filter selection The 1st step	
	Measurement complete

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 Param	ieter.
and the second se	
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.

# Monitoring

This chapter provides information on monitoring SERVO-PACK product information and SERVOPACK status.

9.1	Monit	oring Product Information9-2
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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

The items that you can monitor in the SigmaWin+ Product Information Window are listed below.

	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 product information monitor dialog box.

• Select *Read Product Information* in the Menu Dialog Box of the SigmaWin+. The Read Product information Window will be displayed.

0	duct Information	Export				
- (	0001-SGD7S-1R6AE0A					
SEF	RVOPACK	Model/Type	Serial Number	Manufacturing Date	SW Ver.	Remarks
	SERVOPACK	SGD7S-1R6AE0A (Command-Option module type single		2015.01	001D	[Specification] : Standard
Mot	or	Model/Type	Number	Manufacturing Date	SW Ver.	Remarks
Motor 1		SGM7J-02A7A21	20131204	2013.12		[Resolution]: 16777216 [Pulse/rev]
1	Encoder	UTTAI-B24RH		2013.12	0001	[Encoder type] : absolute
Cor	nmand Option Module	Model/Type	Serial Number	Manufacturing Date	SW Ver.	Remarks
	Option Module	SGDV-OCA03A (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.

001-9 -R90/	SGD7S A00A	÷		
		HBB	P-OT	The Serve Drive statue is displayed
	POWER	ESTP	N-OT	<ul> <li>The Servo Drive status is displayed.</li> </ul>
				•

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

Mon	itor Items
<ul> <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> <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 (Lower)</li> </ul>	<ul> <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> <li>Maximum Value of Amplitude of Estimated Vibration*</li> <li>Estimated External Disturbance Torque*</li> <li>Maximum Value of Estimated External Disturbance Torque*</li> <li>Munimum Value of Estimated External Disturbance Torque*</li> <li>Number of Serial Encoder Communications Errors*</li> <li>Settling Time*</li> <li>Amount of Overshoot*</li> <li>Residual Vibration Frequency*</li> <li>Estimated Vibration*</li> <li>Maximum Value of Accumulated Load Ratio*</li> <li>Number of MECHATROLINK Communications Errors*</li> <li>Margin until Overload*</li> <li>Temperature Margin until Servomotor Overheats*</li> </ul>

\* These items can be monitored using SERVOPACKs with software version 002C or higher.

### Status Pane

Mon	itor 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> </ul>	<ul> <li>Position Reference (PULS)</li> <li>Position Reference Direction</li> <li>Surge Current Limiting Resistor Short Relay</li> <li>Regenerative Transistor</li> <li>Regenerative Error Detection</li> <li>AC Power ON</li> <li>Overcurrent</li> <li>Origin Not Passed</li> </ul>

9.2.2 Monitoring Operation, Status, and I/O

• I/O Pane

	Mon	itor	Items
Input Signal Status	<ul> <li>P-OT (Forward Drive Prohibit Input Signal)</li> <li>N-OT (Reverse Drive Prohibit Input Signal)</li> <li>/P-CL (Forward External Torque Limit Signal)</li> <li>/N-CL (Reverse External Torque Limit Signal)</li> <li>/G-SEL (Gain Selection Input Signal)</li> <li>/P-DET (Polarity Detection Input Signal)</li> <li>/DEC (Origin Return Deceleration Switch Input Signal)</li> <li>/EXT1 (External Latch Input 1 Signal)</li> <li>/EXT2 (External Latch Input 2 Signal)</li> <li>/EXT3 (External Latch Input 3 Signal)</li> <li>FSTP (Forced Stop Input Signal)</li> </ul>	Output Signal Status	<ul> <li>ALM (Servo Alarm Output Signal)</li> <li>/COIN (Positioning Completion Output Signal)</li> <li>/V-CMP (Speed Coincidence Detection Output Signal)</li> <li>/TGON (Rotation Detection Output Signal)</li> <li>/S-RDY (Servo Ready Output Signal)</li> <li>/CLT (Torque Limit Detection Signal)</li> <li>/VLT (Speed Limit Detection Output Signal)</li> <li>/VLT (Speed Limit Detection Output Signal)</li> <li>/WLT (Speed Limit Detection Output Signal)</li> <li>/WARN (Warning Output Signal)</li> <li>/NEAR (Near Output Signal)</li> <li>/NEAR (Near 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>/PM (Preventative Maintenance Output Signal)</li> </ul>

# **Operating Procedure**

Use the following procedure to display the Operation Monitor, Status Monitor, and I/O Monitor for the SERVOPACK.

- Select Monitor in the SigmaWin+ Menu Dialog Box.
- The Operation Pane, Status Pane, and I/O Pane will be displayed in the Monitor Window.

			YASK	AWA SigmaWin	+ Ver.7	
	Monitor					
	Operation					
0001-SV2	Control	1/F 🗸	Item 🗸	Unit	0001-SV2· Axis A	
0001-SV2 -020L2 +	POS SPO TRQ	Common	Mctor rotating speed	min-1	0	
POWER ESTP N-OT	SPO	Common	Speed reference	min-1	0	
	POS SPO TRQ	Common	Input reference pulse speed	min-1	0	
	POS SPO TRQ	Common	Position error amount	reference ur	0	
	POS SPO TRQ	Common	Accumulated load ratio	%	0	
	POS SPO TRQ	Common	Regenerative load ratio	96	0	
	POS SPO TRQ	Common	Power consumed by DB resi	%	0	
	PDS SP0 TEQ	Common	Current Alarm State	-	Normal	
	Status 1/O Status	Common	Current Alarm State	-		
	Status 1/0 Status			-	0001-SV2·	
	Status 1/0 Status Control	1/F 🗸	Item 🗸		0001-SV2- Axis A	
	Status 1/O Status Control POS 5P0 180	I/F 🗸	Item 🗸	- ON(ALL)	0001-SV2- Axis A ON	
	Status I/O Status Control POS SPO TRO POS SPO TRO	I/F ✓ Common Common	Item V Dynamic Brake (DB) Orgin not Passed		0001-SV2- Axis A ON OFF	
	Status 1/0 Status Control Pos sP0 110 Pos sP0 110 Pos sP0 110	I/F ✓ Common Common Common	Item V Dynamic Brake (DB) Origin not Passed /COIN	ON(ALL)	0001-SV2- Axis A ON OFF OFF	
	Status 1/0 Status Control POS SP0 TEO POS SP0 TEO POS SP0 TEO POS SP0 TEO	I/F Common Common Common Common	Item V Dynamic Brake (DB) Origin not Passed /COIN /V-CMP	ON(ALL) -	0001-SV2- Axis A ON OFF OFF OFF	
	Status         1/0           Status         Control           P05         540         110           P05         540         110           P05         540         110           P05         540         110	I/F / Common Common Common Common Common	Item  Dynamic Brake (DB) Orgin not Passed /COIN /V-CMP /S-RDY	ON(ALL) -	0001-SV2- Axis A ON OFF OFF OFF OFF	
	Status 1/0 Status Control P05 510 110 P05 510 110 P05 510 110 P05 510 110 III0	I/F Common Common Common Common Common Common	Item  V Dynamic Brake (DB) Orgin not Passed /COIN //-CMP /S-RDY /VLT	ON(ALL) - - - - -	0001-SV2- Axis A ON OFF OFF OFF OFF OFF	
	Status         1/0           Status         Control           P05         540         110           P05         540         110           P05         540         110           P05         540         110	I/F Common Common Common Common Common Common Common	Item  Dynamic Brake (DB) Orgin not Passed /COIN /V-CMP /S-RDY	ON(ALL) - - - -	0001-SV2- Axis A ON OFF OFF OFF OFF	

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

# 9.2.3 I/O Signals Status Monitor

Use the following procedure to check the status of the I/O signals.

- 1. Click the *P* 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.
- 3. Click the Input Signal Tab.

	cation : 0003											
0001-560	75-R70F20A											
Write	Change Method		y List									
	Allocate Sig											
ut Signal ut Signal	Output Sig	sal				▼ a Manu	ual					
							4.5 1/0 54	nal Connection				
CN1-13	xis Nam	Status				n l	4.5.1 VO 8	ignal Connecto	r (CN1) Nam	es and Functions		
CN1-7		н					4.5	I/O Si	anal	Connection	e	
CN1-8		Hi					4.0	1/0 01	gnar	connection	3	
CN1-9	Axis A	н						1/0 01		(0)14		
CN1-10		Hi					4.5.1				Names and Function	
CN1-11 CN1-12		Hi Mi				*		The followin default sett		ves the pin numbers, na	imes, and functions the I/O signal pin	s for the
Allocatio	on Method		allocations					Input S		ven in parentheses.		
	xis Nam	Allocation	1	Polarity	Status			Signal	Pin No.	Name	Function	Reference
P-OT N-OT		Possible Possible	Always inactive		Allow Forward Run Allow Reverse Run			/SI1*		General-purpose	You can allocate the input signal to use	1101010100
/P-CL		Possible	Always inactive Always inactive		No Forward External Torgue			(P-OT)	7	Sequence Input 1 (For- ward Drive Prohibit Input)		
/N-CL		Possible	Always inactive		No Forward Reverse Torque			/5/2*		General-purpose Sequence Input 2	travel) when the moving part of the machine exceeds the range of move-	page 5-27
/DEC	Axis A	Possible	CN1-9	Normal	Deceleration Limit Switch In			(N-OT)	•	(Reverse Drive Prohibit Input)	ment.)	
/EXT1		Possible	CN1-10	Normal	No EXT1 Interrupt Request			/5/3*		General-purpose Sequence Input 3 (Ori-	You can allocate the input signal to use with a parameter.	
/D/T2		Possible	CN1-11	Normal	No EXT2 Interrupt Request			(/DEC)	9	gin Return Deceleration Switch Inputi	(Connects the deceleration limit switch for origin return.)	-
/EXT3 FSTP		Possible	CN1-12 Always inactive	Normal	No EXT3 Interrupt Request Emergency stop off			/S14*		General-purpose	a dan manuni	
rair		- APPROVE	noneys ridcove		Energend with on			(/EXT1)	10	Sequence Input 4 (Exter- nal Latch Input 1)	Maximum allocate the local size in the	
								/\$15* (/EXT2)	11	General-purpose Sequence Input 5 (Exter-	You can allocate the input signals to use with parameters. (Connect the external signals that latch	-
									-	nal Latch Input 2) General ouroose	the current feedback pulse counter.)	
								/Si6* (/EXT3)	12	General-purpose Sequence Input 6 (Exter-	the current feedback pulse counter.)	
								/5/6*	12	General-purpose	the current feedback pulse counter.) You can allocate the input signal to use with a parameter. (Josed for general purpose input. You can monitor this signal in the I/O monitor field of MECHATPOLINK.)	-
								/516* (/EXT3)		General-purpose Sequence Input 6 (Exter- nal Latch Input 3) General-purpose	the current feedback pulse counter.) You can allocate the input signal to use with a parameter. (Used for general purpose input. You can monitor this signal in the I/O monitor field	

Check the status of the input signals.

4. Click the Output Signal Tab.

	Mode	Forced	Output Mode			
	xis Nam	Status				
N1-1,2		Hi				
N1-23,24	Axis A	н				
N1-25,26		Hi				
	xis Nav	Allocation	Pin Number	Polarity	Status	
COIN	_	Possible	Disabled (not use		Positioning Incomplete	
V-CMP		Possible	Disabled (not use		Speed Non-Coincidence	
TGON		Possible	Disabled (not use		Motor Stopped	
S-RDY		Possible	Disabled (not use		Servo Preparation Incomple	
CLT		Possible	Disabled (not use		No Torque/Thrust Limit Del	
VLT.	Axis A	Possible	Disabled (not use		No Speed Limit Detected	
ВK		Possible	CN1-1,2	Normal output	Braking	
WARN		Possible	Disabled (not use		Normal	
NEAR		Possible	Disabled (not use		No Positioning Completion	
PM		Possible	Disabled (not use		Preventative Maintenance (	

Check the status of the output signals.

### 9.2.3 I/O Signals Status Monitor

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 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

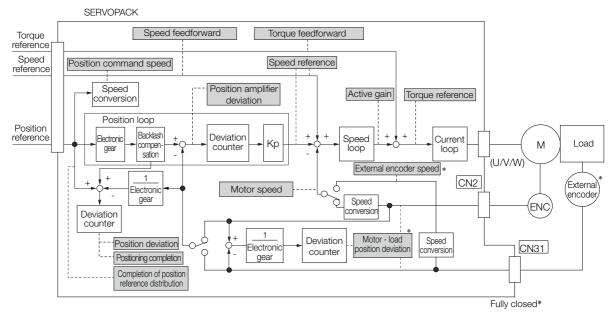
### **Monitoring Machine Operation Status and Signal Waveforms** 9.3

To monitor waveforms, use the SigmaWin+ trace function or a measuring instrument, such as a memory recorder.

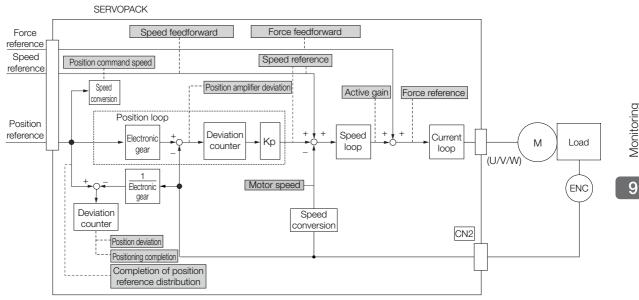
#### Items That You Can Monitor 9.3.1

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



9.3.2 Using the SigmaWin+

# 9.3.2 Using the SigmaWin+

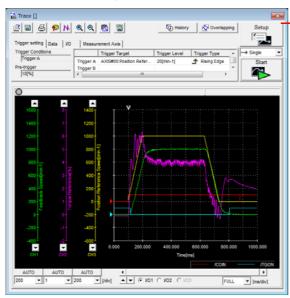
This section describes how to trace data and I/O with the SigmaWin+.

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

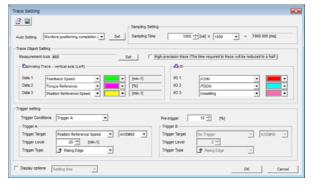
C Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)

# **Operating Procedure**

- 1. Click the 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.



Click this button to display the Trace Setting Dialog Box shown below, and set the data to trace and the trace conditions.



# **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> <li>Motor - Load Position Deviation</li> <li>Speed Feedforward</li> <li>Torque Feedforward</li> <li>Effective (Active) Gain</li> </ul>	<ul> <li>Main Circuit DC Voltage</li> <li>External Encoder Speed</li> <li>Control Mode</li> <li>Estimated Vibration</li> <li>Estimated External Disturbance Torque</li> <li>Number of Serial Encoder Communications Errors</li> <li>Number of MECHATROLINK Communications Errors</li> <li>Temperature Margin Until Servomotor Overheats</li> <li>Margin Until Overload</li> </ul>		

### • I/O Tracing

	Trace Objects					
Input Signals	<ul> <li>P-OT (Forward Drive Prohibit Input Signal)</li> <li>N-OT (Reverse Drive Prohibit Input Signal)</li> <li>/P-CL (Forward External Torque/Force Limit Input Signal)</li> <li>/N-CL (Reverse External Torque/Force Limit Input Signal)</li> <li>/G-SEL (Gain Selection Input Signal)</li> <li>/P-DET (Polarity Detection Input Signal)</li> <li>/DEC (Origin Return Deceleration Switch Input Signal)</li> <li>/EXT1 (External Latch Input 1 Signal)</li> <li>/EXT2 (External Latch Input 2 Signal)</li> <li>/EXT3 (External Latch Input 3 Signal)</li> <li>FSTP (Forced Stop Input Signal)</li> <li>/HWBB1 (Hard Wire Base Block Input 1</li> </ul>	Output Signals	<ul> <li>ALM (Servo Alarm Output Signal)</li> <li>/COIN (Positioning Completion Output Signal)</li> <li>/V-CMP (Speed Coincidence Detection Output Signal)</li> <li>/TGON (Rotation Detection Output Signal)</li> <li>/S-RDY (Servo Ready Output Signal)</li> <li>/CLT (Torque Limit Detection Output Signal)</li> <li>/CLT (Torque Limit Detection Output Signal)</li> <li>/VLT (Speed Limit Detection Output Signal)</li> <li>/WARN (Warning Output Signal)</li> <li>/NEAR (Near Output Signal)</li> <li>/NEAR (Near 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> </ul>			
	Signal) • /HWBB2 (Hard Wire Base Block Input 2 Signal)	Internal Status	<ul> <li>ACON (Main Circuit ON Signal)</li> <li>PDETCMP (Polarity Detection Completed Signal)</li> <li>DEN (Position Reference Distribution Completed Signal)</li> <li>PSET (Positioning Completion Output Signal)</li> <li>CMDRDY (Command Ready 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 4-46

# 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 (2 lines)	GND	_

Dor	amator		Description	
Par	ameter	Monitor Signal	Output Unit	Remarks
	n.□□00 (default setting of 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 (default setting of Pn006)	Torque Reference	1 V/100% rated torque	_
	n.□□03	Position Deviation	0.05 V/Reference unit	0 V for speed or torque control
	n.□□04	Position Amplifier Devi- ation	0.05 V/encoder pulse unit	Position deviation after electronic gear conversion
	n.□□05	Position Command 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 or	n.□□06	Reserved parameter (Do not change.)	_	-
Pn007	n.□□07	Motor - Load Position Deviation	0.01 V/Reference unit	_
	n.□□08	Positioning Completion	Positioning completed: 5 V Positioning not completed: 0 V	Completion is indi- cated by the output 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.ロロ0B	Active Gain*	1st gain: 1 V 2nd gain: 2 V	The gain that is active is indicated by the output voltage.
	n.□□0C	Completion of Position Reference Distribution	Distribution completed: 5 V Distribution not completed: 0 V	Completion is indi- cated by the output voltage.
	n.□□0D	External Encoder 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.

# **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 output voltage $= (-1) \times (-1)$	Analog Monitor 1 Signal	Analog Monitor 1	Analog Monitor 1
	Selection (Pn006 = n.□□XX) <sup>&gt;</sup>	<sup>×</sup> Magnification (Pn552) <sup>+</sup>	Offset Voltage (Pn550)
Analog monitor 2 $= (-1) \times$ output voltage	Analog Monitor 2 Signal	× Analog Monitor 2 .	Analog Monitor 2
	Selection (Pn007 = n.□□XX)	Magnification (Pn553)	Offset Voltage (Pn551)

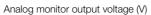
The following parameters are set.

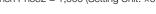
	Analog Monitor 1 Of	fset Voltage	Speed	Speed Position Torque		
Pn550	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	-10,000 to 10,000	0.1 V	0	Immediately	Setup	
	Analog Monitor 2 Of	fset Voltage		Speed	osition Torque	
Pn551	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	-10,000 to 10,000	0.1 V	0	Immediately	Setup	
	Analog Monitor 1 Ma	agnification	Speed Position Torque			
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		Speed	osition Torque	
Pn553	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	-10,000 to 10,000	×0.01	100	Immediately	Setup	

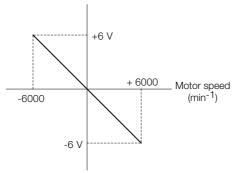
**Example** • Example for Setting the Item to Monitor to the Motor Speed (Pn006 =  $n.\Box\Box00$ )

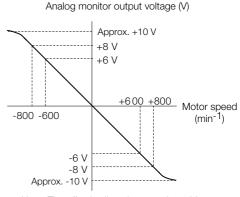
When Pn552 = 100 (Setting Unit:  $\times 0.01$ )

When Pn552 = 1,000 (Setting Unit: ×0.01)









Note: The effective linearity range is  $\pm 8$  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.

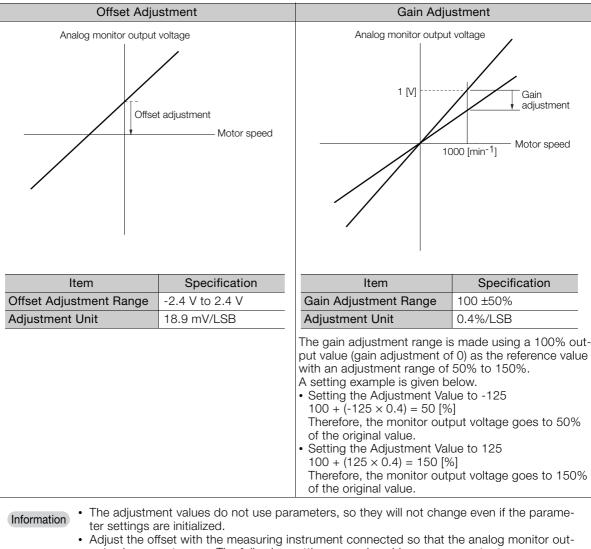
The offset is adjusted to compensate for offset in the zero point caused by output voltage drift or noise in the monitoring system.

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.



 Adjust the onset with the measuring instrument connected so that the analog monitor ou put 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 (Manual No.: SIEP S800001 33)
SigmaWin+	Others – Adjust the Analog Monitor Output	G  → Operating Procedure on page 9-13

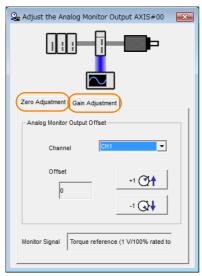
• Gain Adjustment

Tool	Fn No./Function Name	Operating Procedure Reference
Digital Operator	Fn00D	Ω-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)
SigmaWin+	Others – Adjust the Analog 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.



**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				
offset +1 ♂↑				
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 Envi- ronment	<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 Environ- ment	<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 Predic- tion	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. <i>[] 12.1.2 Guidelines for Part Replacement</i> on page 12-2
Capacitor Service Life Predic- tion	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 Ser- vice 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 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.

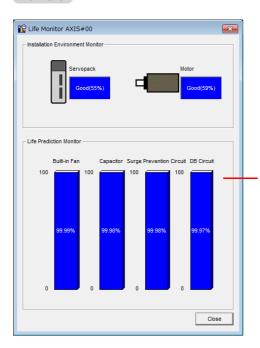
9.4.2 Operating Procedure

# 9.4.2 Operating Procedure

Use the following procedure to display the installation environment and service life prediction monitor dialog boxes.

- 1. Click the El 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.



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 the following functions for preventative maintenance.

- Preventative maintenance warnings
- /PM (Preventative Maintenance Output) signal

The SERVOPACK 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 =  $n.\square\square\squareX$  to enable or disable these warnings.

Parameter		Description	When Enabled	Classifi- cation
Pn00F	n.□□□0 (default setting)	Do not detect preventative maintenance warnings.	After restart	Setup
	n.0001	Detect preventative maintenance warnings.	restart	

# /PM (Preventative Maintenance Output) Signal

The /PM (Preventative Maintenance Output) signal is output when any of the following service life prediction values reaches 10% or less: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, and dynamic brake circuit life. The /PM (Preventative Maintenance Output) signal must be allocated.

Even if detection of preventive maintenance warnings is disabled (Pn00F =  $n.\Box\Box\Box$ ), the /PM signal will still be output as long as it is allocated.

Classifi- cation	Signal	Connector Pin No.	Signal Status	Description
Output	/PM	Must be allocated.	ON (closed)	One of the following service life prediction values reached 10% or less: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, and dynamic brake circuit life.
			OFF (open)	All of the following service life prediction values are greater than 10%: SERVOPACK built-in fan life, capacitor life, inrush current limiting circuit life, and dynamic brake circuit life.

Note: You must allocate the /PM signal to use it. Use  $Pn514 = n.\Box X \Box \Box$  (/PM (Preventative Maintenance Output) Signal Allocation) to allocate the signal to connector pins. Refer to the following section for details.

3 6.1.2 Output Signal Allocations on page 6-5

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+.

- Information
  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.
  - - · 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.

ON/OFF Data
ALM
Servo ON command (/S-ON)
Proportional control command (/P-CON)
Forward torque command (/P-CL)
Reverse torque command (/N-CL)
G-SEL1 signal (/G-SEL1)
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 tracing data from the Digital Operator.			
SigmaWin+	Troubleshooting - Alarm Trace	Engineering Tool SigmaWin+ Operation Manual (Manual No.: SIET S800001 34)		

# Fully-Closed Loop Control

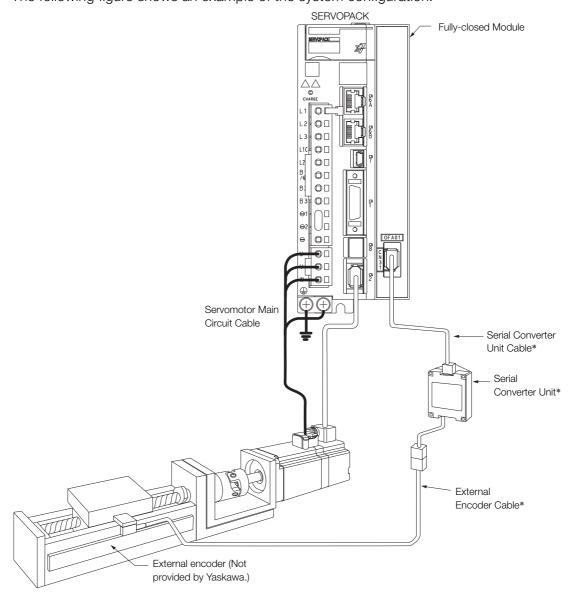
This chapter provides detailed information on performing fully-closed loop control with the SERVOPACK.

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	10.3.8	Analog Monitor Signal Settings 10-9
	10.3.9	Setting to Use an External Encoder for Speed Feedback

# 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.

2.4 Examples of Standard Connections between SERVOPACKs and Peripheral Devices on page 2-24

# **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 SER-VOPACK? (External Encoder wiring Servomotor wiring Does jogging function correctly Usage) SERVO- Pn20E (Electronic Gear Encoder wiring when you operate the SERVO-PACK or • Wiring of I/O signal PACK without a load? Ratio (Numerator)) 1 host conlines from the host con-• Do the I/O signals turn ON and • Pn210 (Electronic Gear troller Ratio (Denominator)) troller OFF correctly? Servomotor rotation · Is power supplied to the Servo-• Pn50A, Pn50B, Pn511, motor when the SV\_ON (Servo direction, motor speed, and Pn516 (Input Signal Selections) and multiturn data ON) command is sent from the • Pn50E, Pn50F, Pn510, Operation of safety host controller? mechanisms, such as Does the Servomotor operate and Pn514 (Output Sigthe brakes and the correctly when a position refernal Selections) overtravel mechanisms ence is input by the host controller? Check operation with the Servomotor connected to the machine with Connect the Servomotor to the semi-closed loop control. Items to Check machine. Set the moment of inertia · 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 references from the host controller. movement speed as specified by the references from the host controller • Pn002 = n.X□□□ Set the parameters related to fully-(External Encoder closed loop control and move the Usage) machine with your hand without Pn20A (Number of turning ON the power supply to the External Scale Pitches) Servomotor. Check the following Pn20E (Electronic Gear status with the Digital Operator or Ratio (Numerator)) SigmaWin+. Check the external • Pn210 (Electronic Gear • Does the fully-closed feedback Ratio (Denominator)) encoder. pulse counter count up when the Items to Check Pn281 (Encoder Output Servomotor moves in the forward 3 Is the signal from the Resolution) direction? Pn51B (Excessive Error external encoder · Is the travel distance of the received correctly? Level between Servomachine visually about the same motor and Load Posias the amount counted by the tions) fully-closed feedback pulse Pn522 (Positioning counter? Completed Width) Note: The unit for the fully-closed feed- Pn52A (Multiplier per back pulse counter is pulses, which is equivalent to the exter-One Fully-closed Rotanal encoder sine wave pitch. tion)

Continued from previous page.

Step	Description	Operation	Required Parameter Settings	Con- trolling Device
4	Perform a program jog- ging operation. Items to Check Does the fully-closed system operate correctly for the SERVOPACK without a load?	Perform a program jogging opera- tion and confirm that the travel dis- tance is the same as the reference value in Pn531. When you perform program jog- ging, start from a low speed and gradually increase the speed.	Pn530 to Pn536 (program jogging-related parame- ters)	SERVO- PACK
5	Operate the SERVO- PACK. Items to Check Does the fully-closed system operate correctly, including the host con- troller?	Input a position reference and con- firm that the SERVOPACK oper- ates correctly. Start from a low speed and gradu- ally increase the speed.	_	Host con- troller

10.3.1 Control Block Diagram for Fully-Closed Loop Control

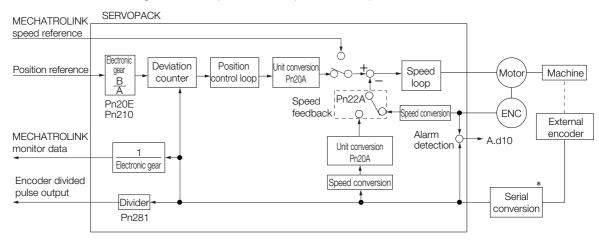
# 10.3 Parameter Settings for Fully-Closed Loop Control

Parameter to Set	Setting	Position Control	Speed Control	Torque Control	Reference
Pn000 = n.□□□X	Motor direction	$\checkmark$	$\checkmark$	$\checkmark$	
Pn002 = n.X <b>DDD</b>	External encoder usage method	$\checkmark$	$\checkmark$	$\checkmark$	page 10-6
Pn20A	Number of external scale pitches	$\checkmark$	$\checkmark$	$\checkmark$	page 10-7
Pn281	Encoder divided pulse output signals (PAO, PBO, and PCO) from the SERVO- PACK	$\checkmark$	$\checkmark$	$\checkmark$	page 10-7
_	External absolute encoder data reception sequence	$\checkmark$	$\checkmark$	$\checkmark$	page 6-44
Pn20E and Pn210	Electronic gear ratio	$\checkmark$	-	-	page 5-44
Pn51B	Excessive deviation level between Servo- motor and load positions	$\checkmark$	_	_	page 10-8
Pn52A	Multiplier for one fully-closed rotation	$\checkmark$	_	_	
Pn006/Pn007	Analog monitor signal	$\checkmark$	$\checkmark$		page 10-9
Pn22A = n.X□□□	Speed feedback method during fully- closed loop control	$\checkmark$	-	_	page 10-9

This section describes the parameter settings that are related to fully-closed loop control.

### 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

# 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)			
Farameter		n.1⊏		n.3000			
		Reference direction	Forward reference	Reverse reference	Forward reference	Reverse reference	
Pn000 =n.□□□X (Direction Selection)	n.□□□0	Motor direction	CCW	CW	CCW	CW	
		External encoder	Forward movement	Reverse movement	Reverse movement	Forward movement	
		Reference direction	Forward reference	Reverse reference	Forward reference	Reverse reference	
	n.□□□1	Motor direction	CW	CCW	CW	CCW	
		External encoder	Reverse movement	Forward movement	Forward movement	Reverse movement	

• 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. 5.5 Motor Direction Setting on page 5-17

#### ◆ Pn002 = n.X□□□

When you perform fully-closed loop control, set Pn002 to  $n.1\square\square\square$  or  $n.3\square\square\square$ .

Pa	arameter	Name	Meaning	When Enabled	Classifi- cation
	n.0□□□ (default set- ting)		Do not use an external encoder.		
Pn002	n.1000	External Encoder Usage	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

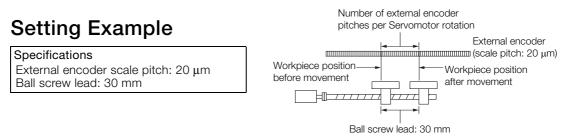
Determine the setting of Pn002 =  $n.X\Box\Box\Box$  as described below.

- Set Pn000 to n. DD (Use the direction in which the linear encoder counts up as the forward direction) and set Pn002 to n.1DD (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

### 10.3.3 Setting the Number of External Encoder Scale Pitches

Set the number of external encoder scale pitches per Servomotor rotation in Pn20A.



If the external encoder is connected directly to the Servomotor, the setting will be 1,500 (30 mm/0.02 mm = 1,500).

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 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.

#### **Related Parameters**

	Number of External Scale Pitches				ition
Pn20A	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
FIIZUA	4 to 1,048,576	1 scale pitch/revo- 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.

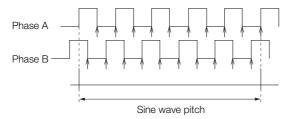
### Setting Example

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 output.

#### 10.3.5 External Absolute Encoder Data Reception Sequence

**Example** If the setting is 20 and the speed is 1,600 mm/s, the output frequency would be 1.6 Mpps 1600 mm/s

$$\frac{1000 \text{ mm/s}}{0.001 \text{ mm}} = 1,600,000 = 1.6 \text{ Mpps}$$

Because 1.6 Mpps is less than 6.4 Mpps, this setting can be used.

### **Related Parameters**

	Encoder Output Re	solution	Position		
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 5-47.

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 External Absolute Encoder Data Reception Sequence

Refer to the following section for details.

G 6.9.4 Reading the Position Data from the Absolute Linear Encoder on page 6-44 With fully-closed loop control, the same sequence as for a Linear Servomotor is used.

### 10.3.6 Electronic Gear Setting

Refer to the following section for details.

5.15 Electronic Gear Settings on page 5-44

With fully-closed loop control, the same setting as for a Linear Servomotor is used.

# 10.3.7 Alarm Detection Settings

This section describes the alarm detection settings (Pn51B and Pn52A).

# Pn51B (Excessive Error Level between Servomotor and Load Positions)

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.

	Excessive Error Level between Servomotor and Load Positions					
Pn51B	Setting Range	Setting Unit	Default Setting	When Enabled	Classifica- tion	
	0 to 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 One 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.

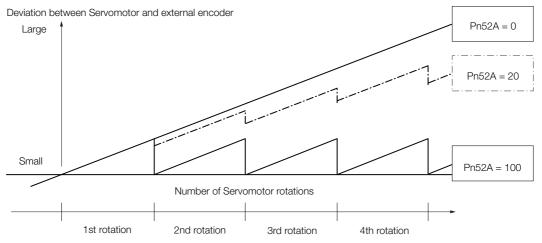
10.3.8 Analog Monitor Signal Settings

#### 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 Parameters

	Multiplier per One F	ully-closed Rotatio	Position		
Pn52A	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 100	1%	20	Immediately	Setup

# 10.3.8 Analog Monitor Signal Settings

You can monitor the position deviation between the Servomotor and load with an analog monitor.

Para	Parameter Name Meaning		When Enabled	Classifi- cation	
Pn006	n.□□07	Analog Monitor 1 Signal Selection	Position deviation between motor and load (output unit: 0.01 V/reference unit).	Immedi-	Setup
Pn007	n.□□07	Analog Monitor 2 Signal Selection	Position deviation between motor and load (output unit: 0.01 V/reference unit).	ately	Setup

# 10.3.9 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 Enabled	Classification
Pn22A	n.0□□□ (default set- 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, 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.

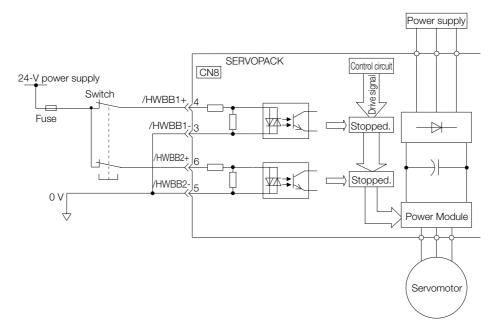
This is opposite to other signals described in this manual.

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, 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 levels 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.

11.2.2 Hard Wire Base Block (HWBB) State

- 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)
  - 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.

#### • When HWBB Operates after Servo OFF (Power Not Supplied to Motor)

/HWBB1 /HWBB2	ON (normal operation)		OFF (motor current shut-OFF request)
MECHATROLINK-III command	Motion or other command	SV_OFF command	SMON or other command
Servo command status SV_ON	1	0	
Servo command input signal monitor ESTP	0		1
SERVOPACK Status	Operating Status	BB state	HWBB state

#### • When HWBB Operates While Power Is Supplied to Servomotor

/HWBB1 <sub>C</sub> /HWBB2	N (normal operation)	OFF (motor current shut-OFF request)
MECHATROLINK-III command	Motion or other command	SMON or other command
Servo command status SV_ON	1	0
Servo command input signal monitor ESTP	0	1
SERVOPACK Status	Operating Status	HWBB state

11.2.3 Resetting the HWBB State

# 11.2.3 Resetting the HWBB State

Normally, after the SV\_OFF (Servo OFF: 32h) command is received 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 SERVOPACK will enter a base block (BB) state and will be ready to acknowledge the SV\_ON (Servo ON: 31h) command.

/HWBB1 /HWBB2	OFF (motor current shut-OFF request)	ON (normal	operation)
MECHATRO- LINK-III command	SMON or other command		SV_ON command
Servo command status SV_ON -	0		1
- Servo command input signal monitor ESTP	1	0	0
- SERVO- PACK Status	HWBB state	BB state	Operating Status

If the /HWBB1 and /HWBB2 signals are OFF and the SV\_ON (Servo ON: 31h) command is received, the HWBB state will be maintained even after the /HWBB1 and /HWBB2 signals are turned ON. Send the SV\_OFF (Servo OFF: 32h) command to place the SERVOPACK in the BB state and then send the SV\_ON (Servo ON: 31h) command.

/HWBB1 /HWBB2	OFF (motor current shut-OFF request)	ON (normal operation)	
MECHATROLINK-III command	SV_ON command	SV_OFF SV_ON command command	
Servo command status SV_ON	0	0 1	
Servo command input signal monitor ESTP	1	0 0	
SERVOPACK Status	HWBB state	BB state Operating Status	

Note: 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 SV\_OFF (Servo OFF: 32h) command is received.

11.2.4 Related Commands

## 11.2.4 Related Commands

If the /HWBB1 or /HWBB2 signal turns OFF and the HWBB operates, the ESTP bit in the servo command input signal monitor (SVCMD\_IO) will change to 1. The host controller can monitor this bit to determine the status.

If the state changes to the HWBB state during the execution of the next motion command, a command warning occurs. If a warning occurs, clear the alarm to return to normal operating status. After stopping or canceling the motion command, using the sequence of commands to return to the HWBB status is recommended.

Applicable Motion Commands		
SV_ON (Servo ON)		
INTERPOLATE (Interpolating)		
POSING (Positioning)		
FEED (Constant Speed Feed)		
EX_FEED (External Input Feed Command)		
EX_POSING (External Input Positioning)		
ZRET (Origin Return)		

# 11.2.5 Detecting Errors in HWBB Signal

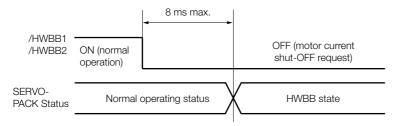
If only the /HWBB1 or the /HWBB2 signal is input, an A.Eb1 alarm (Safety Function Signal Input Timing Error) will occur unless the other signal is input within 10 seconds. This makes it possible to detect failures, such as disconnection of an HWBB signal.

# 

• 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.

# 11.2.6 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.

11.2.7 Operation without a Host Controller

# 11.2.7 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.

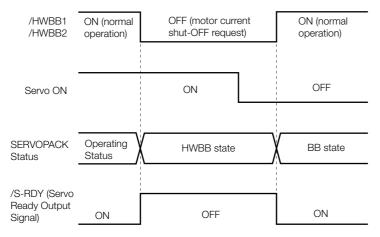
Applicable Functions	Resetting the HWBB State	
<ul> <li>Jogging</li> <li>Origin search</li> </ul>	After you turn ON the /HWBB1 and /HWBB2 signals, leave the execution mode for the function and then enter it again.	
<ul> <li>Program jogging</li> <li>Automatic adjustment without host reference</li> </ul>	execution mode status OFF (motor	
<ul> <li>Easy FFT</li> <li>Adjustment of motor current detection signal offset</li> </ul>	/HWBB1 ON (normal /HWBB2 operation) request) ON (normal operation)	_
	SERVOPACK Operating HWBB state BB state Operating Status	_

# 11.2.8 /S-RDY (Servo Ready Output) Signal

The SV\_ON (Servo ON: 31h) command 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 servo is turned OFF (BB state).

An example is provided below for when the main circuit power supply is ON and the SENS\_ON (Turn Sensor ON) command is input when there is no servo alarm. (An absolute encoder is used in this example.)



11.2.9 /BK (Brake Output) Signal

# 11.2.9 /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.

# 11.2.10 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 =  $n.\square\square\square0$  or  $n.\square\square\square1$ ), 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.

# 11.2.11 ALM (Servo Alarm) Signal

The ALM (Servo Alarm) signal is 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.

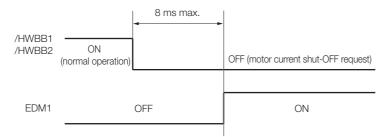
Detection of failures in the EDM1 signal circuit can be achieved by using the status of the /HWBB1, /HWBB2, and EDM1 signals in the following table. A failure can be detected by checking the failure status, e.g., when the power supply is turned ON.

Signal		Lo	gic	
/HWBB1	ON	ON	OFF	OFF
/HWBB2	ON	OFF	ON	OFF
EDM1	OFF	OFF	OFF	ON

• 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.



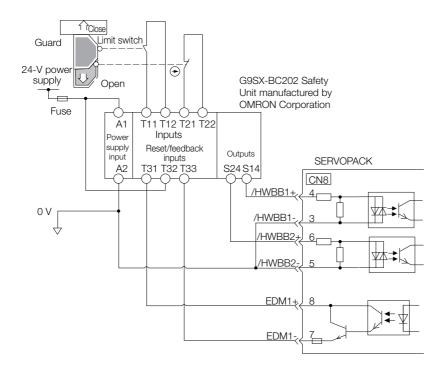
11.4.1 Connection Example

# **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-.

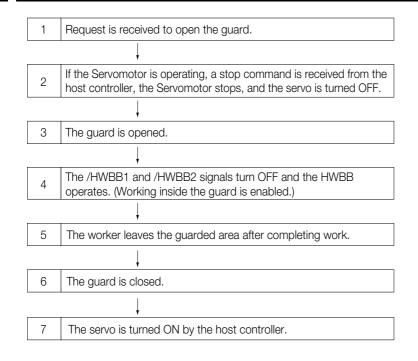
### 11.4.2 Failure Detection Method

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**

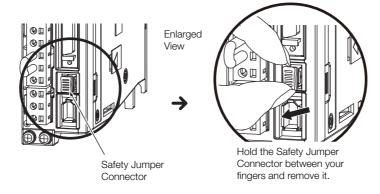
When you commission the system or perform maintenance or SERVOPACK replacement, you must always perform the following validation test on the HWBB after completing the wiring. (It is recommended that you keep the confirmation results as a record.)

- 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.

# Maintenance



This chapter provides information on the meaning of, causes of, and corrections for alarms and warnings.

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12.1.1 Inspections

# 2.1 Inspections and Part Replacement

This section describes inspections and part replacement for SERVOPACKs.

## 12.1.1 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	At least once a year	Check for dust, dirt, and oil on the surfaces.	Clean with compressed air or a cloth.
Loose Screws		Check for loose terminal block and connector screws and for other loose parts.	Tighten any loose screws or other loose parts.

# 12.1.2 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.
   *9.4 Monitoring Product Life* on page 9-15
- Use the following table.

Part	Standard Replace- 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 factory 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.

# 12.1.3 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).

Parameter		Meaning	When Enabled	Classification
	n.□□□0 (default setting)	Output alarm (A.830) for low battery voltage.	After restart	Setup
	n.0001	Output warning (A.930) for low battery voltage.		

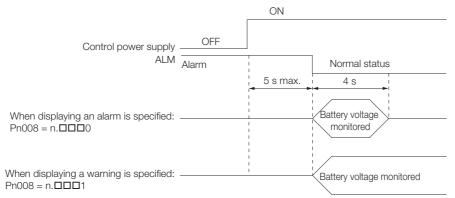
• Pn008 = n.□□□0

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.



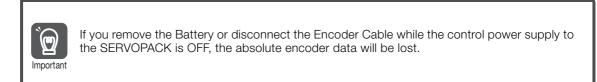
### **Battery Replacement Procedure**

- 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.

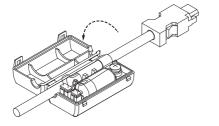
#### 12.1.3 Replacing the Battery

#### When Using an Encoder Cable with a Battery Case

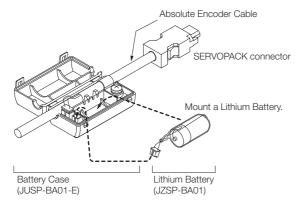
1. Turn ON only the control power supply to the SERVOPACK.



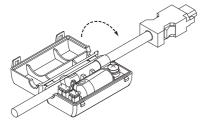
2. Open the cover of the Battery Case.



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.

# 12.2 Alarm Displays

If an error occurs in the SERVOPACK, an alarm number will be displayed on the panel display. However, if no alarm number appears on the panel display, this indicates a SERVOPACK system error. Replace the SERVOPACK.

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

Example: Alarm A.E60

```
\xrightarrow{\text{Status}} \longrightarrow \text{Not lit.} \longrightarrow \textbf{R}, \longrightarrow \text{Not lit.} \longrightarrow \textbf{E} \longrightarrow \text{Not lit.} \longrightarrow \textbf{E} \longrightarrow \text{Not lit.} \longrightarrow \textbf{D} \longrightarrow \text{Not lit.}
```

This section provides a list of the alarms that may occur and the causes of and corrections for those alarms.

# 12.2.1 List of Alarms

The following alarm tables gives the alarm name, alarm meaning, alarm stopping method, and alarm reset possibility in order of the alarm numbers.

### Servomotor Stopping Method for Alarms

Refer to the following section for information on the stopping method for alarms. 5.13.2 Servomotor Stopping Method for Alarms on page 5-40

# 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.

# List of Alarms

Alarm Number	Alarm Name	Alarm Meaning	Servo- motor Stop- ping Method	Alarm Reset Possi- ble?
A.020	Parameter Checksum Error	There is an error in the parameter data in the SERVOPACK.	Gr.1	No
A.021	Parameter Format Error	There is an error in the parameter data format in the SERVOPACK.		No
A.022	System Checksum 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 SER- VOPACK.	Gr.1	No
A.025	System Alarm	An internal program error occurred in the SER- VOPACK.	Gr.1	No
A.030	Main Circuit Detector Error	There is an error in the detection data for the main circuit.	Gr.1	Yes
A.040	Parameter Setting Error	A parameter setting is outside of the setting range.	Gr.1	No

Continued on next page.

Servo-Alarm motor Alarm Reset Alarm Name Alarm Meaning Stop-Number Possiping ble? Method The setting of Pn212 (Encoder Output Pulses) or **Encoder Output Pulse** Pn281 (Encoder Output Resolution) is outside of A.041 Gr.1 No Setting Error the setting range or does not satisfy the setting conditions. Parameter Combination The combination of some parameters exceeds A.042 Gr.1 No Error the setting range. Semi-Closed/Fully-Closed The settings of the Option Module and Pn002 = A.044 Loop Control Parameter n.XDDD (External Encoder Usage) do not Gr 1 No Setting Error match. There is an error in the bank members or bank A.04A Parameter Setting Error 2 Gr.1 No data settings. The capacities of the SERVOPACK and Servomo-A.050 Combination Error Gr.1 Yes tor do not match. **Unsupported Device** A.051 Gr 1 No An unsupported device was connected. Alarm Motor Type Change The connected motor is a different type of motor A.070 Gr.1 No Detected from the previously connected motor. Linear Encoder Pitch Set-The setting of Pn282 (Linear Encoder Pitch) has A.080 Gr.1 No not been changed from the default setting. tina Error The SV\_ON (Servo ON) command was sent from Invalid Servo ON Com-A.0b0 the host controller after a utility function that turns Gr.1 Yes mand Alarm ON the Servomotor was executed. An overcurrent flowed through the power transis-A.100 **Overcurrent Detected** Gr.1 No tor or the heat sink overheated. Motor Overcurrent The current to the motor exceeded the allowable A.101 Gr.1 No Detected current. A.300 There is an error related to regeneration. Gr.1 Yes **Regeneration Error** A.320 Gr.2 Yes **Regenerative Overload** A regenerative overload occurred. • The AC power supply input setting or DC power Main Circuit Power Supply A.330 supply input setting is not correct. Gr.1 Yes Wiring Error • The power supply wiring is not correct. A.400 Overvoltage The main circuit DC voltage is too high. Gr.1 Yes A.410 Undervoltage The main circuit DC voltage is too low. Gr.2 Yes A.510 Overspeed Gr.1 Yes The motor exceeded the maximum speed. · Rotary Servomotor: The pulse output speed for the setting of Pn212 (Encoder Output Pulses) **Encoder Output Pulse** was exceeded. A.511 Gr.1 Yes Overspeed • Linear Servomotor: The motor speed upper limit for the setting of Pn281 (Encoder Output Resolution) was exceeded. Abnormal oscillation was detected in the motor A.520 Vibration Alarm Gr.1 Yes speed Vibration was detected during autotuning for the A.521 Autotuning Alarm Gr.1 Yes tuning-less function. Maximum Speed Setting The setting of Pn385 (Maximum Motor Speed) is A.550 Gr.1 Yes greater than the maximum motor speed. Frror The Servomotor was operating for several sec-A.710 Instantaneous Overload onds to several tens of seconds under a torque Gr 2 Yes that largely exceeded the rating. The Servomotor was operating continuously A.720 Continuous Overload Gr.1 Yes under a torque that exceeded the rating. When the dynamic brake was applied, the rota-A.730 Dynamic Brake Overload tional or linear kinetic energy exceeded the Gr.1 Yes A.731 capacity of the dynamic brake resistor.

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Alarm Number	Alarm Name	Alarm Meaning	Servo- motor Stop- ping Method	Alarm Reset Possi- ble?
A.740	Inrush Current Limiting Resistor Overload	The main circuit power supply was frequently turned ON and OFF.		Yes
A.7A1	Internal Temperature Error 1 (Control Board Tempera- ture Error)	The surrounding temperature of the control PCB is abnormal.	Gr.2	Yes
A.7A2	Internal Temperature Error 2 (Power Board Tempera- ture Error)	The surrounding temperature of the power PCB is abnormal.	Gr.2	Yes
A.7A3	Internal Temperature Sen- sor Error	An error occurred in the temperature sensor circuit.	Gr.2	No
A.7Ab	SERVOPACK Built-in Fan Stopped	The fan inside the SERVOPACK stopped.	Gr.1	Yes
A.810	Encoder Backup Alarm	The power supplies to the encoder all failed and the position data was lost.	Gr.1	No
A.820	Encoder Checksum Alarm	There is an error in the checksum results for encoder memory.	Gr.1	No
A.830	Encoder Battery Alarm	The battery voltage was lower than the specified level after the control power supply was turned ON.	Gr.1	Yes
A.840	Encoder Data Alarm	der Data Alarm There is an internal data error in the encoder.		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
A.861	Motor OverheatedThe 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.		No
A.891	Encoder Module Error	An error occurred in the linear encoder.	Gr.1	No
A.8A0	External Encoder Error	An error occurred in the external encoder.	Gr.1	Yes
A.8A1	External Encoder Module Error	An error occurred in the Serial Converter Unit.	Gr.1	Yes
A.8A2	External Incremental Encoder Sensor Error	An error occurred in the external encoder.	Gr.1	Yes
A.8A3	External Absolute EncoderAn error occurred in the position data of the external encoder.Position Errorexternal encoder.		Gr.1	Yes
A.8A5	External Encoder Over- speed	An overspeed error occurred in the external encoder.	Gr.1	Yes
A.8A6	External Encoder Over- heated	coder Over- An overheating error occurred in the external encoder.		Yes
A.b33	Current Detection Error 3	An error occurred in the current detection circuit.	Gr.1	No
A.b6A	MECHATROLINK Commu- nications ASIC Error 1	ASIC error 1 occurred in MECHATROLINK com- munications.	Gr.1	No
A.b6b	MECHATROLINK Commu- nications ASIC Error 2 ASIC error 2 occurred in MECHATRC munications.		Gr.2	No
A.bC0	System Alarm 10	Internal program error 10 occurred in the SER- VOPACK.	Gr.1	No
A.bF0	System Alarm 0	Internal program error 0 occurred in the SERVO- PACK.	Gr.1	No
A.bF1	System Alarm 1	Internal program error 1 occurred in the SERVO-PACK.	Gr.1	No

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Continued on next page.

Servo-Alarm motor Alarm Reset Alarm Name Alarm Meaning Stop-Number Possiping ble? Method Internal program error 2 occurred in the SERVO-A.bF2 System Alarm 2 Gr.1 No PACK. Internal program error 3 occurred in the SERVO-A.bF3 Gr.1 No System Alarm 3 PACK. Internal program error 4 occurred in the SERVO-Gr.1 A.bF4 System Alarm 4 No PACK. Internal program error 5 occurred in the SERVO-A.bF5 System Alarm 5 Gr.1 No PACK. Internal program error 6 occurred in the SERVO-A.bF6 System Alarm 6 Gr.1 No PACK. Internal program error 7 occurred in the SERVO-A.bF7 System Alarm 7 Gr 1 No PACK. Internal program error 8 occurred in the SERVO-A.bF8 System Alarm 8 Gr.1 No PACK. A.C10 Servomotor Out of 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 Polarity Sensor Error A.C21 An error occurred in the polarity sensor. Gr.1 No Phase Information Dis-A.C22 The phase information does not match. Gr.1 No agreement A.C50 Polarity Detection Failure The polarity detection failed. Gr.1 No **Overtravel Detected** The overtravel signal was detected during polarity A.C51 Gr.1 Yes during Polarity Detection detection. Polarity Detection Not The servo was turned ON before the polarity was A.C52 Gr.1 Yes Completed detected. Out of Range of Motion for The travel distance exceeded the setting of A.C53 Gr.1 No **Polarity Detection** Pn48E (Polarity Detection Range). Polarity Detection Failure A.C54 The polarity detection failed. Gr.1 No 2 Encoder Clear Error or The multiturn data for the absolute encoder was A.C80 Multiturn Limit Setting Gr.1 No not correctly cleared or set. Error **Encoder Communications** Communications between the encoder and SER-A.C90 Gr.1 No Frror VOPACK is not possible. **Encoder Communications** An error occurred in calculating the position data Position Data Acceleration A.C91 Gr.1 No of the encoder. Rate Error **Encoder Communications** An error occurred in the communications timer A.C92 Gr.1 No Timer Error between the encoder and SERVOPACK. A.CA0 Encoder Parameter Error The parameters in the encoder are corrupted. Gr.1 No The contents of communications with the A.Cb0 Encoder Echoback Error Gr.1 No encoder are incorrect. Multiturn Limit Disagree-Different multiturn limits have been set in the A.CC0 Gr.1 No encoder and the SERVOPACK. ment Reception Failed Error in Receiving data from the Feedback Option Mod-A.CF1 Feedback Option Module Gr.1 No ule failed. Communications Timer Stopped Error in An error occurred in the timer for communica-A.CF2 Feedback Option Module Gr.1 No tions with the Feedback Option Module. Communications The setting of Pn520 (Excessive Position Devia-Position Deviation Over-A.d00 tion Alarm Level) was exceeded by the position Gr.1 Yes flow deviation.

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Alarm Number	Alarm Name	Alarm Meaning	Servo- motor Stop- ping Method	Alarm Reset Possi- ble?
A.d01	Position Deviation Over- flow Alarm at Servo ON	The servo was turned ON after the position devi- ation exceeded the setting of Pn526 (Excessive Position Deviation Alarm Level at Servo ON) while the servo was OFF.	Gr.1	Yes
A.d02	Position Deviation Over- flow Alarm for Speed Limit at Servo ON	Alarm for Speed Limit the servo is turned ON. This alarm occurs if a		Yes
A.d10	Motor-Load Position Devi- ation Overflow	There was too much position deviation between the motor and load during fully-closed loop con- trol.	Gr.2	Yes
A.d30	Position Data Overflow	The position feedback data exceeded ±1,879,048,192.	Gr.1	No
A.E02	MECHATROLINK Internal Synchronization Error 1	A synchronization error occurred during MECHATROLINK communications with the SER- VOPACK.	Gr.1	Yes
A.E40	MECHATROLINK Trans- mission Cycle Setting Error	The setting of the MECHATROLINK communica- tions transmission cycle is not correct.	Gr.2	Yes
A.E41	MECHATROLINK Commu- nications Data Size Set- ting Error	The setting of the MECHATROLINK communica- tions data size is not correct.	Gr.2	Yes
A.E42	MECHATROLINK Station Address Setting Error	The setting of the MECHATROLINK station address is not correct.	Gr.2	No
A.E50*	MECHATROLINK Syn- chronization Error A synchronization error occurred during MECHATROLINK communications.		Gr.2	Yes
A.E51	MECHATROLINK Syn- chronization Failed	Synchronization failed during MECHATROLINK communications.	Gr.2	Yes
A.E60*	Reception Error in MECHATROLINK Commu- nications	eption Error in CHATROLINK Communications errors occurred continuously during MECHATROLINK communications		Yes
A.E61	Synchronization Interval Error in MECHATROLINK Transmission Cycle	Synchronization Interval Error in MECHATROLINK		Yes
A.E63	MECHATROLINK Syn- chronization Frame Not Received			Yes
A.E71	Safety Option Module Detection Failure	Detection of the Safety Option Module failed.	Gr.1	No
A.E72	Feedback Option Module Detection Failure	Detection of the Feedback Option Module failed.	Gr.1	No
A.E74	Unsupported Safety Option Module Alarm	An unsupported Safety Option Module was connected.	Gr.1	No
A.Eb1	Safety Function SignalAn error occurred in the input timing of the safetyInput Timing Errorfunction signal.		Gr.1	No
A.EC8	Gate Drive Error 1	-		No
A.EC9	Gate Drive Error 2	An error occurred in the gate drive circuit.	Gr.1	No
A.Ed1	Command Execution Tim- eout	A timeout error occurred for a MECHATROLINK command.	Gr.2	Yes

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Continued on next page.

Alarm Number	Alarm Name	Alarm Meaning	Servo- motor Stop- ping Method	Alarm Reset Possi- ble?
A.F10	Power Supply Line 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
FL-1*			_	No
FL-2*				
FL-3*				
FL-4*	System Alarm	An internal program error occurred in the SER- VOPACK.		
FL-5*				
FL-6*				
FL-7*				
CPF00	Digital Operator Commu- nications Error 1	Communications were not possible between the	_	No
CPF01	Digital Operator Commu- nications Error 2	Digital Operator (model: JUSP-OP05A-1-E) and the SERVOPACK (e.g., a CPU error occurred).		INO

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\* These alarms are not stored in the alarm history. They are only displayed on the panel display.

Note: The A.Eb0, A.Eb2 to A.Eb9, and A.EC0 to A.EC2 alarms can occur when a Safety Module is connected. Refer to the following manual for details.  $\bigcap AC \text{ Servo Drive } \Sigma\text{-V-Series}/\Sigma\text{-V-Series for Large-Capacity Models}/\Sigma\text{-7-Series User's Manual Safety Module} (Manual No.: SIEP C720829 06)$ 

# 12.2.2 Troubleshooting Alarms

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: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The power supply voltage suddenly dropped.	Measure the power supply voltage.	Set the power supply volt- age within the specified range, and initialize the parameter settings.	page 5-11
	The power supply was shut OFF while writing parameter set- tings.	Check the timing of shutting OFF the power supply.	Initialize the parameter settings and then set the parameters again.	page e
<b>A.020:</b> Parameter	The number of times that parameters were written exceeded the limit.	Check to see if the parameters were fre- quently changed from the host controller.	The SERVOPACK may be faulty. Replace the SER- VOPACK. Reconsider the method for writing the parame- ters.	-
Checksum Error (There is an error in the parameter data in the SER- VOPACK.)	A malfunction was caused by noise from the AC power supply, ground, static elec- tricity, or other source.	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, noise may be the cause.	Implement countermea- sures against noise.	page 4-5
	Gas, water drops, or cutting oil entered the SERVOPACK and caused failure of the internal components.	Check the installation conditions.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
	A failure occurred in the SERVOPACK.	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may have failed.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	_
A.021: Parameter For- mat Error (There is an error in the parameter data format in the	The software version of the SERVOPACK that caused the alarm is older than the soft- ware version of the parameters specified to write.	Read the product infor- mation to see if the soft- ware versions are the same. If they are differ- ent, it could be the cause of the alarm.	Write the parameters from another SERVOPACK with the same model and the same software version, and then turn the power OFF and ON again.	page 9-2
SERVOPACK.)	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
	The power supply voltage suddenly dropped.	Measure the power supply voltage.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.022: System Check- sum Error (There is an error	The power supply was shut OFF while setting a utility func- tion.	Check the timing of shutting OFF the power supply.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
in the parameter data in the SER- VOPACK.)	A failure occurred in the SERVOPACK.	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may have failed.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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#### 12.2.2 Troubleshooting Alarms

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.024: System Alarm (An internal pro- gram error occurred in the SERVOPACK.)	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.025: System Alarm (An internal pro- gram error occurred in the SERVOPACK.)	A failure occurred in the SERVOPACK.	_	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.030: Main Circuit Detector Error	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
	The SERVOPACK and Servomotor capaci- ties do not match each other.	Check the combination of the SERVOPACK and Servomotor capacities.	Select a proper combina- tion of SERVOPACK and Servomotor capacities.	page 1-8
A.040: Parameter Set-	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
ting Error (A parameter set- ting is outside of the setting	A parameter setting is outside of the setting range.	Check the setting ranges of the parame- ters that have been changed.	Set the parameters to val- ues within the setting ranges.	-
range.)	The electronic gear ratio is outside of the setting range.	Check the electronic gear ratio. The ratio must be within the fol- lowing range: 0.001 < (Pn20E/Pn210) < 64,000.	Set the electronic gear ratio in the following range: 0.001 < (Pn20E/ Pn210) < 64,000.	page 5-45
A.041: Encoder Output Pulse Setting Error	The setting of Pn212 (Encoder Output Pulses) or Pn281 (Encoder Output Res- olution) is outside of the setting range or does not satisfy the setting conditions.	Check the setting of Pn212 or Pn281.	Set Pn212 or Pn281 to an appropriate value.	page 6-20
	The speed of program jogging went below the setting range when the electronic gear ratio (Pn20E/ Pn210) or the Servo- motor was changed.	Check to see if the detection conditions <sup>*1</sup> are satisfied.	Decrease the setting of the electronic gear ratio (Pn20E/Pn210).	page 5-45
A.042: Parameter Com- bination Error	The speed of program jogging went below the setting range when Pn533 or Pn585 (Program Jogging Speed) was changed.	Check to see if the detection conditions <sup>*1</sup> are satisfied.	Increase the setting of Pn533 or Pn585.	page 7-14
	The movement speed of advanced autotun- ing went below the setting range when the electronic gear ratio (Pn20E/ Pn210) or the Servomotor was changed.	Check to see if the detection conditions <sup>*2</sup> are satisfied.	Decrease the setting of the electronic gear ratio (Pn20E/Pn210).	page 5-45

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12.2.2 Troubleshooting Alarms

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference	
A.044: Semi-Closed/ Fully-Closed Loop Control Parameter Setting Error	The setting of the Fully-closed Module does not match the setting of Pn002 = n.X□□□ (External Encoder Usage).	Check the setting of Pn002 = $n.X\square\square\square$ .	Make sure that the setting of the Fully-closed Mod- ule agrees with the setting of Pn002 = $n.X\Box\Box\Box$ .	page 10-6	
A.04A: Parameter Set-	For 4-byte parameter bank members, there are two consecutive members with nothing registered.	_	Change the number of bytes for bank members to an appropriate value.	-	
ting Error 2	The total amount of bank data exceeds 64 (Pn900 × Pn901 > 64).	-	Reduce the total amount of bank data to 64 or less.	-	
<b>A.050:</b> Combination Error	The SERVOPACK and Servomotor capaci- ties do not match each other.	Confirm that the follow- ing condition is met: $1/4 \le$ (Servomotor capacity/SERVOPACK capacity) $\le 4$	Select a proper combina- tion of the SERVOPACK and Servomotor capaci- ties.	page 1-8	
(The capacities of the SERVOPACK and Servomotor	A failure occurred in the encoder.	Replace the encoder and check to see if the alarm still occurs.	Replace the Servomotor or encoder.	-	
do not match.)	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	_	
A.051:	The motor parameter file was not written to the linear encoder. (This applies only when not using a Serial Converter Unit.)	Check to see if the motor parameter file was written to the lin- ear encoder.	Write the motor parame- ter file to the linear encoder.	page 5-19	
Unsupported Device Alarm	An unsupported Serial Converter Unit or encoder (e.g., an external encoder) is connected to the SERVOPACK.	Check the product combination specifica-tions.	Change to a correct com- bination of models.	-	
A.070: Motor Type Change Detected (The connected motor is a differ	A Rotary Servomotor was removed and a Linear Servomotor was connected.	_	Set the parameters for a Linear Servomotor and reset the motor type alarm. Then, turn the power supply to the SER- VOPACK OFF and ON again.	page 12-47	
motor is a differ- ent type of motor from the previ- ously connected motor.)	A Linear Servomotor was removed and a Rotary Servomotor was connected.	_	Set the parameters for a Rotary Servomotor and reset the motor type alarm. Then, turn the power supply to the SER- VOPACK OFF and ON again.	page 12-47	
A.080: Linear Encoder Pitch Setting Error	The setting of Pn282 (Linear Encoder Pitch) has not been changed from the default set- ting.	Check the setting of Pn282.	Correct the setting of Pn282.	page 5-18	

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.0b0: Invalid Servo ON Command Alarm	The SV_ON (Servo ON) command was sent from the host controller after a util- ity function that turns ON the Servomotor was executed.	_	Turn the power supply to the SERVOPACK OFF and ON again. Or, execute a software reset.	page 6-48
	The Main Circuit Cable is not wired correctly or there is faulty contact.	Check the wiring.	Correct the wiring.	
	There is a short-circuit or ground fault in a Main Circuit Cable.	Check for short-circuits across Servomotor phases U, V, and W, or between the ground and Servomotor phases U, V, and W.	The cable may be short- circuited. Replace the cable.	
<b>A.100:</b> Overcurrent	There is a short-circuit or ground fault inside the Servomotor.	Check for short-circuits across Servomotor phases U, V, and W, or between the ground and Servomotor phases U, V, or W.	The Servomotor may be faulty. Replace the Servo- motor.	page 4-25
Detected (An overcurrent flowed through the power tran- sistor or the heat sink overheated.)	There is a short-circuit or ground fault inside the SERVOPACK.	Check for short-circuits across the Servomotor connection terminals U, V, and W on the SER- VOPACK, or between the ground and termi- nals U, V, or W.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	
	The regenerative resistor is not wired correctly or there is faulty contact.	Check the wiring.	Correct the wiring.	page 4-22
	The dynamic brake (DB, emergency stop executed from the SERVOPACK) was frequently activated, or a DB overload alarm occurred.	Check the power con- sumed by the DB resis- tor to see how frequently the DB is being used. Or, check the alarm display to see if a DB overload alarm (A.730 or A.731) has occurred.	Change the SERVOPACK model, operating meth- ods, or the mechanisms so that the dynamic brake does not need to be used so frequently.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The regenerative pro- cessing capacity was exceeded.	Check the regenerative load ratio in the Sig- maWin+ Motion Monitor Tab Page to see how frequently the regenera- tive resistor is being used.	Recheck the operating conditions and load.	*3
<b>A.100:</b> Overcurrent	The SERVOPACK regenerative resis- tance is too small.	Check the regenerative load ratio in the Sig- maWin+ Motion Monitor Tab Page to see how frequently the regenera- tive resistor is being used.	Change the regenerative resistance to a value larger than the SERVO- PACK minimum allowable resistance.	
Detected (An overcurrent flowed through the power tran- sistor or the heat	A heavy load was applied while the Ser- vomotor was stopped or running at a low speed.	Check to see if the operating conditions exceed Servo Drive specifications.	Reduce the load applied to the Servomotor. Or, increase the operating speed.	-
sink overheated.)	A malfunction was caused by noise.	Improve the noise envi- ronment, e.g. by improving the wiring or installation conditions, and check to see if the alarm still occurs.	Implement countermea- sures against noise, such as correct wiring of the FG. Use an FG wire size equivalent to the SERVO- PACK's main circuit wire size.	-
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	The Main Circuit Cable is not wired correctly or there is faulty contact.	Check the wiring.	Correct the wiring.	_
	There is a short-circuit or ground fault in a Main Circuit Cable.	Check for short-circuits across cable phases U, V, and W, or between the ground and cable phases U, V, and W.	The cable may be short- circuited. Replace the cable.	
A.101: Motor Overcur- rent Detected (The current to the motor exceeded the allowable cur- rent.)	There is a short-circuit or ground fault inside the Servomotor.	Check for short-circuits across Servomotor phases U, V, and W, or between the ground and Servomotor phases U, V, or W.	The Servomotor may be faulty. Replace the Servo- motor.	page 4-25
	There is a short-circuit or ground fault inside the SERVOPACK.	Check for short-circuits across the Servomotor connection terminals U, V, and W on the SER- VOPACK, or between the ground and termi- nals U, V, or W.	The SERVOPACK may be faulty. Replace the SER- VOPACK.	
	A heavy load was applied while the Ser- vomotor was stopped or running at a low speed.	Check to see if the operating conditions exceed Servo Drive specifications.	Reduce the load applied to the Servomotor. Or, increase the operating speed.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.101: Motor Overcurrent Detected (The current to	A malfunction was caused by noise.	Improve the noise envi- ronment, e.g. by improving the wiring or installation conditions, and check to see if the alarm still occurs.	Implement countermea- sures against noise, such as correct wiring of the FG. Use an FG wire size equivalent to the SERVO- PACK's main circuit wire size.	-
the motor exceeded the allowable current.)	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	When using the built- in regenerative resis- tor, the jumper between the regener- ative resistor terminals (B2 and B3) was removed from one of the following SERVO- PACKs: SGD7S- 3R8A, -5R5A, -7R6A, -120A, -180A, -200A, or -330A.	Check to see if the jumper is connected between power supply terminals B2 and B3.*4	Correctly connect a jumper.	page 4-22
	The External Regener- ative Resistor or Regenerative Resis- tor Unit is not wired correctly, or was removed or discon- nected.	Check the wiring of the External Regenerative Resistor or Regenera- tive Resistor Unit.*4	Correct the wiring of the External Regenerative Resistor or Regenerative Resistor Unit.	
A.300: Regeneration Error	Pn600 (Regenerative Resistor Capacity) is not set to 0 and an External Regenerative Resistor is not con- nected to one of the following SERVO- PACKs: SGD7S- R70A, -R90A, -1R6A, -2R8A, -R70F, -R90F, -2R1F, or -2R8F.	Check to see if an External Regenerative Resistor is connected and check the setting of Pn600.	Connect an External Regenerative Resistor, or set Pn600 (Regenerative Resistor Capacity) to 0 (setting unit: × 10 W) if no Regenerative Resistor is required.	page 5-56
	An External Regener- ative Resistor is not connected to one of the following SERVO- PACKs: SGD7S- 470A, -550A, -590A, or -780A.	Check to see if an External Regenerative Resistor or a Regenera- tive Resistor Unit is con- nected and check the setting of Pn600.	Connect an External Regenerative Resistor and set Pn600 to an appropri- ate value, or connect a Regenerative Resistor Unit and set Pn600 to 0.	
	A failure occurred in the SERVOPACK.	-	While the main circuit power supply is OFF, turn the control power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVO- PACK may be faulty. Replace the SERVO- PACK. Continued o	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The power supply voltage exceeded the specified range.	Measure the power supply voltage.	Set the power supply volt- age within the specified range.	-
	The external regener- ative resistance value or regenerative resis- tor capacity is too small, or there has been a continuous regeneration state.	Check the operating conditions or the capacity.	Change the regenerative resistance value or capac- ity. Reconsider the operating conditions.	*3
	There was a continu- ous regeneration state because a negative load was continu- ously applied.	Check the load applied to the Servomotor during operation.	Reconsider the system including the servo, machine, and operating conditions.	-
A.320: Regenerative Overload	The setting of Pn600 (Regenerative Resis- tor Capacity) is smaller than the capacity of the Exter- nal Regenerative Resistor.	Check to see if a Regenerative Resistor is connected and check the setting of Pn600.	Correct the setting of Pn600.	page 5-56
	The setting of Pn603 (Regenerative Resis- tor Capacity) is smaller than the capacity of the Exter- nal Regenerative Resistor.	Check to see if a Regenerative Resistor is connected and check the setting of Pn603.	Correct the setting of Pn603.	page 5-56
	The external regener- ative resistance is too high.	Check the regenerative resistance.	Change the regenerative resistance to a correct value or use an External Regenerative Resistor of an appropriate capacity.	*3
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The regenerative resistor was discon- nected when the SERVOPACK power supply voltage was high.	Measure the resistance of the regenerative resistor using a measur- ing instrument.	If you are using the regen- erative resistor built into the SERVOPACK, replace the SERVOPACK. If you are using an Exter- nal Regenerative Resis- tor, replace the External Regenerative Resistor.	-
A.330:	DC power was sup- plied when an AC power supply input was specified in the settings.	Check the power sup- ply to see if it is a DC power supply.	Correct the power supply setting to match the actual power supply.	page 5-14
Main Circuit Power Supply Wiring Error (Detected when the main circuit	AC power was sup- plied when a DC power supply input was specified in the settings.	Check the power sup- ply to see if it is an AC power supply.	Correct the power supply setting to match the actual power supply.	page 3-14
power supply is turned ON.)	Pn600 (Regenerative Resistor Capacity) is not set to 0 and an External Regenerative Resistor is not con- nected to one of the following SERVO- PACKs: SGD7S- R70A, -R90A, -1R6A, -2R8A, -R70F, -R90F, -2R1F, or -2R8F.	Check to see if an External Regenerative Resistor is connected and check the setting of Pn600.	Connect an External Regenerative Resistor, or if an External Regenera- tive Resistor is not required, set Pn600 to 0.	page 4-22, page 5-56
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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Alarm Number: 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 not stable or was influenced by a light- ning surge.	Measure the power supply voltage.	Improve the power sup- ply conditions, install a surge absorber, and then turn the power supply OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.400: Overvoltage (Detected in the	The voltage for AC power supply was too high during accelera- tion or deceleration.	Check the power sup- ply voltage and the speed and torque during operation.	Set the AC power supply voltage within the speci- fied range.	_
main circuit power supply section of the SERVOPACK.)	The external regener- ative resistance is too high for the operating conditions.	Check the operating conditions and the regenerative resistance.	Select a regenerative resistance value that is appropriate for the oper- ating conditions and load.	*3
	The moment of inertia ratio or mass ratio exceeded the allow- able value.	Check to see if the moment of inertia ratio or mass ratio is within the allowable range.	Increase the deceleration time, or reduce the load.	_
	A failure occurred in the SERVOPACK.	_	While the main circuit power supply is OFF, turn the control power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVO- PACK may be faulty. Replace the SERVO- PACK.	_
	The power supply voltage went below the specified range.	Measure the power supply voltage.	Set the power supply volt- age within the specified range.	-
	The power supply voltage dropped during operation.	Measure the power supply voltage.	Increase the power supply capacity.	-
A.410: Undervoltage (Detected in the main circuit power supply section of the SERVOPACK.)	A momentary power interruption occurred.	Measure the power supply voltage.	If you have changed the setting of Pn509 (Momen- tary Power Interruption Hold Time), decrease the setting.	page 6-16
	The SERVOPACK fuse is blown out.	-	Replace the SERVO- PACK and connect a reactor to the DC reactor terminals ( $\ominus$ 1 and $\ominus$ 2) on the SERVOPACK.	-
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The order of phases U, V, and W in the motor wiring is not correct.	Check the wiring of the Servomotor.	Make sure that the Servo- motor is correctly wired.	-
A.510: Overspeed (The motor	A reference value that exceeded the over- speed detection level was input.	Check the input refer- 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.	Reduce the speed refer- ence input gain and adjust the servo gain. Or, reconsider the operating conditions.	_
	A failure occurred in the SERVOPACK.	_	The SERVOPACK may be faulty. Replace the SER- VOPACK.	_
A.511:	The encoder output pulse frequency exceeded the limit.	Check the encoder out- put pulse setting.	Decrease the setting of Pn212 (Encoder Output Pulses) or Pn281 (Encoder Output Resolu- tion).	page 6-25
Encoder Output Pulse Overspeed	The encoder output pulse frequency exceeded the limit because the motor speed was too high.	Check the encoder out- put pulse setting and the motor speed.	Reduce the motor speed.	-
	Abnormal oscillation was detected in the motor speed.	Check for abnormal motor noise, and check the speed and torque waveforms during oper- ation.	Reduce the motor speed. Or, reduce the setting of Pn100 (Speed Loop Gain).	page 8-81
<b>A.520:</b> Vibration Alarm	The setting of Pn103 (Moment of Inertia Ratio) is greater than the actual moment of inertia or was greatly changed.	Check the moment of inertia ratio or mass ratio.	Set Pn103 (Moment of Inertia Ratio) to an appro- priate value.	page 8-16
	The vibration detec- tion level (Pn312 or Pn384) is not suitable.	Check that the vibra- tion detection level (Pn312 or Pn384) is suitable.	Set a suitable vibration detection level (Pn312 or Pn384).	page 6-51
A.521: Autotuning Alarm (Vibration was detected while executing the custom tuning, Easy FFT, or the tuning-less func- tion.)	The Servomotor vibrated considerably while performing the tuning-less function.	Check the waveform of the motor speed.	Reduce the load so that the moment of inertia ratio is within the allowable value. Or increase the load level or reduce the rigidity level in the tuning- less level settings.	page 8-13
	The Servomotor vibrated considerably while performing cus- tom tuning or Easy FFT.	Check the waveform of the motor speed.	Check the operating pro- cedure of corresponding function and implement corrections.	page 8-42, page 8-97
A.550: Maximum Speed Setting Error	The setting of Pn385 (Maximum Motor Speed) is greater than the maximum speed.	Check the setting of Pn385, and the upper limits of the maximum motor speed setting and the encoder output resolution setting.	Set Pn385 to a value that does not exceed the max- imum motor speed.	page 6-19

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The wiring is not cor- rect or there is a faulty connection in the motor or encoder wir- ing.	Check the wiring.	Make sure that the Servo- motor and encoder are correctly wired.	page 4-25
	Operation was per- formed that exceeded the overload protec- tion characteristics.	Check the motor over- load characteristics and Run command.	Reconsider the load and operating conditions. Or, increase the motor capacity.	-
A.710: Instantaneous Overload A.720: Continuous	An excessive load was applied during operation because the Servomotor was not driven due to mechanical problems.	Check the operation reference and motor speed.	Correct the mechanical problem.	-
Overload	There is an error in the setting of Pn282 (Lin- ear Encoder Pitch).	Check the setting of Pn282.	Correct the setting of Pn282.	page 5-18
	There is an error in the setting of Pn080 = n.□□X□ (Motor Phase Selection).	Check the setting of Pn080 = $n.\Box\Box X\Box$ .	Set Pn080 = $n.\Box\Box X\Box$ to an appropriate value.	page 5-23
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
4 700 and	The Servomotor was rotated by an external force.	Check the operation status.	Implement measures to ensure that the motor will not be rotated by an external force.	-
A.730 and A.731: Dynamic Brake Overload (An excessive power consump- tion by the dynamic brake was detected.)	When the Servomo- tor was stopped with the dynamic brake, the rotational or linear kinetic energy exceeded the capac- ity of the dynamic brake resistor.	Check the power con- sumed by the DB resis- tor to see how frequently the DB is 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- VOPACK.	-
A.740: Inrush Current Limiting Resistor Overload (The main circuit power supply	The allowable fre- quency of the inrush current limiting resis- tor was exceeded when the main circuit power supply was turned ON and OFF.	_	Reduce the frequency of turning the main circuit power supply ON and OFF.	-
was frequently turned ON and OFF.)	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The surrounding tem- perature is too high.	Check the surrounding temperature using a thermometer. Or, check the operating status with the SERVOPACK installation environment monitor.	Decrease the surround- ing temperature by improving the SERVO- PACK installation condi- tions.	page 3-7
	An overload alarm was reset by turning OFF the power sup- ply too many times.	Check the alarm display to see if there is an overload alarm.	Change the method for resetting the alarm.	-
A.7A1: Internal Tempera- ture Error 1 (Control Board Temperature Error)	There was an exces- sive load or operation was performed that exceeded the regen- erative processing capacity.	Use the accumulated load ratio to check the load during operation, and use the regenera- tive load ratio to check the regenerative pro- cessing capacity.	Reconsider the load and operating conditions.	-
	The SERVOPACK installation orientation is not correct or there is insufficient space around the SERVO- PACK.	Check the SERVOPACK installation conditions.	Install the SERVOPACK according to specifica- tions.	page 3-3, page 3-6
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
	The surrounding tem- perature is too high.	Check the surrounding temperature using a thermometer. Or, check the operating status with the SERVOPACK installation environment monitor.	Decrease the surround- ing temperature by improving the SERVO- PACK installation condi- tions.	page 3-7
	An overload alarm was reset by turning OFF the power sup- 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: Internal Tempera- ture Error 2 (Power Board Temperature Error)	There was an exces- sive load or operation was performed that exceeded the regen- erative processing capacity.	Use the accumulated load ratio to check the load during operation, and use the regenera- tive load ratio to check the regenerative pro- cessing capacity.	Reconsider the load and operating conditions.	-
	The SERVOPACK installation orientation is not correct or there is insufficient space around the SERVO- PACK.	Check the SERVOPACK installation conditions.	Install the SERVOPACK according to specifica- tions.	page 3-3, page 3-6
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	_
A.7A3: Internal Tempera- ture Sensor Error (An error occurred in the temperature sen- sor circuit.)	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.7Ab: SERVOPACK Built-in Fan Stopped	The fan inside the SERVOPACK stopped.	Check for foreign matter inside the SERVOPACK.	Remove foreign matter from the SERVOPACK. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SER- VOPACK.	-
	The power to the absolute encoder was turned ON for the first time.	Check to see if the power supply was turned ON for the first time.	Set up the encoder.	
A.810:	The Encoder Cable was disconnected and then connected again.	Check to see if the power supply was turned ON for the first time.	Check the encoder con- nection and set up the encoder.	page 5-50
Encoder Backup Alarm (Detected at the encoder, but only when an abso- lute encoder is used.)	Power is not being supplied both from the control power supply (+5 V) from the SERVOPACK and from the battery power supply.	Check the encoder connector battery and the connector status.	Replace the battery or implement similar mea- sures to supply power to the encoder, and set up the encoder.	
	A failure occurred in the absolute encoder.	_	If the alarm still occurs after setting up the encoder again, replace the Servomotor.	-
	A failure occurred in the SERVOPACK.	_	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
<b>A.820:</b> Encoder Check- sum Alarm (Detected at the 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 5-50
	A failure occurred in the SERVOPACK.	-	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-
A.830: Encoder Battery Alarm (The absolute encoder battery	The battery connec- tion is faulty or a bat- tery is not connected.	Check the battery con- nection.	Correct the battery con- nection.	page 4-26
	The battery voltage is lower than the specified value (2.7 V).	Measure the battery voltage.	Replace the battery.	page 12-3
voltage was lower than the speci- fied level.)	A failure occurred in the SERVOPACK.	_	The SERVOPACK may be faulty. Replace the SER- VOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The encoder malfunc- tioned.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	-
	An error occurred in reading data from the linear encoder.	_	The linear encoder is not mounted within an appro- priate tolerance. Correct the mounting of the linear encoder.	-
A.840: Encoder Data Alarm (Detected at the encoder.)	Excessive speed occurred in the linear encoder.	_	Control the motor speed within the range specified by the linear encoder manufacturer and then turn ON the control power supply.	_
	The encoder malfunc- tioned due to noise.	_	Correct the wiring around the encoder by separating the Encoder Cable from the Servomotor Main Cir- cuit Cable or by ground- 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- sor.	-
	Rotary Servomotor: The Servomotor speed was 200 min <sup>-1</sup> or higher when the control power supply was turned ON.	Check the motor speed when the power supply is turned ON.	Reduce the Servomotor speed to a value less than 200 min <sup>-1</sup> , and turn ON the control power supply.	_
A.850: Encoder Over- speed	Linear Servomotor: The Servomotor exceeded the speci- fied speed when the control power supply was turned ON.	Check the motor speed when the power supply is turned ON.	Control the motor speed within the range specified by the linear encoder manufacturer and then turn ON the control power supply.	-
(Detected at the encoder when the control power supply is turned ON.)	A failure occurred in the encoder.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	_
	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK. Continued o	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
4.000	The surrounding air temperature around the Servomotor is too high.	Measure the surround- ing air temperature around the Servomotor.	Reduce the surrounding air temperature of the Servomotor to 40°C or less.	-
A.860: Encoder Over- heated (Detected when a Rotary Servomo-	The Servomotor load is greater than the rated load.	Use the accumulated load ratio to check the load.	Operate the Servo Drive so that the motor load remains within the speci- fied range.	page 9-3
tor, Absolute Lin- ear Encoder, or Direct Drive Ser- vomotor is con- nected. However, this does not apply to SGMCS Servomotor.)	A failure occurred in the encoder.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the Servomotor or absolute linear encoder may be faulty. Replace the Servomotor or absolute linear encoder.	_
Servomotor.) (Detected at the encoder.)	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	_
	The surrounding tem- perature around the Servomotor is too high.	Measure the surround- ing temperature around the Servomotor.	Reduce the surrounding air temperature of the Servomotor to 40°C or less.	-
A.861: Motor Over- heated	The motor load is greater than the rated load.	Check the load with the accumulated load ratio on the Motion Monitor Tab Page on the Sig-maWin+.	Operate the Servo Drive so that the motor load remains within the speci- fied range.	page 9-3
	A failure occurred in the Serial Converter Unit.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the Serial Con- verter Unit may be faulty. Replace the Serial Con- verter Unit.	_
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK. Continued o	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The surrounding tem- perature is too high.	Check the surrounding temperature using a thermometer.	Lower the surrounding temperature by improving the installation conditions of the Linear Servomotor or the machine.	-
	The overheat protec- tion input signal line is disconnected or short-circuited.	Check the input voltage with the overheat pro- tection input information on the Motion Monitor Tab Page on the SigmaWin+.	Repair the line for the overheat protection input signal.	-
A.862:	An overload alarm was reset by turning OFF the power sup- ply too many times.	Check the alarm display to see if there is an overload alarm.	Change the method for resetting the alarm.	-
Overheat Alarm	Operation was per- formed under an 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 detection circuit in the Linear Servomotor is faulty or the sensor attached to the machine is faulty.	_	The temperature detec- tion circuit in the Linear Servomotor may be faulty or the sensor attached to the machine may be faulty. Replace the Linear Servomotor or repair the sensor attached to the machine.	-
A.890: Encoder Scale Error	A failure occurred in the linear encoder.	-	The linear encoder may be faulty. Replace the linear encoder.	-
A.891: Encoder Module Error	A failure occurred in the linear encoder.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the linear encoder may be faulty. Replace the linear encoder.	-
<b>A.8A0:</b> External Encoder Error	Setting the origin of the absolute linear encoder failed because the motor moved.	Before you set the ori- gin, use the fully-closed feedback pulse counter to confirm that the motor is not moving.	The motor must be stopped while setting the origin position.	page 5-53
	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 Module Error	A failure occurred in the Serial Converter Unit.	_	Replace the Serial Con- verter Unit.	-
A.8A2: External Incre- mental Encoder Sensor Error	A failure occurred in the external encoder.	_	Replace the external encoder.	-
A.8A3: External Abso- lute Encoder Position Error	A failure occurred in the external absolute encoder.	-	The external absolute encoder may be faulty. Refer to the encoder manufacturer's instruc- tion manual for correc- tions.	-

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Alarm Number:			Continued from pr	evious page.
Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.8A5: External Encoder Overspeed	An overspeed error was detected in the external encoder.	Check the maximum speed of the external encoder.	Keep the external encoder below its maximum speed.	-
A.8A6: External Encoder Overheated	An overheating error was detected in the external encoder.	_	Replace the external encoder.	-
A.b33: Current Detec- tion Error 3	A failure occurred in the current detection circuit.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.b6A: MECHATROLINK Communications ASIC Error 1	There is a fault in the SERVOPACK MECHATROLINK communications sec- tion.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.b6b: MECHATROLINK Communications ASIC Error 2	A malfunction occurred in the MECHATROLINK communications sec- tion due to noise.	_	<ul> <li>Implement the following countermeasures against noise.</li> <li>Check the MECHATROLINK-III Communications Cable (RJ-45) and FG wiring.</li> <li>Attach a ferrite core to the MECHATROLINK-III Communications Cable (RJ-45).</li> </ul>	-
	There is a fault in the SERVOPACK MECHATROLINK communications sec- tion.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.bC0: System Alarm 10	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.bF0: System Alarm 0	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.bF1: System Alarm 1	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
<b>A.bF2:</b> System Alarm 2	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.bF3: System Alarm 3	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	_
A.bF4: System Alarm 4	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.bF5: System Alarm 5	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
<b>A.bF6:</b> System Alarm 6	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.bF7: System Alarm 7	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
<b>A.bF8:</b> System Alarm 8	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	The order of phases U, V, and W in the motor wiring is not correct.	Check the Servomotor wiring.	Make sure that the Servo- motor is correctly wired.	-
	There is an error in the setting of Pn080 = n.□□X□ (Motor Phase Selection).	Check the setting of Pn080 = $n.\Box\BoxX\Box$ .	Set Pn080 = n.□□X□ to an appropriate value.	page 5-23
A.C10: Servomotor Out of Control (Detected when the servo is turned ON.)	A failure occurred in the encoder.	_	If the motor wiring is cor- rect and the alarm still occurs after turning the power supply OFF and ON again, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	-
	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The linear encoder signal level is too low.	Check the voltage of the linear encoder signal.	Fine-tune the mounting of the scale head. Or, replace the linear encoder.	-
A.C20: Phase Detection Error	The count-up direc- tion of the linear encoder does not match the forward direction of the Mov- ing Coil in the motor.	Check the setting of Pn080 = $n.\Box\Box X\Box$ (Motor Phase Selec- tion). Check the installa- tion orientation for the linear encoder and Moving Coil.	Change the setting of Pn080 = $n.\Box\Box X\Box$ . Correctly reinstall the lin- ear encoder or Moving Coil.	page 5-23
	The polarity sensor signal is being affected by noise.	_	Correct the FG wiring. Implement countermea- sures against noise for the polarity sensor wiring.	-
	The setting of Pn282 (Linear Encoder Pitch) is not correct.	Check the setting of Pn282 (Linear Encoder Pitch).	Check the specifications of the linear encoder and set a correct value.	page 5-18
A.C21:	The polarity sensor is protruding from the Magnetic Way of the motor.	Check the polarity sen- sor.	Correctly reinstall the Moving Coil or Magnetic Way of the motor.	-
Polarity Sensor 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- sor.	-
A.C22: Phase Informa- tion Disagree- ment	The SERVOPACK phase information is different from the lin- ear encoder phase information.	-	Perform polarity detec- tion.	page 5-28

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.C50: Polarity Detec- tion Failure	The parameter set- tings are not correct.	Check the linear encoder specifications and feedback signal status.	The settings of Pn282 (Linear Encoder Pitch) and Pn080 = n. $\Box$ $\Box$ X $\Box$ (Motor Phase Selection) may not match the instal- lation. Set the parame- ters to correct values.	page 5-18, page 5-23
	There is noise on the scale signal.	Check to make sure that the frame grounds of the Serial Converter Unit and Servomotor are connected to the FG terminal on the SER- VOPACK and that the FG terminal on the SER- VOPACK is connected to the frame ground on the power supply. And, confirm that the shield is properly pro- cessed on the Linear Encoder Cable. Check to see if the detection reference is repeatedly output in one direction.	Implement appropriate countermeasures against noise for the Linear Encoder Cable.	-
	An external force was applied to the Moving Coil of the motor.	_	The polarity cannot be properly detected if the detection reference is 0 and the speed feedback is not 0 because of an external force, such as cable tension, applied to the Moving Coil. Imple- ment measures to reduce the external force so that the speed feedback goes to 0. If the external force cannot be reduced, increase the setting of Pn481 (Polarity Detection Speed Loop Gain).	-
	The linear encoder resolution is too low.	Check the linear encoder scale pitch to see if it is within 100 μm.	If the linear encoder scale pitch is 100 μm or higher, the SERVOPACK cannot detect the correct speed feedback. Use a linear encoder scale pitch with higher resolution. (We rec- ommend a pitch of 40 μm or less.) Or, increase the setting of Pn485 (Polarity Detection Reference Speed). However, increasing the setting of Pn485 will increase the Servomotor movement range that is required for polarity detection.	_
A.C51: Overtravel Detected during Polarity Detection	The overtravel signal was detected during polarity detection.	Check the overtravel position.	Wire the overtravel sig- nals. Execute polarity detection at a position where an overtravel sig- nal would not be detected.	page 4-38

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
A.C52: Polarity Detec- tion Not Com- pleted	The servo was turned ON when using an absolute linear encoder, Pn587 was set to n. DDD (Do not detect polarity), and the polarity had not been detected.	-	When using an absolute linear encoder, set Pn587 to n.DDD1 (Detect polar- ity).	-
A.C53: Out of Range of Motion for Polar- ity Detection	The travel distance exceeded the setting of Pn48E (Polarity Detection Range) in the middle of detec- tion.	_	Increase the setting of Pn48E (Polarity Detection Range). Or, increase the setting of Pn481 (Polarity Detection Speed Loop Gain).	-
A.C54: Polarity Detec- tion Failure 2	An external force was applied to the Servo- motor.	_	Increase the setting of Pn495 (Polarity Detection Confirmation Force Refer- ence). Increase the setting of Pn498 (Polarity Detec- tion Allowable Error Range). Increasing the allowable error will also increase the motor tem- perature.	-
A.C80: Encoder Clear	A failure occurred in the encoder.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	-
Error or Multiturn Limit Setting Error	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number:	Possible Cause	Confirmation	Continued from pro	Reference
Alarm Name		Commation	Correction	neierence
	There is a faulty con- tact in the connector or the connector is not wired correctly for the encoder.	Check the condition of the encoder connector.	Reconnect the encoder connector and check the encoder wiring.	page 4-25
	There is a cable dis- connection or short- circuit in the encoder. Or, the cable imped- ance is outside the specified values.	Check the condition of the Encoder Cable.	Use the Encoder Cable within the specified specifications.	-
A.C90: Encoder Commu- nications Error	One of the following has occurred: corro- sion caused by improper tempera- ture, humidity, or gas, a short-circuit caused by entry of water drops or cutting oil, or faulty contact in con- nector caused by vibration.	Check the operating environment.	Improve the operating environment, and replace the cable. If the alarm still occurs, replace the SER- VOPACK.	page 3-2
	A malfunction was caused by noise.	_	Correct the wiring around the encoder by separating the Encoder Cable from the Servomotor Main Cir- cuit Cable or by ground- ing the encoder.	page 4-5
	A failure occurred in the SERVOPACK.	_	Connect the Servomotor to another SERVOPACK, and turn ON the control power supply. If no alarm occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	Noise entered on the signal lines because the Encoder Cable is bent or the sheath is damaged.	Check the condition of the Encoder Cable and connectors.	Check the Encoder Cable to see if it is installed correctly.	page 4-8
A.C91: Encoder Commu- nications Posi- tion Data Acceleration Rate	The Encoder Cable is bundled with a high- current line or installed near a high- current line.	Check the installation condition of the Encoder Cable.	Confirm that there is no surge voltage on the Encoder Cable.	-
Error	There is variation in the FG potential because of the influ- ence of machines on the Servomotor side, such as a welder.	Check the installation condition of the Encoder Cable.	Properly ground the machine to separate it from the FG of the encoder. Continued o	-

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Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	Noise entered on the signal line from the encoder.	_	Implement countermea- sures against noise for the encoder wiring.	page 4-5
	Excessive vibration or shock was applied to the encoder.	Check the operating conditions.	Reduce machine vibra- tion. Correctly install the Ser- vomotor or linear encoder.	-
A.C92: Encoder Commu- nications Timer Error	A failure occurred in the encoder.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	-
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.CA0: Encoder Parame- ter Error	A failure occurred in the encoder.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	-
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number: 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 4-25
	The specifications of the Encoder Cable are not correct and noise entered on it.	_	Use a shielded twisted- pair wire cable or a screened twisted-pair cable with conductors of at least 0.12 mm <sup>2</sup> .	-
	The Encoder Cable is too long and noise entered on it.	_	<ul> <li>Rotary Servomotors: The Encoder Cable wir- ing distance must be 50 m max.</li> <li>Linear Servomotors: The Encoder Cable wir- ing distance must be 20 m max.</li> </ul>	-
A.Cb0: Encoder Echo- back Error	There is variation in the FG potential because of the influ- ence of machines on the Servomotor side, such as a welder.	Check the condition of the Encoder Cable and 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- tion. Correctly install the Ser- vomotor or linear encoder.	-
	A failure occurred in the encoder.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the Servomotor or linear encoder may be faulty. Replace the Servo- motor or linear encoder.	-
	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	When using a Direct Drive Servomotor, the setting of Pn205 (Mul- titurn Limit Setting) does not agree with the encoder.	Check the setting of Pn205.	Correct the setting of Pn205 (0 to 65,535).	page 6-40
A.CC0: Multiturn Limit Disagreement	The multiturn limit of the encoder is differ- ent from that of the SERVOPACK. Or, the multiturn limit of the SERVOPACK has been changed.	Check the setting of Pn205 in the SERVO- PACK.	Change the setting if the alarm occurs.	page 6-40
	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number:			Continued from pre	evious page.
Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The cable between the Serial Converter Unit and SERVOPACK is not wired correctly or there is a faulty contact.	Check the wiring of the external encoder.	Correctly wire the cable between the Serial Con- verter Unit and SERVO- PACK.	page 4-27
A.CF1: Reception Failed Error in Feed- back Option	A specified cable is not being used between Serial Con- verter Unit and SER- VOPACK.	Check the wiring speci- fications of the external encoder.	Use a specified cable.	-
Module Commu- nications	The cable between the Serial Converter Unit and SERVOPACK is too long.	Measure the length of the cable that connects the Serial Converter Unit.	The length of the cable between the Serial Con- verter Unit and SERVO- PACK must be 20 m or less.	-
	The sheath on cable between the Serial Converter Unit and SERVOPACK is bro- ken.	Check the cable that connects the Serial Converter Unit.	Replace the cable between the Serial Con- verter Unit and SERVO- PACK.	-
A.CF2: Timer Stopped Error in Feed-	Noise entered the cable between the Serial Converter Unit and SERVOPACK.	_	Correct the wiring around the Serial Converter Unit, e.g., separate I/O signal lines from the Main Circuit Cables or ground.	-
back Option Module Commu- nications	A failure occurred in the Serial Converter Unit.	_	Replace the Serial Con- verter Unit.	-
	A failure occurred in the SERVOPACK.	_	Replace the SERVO- PACK.	-
	The Servomotor U, V, and W wiring is not correct.	Check the wiring of the Servomotor's Main Cir- cuit Cables.	Make sure that there are no faulty contacts in the wiring for the Servomotor and encoder.	-
	The position com- mand speed is too fast.	Reduce the position command speed and try operating the SER- VOPACK.	Reduce the position refer- ence speed or the refer- ence acceleration rate, or reconsider the electronic gear ratio.	page 5-45
A.d00: Position Devia- tion Overflow (The setting of Pn520 (Exces- sive Position Deviation Alarm Level) was exceeded by the position deviation.)	The acceleration of the position reference is too high.	Reduce the reference acceleration and try operating the SERVO- PACK.	Reduce the acceleration of the position reference using a MECHATROLINK command. Or, smooth the position reference accel- eration by selecting the position reference filter (ACCFIL) using a MECHATROLINK com- mand.	_
	The setting of Pn520 (Excessive Position Deviation Alarm Level) is too low for the operating conditions.	Check Pn520 (Exces- sive Position Deviation Alarm Level) to see if it is set to an appropriate value.	Optimize the setting of Pn520.	page 8-8
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number:	Possible Cause	Confirmation	Continued from pro	Reference
Alarm Name		Commation		Tererence
A.d01: Position Devia- tion Overflow Alarm at Servo ON	The servo was turned ON after the position deviation exceeded the setting of Pn526 (Excessive Position Deviation Alarm Level at Servo ON) while the servo was OFF.	Check the position deviation while the servo is OFF.	Optimize the setting of Pn526 (Excessive Position Deviation Alarm Level at Servo ON).	
A.d02: Position Devia- tion Overflow Alarm for Speed Limit at Servo ON	If position deviation remains in the devia- tion counter, the set- ting of Pn529 or Pn584 (Speed Limit Level at Servo ON) limits the speed when the servo is turned ON. This alarm occurs if a position reference is input and the set- ting of Pn520 (Exces- sive Position Deviation Alarm Level) is exceeded.	_	Optimize the setting of Pn520 (Excessive Position Deviation Alarm Level). Or, adjust the setting of Pn529 or Pn584 (Speed Limit Level at Servo ON).	page 8-8
A.d10: Motor-Load Posi- tion Deviation	The motor direction and external encoder installation orientation are backward.	Check the motor direc- tion and the external encoder installation ori- entation.	Install the external encoder in the opposite direction, or change the setting of Pn002 = n.XDDD (External Encoder Usage) to reverse the direction.	page 10-6
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: Position Data Overflow	The position data exceeded ±1,879,048,192.	Check the input refer- ence pulse counter.	Reconsider the operating specifications.	-
A.E02:	The MECHATROLINK transmission cycle fluctuated.	_	Remove the cause of transmission cycle fluctu- ation at the host control- ler.	-
MECHATROLINK Internal Synchro- nization Error 1	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
A.E40: MECHATROLINK Transmission Cycle Setting Error	The setting of MECHATROLINK transmission cycle is outside of the speci- fied range.	Check the setting of the MECHATROLINK trans- mission cycle.	Set the MECHATROLINK transmission cycle to an appropriate value.	-
A.E41: MECHATROLINK Communications Data Size Setting Error	The number of trans- mission bytes set on DIP switch S3 is not correct.	Check the MECHATROLINK com- munications data size of the host controller.	Reset DIP switch S3 to change the number of transmission bytes to an appropriate value.	page 5-13

Continued from previous page.

			Continued from pre	evious page.
Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
<b>A.E42:</b> MECHATROLINK	The station address is outside of the setting range.	Check rotary switches S1 and S2 to see if the station address is between 03 and EF.	Check the setting of the station address of the host controller, and reset rotary switches S1 and S2 to change the address to an appropriate value between 03 and EF.	page 5-13
Station Address Setting Error	Two or more stations on the communica- tions network have the same address.	Check to see if two or more stations on the communications net- work have the same address.	Check the setting of the station address of the host controller, and reset rotary switches S1 and S2 to change the address to an appropriate value between 03 and EF.	page 5-15
A.E50 <sup>*5</sup> :	The WDT data in the host controller was not updated normally.	Check to see if the WDT data is being updated at the host controller.	Correctly update the WDT data at the host controller.	-
MECHATROLINK Synchronization Error	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	_
A.E51: MECHATROLINK Synchronization	The WDT data at the host controller was not updated correctly at the start of syn- chronous communi- cations, so synchronous commu- nications could not be started.	Check to see if the WDT data is being updated in the host controller.	Correctly update the WDT data at the host controller.	_
Failed	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	MECHATROLINK wir- ing is not correct.	Check the MECHATROLINK wir- ing.	Correct the MECHATROLINK-III Com- munications Cable (RJ- 45) wiring.	-
A.E60 <sup>*5</sup> : Reception Error in MECHATROLINK Communications	A MECHATROLINK data reception error occurred due to noise.	-	Implement countermea- sures against noise. (Check the MECHATROLINK-III Com- munications Cable (RJ- 45) and FG wiring, and implement measures such as attaching a ferrite core to the MECHATROLINK-III Communications Cable (RJ-45).)	_
	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

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Alarm Number:	Possible Cause	Confirmation	Correction	Reference
Alarm Name A.E61: Synchronization	The MECHATROLINK transmission cycle fluctuated.	Check the setting of the MECHATROLINK trans- mission cycle.	Remove the cause of transmission cycle fluctu- ation at the host control- ler.	-
Interval Error in MECHATROLINK Transmission Cycle	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	MECHATROLINK wir- ing is not correct.	Check the Servomotor wiring.	Correct the MECHATROLINK-III Com- munications Cable (RJ- 45) wiring.	-
A.E63: MECHATROLINK Synchronization Frame Not Received	A MECHATROLINK data reception error occurred due to noise.	_	Implement countermea- sures against noise. (Check the MECHATROLINK-III Com- munications Cable (RJ- 45) and FG wiring, and implement measures such as attaching a ferrite core to the MECHATROLINK-III Communications Cable (RJ-45).)	_
	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
	There is a faulty con- nection between the SERVOPACK and the Safety Option Module.	Check the connection between the SERVO- PACK and the Safety Option Module.	Correctly connect the Safety Option Module.	-
A.E71: Safety Option Module Detec- tion Failure	The Safety Option Module was discon- nected.	-	Execute Fn014 (Reset Option Module Configura- tion Error) from the Digital Operator or SigmaWin+ and then turn the power supply to the SERVO- PACK OFF and ON again.	page 12-45
	A failure occurred in the Safety Option Module.	-	Replace the Safety Option Module.	-
	A failure occurred in the SERVOPACK.	-	Replace the SERVO- PACK.	-
	There is a faulty con- nection between the SERVOPACK and the Feedback Option Module.	Check the connection between the SERVO- PACK and the Feed- back Option Module.	Correctly connect the Feedback Option Module.	-
A.E72: Feedback Option Module Detec- tion Failure	The Feedback Option Module was discon- nected.	-	Reset the Option Module con- figuration error and turn the power supply to the SERVO- PACK OFF and ON again.	page 12-45
	A failure occurred in the Feedback Option Module.	-	Replace the Feedback Option Module.	-
	A failure occurred in the SERVOPACK.	_	Replace the SERVO- PACK.	_

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			Continued from pr	evious page.
Alarm Number: Alarm Name	Possible Cause	Confirmation	Correction	Reference
<b>A.E74:</b> Unsupported	A failure occurred in the Safety Option Module.	-	Replace the Safety Option Module.	-
Safety Option Module	An unsupported Safety Option Module was connected.	Refer to the catalog of the connected Safety Option Module.	Connect a compatible Safety Option Module.	-
A.Eb1: Safety Function Signal Input Tim- ing Error	The delay between activation of the /HWBB1 and /HWBB2 input sig- nals for the HWBB was ten second or longer.	Measure the time delay between the /HWBB1 and /HWBB2 signals.	The output signal circuits or devices for /HWBB1 and /HWBB2 or the SER- VOPACK input signal cir- cuits may be faulty. Alternatively, the input sig- nal cables may be discon- nected. Check to see if any of these items are faulty or have been dis- connected.	-
	A failure occurred in the SERVOPACK.	-	Replace the SERVO- PACK.	-
A.EC8: Gate Drive Error 1 (An error occurred in the gate drive circuit.) A.EC9: Gate Drive Error 2 (An error occurred in the gate drive cir- cuit.)	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	_
		Check the motor status when the command is executed.	Execute the SV_ON or SENS_ON command only when the motor is not operating.	-
A.Ed1: Command Exe- cution Timeout	A timeout error occurred for a MECHATROLINK command.	<ul> <li>For fully-closed loop control, check the status of the external encoder when the command is exe- cuted.</li> <li>For other types of control, check the status of the linear encoder when the command is exe- cuted.</li> </ul>	Execute the SENS_ON command only when an external encoder (e.g., a linear encoder) is con- nected.	-

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Alarm Number:			Continued from pro	
Alarm Name	Possible Cause	Confirmation	Correction	Reference
	The three-phase power supply wiring is not correct.	Check the power sup- ply wiring.	Make sure that the power supply is correctly wired.	page 4-11
<b>A.F10:</b> Power Supply Line Open Phase	The three-phase power supply is unbalanced.	Measure the voltage for each phase of the three-phase power sup- ply.	Balance the power sup- ply by changing phases.	-
(The voltage was low for more than one second for phase R, S, or T when the main power supply	A single-phase power supply was input with- out specifying a sin- gle-phase AC power supply input (Pn00B = $n.\Box 1\Box \Box$ ).	Check the power sup- ply and the parameter setting.	Match the parameter set- ting to the power supply.	page 4-11
was ON.)	A failure occurred in the SERVOPACK.	_	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-
FL-1 <sup>*5</sup> : System Alarm FL-2 <sup>*5</sup> : System Alarm				
FL-3 <sup>*5</sup> : System Alarm FL-4 <sup>*5</sup> :			Turn the power supply to the SERVOPACK OFF and	
System Alarm	A failure occurred in the SERVOPACK.	-	ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the	_
FL-5 <sup>*5</sup> : System Alarm			SERVOPACK.	
FL-6 <sup>*5</sup> : System Alarm				
FL-7 <sup>*5</sup> : System Alarm				
CPF00: Digital Operator	There is a faulty con- tact between the Digi- tal Operator and the SERVOPACK.	Check the connector contact.	Disconnect the connec- tor and insert it again. Or, replace the cable.	_
Communications Error 1	A malfunction was caused by noise.	_	Keep the Digital Operator or the cable away from sources of noise.	-
<b>CPF01:</b> Digital Operator	A failure occurred in the Digital Operator.	_	Disconnect the Digital Operator and then con- nect it again. If the alarm still occurs, the Digital Operator may be faulty. Replace the Digital Oper- ator.	_
Communications Error 2	A failure occurred in the SERVOPACK.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.	-

<ul> <li>*1. Detection Conditions</li> <li>Rotary Servomotor</li> <li>If either of the following conditions is detected, an alarm will occur.</li> </ul>
• Pn533 [min <sup>-1</sup> ] × $\frac{\text{Encoder resolution}}{6 \times 10^5} \leq \frac{\text{Pn20E}}{\text{Pn210}}$
• Maximum motor speed [min <sup>-1</sup> ] × $\frac{\text{Encoder resolution}}{\text{Approx. } 3.66 \times 10^{12}} \ge \frac{\text{Pn20E}}{\text{Pn210}}$
<ul> <li>Linear Servomotor If either of the following conditions is detected, an alarm will occur.</li> </ul>
$ - \frac{\text{Pn585 [mm/s]}}{\text{Linear encoder pitch [µm]}} \times \frac{\text{Resolution of Serial Converter Unit}}{10} \leq \frac{\text{Pn20E}}{\text{Pn210}} $
$\frac{\text{Pn385 [100 mm/s]}}{\text{Linear encoder pitch [µm]}} \times \frac{\text{Resolution of Serial Converter Unit}}{\text{Approx. 6.10 \times 10^{5}}} \ge \frac{\text{Pn20E}}{\text{Pn210}}$
<ul> <li>*2. Detection Conditions</li> <li>Rotary Servomotor</li> <li>If either of the following conditions is detected, an alarm will occur.</li> </ul>
• Rated motor speed [min <sup>-1</sup> ] $\times 1/3 \times \frac{\text{Encoder resolution}}{6 \times 10^5} \leq \frac{\text{Pn20E}}{\text{Pn210}}$
• 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.
$\frac{\text{Rated motor speed [mm/s] \times 1/3}}{\text{Linear encoder pitch [µm]}} \times \frac{\text{Resolution of Serial Converter Unit}}{10} \leq \frac{\text{Pn20E}}{\text{Pn210}}$

	Linear encoder pitch [µm]	10	THETO
• -	Pn385 [100 mm/s]	× Resolution of Serial Converter Unit	≧ <u>Pn20E</u>
	Linear encoder pitch [μm]	Approx. 6.10 ×10 <sup>5</sup>	Pn210

\*3. Refer to the following manual for details.  $\square \Sigma$ -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.

12.2.3 Resetting Alarms

## 12.2.3 Resetting 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.

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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.
- 3. Click the Reset axes Button.

Axis			iser axes.	v Trace Wavefo
				Alar
	2R8A20A	A.C90 : Encoder	Communications	Error
n diagnosis Alarm History				
n diagnosis Alarm History				
			C	Cause 1/5 ┥ 🕨
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ivestigated actions Check the encoder connector of corrective actions Re-insert the encoder connector fonitor at occurrence of alarm Name Motor rotating speed Speed reference	r and confirm	n that the encoder	is correctly wire	4. ^ ~
Investigated actions Check the encoder connector of Corrective actions Re-insert the encoder connector Ionitor at occurrence of alarm Name Motor rotating speed	r and confirm	n that the encoder	is correctly wire	4. A. V.

The alarm will be reset, and the alarm display will be cleared.

This concludes the procedure to reset alarms.

# Resetting Alarms by Sending the ALM\_CLR (Clear Warning or Alarm) Command

Refer to the following manual for details.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

12.2.4 Displaying the Alarm History

## **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.

~~~  $\Sigma$ -7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)

## 12.2.4 Displaying the Alarm History

The alarm history displays up to the last ten alarms that have occurred in the SERVOPACK.

Note: The following alarms are not displayed in the alarm history: A.E50 (MECHATROLINK Synchronization Error), A.E60 (Reception Error in MECHATROLINK Communications), and FL-1 to FL-7.

## 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 | Fn000                              | Σ-7-Series Digital Operator Operating Manual<br>(Manual No.: SIEP S800001 33) |
| SigmaWin+        | Troubleshooting – Display<br>Alarm | Operating Procedure on page 12-43                                             |

## **Operating Procedure**

Use the following procedure to display the alarm history.

- 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 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.

| No.       | Name                                                                    |                          | Clea                     | _   |
|-----------|-------------------------------------------------------------------------|--------------------------|--------------------------|-----|
| NO.<br>01 |                                                                         |                          |                          | - A |
| 01<br>02  | A.CC0 : Multiturn Limit Disagreeme                                      |                          | 58:05:29.8<br>56:13:55.3 |     |
| 02        | A.CC0 : Multiturn Limit Disagreeme<br>A.C60 : Encoder Clear Error or Mu |                          | 55:52:55.1               |     |
| 03        | A.000 : Encoder Clear Error or Mu<br>A.810 : Encoder Backup Alarm       | teurn Lime Setting Error | 55:48:10.1               |     |
| 04        | A.010 : Encoder Backup Alarm<br>A.080 : Encoder Clear Error or Mu       | River Lind Calling Frees | 55:47:08.6               |     |
| 06<br>06  | A.030 : Encoder Clear Error or Mu<br>A.830 : Encoder Battery Alarm      | tturn Lint Setting Error | 55:45:19.1               |     |
| 07        | A.810 : Encoder Backup Alarm                                            |                          | 55:45:18.9               |     |
| 08        | A.C90 : Encoder Communications                                          | Error                    | 55.44.37.2               |     |
| 09        | A.F10 : Power Supply Line Open F                                        |                          | 55:34:04.2               |     |
| -         | A TO POWER Supply Circ Open P                                           | 1030                     | 00.04.04.2               |     |
|           |                                                                         |                          |                          |     |

Accumulated operation time Total operation time to the point at which the alarm occurred is displayed in increments of 100 ms from when the control power supply and main circuit power supply turned ON. For 24-hour, 365-day operation, measurements are possible for approximately 13 years.

Alarm number: Alarm name

Alarms in order of occurrence

(Older alarms have higher numbers.)

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.

12.2.5 Clearing the Alarm History

## 12.2.5 Clearing the Alarm History

You can clear the alarm history that is recorded in the SERVOPACK.

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 | Fn006                              | Chanal Σ-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33) |
| SigmaWin+        | Troubleshooting – Display<br>Alarm | G Operating Procedure on page 12-44                                               |

#### **Operating Procedure**

Use the following procedure to reset the alarm history.

- 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.
- 3. Click the Alarm History Tab.
- 4. Click the Clear Button.

The alarm history will be cleared.

|     | Name                               |                             | Accumulated o | - |
|-----|------------------------------------|-----------------------------|---------------|---|
| No. |                                    |                             |               | - |
| 01  | A.CC0 : Multiturn Limit Disagreeme |                             | 58:05:29.8    |   |
| 02  | A.CC0 : Multiturn Limit Disagreeme |                             | 56:13:55.3    |   |
| 03  | A.C80 : Encoder Clear Error or Mu  | Ititurn Limit Setting Error | 55:52:55.1    |   |
| 04  | A.810 : Encoder Backup Alarm       |                             | 55:48:10.1    | Ξ |
| 05  | A.C80 : Encoder Clear Error or Mu  | Ititurn Limit Setting Error | 55:47:08.6    |   |
| 06  | A.830 : Encoder Battery Alarm      |                             | 55:45:19.1    |   |
| 07  | A.810 : Encoder Backup Alarm       |                             | 55:45:18.9    |   |
| 08  | A.C90 : Encoder Communications     |                             | 55:44:37.2    |   |
| 09  | A.F10 : Power Supply Line Open F   | Phase                       | 55:34:04.2    | Ŧ |
| •   | III                                |                             | •             |   |
|     |                                    |                             |               |   |

This concludes the procedure to reset the alarm history.

12.2.6 Resetting Alarms Detected in Option Modules

## 12.2.6 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 | Gerating Procedure on page 12-45                                                |

## **Operating Procedure**

Use the following procedure to reset alarms detected in Option Modules.

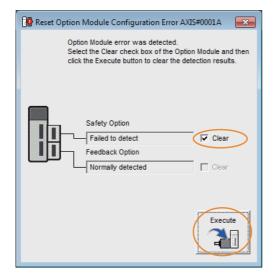
- 1. Click the *P* Servo Drive Button in the workspace of the Main Window of the SigmaWin+.
- 2. Select Display Alarm in the Menu Dialog Box. The Display Alarm Dialog Box will be displayed.
- 3. Click the Reset axes Button.

|                                                                                                                                                                                                       |                                                 |                                                | Reset axes.    | View Trace     | e Wavef          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------------------------------|----------------|----------------|------------------|
| Axis                                                                                                                                                                                                  |                                                 |                                                | $\sim$         | -              |                  |
| - AXIS#0001A : SGD7S-:                                                                                                                                                                                | 2R8A20A                                         | A.E71 : Safet                                  | y Option Moc   | lule Detection | n Failure        |
|                                                                                                                                                                                                       |                                                 |                                                |                |                |                  |
|                                                                                                                                                                                                       |                                                 |                                                |                |                |                  |
| m diagnosis Alarm History                                                                                                                                                                             |                                                 |                                                |                |                |                  |
| m diagnosis Alarm History                                                                                                                                                                             |                                                 |                                                |                |                |                  |
|                                                                                                                                                                                                       |                                                 |                                                |                | Cause 1        | /4 🔳             |
| Cause                                                                                                                                                                                                 | 0501/0001                                       |                                                |                |                |                  |
| Faulty connection between the                                                                                                                                                                         | SERVOPA                                         | CK and Safety C                                | ption Module.  |                | 1                |
|                                                                                                                                                                                                       |                                                 |                                                |                |                | -                |
|                                                                                                                                                                                                       |                                                 |                                                |                |                |                  |
| Investigated actions                                                                                                                                                                                  |                                                 |                                                |                |                |                  |
| Investigated actions                                                                                                                                                                                  | the SERVO                                       | PACK and Safe                                  | ty Option Mod  | ule            |                  |
| Investigated actions<br>Check the connection between                                                                                                                                                  | the SERVO                                       | PACK and Safe                                  | ty Option Mod  | ule.           | -                |
| -                                                                                                                                                                                                     | the SERVO                                       | PACK and Safe                                  | ty Option Mod  | ule.           | -                |
| -                                                                                                                                                                                                     | the SERVO                                       | PACK and Safe                                  | ty Option Mod  | ule.           | -                |
| Check the connection between                                                                                                                                                                          |                                                 | PACK and Safe                                  | ty Option Mod  | ule.           | -                |
| Check the connection between<br>Corrective actions                                                                                                                                                    |                                                 | DPACK and Safe                                 | ty Option Mod  | ule.           | -                |
| Check the connection between<br>Corrective actions<br>Reconnect the Safety Option M                                                                                                                   |                                                 | PACK and Safe                                  | ty Option Mod  | ule.           | -                |
| Check the connection between<br>Corrective actions                                                                                                                                                    |                                                 | DPACK and Safe                                 | ty Option Mod  | ule.           |                  |
| Check the connection between<br>Corrective actions<br>Reconnect the Safety Option M<br>Monitor at occurrence of alarm                                                                                 | odule.                                          |                                                | ty Option Mod  | ule.           | -<br>-<br>-<br>- |
| Check the connection between<br>Corrective actions<br>Reconnect the Safety Option M<br>Monitor at occurrence of alarm<br>Name                                                                         | odule.                                          | Unit                                           | ty Option Mod  | ule.           | -<br>-<br>-<br>- |
| Check the connection between<br>Corrective actions<br>Reconnect the Safety Option M<br>Monitor at occurrence of alarm<br>Name<br>Motor rotating speed                                                 | odule.                                          | Unit<br>min-1                                  | ity Option Mod | ule.           |                  |
| Check the connection between<br>Corrective actions<br>Reconnect the Safety Option M<br>Monitor at occurrence of alarm<br>Name<br>Motor rotating speed<br>Speed reference<br>Internal torque reference | odule.<br>Val<br>-<br>-                         | Unit<br>min-1<br>min-1<br>%                    | ty Option Mod  | ule.           |                  |
| Check the connection between<br>Corrective actions<br>Reconnect the Safety Option M<br>Monitor at occurrence of alarm<br>Name<br>Motor rotating speed<br>Speed reference                              | odule.<br>Val<br>-<br>-<br>-<br>-<br>uggest pos | Unit<br>min-1<br>%<br>min-1<br>sible causes of |                | ule.           |                  |

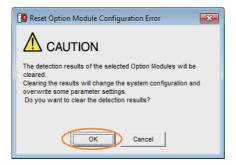
The Reset Option Module Configuration Error Dialog Box will be displayed.

12.2.6 Resetting Alarms Detected in Option Modules

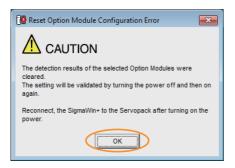
4. Select the Clear Check Box for the Option Module for which to reset the alarm and then click the Execute Button.



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.

## 12.2.7 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**

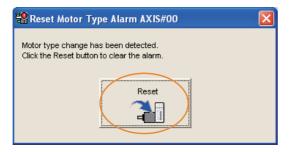
The following table lists the tools that you can use to clear the motor type alarm.

| Tool             | Fn No./Function Name                        | Reference                                                                                 |
|------------------|---------------------------------------------|-------------------------------------------------------------------------------------------|
| Digital Operator | Fn021                                       | $\bigcap \Sigma-7-Series Digital Operator Operating Manual (Manual No.: SIEP S800001 33)$ |
| SigmaWin+        | Troubleshooting – Reset Motor<br>Type Alarm | G Operating Procedure on page 12-47                                                       |

## **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.



12.2.7 Resetting Motor Type Alarms

4. Read the precaution and then click the OK Button.



5. Read the precaution and then click the OK Button.

| 📽 Reset Motor Type Alarm                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                               |
| The motor type alarm was reset.<br>When the power supply is turned on next time, the setting is reflected.<br>Reconnect to SigmaWin+ after turning on the power supply again. |
| OK                                                                                                                                                                            |

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

This concludes the procedure to reset Motor Type alarms.

12.3.1 List of Warnings

## 12.3 Warning Displays

If a warning occurs in the SERVOPACK, a warning number will be displayed on the panel display. Warnings are displayed to warn you before an alarm occurs.

This section provides a list of warnings and the causes of and corrections for warnings.

## 12.3.1 List of Warnings

The warning table gives the warning name and warning meaning in order of the warning numbers.

| Warning<br>Number | Warning Name                                                              | Meaning                                                                                                                                                                                                 | Resetting             |
|-------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A.900             | Position Deviation<br>Overflow                                            | The position deviation exceeded the percentage set with the following formula: $(Pn520 \times Pn51E/100)$                                                                                               | Required.             |
| 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: $(Pn526 \times Pn528/100)$                                                                  | Required.             |
| 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.                                                         | Required.             |
| A.911             | Vibration                                                                 | Abnormal vibration was detected during motor opera-<br>tion. The detection level is the same as A.520. Set<br>whether to output an alarm or a warning by setting<br>Pn310 (Vibration Detection Switch). | Required.             |
| A.912             | Internal Temperature<br>Warning 1 (Control<br>Board Temperature<br>Error) | The surrounding temperature of the control PCB is abnormal.                                                                                                                                             | Required.             |
| A.913             | Internal Temperature<br>Warning 2 (Power<br>Board Temperature<br>Error)   | The surrounding temperature of the power PCB is abnormal.                                                                                                                                               | Required.             |
| A.920             | Regenerative Overload                                                     | This warning occurs before an A.320 alarm (Regenera-<br>tive Overload) occurs. If the warning is ignored and<br>operation is continued, an alarm may occur.                                             | Required.             |
| A.921             | Dynamic Brake Over-<br>load                                               | This warning occurs before an A.731 alarm (Dynamic Brake Overload) occurs. If the warning is ignored and operation is continued, an alarm may occur.                                                    | Required.             |
| A.923             | SERVOPACK Built-in<br>Fan Stopped                                         | The fan inside the SERVOPACK stopped.                                                                                                                                                                   | Required.             |
| A.930             | Absolute Encoder Bat-<br>tery Error                                       | This warning occurs when the voltage of absolute encoder's battery is low.                                                                                                                              | Required.             |
| A.93B             | Overheat Warning                                                          | The input voltage (temperature) for the overheat protec-<br>tion input (TH) signal exceeded the setting of Pn61C<br>(Overheat Warning Level).                                                           | Required.             |
| A.942             | Speed Ripple Com-<br>pensation Information<br>Disagreement                | The speed ripple compensation information stored in<br>the encoder does not agree with the speed ripple com-<br>pensation information stored in the SERVOPACK.                                          | Required.             |
| A.94A             | Data Setting Warning 1<br>(Parameter Number<br>Error)                     | There is an error in the parameter number for a Data Setting Warning 1 (Parameter Number) command.                                                                                                      | Automatically reset.* |
| A.94b             | Data Setting Warning 2<br>(Out of Range)                                  | The command data is out of range.                                                                                                                                                                       | Automatically reset.* |
| A.94C             | Data Setting Warning 3<br>(Calculation Error)                             | A calculation error was detected.                                                                                                                                                                       | Automatically reset.* |

Continued on next page.

12.3.1 List of Warnings

Continued from previous page.

| Warning<br>Number | Warning Name                                               | Meaning                                                                                                                                            | Resetting             |
|-------------------|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A.94d             | Data Setting Warning 4<br>(Parameter Size)                 | The data sizes do not match.                                                                                                                       | Automatically reset.* |
| A.94E             | Data Setting Warning 5<br>(Latch Mode Error)               | A latch mode error was detected.                                                                                                                   | Required.             |
| A.95A             | Command Warning 1<br>(Unsatisfied Com-<br>mand Conditions) | A command was sent when the conditions for sending a command were not satisfied.                                                                   | Automatically reset.* |
| A.95b             | Command Warning 2<br>(Unsupported Com-<br>mand)            | An unsupported command was sent.                                                                                                                   | Automatically reset.* |
| A.95d             | Command Warning 4<br>(Command Interfer-<br>ence)           | There was command interference, particularly latch command interference.                                                                           | Automatically reset.* |
| A.95E             | Command Warning 5<br>(Subcommand Not<br>Possible)          | The subcommand and main command interfere with each other.                                                                                         | Automatically reset.* |
| A.95F             | Command Warning 6<br>(Undefined Command)                   | An undefined command was sent.                                                                                                                     | Automatically reset.* |
| A.960             | MECHATROLINK<br>Communications<br>Warning                  | A communications error occurred during MECHATROLINK communications.                                                                                | Required.             |
| A.971             | Undervoltage                                               | This warning occurs before an A.410 alarm (Undervolt-<br>age) occurs. If the warning is ignored and operation is<br>continued, an alarm may occur. | Required.             |
| A.97A             | Command Warning 7<br>(Phase Error)                         | A command that cannot be executed in the current phase was sent.                                                                                   | Automatically reset.* |
| A.97b             | Data Clamp Out of<br>Range                                 | The set command data was clamped to the minimum or maximum value of the allowable setting range.                                                   | Automatically reset.* |
| A.9A0             | Overtravel                                                 | Overtravel was detected while the servo was ON.                                                                                                    | Required.             |
| A.9b0             | Preventative Mainte-<br>nance Warning                      | One of the consumable parts has reached the end of its service life.                                                                               | Required.             |

\* If using the commands for the MECHATROLINK-III standard servo profile, the warning will automatically be cleared after the correct command is received. If you use MECHATROLINK-II-compatible profile commands, send an ALM\_CLR (Clear Warning or Alarm) command to clear the warning.

Note: 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 6-51 |
| A.923                            | $_{-}$ (Not affected by the setting of Pn008 = n.□X□□.)                                                                                              | _         |
| A.930                            | Pn008 = n. DDX (Low Battery Voltage Alarm/Warning Selection)                                                                                         | page 12-3 |
| A.942                            | Pn423 = n. DIXI (Speed Ripple Compensation Information Dis-<br>agreement Warning Detection Selection)                                                | page 8-60 |
| A.94A to A.960<br>A.97A to A.97b | Pn800=n.□□X□ (Warning Check Masks)                                                                                                                   | page 13-3 |
| 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 6-17 |
| 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 5-32 |
| A.9b0                            | Pn00F = n.                                                                                                                                           | page 9-17 |

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 |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                               | U, V, and W wiring                                                                                                                                         | 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 8-24 |
| <b>A.900:</b><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.                                                  | Reduce the acceleration of<br>the position reference using<br>a MECHATROLINK com-<br>mand. Or, smooth the posi-<br>tion reference acceleration<br>by selecting the position<br>reference filter (ACCFIL)<br>using a MECHATROLINK<br>command. | -         |
|                                                               | 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 8-8  |
|                                                               | A failure occurred<br>in the SERVO-<br>PACK.                                                                                                               | _                                                                                                                              | Turn the power supply to<br>the SERVOPACK OFF and<br>ON again. If the 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 on next 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 5-42 |
|                                                                          | 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 8-42 |
| 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 8-16 |
|                                                                          | 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 6-51 |

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 3-3,<br>page 3-6 |
|                                                                                         | 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 3-3,<br>page 3-6 |
|                                                                                         | A failure occurred<br>in the SERVO-<br>PACK.                                                                                       | _                                                                                                                                                                           | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                            | -                     |

Continued on next page.

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Continued from previous page.

| Warning Number:                                                                                                  | Possible Cause                                                                                                                                                                                            | Confirmation                                                                                            | Continued from pre                                                                                                                                                                                             | Reference |
|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Warning Name                                                                                                     |                                                                                                                                                                                                           | Commation                                                                                               | 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<br>range.                                                                                                                                               | -         |
| <b>A.920:</b><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 conditions or the capacity.                                                         | Change the regenerative<br>resistance value, regenera-<br>tive resistance capacity, or<br>SERVOPACK capacity.<br>Reconsider the operating<br>conditions.                                                       | -         |
|                                                                                                                  | 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<br>was rotated by an<br>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 the<br>alarm still occurs, the SER-<br>VOPACK may be faulty.<br>Replace the SERVOPACK.                                                                         | -         |
| A.930:<br>Absolute Encoder<br>Battery Error (The                                                                 | 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 4-26 |
| absolute encoder<br>battery voltage was<br>lower than the spec-<br>ified level.) (Detected<br>only when an abso- | The battery volt-<br>age is lower than<br>the specified value<br>(2.7 V).                                                                                                                                 | Measure the battery voltage.                                                                            | Replace the battery.                                                                                                                                                                                           | page 12-3 |
| lute encoder is con-<br>nected.)                                                                                 | 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:                                                        |                                                                                                                                                                   |                                                                    | Continued from pre                                                                                                                                                                                                                 |                |
|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 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 8-60      |
| A.942:<br>Speed Ripple Com-<br>pensation Informa-<br>tion Disagreement | compensation<br>information stored<br>in the encoder<br>does not agree<br>with the speed<br>ripple compensa-<br>tion information<br>stored in the SER-<br>VOPACK. | _                                                                  | Set Pn423 to n. D11 (Do<br>not detect A.942 alarms).<br>However, changing the set-<br>ting may increase the speed<br>ripple.                                                                                                       | page 8-60      |
| tion Disagreement                                                      |                                                                                                                                                                   | _                                                                  | Set Pn423 to n. DDD<br>(Disable torque ripple com-<br>pensation). However,<br>changing the setting may<br>increase the speed ripple.                                                                                               | page 8-60      |
| A.94A:<br>Data Setting Warn-<br>ing 1 (Parameter<br>Number Error)      | An invalid param-<br>eter number was<br>used.                                                                                                                     | Check the command that caused the warn-ing.                        | Use the correct parameter number.                                                                                                                                                                                                  | page 12-<br>58 |
| A.94b:<br>Data Setting Warn-<br>ing 2 (Out of Range)                   | The set com-<br>mand data was<br>clamped to the<br>minimum or maxi-<br>mum value of the<br>setting range.                                                         | Check the command<br>that caused the warn-<br>ing.                 | Set the parameter within the setting range.                                                                                                                                                                                        | page 12-<br>58 |
| A.94C:<br>Data Setting Warn-<br>ing 3 (Calculation<br>Error)           | The calculation result of the set-<br>ting is not correct.                                                                                                        | Check the command that caused the warn-<br>ing.                    | Set the parameter within the setting range.                                                                                                                                                                                        | page 12-<br>58 |
| A.94d:<br>Data Setting Warn-<br>ing 4 (Parameter<br>Size)              | The parameter<br>size set in the<br>command is not<br>correct.                                                                                                    | Check the command that caused the warn-ing.                        | Set the correct parameter size.                                                                                                                                                                                                    | page 12-<br>58 |
| A.94E:<br>Data Setting Warn-<br>ing 5 (Latch Mode<br>Error)            | A latch mode error<br>was detected.                                                                                                                               | Check the command that caused the warn-ing.                        | Change the setting of<br>Pn850 or the LT_MOD data<br>for the LTMOD_ON com-<br>mand sent by the host con-<br>troller to an appropriate<br>value.<br>(This applies when using<br>the MECHATROLINK-II-<br>compatible profile.)        | page 12-<br>58 |

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| Warning Number:                                                      | Dessible Orec                                                                                    | Confirmentian                               | Continued from pre                                                                                                                                                                                                                                                                                           |                |
|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Warning Name                                                         | Possible Cause                                                                                   | Confirmation                                | Correction                                                                                                                                                                                                                                                                                                   | Reference      |
| A.95A:<br>Command Warning<br>1 (Unsatisfied Com-<br>mand Conditions) | The command conditions are not satisfied.                                                        | Check the command that caused the warn-ing. | Send the command after the command conditions are satisfied.                                                                                                                                                                                                                                                 | page 12-<br>58 |
| A.95b:<br>Command Warning<br>2 (Unsupported<br>Command)              | An unsupported command was received.                                                             | Check the command that caused the warn-ing. | Do not send unsupported commands.                                                                                                                                                                                                                                                                            | page 12-<br>58 |
| A.95d:<br>Command Warning<br>4 (Command Inter-<br>ference)           | The command<br>sending condi-<br>tions for latch-<br>related com-<br>mands was not<br>satisfied. | Check the command that caused the warn-ing. | Send the command after<br>the command conditions<br>are satisfied.                                                                                                                                                                                                                                           | page 12-<br>58 |
| A.95E:<br>Command Warning<br>5 (Subcommand<br>Not Possible)          | The command<br>sending condi-<br>tions for subcom-<br>mands was not<br>satisfied.                | Check the command that caused the warn-ing. | Send the command after the conditions are satisfied.                                                                                                                                                                                                                                                         | page 12-<br>58 |
| A.95F:<br>Command Warning<br>6 (Undefined Com-<br>mand)              | An undefined<br>command was<br>sent.                                                             | Check the command that caused the warn-ing. | Do not send undefined commands.                                                                                                                                                                                                                                                                              | page 12-<br>58 |
|                                                                      | The<br>MECHATROLINK-<br>III Communica-<br>tions Cable (RJ-<br>45) is not wired<br>correctly.     | Check the wiring condi-<br>tions.           | Correct the<br>MECHATROLINK-III Com-<br>munications Cable (RJ-45)<br>wiring.                                                                                                                                                                                                                                 | page 4-44      |
| A.960:<br>MECHATROLINK<br>Communications<br>Warning                  | A<br>MECHATROLINK<br>data reception<br>error occurred<br>due to noise.                           | Confirm the installation conditions.        | <ul> <li>Implement the following countermeasures against noise.</li> <li>Check the MECHATROLINK-III Communications Cable (RJ-45) and FG wiring and implement countermeasures to prevent noise from entering.</li> <li>Attach a ferrite core to the MECHATROLINK-III Communications Cable (RJ-45).</li> </ul> | -              |
|                                                                      | 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:                                                |                                                                                                           |                                                                         | Continued from pre                                                                                                                                                                                                                                                                                                                                                                                                 |           |
|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Warning Name                                                   | Possible Cause                                                                                            | Confirmation                                                            | Correction                                                                                                                                                                                                                                                                                                                                                                                                         | Reference |
|                                                                | 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<br>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<br>range.                                                                                                                                                                                                                                                                                                                                                   | -         |
| A.971:<br>Undervoltage                                         | The power supply voltage dropped during operation.                                                        | Measure the power supply voltage.                                       | Increase the power supply capacity.                                                                                                                                                                                                                                                                                                                                                                                | -         |
|                                                                | 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 6-16 |
|                                                                | The SERVOPACK fuse is blown out.                                                                          | -                                                                       | Replace the SERVOPACK and connect a reactor.                                                                                                                                                                                                                                                                                                                                                                       | page 4-24 |
|                                                                | A failure occurred<br>in the SERVO-<br>PACK.                                                              | -                                                                       | The SERVOPACK may be faulty. Replace the SERVO-<br>PACK.                                                                                                                                                                                                                                                                                                                                                           | -         |
| <b>A.97A:</b><br>Command Warning<br>7 (Phase Error)            | A command that<br>cannot be exe-<br>cuted in the cur-<br>rent phase was<br>sent.                          | _                                                                       | Send the command after the command conditions are satisfied.                                                                                                                                                                                                                                                                                                                                                       | -         |
| <b>A.97b:</b><br>Data Clamp Out of<br>Range                    | The set com-<br>mand data was<br>clamped to the<br>minimum or maxi-<br>mum value of the<br>setting range. | _                                                                       | Set the command data within the setting ranges.                                                                                                                                                                                                                                                                                                                                                                    | -         |
| 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 5-32 |
| 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 your Yaskawa representa-<br>tive for replacement.                                                                                                                                                                                                                                                                                                                                        | page 9-17 |

## **12.4** Monitoring Communications Data during Alarms or Warnings

You can monitor the command data that is received when an alarm or warning occurs, such as a data setting warning  $(A.94\Box)$  or a command warning  $(A.95\Box)$  by using the following parameters. The following is an example of the data when an alarm or warning has occurred in the normal state.

Command Data during Alarms and Warnings: Pn890 to Pn8A6 Response Data during Alarms and Warnings: Pn8A8 to Pn8BE

| Command Byte | Command Data Storage When an Alarm or Warning Occurs |                    |  |
|--------------|------------------------------------------------------|--------------------|--|
| Sequence     | CMD                                                  | RSP                |  |
| 0            | Pn890 = n.□□□□□□XX                                   | Pn8A8 = n.00000XX  |  |
| 1            | Pn890 = n.□□□□XX□□                                   | Pn8A8 = n.DDDDXXDD |  |
| 2            | Pn890 = n.□□XX□□□□                                   | Pn8A8 = n.DDXXDDDD |  |
| 3            | Pn890 = n.XX□□□□□□                                   | Pn8A8 = n.XXDDDDDD |  |
| 4 to 7       | Pn892                                                | Pn8AA              |  |
| 8 to 11      | Pn894                                                | Pn8AC              |  |
| 12 to 15     | Pn896                                                | Pn8AE              |  |
| 16 to 19     | Pn898                                                | Pn8B0              |  |
| 20 to 23     | Pn89A                                                | Pn8B2              |  |
| 24 to 27     | Pn89C                                                | Pn8B4              |  |
| 28 to 31     | Pn89E                                                | Pn8B6              |  |
| 32 to 35     | Pn8A0                                                | Pn8B8              |  |
| 36 to 39     | Pn8A2                                                | Pn8BA              |  |
| 40 to 43     | Pn8A4                                                | Pn8BC              |  |
| 44 to 47     | Pn8A6                                                | Pn8BE              |  |

Note: 1. Data is stored in little endian byte order and displayed in the hexadecimal.

2. Refer to the following manual for command details.

Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

## **12.5** 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 6-4,<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 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 6-33             |
|                                 | There is a mistake in the<br>input signal allocations<br>(Pn50A, Pn50B, Pn511, and<br>Pn516).                           | Check the input signal<br>allocations (Pn50A,<br>Pn50B, Pn511, and<br>Pn516).                                                       | Correctly allocate the<br>input signals (Pn50A,<br>Pn50B, Pn511, and<br>Pn516).                                                                                                          | page 6-4,<br>page 9-5 |
|                                 | The SV_ON command was not sent.                                                                                         | Check the commands sent from the host con-<br>troller.                                                                              | Send the SV_ON com-<br>mand from the host controller.                                                                                                                                    | -                     |
|                                 | The SENS_ON (Turn ON Sensor) command was not sent.                                                                      | Check the commands sent from the host con-<br>troller.                                                                              | Send the commands to the SERVOPACK in the correct sequence.                                                                                                                              | -                     |
|                                 | 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 safety input signals<br>(/HWBB1 or /HWBB2) were<br>not turned ON.                                                   | Check the /HWBB1 and /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              |

Continued on next page.

Maintenance

|                                    |                                                                                                                    |                                                                                                                                                                                                                          | Continued from pre                                                                                                                                                                                        |           |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Problem                            | Possible Cause                                                                                                     | Confirmation                                                                                                                                                                                                             | Correction                                                                                                                                                                                                | Reference |
|                                    | The FSTP (Forced Stop<br>Input) signal is still OFF.                                                               | Check the FSTP signal.                                                                                                                                                                                                   | <ul> <li>Turn ON the FSTP signal.</li> <li>If you will not use the function to force the motor to stop, set Pn516 = n. DDX (FSTP (Forced Stop Input) Signal Allocation) to disable the signal.</li> </ul> | page 9-5  |
| Servomotor<br>Does Not<br>Start    | 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 5-25 |
|                                    | The polarity detection was not executed.                                                                           | Check the inputs to the SV_ON (Servo ON) com-<br>mand.                                                                                                                                                                   | <ul> <li>If you are using an incremental linear encoder, send the SV_ON command from the host controller.</li> <li>If you are using an absolute linear encoder, execute polarity detection.</li> </ul>    | page 5-26 |
|                                    | 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 5-18 |
| 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 = $n.\square\squareX\square$<br>(Motor Phase Selec-<br>tion). Place the linear<br>encoder and motor in<br>the same direction.                                              | page 5-23 |
|                                    | Polarity detection was not 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.                                                                                                                                 | -         |

|                                                         |                                                                                                                    |                                                                                                                                                                                                                                                       | Continued from pre                                                                                                                                         | vious page. |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Problem                                                 | Possible Cause                                                                                                     | Confirmation                                                                                                                                                                                                                                          | Correction                                                                                                                                                 | Reference   |
|                                                         | 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.                                                                        | -           |
| Servomotor<br>Moves with-<br>out a Refer-<br>ence Input | 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).<br>Match the linear<br>encoder direction and<br>Servomotor direction. | page 5-23   |
|                                                         | 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.  | -           |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                           | Continued from pre                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                  |           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Problem                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Possible Cause                                                                                                                                                                                                                                                            | Confirmation                                                                                                                                          | Correction                                                                                                                                                                                                                                                                                                                                                                                                       | Reference |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 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 8-12 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                           | 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.                                                                                                                                                                                                                                                                                                                                                                                              | -         |
| Abnormal<br>Noise from<br>Servomotor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                           | 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.                                                                                                                                                                                                                                                                                                                                                                                     | -         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 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.                                                                                                                                                                                                                                                                                                                                                                           | -         |
| Abnormal<br>Noise from<br>ServomotorCheck the uning-less function<br>with the default settings.Check the weak<br>the motor state<br>Check to state<br>any loose n<br>screws.Abnormal<br>Noise from<br>ServomotorThe machine mounting is not<br>secure.Turn OFF th<br>ply to the s<br>Check to state<br>misalignme<br>pling.Abnormal<br>Noise from<br>ServomotorThe bearings are defective.Turn OFF th<br>ply to the s<br>Check to state<br>misalignme<br>pling.The bearings are defective.Turn OFF th<br>ply to the s<br>Check to state<br>misalignme<br>pling is balaThe bearings are defective.Turn OFF th<br>ply to the s<br>Check for r<br>vibration are<br>ings.There is a vibration source at<br>the driven machine.Turn OFF th<br>ply to the s<br>Check for a<br>matter, dan<br>mation in th<br>moving parNoise interference occurred<br>because of incorrect I/O sig-<br>nal cable specifications.Turn OFF th<br>ply to the s<br>Check the I<br>cables to s<br>isfy specific<br>shielded tw<br>source of the ply to the s<br>Check the I<br>cables or s<br>twisted-pai<br>conductors<br>0.12 mm².Noise interference occurred<br>because an I/O signal cableTurn OFF th<br>ply to the s<br>check the I<br>check the I<br>check the INoise interference occurred<br>because an I/O signal cableTurn OFF th<br>ply to the s<br>check the I<br>check the I | 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.                                                                                                           | -                                                                                                                                                                                                                                                                                                                                                                                                                |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | because an I/O signal cable                                                                                                                                                                                                                                               | 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.                                                                                                                                                                                                                                                                                                                                                          | _         |

| Problem                              | Possible Cause                                                                                                                    | Confirmation                                                                                                                                                                                                                                                                                                                             | Continued from pre                                                                                                                                                                                                                                                                                                     | Reference |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                      | Noise interference occurred<br>because of incorrect Encoder<br>Cable specifications.                                              | Turn OFF the power sup-<br>ply to the servo system.<br>Make sure that the rotary<br>or Linear Encoder Cable<br>satisfies the specifica-<br>tions. 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.                                                                                                                                                                                                                                                                            | -         |
|                                      | 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 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.                                                                                                                                                                                                                                   | -         |
| Abnormal<br>Noise from<br>Servomotor | 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.                                                                           | 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.                                                                                                                                                                                                                                   | -         |

The setting of Pn103 (Moment of Inertia Ratio or

ate.

rated.

values.

Mass Ratio) is not appropri-

The torque reference is satu-

The force limits (Pn483 and

Pn484) are set to the default

| Problem                                                                                                           | Possible Cause                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Confirmation                                                              | Correction                                                                                      | Reference |
|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------|
| Abnormal<br>Noise from<br>Servomotor<br>Servomotor<br>Vibrates at<br>Frequency<br>of Approx.<br>200 to 400<br>Hz. | 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.          | -         |
|                                                                                                                   | 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 8-24 |
| Abnormal<br>Noise from<br>Servomotor<br>Servomotor<br>Vibrates at<br>Frequency<br>of Approx.<br>200 to 400<br>Hz. | 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 appro-<br>priate 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.                                                              | -         |
|                                                                                                                   | A failure occurred in the<br>Serial Converter UnitTurn OFF the power<br>supply to the servo<br>system.<br>Replace the Serial Converter Unit.A failure occurred in the linear<br>encoderTurn OFF the power<br>supply to the servo<br>system.<br>Replace the linear<br>encoder.A failure occurred in the linear<br>encoderTurn OFF the power<br>supply to the servo<br>system.<br>Replace the linear<br>encoder.The servo gains are not bal-<br>anced.Check to see if the servo<br>gains have been cor-<br>rectly tuned.Perform autotuning<br>without a host refer-<br>ence.The setting of Pn100 (Speed<br>Loop Gain) is too high.Check the setting of<br>Pn102.<br>The default setting is Kv =<br>40.0 Hz.Set Pn100 to an appro<br>priate value.The setting of Pn101 (Speed<br>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 appro<br>priate value.The setting of Pn101 (Speed<br>Loop Integral Time Con-<br>stant) is not appropriate.Check the setting of<br>Pn103.Set Pn101 to an appro<br>priate value.The setting of Pn103<br>(Moment of Inertia Ratio or<br>anced.Check to see if the servo<br>gains have been cor-<br>rectly tuned.Set Pn103 to an appro<br>priate value.The setting of Pn100 (Speed<br>Loop Gain) is too high.Check to see if the servo<br>gains have been cor-<br>rectly tuned.Set Pn103 to an appro<br>priate value.The setting of Pn100 (Speed<br>Loop Gain) is too high.Check the setting of<br>Pn103.Set Pn100 to an appro<br>priate value.The setting of Pn100 (Speed<br>Loop Gain) is too high.Check the setting of<br>Pn100.Set Pn100 to an | -                                                                         |                                                                                                 |           |
|                                                                                                                   | (Moment of Inertia Ratio or<br>Mass Ratio) is not appropri-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 5                                                                         | Set Pn103 to an appro-<br>priate value.                                                         | -         |
|                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | gains have been cor-                                                      | without a host refer-                                                                           | page 8-24 |
|                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Pn100.<br>The default setting is Kv =                                     | Set Pn100 to an appropriate value.                                                              | -         |
|                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Pn102.<br>The default setting is Kp                                       | Set Pn102 to an appropriate value.                                                              | -         |
| on Starting<br>and Stop-                                                                                          | Loop Integral Time Con-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Pn101.<br>The default setting is Ti =                                     | Set Pn101 to an appropriate value.                                                              | -         |
|                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                           |                                                                                                 |           |

Check the setting of

Check the waveform of

The default values of the

force limits and Pn483 =

30% and Pn484 = 30%.

the torque reference.

Pn103.

Continued from previous page.

Continued on next page.

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page 6-28

Set Pn103 to an appro-

Use the mode switch.

Set Pn483 and Pn484

to appropriate values.

priate value.

| Problem                                                                                                                                                    | Possible Cause                                                                                                                    | Confirmation                                                                                                                                                                                                                                                             | Continued from pre                                                                                                                                                                                                                                                                                                     | Reference |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| TODIETT                                                                                                                                                    | 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.                                                                                                                                                                                                                                                                            | -         |
| Absolute<br>Encoder<br>Position<br>Deviation<br>Error (The<br>position<br>that was<br>saved in the<br>host con-<br>troller when<br>the power<br>was turned | 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> | _         |
| OFF is dif-<br>ferent from<br>the posi-<br>tion when<br>the power                                                                                          | 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.                                                                                                                                                                                                                                   | -         |
| was next<br>turned ON.)                                                                                                                                    | The Encoder Cable was sub-<br>ject 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.                                                                                                                                                                                                                                 | -         |
|                                                                                                                                                            | 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.                                                                                                                                                                                                                                              | -         |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                         |                                                                                                                                                                                    | Continued from pre                                                                                                                                           | vious page. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Problem                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Possible Cause                                          | Confirmation                                                                                                                                                                       | Correction                                                                                                                                                   | Reference   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 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.                                                       | -           |
| Problem         Possible Cause         Confirmation         Correction           There is a SERVOPACK<br>pulse counting error due to<br>noise.         There is a SERVOPACK<br>pulse counting error due to<br>noise.         The serve system.<br>Check to see if there is<br>noise interference on the<br>loginal line from the<br>encoder or Serial Con-<br>verter Unit.         Implement counter<br>measures against n<br>counter function           Absolute<br>Encoder<br>Position<br>Deviation<br>Error (The<br>position<br>that was<br>saved in the<br>host con-<br>troller when<br>the power<br>was turned         The encoder was subjected<br>to excessive vibration or<br>shock.         Turn OFF the power sup-<br>ply to the serve system.<br>Check the Servomotor<br>installation (mounting sur-<br>face precision and secur-<br>ing method).         Reduce machine vi<br>mounting state of the<br>servemotor or linear<br>encoder.           A failure occurred in the<br>encoder.         A failure occurred in the<br>servemotor.         Turn OFF the power<br>supply to the serve<br>supply to the serve<br>controller.         Turn OFF the powe<br>supply to the serve<br>to read the serve<br>controller.           A failure occurred in the SER-<br>the power<br>was next<br>turned ON.)         A failure occurred in the SER-<br>Position Data Reading Error<br>Position Data Reading Error<br>Position Data Reading Error<br>Drive Prohibit or Reverse<br>Drive Prohibit or Reverse<br>Drive Prohibit signal was<br>input.         Check the external power<br>supply (+24 V) voltage for<br>the input signals.         Correct the external<br>power supply (+24<br>voltage fort | mounting state of the Servomotor or linear              | _                                                                                                                                                                                  |                                                                                                                                                              |             |
| host con-<br>troller when<br>the power<br>was turned                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                         | _                                                                                                                                                                                  | Turn OFF the power<br>supply to the servo<br>system.<br>Replace the Servomo-<br>tor or linear encoder.                                                       | -           |
| ferent from<br>the posi-<br>tion when                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                         | _                                                                                                                                                                                  | Replace the SERVO-                                                                                                                                           | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                         | tion section of the host                                                                                                                                                           | Correct the error detec-<br>tion section of the host controller.                                                                                             | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                         | controller is executing                                                                                                                                                            | Perform parity checks<br>for the multiturn data or<br>absolute encoder posi-<br>tion data.                                                                   | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                         | ence in the cable<br>between the SERVO-<br>PACK and the host con-                                                                                                                  | Implement counter-<br>measures against noise<br>and then perform parity<br>checks again for the<br>multiturn data or abso-<br>lute encoder position<br>data. | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                         | supply (+24 V) voltage for                                                                                                                                                         | Correct the external<br>power supply (+24 V)<br>voltage for the input<br>signals.                                                                            | -           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Drive Prohibit or Reverse                               | dition of the overtravel                                                                                                                                                           | overtravel limit switches                                                                                                                                    | -           |
| Occurred                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | , .                                                     |                                                                                                                                                                                    |                                                                                                                                                              | page 5-29   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                         |                                                                                                                                                                                    | Set the parameters to correct values.                                                                                                                        | page 5-29   |

| _                                                                                                                              |                                                                                                                      | -                                                                                                                                                                                                                                                                    | Continued from pre                                                                                                                                                                                                                                                                                                     |             |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Problem                                                                                                                        | Possible Cause                                                                                                       | Confirmation                                                                                                                                                                                                                                                         | Correction                                                                                                                                                                                                                                                                                                             | Reference   |
|                                                                                                                                |                                                                                                                      | 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.                                                                                                                                                                                                                                               | -           |
| Overtravel<br>Occurred<br>Improper<br>Stop Posi-<br>tion for<br>Overtravel<br>(OT) Signal<br>Position<br>Deviation<br>(without | 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.                                                                                                                                                                                                                                                                   | -           |
| Overtravel<br>Occurred                                                                                                         | There is a mistake in the allo-<br>cation of the P-OT or N-OT<br>(Forward Drive Prohibit or                          | Check to see if the P-OT signal is allocated in Pn50A = $n.X\square\square\square$ .                                                                                                                                                                                 | If another signal is allo-<br>cated in Pn50A<br>=n.X□□□, allocate the<br>P-OT signal instead.                                                                                                                                                                                                                          | - page 5-29 |
|                                                                                                                                | Reverse Drive Prohibit) sig-<br>nal in Pn50A = $n.X\square\square\square$ or<br>Pn50B = $n.\square\square\squareX$ . | Check to see if the N-OT signal is allocated in Pn50B = $n.\square\square\squareX$ .                                                                                                                                                                                 | If another signal is allo-<br>cated in Pn50B<br>=n.□□□X, allocate the<br>N-OT signal instead.                                                                                                                                                                                                                          | page 3-29   |
|                                                                                                                                | The selection of the Servo-<br>motor stopping method is                                                              | Check the servo OFF stopping method set in Pn001 = $n.\Box\Box\BoxX$ or Pn001 = $n.\Box\BoxX\Box$ .                                                                                                                                                                  | Select a Servomotor<br>stopping method other<br>than coasting to a stop.                                                                                                                                                                                                                                               | page 5-31   |
|                                                                                                                                | not correct.                                                                                                         | Check the torque control stopping method set in Pn001 = $n.\Box\BoxX$ or Pn001 = $n.\Box\BoxX\Box$ .                                                                                                                                                                 | Select a Servomotor stopping method other than coasting to a stop.                                                                                                                                                                                                                                                     | page 5-51   |
| Improper<br>Stop Posi-                                                                                                         | The limit switch position and dog length are not appropriate.                                                        | _                                                                                                                                                                                                                                                                    | Install the limit switch at the appropriate position.                                                                                                                                                                                                                                                                  | -           |
| 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.                                                                                                                                                                                                                                                       | -           |
|                                                                                                                                | 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<br>Deviation<br>(without<br>Alarm)                                                                                    | 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 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.                                                                                                                                                                                                                                   | _           |

|                                             |                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                        | Continued from pre                                                                                            | vious page. |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------|
| Problem                                     | Possible Cause                                                                                                                    | Confirmation                                                                                                                                                                                                                                                                                                                           | Correction                                                                                                    | Reference   |
|                                             | 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. | -           |
| Position<br>Deviation<br>(without<br>Alarm) | 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.                                             | -           |
|                                             | 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.                                                       | -           |
| Position<br>Deviation<br>(without<br>Alarm) | 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.                           | _           |

|                          |                                                   |                                                                                                                      | Continued from pre                                                                                                                                      | vious page. |
|--------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Problem                  | Possible Cause                                    | Confirmation                                                                                                         | Correction                                                                                                                                              | Reference   |
|                          | 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<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.                                                                              | -           |

Continued from previous page.

# **Parameter Lists**

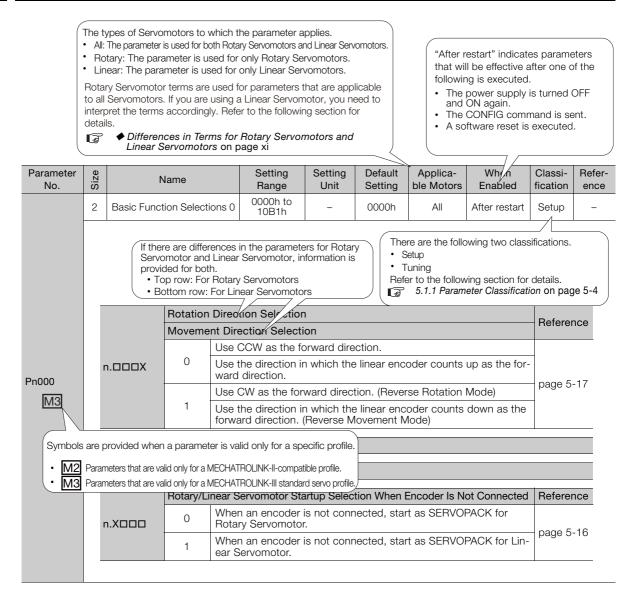
13

This chapter provides information on the parameters.

13.1.1 Interpreting the Parameter Lists

## **13.1 List of Servo Parameters**

### 13.1.1 Interpreting the Parameter Lists



### 13.1.2 List of Servo Parameters

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

| 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                                                      | Basic Fund<br>tions 0                       | ction Selec-         | 0000h to<br>10B1h                                             | -                           | 0000h                     | All                  | After<br>restart | Setup               | -         |  |
|                  |                                                        |                                             |                      |                                                               |                             | I                         |                      |                  | I                   |           |  |
|                  |                                                        |                                             | Rotation I           | Direction Selectio                                            | n                           |                           |                      |                  |                     |           |  |
|                  |                                                        |                                             | Movemen              | t Direction Select                                            | tion                        |                           |                      |                  | - Refere            | Reference |  |
|                  |                                                        |                                             |                      | Use CCW as the t                                              |                             |                           |                      |                  |                     |           |  |
|                  |                                                        | n.DDDX                                      |                      | Use the direction ward direction.                             | in which th                 | ie linear en              | coder counts         | up as the fo     | r-<br>page {        | 5 17      |  |
|                  |                                                        |                                             |                      | Use CW as the fo                                              |                             |                           |                      | ,                |                     | 5-17      |  |
| Pn000            |                                                        |                                             |                      | Use the direction forward direction.                          |                             |                           |                      | down as the      | Э                   |           |  |
|                  |                                                        | n. DDXD Reserved parameter (Do not change.) |                      |                                                               |                             |                           |                      |                  |                     |           |  |
|                  |                                                        | n.DXDD                                      | Reserved             | parameter (Do no                                              | ot change.                  | )                         |                      |                  |                     |           |  |
|                  |                                                        |                                             | Rotary/Lin<br>nected | near Servomotor                                               | Startup Se                  | election W                | hen Encoder          | Is Not Con-      | Refere              | ence      |  |
|                  |                                                        | n.XDDD                                      | 0                    | When an encoder<br>Rotary Servomoto                           | is not con<br>or.           | inected, st               | art as SERVO         | PACK for         | — page {            | 5-16      |  |
|                  |                                                        |                                             |                      | When an encoder<br>ear Servomotor.                            | is not con                  | inected, st               | art as SERVO         | PACK for Lir     | 1-                  |           |  |
|                  |                                                        |                                             |                      |                                                               |                             | 1                         |                      |                  |                     | 1         |  |
|                  | 2                                                      | Application<br>Selections                   | 1 Function           | 0000h to<br>1142h                                             | -                           | 0000h                     | All                  | After<br>restart | Setup               | -         |  |
|                  |                                                        |                                             |                      | I                                                             | 1                           | 1                         | 1                    |                  | 1                   |           |  |
|                  | Motor Stopping Method for Servo OFF and Group 1 Alarms |                                             |                      |                                                               |                             |                           |                      |                  | Refere              | ence      |  |
|                  |                                                        |                                             |                      | Stop the motor by                                             |                             |                           | •                    |                  |                     |           |  |
|                  |                                                        | n.DDDX                                      |                      | Stop the motor by the dynamic brake                           |                             | ing dynam                 | ic brake and t       | hen release      | page 5              | page 5-39 |  |
|                  |                                                        |                                             | 2                    | Coast the motor t                                             | o a stop w                  | ithout the                | dynamic brak         | e.               |                     |           |  |
|                  |                                                        |                                             | Overtrave            | I Stopping Metho                                              | d                           |                           |                      |                  | Refere              | ence      |  |
|                  |                                                        |                                             |                      | Apply the dynamic stopping method                             |                             |                           |                      | p (use the       |                     |           |  |
|                  |                                                        |                                             |                      | Decelerate the mo                                             |                             |                           |                      |                  |                     |           |  |
| Pn001            |                                                        | n.□□X□                                      |                      | Decelerate the mo<br>the maximum toro                         |                             |                           |                      | in Pn406 as      | page 5              | 5-31      |  |
|                  |                                                        |                                             | 3                    | Decelerate the mo<br>Pn30A and then s                         | otor to a st<br>ervo-lock   | op using th<br>the motor. | ne deceleratio       | n time set in    |                     |           |  |
|                  |                                                        |                                             | 4                    | Decelerate the mo<br>Pn30A and then le                        | otor to a st<br>et the moto | op using tł<br>or coast.  | ne deceleratio       | n time set in    |                     |           |  |
|                  |                                                        |                                             | Main Circ            | uit Power Supply                                              | AC/DC In                    | put Select                | ion                  |                  | Refere              | ence      |  |
|                  |                                                        | n.¤X¤¤                                      |                      | Input AC power as<br>and L3 terminals (                       |                             |                           |                      | ng the L1, L2    | ,                   |           |  |
|                  |                                                        |                                             | 1                    | Input DC power a and $\ominus$ 2 terminals converter or the s | s or the B1                 | and $\ominus$ 2           |                      | -                |                     | 5-14      |  |
|                  |                                                        |                                             |                      |                                                               |                             |                           |                      |                  |                     |           |  |
|                  |                                                        | n.XDDD                                      | Reserved             | parameter (Do no                                              | ot change.                  | )                         |                      |                  |                     |           |  |

| Parameter | e    |                          |                   | Setting                             | Setting      | Default      | Con<br>Applicable | When                 | Classi-  | Refer |
|-----------|------|--------------------------|-------------------|-------------------------------------|--------------|--------------|-------------------|----------------------|----------|-------|
| No.       | Size |                          | lame              | Range                               | Unit         | Setting      | Motors            | Enabled              | fication | ence  |
|           | 2    | Applicatio<br>Selections | n Function<br>2   | 0000h to<br>4213h                   | -            | 0011h        | -                 | After<br>restart     | Setup    | -     |
|           |      |                          |                   |                                     |              |              |                   |                      |          |       |
|           |      |                          | MECHATR<br>Option | OLINK Comman                        | d Position   | and Spee     | ed Control        | Applicable<br>Motors | Refere   | ence  |
|           |      | n.DDDX                   | 0 F               | Reserved parame                     | ter (Do not  | change.)     |                   |                      |          |       |
|           |      |                          |                   | Jse TLIM as the te                  |              |              |                   | All                  | *1       |       |
|           |      |                          |                   | leserved parame                     | -            | <b>Q</b> .   |                   |                      |          |       |
|           |      |                          | 3 F               | Reserved parame                     | ter (Do not  | change.)     |                   |                      |          |       |
|           |      |                          | Torque Co         | ntrol Option                        |              |              |                   | Applicable<br>Motors | Refere   | ence  |
|           |      | n.🗆 🗆 X 🗆                | 0 F               | leserved parame                     | ter (Do not  | change.)     |                   |                      |          |       |
|           |      |                          |                   | lse the speed lim<br>peed limit.    | it for torqu | e control (\ | /LIM) as the      | All                  | *1       |       |
| Pn002     |      |                          | Encoder U         | sage                                |              |              |                   | Applicable<br>Motors | Refere   | ence  |
|           |      | n.0X00                   |                   | lse the encoder a ons.              | according    | to encodei   | specifica-        | All                  |          |       |
|           |      |                          | 1 L               | lse the encoder a                   | as an incre  | mental en    | coder.            |                      | page 6   | 6-33  |
|           |      |                          |                   | lse the encoder a ncoder.           | as a single  | -turn abso   | lute              | Rotary               |          |       |
|           | Ī    |                          | External E        | ncoder Usage                        |              |              |                   | Applicable<br>Motors | Refere   | ence  |
|           |      |                          | 0 [               | o not use an ext                    | ernal enco   | der.         |                   |                      |          |       |
|           |      | n.X000                   |                   | he external enco<br>on for CCW moto |              |              | ward direc-       |                      |          |       |
|           |      |                          | 2 F               | Reserved parame                     | ter (Do not  | change.)     |                   | Rotary               | page 1   | 0-6   |
|           |      |                          |                   | he external enco<br>on for CCW moto |              |              | erse direc-       |                      |          |       |
|           |      |                          | 4 F               | Reserved parame                     | ter (Do not  | ( change )   |                   |                      |          |       |

Continued from previous page.

| Parameter<br>No. | Size | Ν                         | lame                                | Setting<br>Range                                                                                     | Setting<br>Unit                                  | Default<br>Setting                          | Applicable<br>Motors         | When<br>Enabled  | Classi-<br>fication                   | Refe<br>ence |  |  |
|------------------|------|---------------------------|-------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------|------------------------------|------------------|---------------------------------------|--------------|--|--|
|                  | 2    | Application<br>Selections | n Function<br>6                     | 0000h to<br>105Fh                                                                                    | -                                                | 0002h                                       | All                          | Immedi-<br>ately | Setup                                 | pag<br>9-9   |  |  |
|                  |      |                           | Analog Mc                           | nitor 1 Signal Se                                                                                    | lection                                          |                                             |                              |                  |                                       |              |  |  |
|                  |      |                           | 00                                  | Motor speed (1 )<br>Motor speed (1 )                                                                 |                                                  | ,                                           |                              |                  |                                       |              |  |  |
|                  |      |                           | 01                                  | Speed reference<br>Speed reference                                                                   |                                                  | ,                                           |                              |                  |                                       |              |  |  |
|                  |      |                           | 02                                  | Torque reference                                                                                     | e (1 V/100                                       | % rated to                                  | • •                          |                  |                                       |              |  |  |
|                  |      |                           | 03                                  | Force reference<br>Position deviatio                                                                 | `                                                |                                             | ,                            |                  |                                       |              |  |  |
|                  |      |                           | 03                                  |                                                                                                      |                                                  |                                             | ,                            | ) 05 V/enco      | der nulse                             | unit)        |  |  |
|                  |      |                           | 04                                  | Position amplifie<br>pulse unit)                                                                     |                                                  |                                             |                              |                  | encoder pulse unit)<br>linear encoder |              |  |  |
|                  |      |                           | 05                                  | Position reference speed (1 V/1,000 min <sup>-1</sup> )<br>Position reference speed (1 V/1,000 mm/s) |                                                  |                                             |                              |                  |                                       |              |  |  |
|                  |      | 06                        | Reserved parameter (Do not change.) |                                                                                                      |                                                  |                                             |                              |                  |                                       |              |  |  |
| Pn006            |      | n.□□XX                    | 07                                  | Load-motor pos                                                                                       | -                                                |                                             |                              | nit)             |                                       |              |  |  |
| 1000             |      |                           | 08                                  |                                                                                                      |                                                  | positioning completed: 5 V, positioning not |                              |                  |                                       | -            |  |  |
|                  |      |                           | ·                                   | 00                                                                                                   | Speed feedforward (1 V/1,000 min <sup>-1</sup> ) |                                             |                              |                  |                                       |              |  |  |
|                  |      |                           | 09                                  | Speed feedforward (1 V/1,000 mm/s)                                                                   |                                                  |                                             |                              |                  |                                       |              |  |  |
|                  |      |                           | 0A                                  | Torque feedforward (1 V/100% rated torque)                                                           |                                                  |                                             |                              |                  |                                       |              |  |  |
|                  |      |                           | UA                                  | 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 pepered: 0 V)                                                                          | osition refe                                     | erence dist                                 | tribution (com               | pleted: 5 V,     | not com-                              |              |  |  |
|                  |      |                           | 0D                                  | External encode                                                                                      | r speed (1                                       | V/1,000 n                                   | nin <sup>-1</sup> : value at | the motor s      | haft)                                 |              |  |  |
|                  |      |                           | 0E                                  | Reserved param                                                                                       | eter (Do n                                       | ot change                                   | .)                           |                  |                                       |              |  |  |
|                  |      |                           | OF                                  | Reserved param                                                                                       | eter (Do n                                       | ot change                                   | .)                           |                  |                                       |              |  |  |
|                  |      |                           | 10                                  | Main circuit DC                                                                                      | voltage                                          |                                             |                              |                  |                                       |              |  |  |
|                  |      |                           | 11 to 5F                            | Reserved param                                                                                       | eters (Do                                        | not change                                  | e.)                          |                  |                                       |              |  |  |
|                  |      | n.🗆X🗆                     | Reserved                            | parameter (Do no                                                                                     | t change.                                        | )                                           |                              |                  |                                       |              |  |  |
|                  |      | n.XDDD                    | Reserved                            | parameter (Do no                                                                                     | t change.                                        | )                                           |                              |                  |                                       |              |  |  |

| Parameter | Size | N                         | lame       | Setting                                 | Setting                                                 | Default       | Applicable      | tinued from      | Classi-    | Refe         |  |  |
|-----------|------|---------------------------|------------|-----------------------------------------|---------------------------------------------------------|---------------|-----------------|------------------|------------|--------------|--|--|
| No.       |      | Application               |            | 0000h to                                | Unit                                                    | Setting       | Motors          | Enabled          | fication   | ence<br>page |  |  |
|           | 2    | Selections                | 7          | 105Fh                                   | -                                                       | 0000h         | All             | ately            | Setup      | page<br>9-9  |  |  |
|           | _    |                           |            |                                         |                                                         |               |                 |                  |            |              |  |  |
|           |      |                           | Analog Mo  | onitor 2 Signal Se                      | election                                                |               |                 |                  |            |              |  |  |
|           |      |                           | 00         | Motor speed (1                          |                                                         | ,             |                 |                  |            |              |  |  |
|           |      |                           | -          | Motor speed (1                          |                                                         | ,             |                 |                  |            |              |  |  |
|           |      |                           | 01         | Speed reference                         | - ( . ,                                                 | - /           |                 |                  |            |              |  |  |
|           |      |                           |            | Speed reference<br>Torque reference     |                                                         | ,             | rauo)           |                  |            |              |  |  |
|           |      |                           | 02         | Force reference                         |                                                         |               | . ,             |                  |            |              |  |  |
|           |      |                           | 03         | Position deviation                      |                                                         |               |                 |                  |            |              |  |  |
|           |      |                           |            | Position amplifie                       |                                                         |               | ,               | 0.05 V/enco      | der pulse  | unit)        |  |  |
|           |      |                           | 04         | Position amplifie pulse unit)           | er deviatior                                            | n (after elec | ctronic gear) ( | 0.05 V/linea     | r encoder  |              |  |  |
|           |      |                           | 05         | Position referen                        | Position reference speed (1 V/1,000 min <sup>-1</sup> ) |               |                 |                  |            |              |  |  |
|           |      |                           | 00         | Position referen                        | ce speed (                                              | 1 V/1,000     | mm/s)           |                  |            |              |  |  |
|           |      |                           | 06         | Reserved paran                          | ,                                                       | Ũ             | ,               |                  |            |              |  |  |
| Pn007     | '    | n.□□XX                    | 07         | Load-motor pos                          |                                                         |               |                 | ,                |            |              |  |  |
|           |      |                           | 08         | Positioning com<br>pleted: 0 V)         |                                                         |               | ompleted: 5     | V, positioninę   | g not com- |              |  |  |
|           |      |                           | 09         | Speed feedforw                          |                                                         |               | \<br>\          |                  |            |              |  |  |
|           |      |                           | -          | Speed feedforw<br>Torque feedforw       | `                                                       |               |                 |                  |            |              |  |  |
|           |      |                           | 0A         | Force feedforwa                         |                                                         |               | . ,             |                  |            |              |  |  |
|           |      |                           | 0B         | Active gain (1st                        |                                                         |               | -               |                  |            |              |  |  |
|           |      |                           | 0C         | Completion of p                         | -                                                       | -             |                 | pleted: 5 V,     | not com-   |              |  |  |
|           |      |                           |            | pleted: 0 V)                            |                                                         |               |                 |                  |            |              |  |  |
|           |      |                           | 0D         | External encode                         |                                                         |               |                 | the motor s      | haft)      |              |  |  |
|           |      |                           | 0E<br>0F   | Reserved paran                          | ,                                                       | Ũ             | ,               |                  |            |              |  |  |
|           |      |                           | 10         | Reserved paran<br>Main circuit DC       | ,                                                       | iot change    | .)              |                  |            |              |  |  |
|           |      |                           | 11 to 5F   |                                         |                                                         |               |                 |                  |            |              |  |  |
|           |      |                           |            | •                                       | ,                                                       | 0             |                 |                  |            |              |  |  |
|           |      | n.¤X¤¤                    | Reserved   | parameter (Do n                         | ot change.                                              | .)            |                 |                  |            |              |  |  |
|           | 1    | n.XDDD                    | Reserved   | parameter (Do n                         | ot change                                               | )             |                 |                  |            |              |  |  |
|           |      |                           |            |                                         |                                                         |               |                 |                  |            | 1            |  |  |
|           | 2    | Application<br>Selections | n Function | 0000h to<br>7121h                       | -                                                       | 4000h         | Rotary          | After<br>restart | Setup      | -            |  |  |
|           |      | Colocitorio               | 0          |                                         |                                                         |               |                 | rootairt         |            |              |  |  |
|           | Ŀ    |                           | Low Batte  | ry Voltage Alarm                        | /Warning !                                              | Selection     |                 |                  | Referer    |              |  |  |
|           |      | n.000X                    | -          | Output alarm (A.8                       | 0                                                       |               | ltage.          |                  | Ticlorer   |              |  |  |
|           |      |                           |            | Output warning (A                       | ,                                                       | ,             | 0               |                  | page 1     | 2-2          |  |  |
|           |      |                           |            |                                         | ,<br>                                                   |               | 0               |                  | Defense    |              |  |  |
|           |      |                           |            | Selection for Und                       |                                                         |               |                 |                  | Referer    | ICe          |  |  |
| -         |      | n.00X0                    |            | Do not detect und<br>Detect undervolta  | v                                                       |               | torque at hos   | t controller     | -          | . –          |  |  |
| n008      |      |                           |            | Detect undervolta                       | <b>°</b>                                                | ,<br>,        |                 |                  | page 6     | -17          |  |  |
| Pn008     |      |                           | 2          | Pn425 (i.e., only i                     | n SERVOP                                                | ÁCK).         |                 |                  |            |              |  |  |
| Pn008     |      |                           |            |                                         |                                                         |               |                 |                  | Deferre    |              |  |  |
| Pn008     | -    |                           | Warning D  | etection Selection                      | on                                                      |               |                 |                  |            | nce          |  |  |
| Pn008     |      | n.0X00                    |            | Detection Selection<br>Detect warnings. | on                                                      |               |                 |                  | Referer    |              |  |  |
| Pn008     | -    | n.OXOO                    | 0          |                                         |                                                         | ept for A.9   | 71.             |                  | page 12    |              |  |  |

Continued from previous 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 | Refe<br>enc |  |  |
|------------------|------|---------------------------|-----------------|----------------------------------------------------------------------------------------|-----------------------------------|-----------------------------|--------------------------------|------------------------------|---------------------|-------------|--|--|
|                  | 2    | Application<br>Selections | n Function<br>9 | 0000h to<br>0121h                                                                      | -                                 | 0010h                       | All                            | After<br>restart             | Tuning              | -           |  |  |
|                  |      | n.🗆 🗆 X                   | Reserved pa     | arameter (Do no                                                                        | t change.                         | )                           |                                |                              |                     |             |  |  |
|                  |      |                           | Current Cor     | trol Mode Seleo                                                                        | ction                             |                             |                                |                              | Refere              | ence        |  |  |
|                  |      |                           |                 | se current contro                                                                      |                                   |                             |                                |                              |                     |             |  |  |
| Pn009            |      | n.00X0                    | 1 • 5           | SERVOPACK Mo<br>3R8A, -5R5A, a<br>SERVOPACK Mo<br>470A, -550A, -5<br>se current contro | nd -7R6A<br>dels SGD<br>590A, and | : Use curre<br>7S-120A,     | ent control mo<br>-180A, -200A | ode 1.<br>A, -330A,          | page 8              | 8-73        |  |  |
|                  |      |                           |                 |                                                                                        |                                   |                             |                                |                              | Defe                |             |  |  |
|                  |      |                           | · ·             | ction Method S                                                                         |                                   |                             |                                |                              | Refere              | ence        |  |  |
|                  |      | n.¤X¤¤                    |                 | se speed detecti<br>se speed detecti                                                   |                                   |                             |                                |                              | – page 8            | 8-70        |  |  |
|                  |      | n.XDDD                    | Posonuod pr     | arameter (Do no                                                                        | t change                          | )                           |                                |                              |                     |             |  |  |
|                  |      | 11.7000                   | neserveu pa     | arameter (D0 no                                                                        | n change.                         | )                           |                                |                              |                     |             |  |  |
|                  |      | Applicatio                | n Function      | 0000h to                                                                               |                                   | 0004                        |                                | After                        | 0.1                 |             |  |  |
|                  | 2    | Selections                |                 | 1244h                                                                                  | -                                 | 0001h                       | All                            | restart                      | Setup               | -           |  |  |
|                  |      |                           |                 |                                                                                        |                                   |                             |                                |                              |                     |             |  |  |
|                  |      |                           | Motor Stop      | ping Method fo                                                                         | r Group 2                         | Alarms                      |                                |                              | Refere              | ence        |  |  |
|                  |      |                           |                 | oply the dynamic opping method                                                         |                                   |                             |                                | op (use the                  |                     |             |  |  |
|                  |      | n.000X                    | 1 th            | ecelerate the mo<br>e maximum torc<br>atus after stopp                                 | jue. Use tł                       | top using t<br>ne setting c | he torque set<br>of Pn001 = n. | : in Pn406 as<br>□□□X for th | е                   |             |  |  |
|                  |      |                           |                 | ecelerate the mo                                                                       |                                   |                             |                                | in Pn406 as                  | s page 5-4          |             |  |  |
|                  |      |                           | 3 Pi            | ecelerate the mo<br>n30A. Use the so<br>opping.                                        |                                   |                             |                                |                              |                     |             |  |  |
|                  |      |                           |                 | ecelerate the mo<br>n30A and then le                                                   |                                   |                             | he decelerati                  | on time set ir               | 1                   |             |  |  |
| Pn00A            |      |                           | Stopping M      | lethod for Force                                                                       | d Stops                           |                             |                                |                              | Refere              | ence        |  |  |
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|                  |      |                           | 3 Pi            | ecelerate the mon<br>n30A. Use the so<br>opping.                                       |                                   |                             |                                |                              |                     |             |  |  |
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|                                            | 2          | 2       Application         n.□□□X       I         n.□□X□       I         n.□□X□       I         1       ·         2       Application         3       ·         1       ·         2       Application         1       ·         1       ·         2       Application         1       ·         2       Application         1       ·         2       Application | 2       Application Function B         Selections B       0         0       0         0       0         1       0         0       1         0       1         0       1         1       2         0       1         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2         1       2 <td>2       Application Function Selections B       0000 to 1121h         2       Application Selections B       0000 to 1121h         0       Display only setup 1       0         1       Display only setup 1       0         1       Display all parameter 00 points to pring Method for 0       0         1       Apply the dynamic stopping method 2       Set the stopping 1         1       Apply the dynamic stopping method 2       Set the stopping 1         1       Use a three-phase 1       Use a three-phase 1         1       Use a three-phase 1       Use a three-phase 1         1       Use a three-phase 1       Use a three-phase 1         1       Use a three-phase 1       Use 3 three-phase 1         1       Use a three-phase 1       Use 3         1       Use a three-phase 1       Use 3         1       Use 20 bits.       0         1       Encoder Resolution for Tes         0       Use 13 bits.       1         1       Use 20 bits.       2         2       Use 22 bits.       3         3       Use 24 bits.       1         1       Use an absolute 4       1         1       Use 24 bits.       2</td> <td>2       Application Function<br/>Selections B       0000 to<br/>1121h       -         n.□□□X       Operator Parameter Display Selection<br/>0       Display only setup parameter<br/>1       Display all parameters.         n.□□X□       Motor Stopping Method for Group 2 /<br/>0       Stop the motor by setting th<br/>1       Apply the dynamic brake or<br/>stopping method with<br/>2         n.□X□□       Power Input Selection for Three-phase<br/>0       Use a three-phase power sup<br/>1         n.□X□□       Reserved parameter (Do not change.)         1       Use a three-phase power sup<br/>supply input.         n.□□DX       Function Function<br/>Selections C       0000h to<br/>0131h         1       Use a three-phase power sup<br/>supply input.         n.□□DX       Function Selection for Test without a moto<br/>1         0       Use a three-phase power sup<br/>supply input.         n.□□DX       Function Selection for Test without a moto<br/>1         0       Use at hree-phase power sup<br/>supply input.         n.□□DX       Function Selection for Test without a<br/>0         0       Use at hree-phase power sup<br/>supply input.         n.□DX       Function Selection for Test without a<br/>0         0       Use at hree-phase power sup<br/>supply input.         n.□DX       Encoder Resolution for Tests without<br/>1         0       Use 20 bits.         2       Use 22 bits.</td> <td>2       Application Function       0000h to<br/>1121h       -       0000h         n.□□□X       0       Display only setup parameters.       0       000h         1       Display all parameters.       1       Display all parameters.       0         n.□□X□       0       Stop the motor by setting the speed re<br/>1       Apply the dynamic brake or coast the r<br/>1       0       0         n.□X□□       Power Input Selection for Three-phase SERVOF<br/>0       Use a three-phase power supply input.       1         n.□X□□       Reserved parameter (Do not change.)       0000h to<br/>0       0       0         n.□□□X       Reserved parameter (Do not change.)       0000h to<br/>0       0       0000h to<br/>0       0000h to<br/>0         n.□□□X       Function Selection for Test without a motor.       1       Encoder Resolution for Tests without a motor.         1       Use 20 bits.       0       0       0       0         0       Use 13 bits.       1       Use 20 bits.       0       0         1       Use 20 bits.       1       Use an absolute encoder.       1         n.□□X□       Reserved parameter (Do not change.)       0       0       Use an absolute encoder.         1       Use 22 bits.       3       02001h       0000h       0</td> <td>2       Application Function       0000h to<br/>1121h       -       0000h       All         n.□□□X       0       Display only setup parameters.       -       0000h       All         0       Display only setup parameters.       1       Display all parameters.       -       0000h       All         0       Display all parameters.       0       Stop the motor by setting the speed reference to 0.       1       Apply the dynamic brake or coast the motor to a stoping method set in Pn001 = n.□□DX.         2       Set the stopping method set in Pn001 = n.□□DX.       2       Set the stoping method set in Pn001 = n.□□DX.         0       Use a three-phase power supply input.       1       Use a three-phase power supply input as a single-ph supply input.         n.X□□□       Reserved parameter (Do not change.)       -       0000h       -         1       Encoder Resolution for Test without a Motor       -       0       0131h       -       0000h       -         1       Use 20 bits.       2       Use 22 bits.       3       Use 24 bits.       -       -         1       Use 20 bits.       2       Use 24 bits.       -       0000h       -       -         1       Use 24 bits.       1       Use 24 bits.       -       -       0000h</td> <td>2       Application Function       0000h to<br/>1121h       -       0000h       All       After<br/>restart         n.□□DX       Operator Parameter Display Selection<br/>0       Display only setup parameters.       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -<td>2       Application Function       0000h to<br/>1121h       -       0000h       All       After restart       Setup         n.□□DX       0       Display only setup parameters.       page 5       page</td></td> | 2       Application Function Selections B       0000 to 1121h         2       Application Selections B       0000 to 1121h         0       Display only setup 1       0         1       Display only setup 1       0         1       Display all parameter 00 points to pring Method for 0       0         1       Apply the dynamic stopping method 2       Set the stopping 1         1       Apply the dynamic stopping method 2       Set the stopping 1         1       Use a three-phase 1       Use a three-phase 1         1       Use a three-phase 1       Use a three-phase 1         1       Use a three-phase 1       Use a three-phase 1         1       Use a three-phase 1       Use 3 three-phase 1         1       Use a three-phase 1       Use 3         1       Use a three-phase 1       Use 3         1       Use 20 bits.       0         1       Encoder Resolution for Tes         0       Use 13 bits.       1         1       Use 20 bits.       2         2       Use 22 bits.       3         3       Use 24 bits.       1         1       Use an absolute 4       1         1       Use 24 bits.       2 | 2       Application Function<br>Selections B       0000 to<br>1121h       -         n.□□□X       Operator Parameter Display Selection<br>0       Display only setup parameter<br>1       Display all parameters.         n.□□X□       Motor Stopping Method for Group 2 /<br>0       Stop the motor by setting th<br>1       Apply the dynamic brake or<br>stopping method with<br>2         n.□X□□       Power Input Selection for Three-phase<br>0       Use a three-phase power sup<br>1         n.□X□□       Reserved parameter (Do not change.)         1       Use a three-phase power sup<br>supply input.         n.□□DX       Function Function<br>Selections C       0000h to<br>0131h         1       Use a three-phase power sup<br>supply input.         n.□□DX       Function Selection for Test without a moto<br>1         0       Use a three-phase power sup<br>supply input.         n.□□DX       Function Selection for Test without a moto<br>1         0       Use at hree-phase power sup<br>supply input.         n.□□DX       Function Selection for Test without a<br>0         0       Use at hree-phase power sup<br>supply input.         n.□DX       Function Selection for Test without a<br>0         0       Use at hree-phase power sup<br>supply input.         n.□DX       Encoder Resolution for Tests without<br>1         0       Use 20 bits.         2       Use 22 bits. | 2       Application Function       0000h to<br>1121h       -       0000h         n.□□□X       0       Display only setup parameters.       0       000h         1       Display all parameters.       1       Display all parameters.       0         n.□□X□       0       Stop the motor by setting the speed re<br>1       Apply the dynamic brake or coast the r<br>1       0       0         n.□X□□       Power Input Selection for Three-phase SERVOF<br>0       Use a three-phase power supply input.       1         n.□X□□       Reserved parameter (Do not change.)       0000h to<br>0       0       0         n.□□□X       Reserved parameter (Do not change.)       0000h to<br>0       0       0000h to<br>0       0000h to<br>0         n.□□□X       Function Selection for Test without a motor.       1       Encoder Resolution for Tests without a motor.         1       Use 20 bits.       0       0       0       0         0       Use 13 bits.       1       Use 20 bits.       0       0         1       Use 20 bits.       1       Use an absolute encoder.       1         n.□□X□       Reserved parameter (Do not change.)       0       0       Use an absolute encoder.         1       Use 22 bits.       3       02001h       0000h       0 | 2       Application Function       0000h to<br>1121h       -       0000h       All         n.□□□X       0       Display only setup parameters.       -       0000h       All         0       Display only setup parameters.       1       Display all parameters.       -       0000h       All         0       Display all parameters.       0       Stop the motor by setting the speed reference to 0.       1       Apply the dynamic brake or coast the motor to a stoping method set in Pn001 = n.□□DX.         2       Set the stopping method set in Pn001 = n.□□DX.       2       Set the stoping method set in Pn001 = n.□□DX.         0       Use a three-phase power supply input.       1       Use a three-phase power supply input as a single-ph supply input.         n.X□□□       Reserved parameter (Do not change.)       -       0000h       -         1       Encoder Resolution for Test without a Motor       -       0       0131h       -       0000h       -         1       Use 20 bits.       2       Use 22 bits.       3       Use 24 bits.       -       -         1       Use 20 bits.       2       Use 24 bits.       -       0000h       -       -         1       Use 24 bits.       1       Use 24 bits.       -       -       0000h | 2       Application Function       0000h to<br>1121h       -       0000h       All       After<br>restart         n.□□DX       Operator Parameter Display Selection<br>0       Display only setup parameters.       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       - <td>2       Application Function       0000h to<br/>1121h       -       0000h       All       After restart       Setup         n.□□DX       0       Display only setup parameters.       page 5       page</td> | 2       Application Function       0000h to<br>1121h       -       0000h       All       After restart       Setup         n.□□DX       0       Display only setup parameters.       page 5       page |

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|                  |      |                          |                                                                                                                                    |                                                                                                                                                                  |                                                                           |                                        |                                                 | tinued from            | promouc                     | puge.                    |
|------------------|------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------|------------------------|-----------------------------|--------------------------|
| 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>Selection | on Function<br>Is F                                                                                                                | 0000h to<br>2011h                                                                                                                                                | -                                                                         | 0000h                                  | All                                             | After<br>restart       | Setup                       | _                        |
|                  |      |                          |                                                                                                                                    | ve Maintenance V                                                                                                                                                 |                                                                           |                                        |                                                 |                        | Referen                     | се                       |
| Pn00F            |      | X                        |                                                                                                                                    | o not detect preve<br>etect preventative                                                                                                                         |                                                                           |                                        | 0                                               |                        | page 9-                     | 17                       |
|                  | n    |                          | Reserved                                                                                                                           | parameter (Do no                                                                                                                                                 | t change.)                                                                | I                                      |                                                 |                        |                             |                          |
|                  | n    |                          | Reserved                                                                                                                           | parameter (Do no                                                                                                                                                 | t change.)                                                                | 1                                      |                                                 |                        |                             |                          |
|                  | n    | .X000                    | Reserved                                                                                                                           | parameter (Do no                                                                                                                                                 | t change.)                                                                |                                        |                                                 |                        |                             |                          |
| Pn021            | 2    | Reserved<br>(Do not d    | d parameter<br>change.)                                                                                                            | -                                                                                                                                                                | _                                                                         | 0000h                                  | All                                             | _                      | _                           | _                        |
| Pn022            | 2    | Reserved<br>not chan     | d parameter (E<br>ge.)                                                                                                             | - 00                                                                                                                                                             | -                                                                         | 0000h                                  | All                                             | -                      | -                           | -                        |
|                  | 2    | Σ-V Com<br>tion Swit     | patible Func-<br>ch                                                                                                                | 0000h to<br>2111h                                                                                                                                                | -                                                                         | 0000h                                  | _                                               | After<br>restart       | Setup                       | _                        |
|                  | -    |                          | Communica                                                                                                                          | tions Interface Co                                                                                                                                               |                                                                           | Applica<br>Moto                        |                                                 |                        |                             |                          |
|                  | n.l  |                          | 0 Pe                                                                                                                               | erform Σ-7 commu<br>erform Σ-V commu                                                                                                                             | inications.                                                               | -                                      |                                                 |                        | - All                       | rs                       |
| Pn040            | _    |                          | Applica                                                                                                                            | hle                                                                                                                                                              |                                                                           |                                        |                                                 |                        |                             |                          |
|                  | n I  |                          |                                                                                                                                    | solution Compatil                                                                                                                                                |                                                                           |                                        | cted motor                                      |                        | Motor                       |                          |
|                  |      |                          | 1 Us                                                                                                                               | e a resolution of 2<br>GM7A, SGM7P, SC                                                                                                                           | 20 bits wh                                                                | en connec                              | ted to an SGI                                   |                        | Rotar                       | У                        |
|                  | n.l  |                          | Reserved pa                                                                                                                        | arameter (Do not                                                                                                                                                 | change.)                                                                  |                                        |                                                 |                        |                             |                          |
|                  | n.)  |                          | Reserved pa                                                                                                                        | arameter (Do not                                                                                                                                                 | change.)                                                                  |                                        |                                                 |                        |                             |                          |
|                  |      |                          |                                                                                                                                    |                                                                                                                                                                  |                                                                           |                                        |                                                 |                        |                             |                          |
|                  | 2    | Application<br>Selection | on Function<br>is 80                                                                                                               | 0000h to<br>1111h                                                                                                                                                | -                                                                         | 0000h                                  | Linear                                          | After<br>restart       | Setup                       | -                        |
|                  | 2    |                          | ıs 80                                                                                                                              | 1111h                                                                                                                                                            | _                                                                         | 0000h                                  | Linear                                          |                        |                             | -                        |
|                  | _    |                          | Polarity Se                                                                                                                        | 1111h nsor Selection Jse polarity sensor                                                                                                                         |                                                                           | 0000h                                  | Linear                                          |                        | Setup Refere page 5         |                          |
|                  | _    | Selection                | Polarity Se                                                                                                                        | 1111h<br>nsor Selection                                                                                                                                          | sensor.                                                                   | 0000h                                  | Linear                                          |                        | Refere                      | -25                      |
| Pn080            |      | Selection                | Polarity Se<br>0 L<br>1 D<br>Motor Pha<br>0 S                                                                                      | 1111h<br>nsor Selection<br>Jse polarity sensor<br>to not use polarity<br>se Sequence Sele<br>Set a phase-A lead                                                  | sensor.<br>ection<br>l as a phas                                          | se sequenc                             | ce of U, V, an                                  | d W.                   | Refere                      | -25<br>nce               |
| Pn080            | n    | Selection                | Polarity Set           0         L           1         L           Motor Pha         0           0         S           1         S | 1111h<br>nsor Selection<br>Use polarity sensor<br>Do not use polarity<br>se Sequence Selection                                                                   | ection<br>as a phas<br>as a phas                                          | se sequend                             | ce of U, V, an                                  | d W.                   | Refere page 5 Refere        | -25<br>nce               |
| Pn080            | n    |                          | Polarity Se<br>0 L<br>1 C<br>Motor Pha<br>0 S<br>1 S<br>Reserved p                                                                 | 1111h<br>nsor Selection<br>Use polarity sensor<br>Do not use polarity<br>se Sequence Selection<br>Set a phase-A lead<br>Set a phase-B lead<br>Doarameter (Do not | sensor.<br>ection<br>l as a phas<br>l as a phas<br>t change.)             | se sequenc                             | ce of U, V, an<br>ce of U, V, an                | d W.<br>d W.           | Refere page 5 Refere page 5 | -25<br>nce<br>-23        |
| Pn080            | n    |                          | NS 80<br>Polarity Se<br>0 L<br>1 E<br>Motor Pha<br>0 S<br>1 S<br>Reserved p<br>Calculation<br>0 C                                  | 1111h nsor Selection Use polarity sensor to not use polarity se Sequence Sele te a phase-A lead tet a phase-B lead                                               | sensor.<br>ection<br>I as a pha:<br>I as a pha:<br>t change.)<br>imum Spe | se sequend<br>se sequend<br>sed or Enc | ce of U, V, an<br>ce of U, V, an<br>oder Output | d W.<br>d W.<br>Pulses | Refere page 5 Refere        | -25<br>nce<br>-23<br>nce |

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|                  |                                            |                                             |                                              |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    | Cont                 | inued from       | previou             | s 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 |
|                  | 2                                          | Application<br>Selections                   | n Function<br>81                             |              | 0000h to<br>1111h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -               | 0000h              | All                  | After<br>restart | Setup               | page<br>6-22   |
|                  |                                            | I                                           |                                              |              | I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                    | 11                   |                  |                     |                |
|                  |                                            |                                             | Phase-C                                      | Puls         | se Output Sele                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ection          |                    |                      |                  |                     |                |
|                  | r                                          | 1.000X                                      | 0                                            |              | put phase-C p                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ,               |                    |                      |                  |                     |                |
| Pn081            |                                            |                                             | 1                                            |              | put phase-C p                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                    | ward and reve        | rse direction    | IS.                 |                |
|                  | 1 3                                        | n.00X0                                      |                                              |              | ameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                    |                      |                  |                     |                |
|                  |                                            | n.0X00                                      | -                                            |              | ameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | ,<br>              |                      |                  |                     |                |
|                  | r                                          | n.X000                                      | Reserved parameter (Do not change.)          |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     |                |
| D=100            |                                            | Creative                                    |                                              |              | 10 += 00 000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.1.1           | 400                | A.II.                | Immedi-          | Tursiana            | page           |
| Pn100            | 2                                          | Speed Loo                                   | •                                            |              | 10 to 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.1 Hz          | 400                | All                  | ately<br>Immedi- | Tuning              | page<br>8-81   |
| Pn101            | 2                                          | Time Cons                                   |                                              |              | 15 to 51,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.01 ms         | 2000               | All                  | ately            | Tuning              | page<br>8-81   |
| Pn102            | 2                                          | Position Lo                                 | oop Gain                                     |              | 10 to 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.1/s           | 400                | All                  | Immedi-<br>ately | Tuning              | page<br>8-81   |
| Pn103            | 2                                          | Moment o                                    | f Inertia Ra                                 | atio         | 0 to 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1%              | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-81   |
| Pn104            | 2                                          | Second Sp<br>Gain                           | beed Loop                                    | )            | 10 to 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.1 Hz          | 400                | All                  | Immedi-<br>ately | Tuning              | page<br>8-66   |
| Pn105            | 2                                          | Second Speed Loop<br>Integral Time Constant |                                              | 15 to 51,200 | 0.01 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2000            | All                | Immedi-<br>ately     | Tuning           | page<br>8-66        |                |
| Pn106            | 2                                          | Gain                                        |                                              | 10 to 20,000 | 0.1/s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 400             | All                | Immedi-<br>ately     | Tuning           | page<br>8-66        |                |
| Pn109            | 2                                          |                                             |                                              | 0 to 100     | 1%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0               | All                | Immedi-<br>ately     | Tuning           | page<br>8-91        |                |
| Pn10A            | 2                                          | Constant                                    |                                              |              | 0 to 6,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.01 ms         | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-91   |
|                  | 2                                          | Gain Appli<br>tions                         | cation Sel                                   | ec-          | 0000h to<br>5334h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | _               | 0000h              | All                  | _                | Setup               | _              |
|                  | Ι_                                         |                                             |                                              |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     |                |
|                  |                                            |                                             | Mode Sv                                      | vitch        | ching Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  | Refere              | ence           |
|                  |                                            |                                             | 0                                            |              | Jse the internal torque reference as the condition level setting: Pn10C).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                    |                      |                  |                     |                |
|                  |                                            |                                             |                                              |              | the speed refe<br>: Pn10D).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | erence as       | the condit         | ion (level set-      |                  |                     |                |
|                  |                                            |                                             | 1                                            | Use          | the speed refe<br>Phi Phi Phi Phi Phi Phi Phi Phi Phi Phi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | erence as       | the condit         | ion (level set-      | _                |                     |                |
|                  | ſ                                          | n.000X                                      |                                              | Use          | the acceleration the ac | on referen      | ce as the o        | condition (leve      | Immedi-<br>ately | page 8              | 3-92           |
| D 40D            |                                            |                                             | 2                                            | Use          | the acceleration the ac | on referen      | ce as the o        | condition (leve      |                  |                     |                |
| Pn10B            |                                            |                                             | 3                                            | Use          | the position d<br>Pn10F).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | eviation as     | s the cond         | ition (level set-    |                  |                     |                |
|                  |                                            |                                             | 4                                            | -            | not use mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | switching.      |                    |                      |                  |                     |                |
|                  |                                            |                                             | Speed L                                      | goo          | Control Metho                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | d               |                    |                      | When             | Refere              | ence           |
|                  |                                            | n.00X0                                      | 0                                            |              | control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                    |                      | Enabled          |                     |                |
|                  |                                            |                                             | 1                                            |              | control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                    |                      | After            | page 8              | 8-87           |
|                  |                                            |                                             | 2 and 3 Reserved parameters (Do not change.) |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    | )                    | restart          |                     |                |
|                  | r                                          | n.0X00                                      | Reserve                                      | d par        | ameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ot change.      | )                  |                      |                  |                     |                |
|                  | n.XDDD Reserved parameter (Do not change.) |                                             |                                              |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     |                |
|                  | r                                          | 1.X000                                      | Reserve                                      | d par        | ameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | t change.       | )                  |                      |                  |                     |                |

| 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                |
|------------------|------|------------------------------------------------|----------------------|----------------------------|--------------------|----------------------|------------------|---------------------|-------------------------------|
| Pn10C            | 2    | Mode Switching Level<br>for Torque Reference   | 0 to 800             | 1%                         | 200                | All                  | Immedi-<br>ately | Tuning              | page<br>8-92                  |
| Pn10D            | 2    | Mode Switching Level<br>for Speed Reference    | 0 to 10,000          | 1 min <sup>-1</sup>        | 0                  | Rotary               | Immedi-<br>ately | Tuning              | page<br>8-92                  |
| Pn10E            | 2    | Mode Switching Level<br>for Acceleration       | 0 to 30,000          | 1 min <sup>-1</sup> /<br>s | 0                  | Rotary               | Immedi-<br>ately | Tuning              | page<br>8-92                  |
| Pn10F            | 2    | Mode Switching Level<br>for Position Deviation | 0 to 10,000          | 1 refer-<br>ence<br>unit   | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-92                  |
| Pn11F            | 2    | Position Integral Time<br>Constant             | 0 to 50,000          | 0.1 ms                     | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-94                  |
| Pn121            | 2    | Friction Compensation<br>Gain                  | 10 to 1,000          | 1%                         | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-66,<br>page<br>8-70 |
| Pn122            | 2    | Second Friction Com-<br>pensation Gain         | 10 to 1,000          | 1%                         | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-66,<br>page<br>8-70 |
| Pn123            | 2    | Friction Compensation<br>Coefficient           | 0 to 100             | 1%                         | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-70                  |
| Pn124            | 2    | Friction Compensation<br>Frequency Correction  | -10,000 to<br>10,000 | 0.1 Hz                     | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-70                  |
| Pn125            | 2    | Friction Compensation<br>Gain Correction       | 1 to 1,000           | 1%                         | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-70                  |
| Pn131            | 2    | Gain Switching Time 1                          | 0 to 65,535          | 1 ms                       | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-66                  |
| Pn132            | 2    | Gain Switching Time 2                          | 0 to 65,535          | 1 ms                       | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-66                  |
| Pn135            | 2    | Gain Switching Waiting<br>Time 1               | 0 to 65,535          | 1 ms                       | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-66                  |
| Pn136            | 2    | Gain Switching Waiting<br>Time 2               | 0 to 65,535          | 1 ms                       | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-66                  |
|                  | 2    | Automatic Gain Switch-<br>ing Selections 1     | 0000h to<br>0052h    | -                          | 0000h              | All                  | Immedi-<br>ately | Tuning              | page<br>8-66                  |

|       |                                              |            | Gain Sw   |                                                                                                                                                                                                                                      |                                                        |              |                |                  |            |              |  |  |
|-------|----------------------------------------------|------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------|----------------|------------------|------------|--------------|--|--|
|       |                                              |            | 0         | Use manual gain s<br>The gain is switch<br>nals (SVCMD_IO).                                                                                                                                                                          | ed manua                                               | lly with G-8 | SEL in the ser | vo commano       | d output s | ig-          |  |  |
|       | n.DDDX 1 Reserved parameter (Do not change.) |            |           |                                                                                                                                                                                                                                      |                                                        |              |                |                  |            |              |  |  |
|       |                                              |            | 2         | Use automatic gain switching pattern 1.<br>The gain settings 1 switch automatically to 2 when?switching condition A is<br>satisfied. The gain settings 2 switch automatically to 1 when switching condi-<br>tion A is not?satisfied. |                                                        |              |                |                  |            |              |  |  |
| Pn139 |                                              |            | Gain Sw   | tching Condition A                                                                                                                                                                                                                   | 4                                                      |              |                |                  |            |              |  |  |
|       |                                              |            | 0         | /COIN (Positioning                                                                                                                                                                                                                   | /COIN (Positioning Completion Output) signal turns ON. |              |                |                  |            |              |  |  |
|       |                                              |            | 1         | /COIN (Positioning Completion Output) signal turns OFF.                                                                                                                                                                              |                                                        |              |                |                  |            |              |  |  |
|       |                                              | n.□□X□     | 2         | /NEAR (Near Output) signal turns ON.                                                                                                                                                                                                 |                                                        |              |                |                  |            |              |  |  |
|       |                                              |            | 3         | /NEAR (Near Output) signal turns OFF.                                                                                                                                                                                                |                                                        |              |                |                  |            |              |  |  |
|       |                                              |            | 4         | Position reference                                                                                                                                                                                                                   | filter outp                                            | ut is 0 and  | position refe  | rence input i    | s OFF.     |              |  |  |
|       |                                              |            | 5         | Position reference                                                                                                                                                                                                                   | input is C                                             | N.           |                |                  |            |              |  |  |
|       |                                              | n.¤X¤¤     | Reserved  | d parameter (Do no                                                                                                                                                                                                                   | ot change                                              | )            |                |                  |            |              |  |  |
|       |                                              | n.XDDD     | Reserved  | d parameter (Do no                                                                                                                                                                                                                   | ot change                                              | )            |                |                  |            |              |  |  |
|       | -                                            |            | -         | . ,                                                                                                                                                                                                                                  |                                                        |              |                |                  |            |              |  |  |
| Pn13D | 2                                            | Current Ga | ain Level | 100 to 2,000                                                                                                                                                                                                                         | 1%                                                     | 2000         | All            | Immedi-<br>ately | Tuning     | page<br>8-74 |  |  |

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|                  |                                                            |                          | Continued 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 |
|                  | 2                                                          | Model Fol                | llowing Co<br>ed Selectic                                                          | n-<br>ons | 0000h to<br>1121h                                      | -                                                                                                                | 0100h              | All                  | Immedi-<br>ately | Tuning              | _              |
|                  | _                                                          | 1                        | Madal                                                                              | - 11      |                                                        |                                                                                                                  | <u> </u>           | L                    |                  | Deferre             |                |
|                  | n                                                          | .000X                    |                                                                                    | 1         | ing Control Sel                                        |                                                                                                                  | control            |                      |                  | Refere              | nce            |
|                  |                                                            |                          | 0     Do not use model following control.       1     Use model following control. |           |                                                        |                                                                                                                  |                    |                      | – page 8         | -88                 |                |
|                  |                                                            |                          | Vibration                                                                          | auS i     | pression Selec                                         | tion                                                                                                             |                    |                      |                  | Refere              | nce            |
|                  |                                                            |                          | 0                                                                                  | -         | not perform vib                                        |                                                                                                                  | pression.          |                      |                  |                     |                |
|                  | n                                                          |                          | 1                                                                                  | Perf      | orm vibration s                                        | uppressio                                                                                                        | n for a spe        | cific frequenc       | cy.              | page 8              | -88            |
|                  |                                                            |                          | 2                                                                                  | Perf      | orm vibration s                                        | uppressio                                                                                                        | n for two s        | pecific freque       | encies.          |                     |                |
| Pn140            | Vibration Suppression Adjustment Se                        |                          |                                                                                    |           |                                                        |                                                                                                                  |                    |                      |                  | Refere              | nce            |
|                  | n                                                          | .0X00                    | 0                                                                                  | tion      | not adjust vibra<br>of autotuning v<br>rence, and cust | vithout a h                                                                                                      | lost referer       |                      |                  | t<br>— page 8       | 2-32           |
|                  |                                                            |                          | 1                                                                                  | auto      |                                                        | suppression automatically during execution of<br>ut a host reference, autotuning with a host refer-<br>m tuning. |                    |                      |                  |                     |                |
|                  | Speed Feedforward (VFF)/Torque Feedforward (TFF) Selection |                          |                                                                                    |           |                                                        |                                                                                                                  |                    |                      |                  | Refere              | nce            |
|                  | n                                                          | .X000                    | 0                                                                                  | Do r      | not use model f<br>ether.                              |                                                                                                                  |                    |                      |                  | d page 8            | -33            |
|                  |                                                            |                          | 1                                                                                  |           | model followin<br>ther.                                | g control :                                                                                                      | and speed          | /torque feedfo       | orward           | page 8              |                |
| Pn141            | 2                                                          | Model Fol<br>trol Gain   | llowing Co                                                                         | n-        | 10 to 20,000                                           | 0.1/s                                                                                                            | 500                | All                  | Immedi-<br>ately | Tuning              | page<br>8-88   |
| Pn142            | 2                                                          | Model Fol<br>trol Gain ( | llowing Co<br>Correction                                                           | n-        | 500 to 2,000                                           | 0.1%                                                                                                             | 1000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-66   |
| Pn143            | 2                                                          |                          | llowing Co<br>n the Forw                                                           |           | 0 to 10,000                                            | 0.1%                                                                                                             | 1000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-88   |
| Pn144            | 2                                                          |                          | llowing Co<br>n the Reve                                                           |           | 0 to 10,000                                            | 0.1%                                                                                                             | 1000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-88   |
| Pn145            | 2                                                          | Vibration<br>Frequency   | Suppressio<br>y A                                                                  | on 1      | 10 to 2,500                                            | 0.1 Hz                                                                                                           | 500                | All                  | Immedi-<br>ately | Tuning              | page<br>8-59   |
| Pn146            | 2                                                          | Vibration<br>Frequence   | Suppressio<br>y B                                                                  | on 1      | 10 to 2,500                                            | 0.1 Hz                                                                                                           | 700                | All                  | Immedi-<br>ately | Tuning              | page<br>8-59   |
| Pn147            | 2                                                          |                          | llowing Co<br>d Feedforw<br>ation                                                  |           | 0 to 10,000                                            | 0.1%                                                                                                             | 1000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-88   |
| Pn148            | 2                                                          | Second M<br>ing Contro   | lodel Follo<br>ol Gain                                                             | W-        | 10 to 20,000                                           | 0.1/s                                                                                                            | 500                | All                  | Immedi-<br>ately | Tuning              | page<br>8-66   |
| Pn149            | 2                                                          |                          | lodel Follo<br>ol Gain Co                                                          |           | 500 to 2,000                                           | 0.1%                                                                                                             | 1000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-66   |
| Pn14A            | 2                                                          | Vibration<br>Frequency   | Suppressio<br>y                                                                    | on 2      | 10 to 2,000                                            | 0.1 Hz                                                                                                           | 800                | All                  | Immedi-<br>ately | Tuning              | page<br>8-59   |
| Pn14B            | 2                                                          | Vibration<br>Correction  | Suppression                                                                        | on 2      | 10 to 1,000                                            | 1%                                                                                                               | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-59   |

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|------------------|---------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No. | Size                                        | Ν                                                                                           | Name                                  | Setting<br>Range                                                                                                                                                         | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|                  | 2                                           | Control-Re<br>tions                                                                         | elated Selec-                         | 0000h to<br>0021h                                                                                                                                                        | -               | 0021h              | All                  | After<br>restart | Tuning              | Ι              |
|                  |                                             |                                                                                             |                                       |                                                                                                                                                                          |                 |                    |                      |                  |                     |                |
|                  | 1                                           |                                                                                             | Model Follo                           | wing Control Ty                                                                                                                                                          | pe Select       | ion                |                      |                  | Refere              | nce            |
|                  |                                             | n.000X                                                                                      | 0 U:                                  | se model followir                                                                                                                                                        | ng control      | type 1.            |                      |                  | page 8-91           |                |
|                  |                                             |                                                                                             | 1 Use model following control type 2. |                                                                                                                                                                          |                 |                    |                      |                  |                     | 5-91           |
| Pn14F            |                                             |                                                                                             | Tuning-less                           | Type Selection                                                                                                                                                           |                 |                    |                      |                  | Refere              | nce            |
|                  |                                             | n.□□X□                                                                                      | 0 U:                                  | se tuning-less ty                                                                                                                                                        | pe 1.           |                    |                      |                  |                     |                |
|                  |                                             |                                                                                             | 1 U:                                  | se tuning-less ty                                                                                                                                                        | pe 2.           |                    |                      |                  | page 8              | 8-13           |
|                  |                                             |                                                                                             | 2 U:                                  | se tuning-less ty                                                                                                                                                        | pe 3.           |                    |                      |                  |                     |                |
|                  |                                             | n.¤X¤¤                                                                                      | Reserved p                            | arameter (Do no                                                                                                                                                          | ot change.      | )                  |                      |                  |                     |                |
|                  | 1                                           | n.X000                                                                                      | Reserved p                            | arameter (Do no                                                                                                                                                          | ot change.      | )                  |                      |                  |                     |                |
|                  |                                             |                                                                                             |                                       |                                                                                                                                                                          |                 |                    |                      |                  |                     |                |
|                  | 2                                           |                                                                                             | nance Con-<br>ed Selections           | 0000h to<br>0011h                                                                                                                                                        | _               | 0010h              | All                  | Immedi-<br>ately | Tuning              | -              |
|                  |                                             |                                                                                             |                                       |                                                                                                                                                                          |                 |                    |                      | utoly            |                     |                |
|                  | _                                           |                                                                                             |                                       |                                                                                                                                                                          |                 |                    |                      |                  |                     | _              |
|                  |                                             |                                                                                             |                                       | nce Control Sel                                                                                                                                                          |                 |                    |                      |                  | Referen             | nce            |
|                  | r                                           | n.□□□X     0     Do not use anti-resonance control.       1     Use anti-resonance control. |                                       |                                                                                                                                                                          |                 |                    |                      |                  |                     | -51            |
|                  |                                             |                                                                                             |                                       |                                                                                                                                                                          |                 |                    |                      |                  |                     |                |
|                  | Anti-Resonance Control Adjustment Selection |                                                                                             |                                       |                                                                                                                                                                          |                 |                    |                      |                  | Referen             | nce            |
| Pn160            |                                             |                                                                                             | 0 tio                                 | Do not adjust anti-resonance control automatically during execu-<br>tion of autotuning without a host reference, autotuning with a host<br>reference, and custom tuning. |                 |                    |                      |                  |                     |                |
|                  | r                                           | 1.00X0                                                                                      |                                       |                                                                                                                                                                          |                 |                    |                      |                  | page 8              | -32            |
|                  |                                             |                                                                                             |                                       | ljust anti-resonar<br>totuning without                                                                                                                                   |                 |                    |                      |                  |                     |                |
|                  | _                                           |                                                                                             |                                       | ce, and custom                                                                                                                                                           |                 | ,                  | 3                    |                  |                     |                |
|                  | r                                           | 1.0X00                                                                                      | Reserved pa                           | arameter (Do not                                                                                                                                                         | t change.)      |                    |                      |                  |                     |                |
|                  | r                                           | n.X000                                                                                      | Reserved pa                           | arameter (Do not                                                                                                                                                         | t change.)      |                    |                      |                  |                     |                |
|                  |                                             |                                                                                             | · · · ·                               |                                                                                                                                                                          |                 |                    |                      |                  |                     |                |
| Pn161            | 2                                           | Anti-Reso<br>quency                                                                         | nance Fre-                            | 10 to 20,000                                                                                                                                                             | 0.1 Hz          | 1000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-51   |
| Pn162            | 2                                           |                                                                                             | nance Gain                            | 1 to 1,000                                                                                                                                                               | 1%              | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-51   |
| Pn163            | 2                                           | Anti-Reso<br>ing Gain                                                                       | nance Damp-                           | 0 to 300                                                                                                                                                                 | 1%              | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-51   |
| Pn164            | 2                                           |                                                                                             | nance Filter<br>stant 1 Cor-          | -1,000 to<br>1,000                                                                                                                                                       | 0.01 ms         | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-51   |
| Pn165            | 2                                           |                                                                                             | nance Filter<br>stant 2 Cor-          | -1,000 to<br>1,000                                                                                                                                                       | 0.01 ms         | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-51   |
|                  |                                             | Anti-Reso                                                                                   | nance Damp-                           | 0 to 1,000                                                                                                                                                               | 1%              | 0                  | All                  | Immedi-          | Tuning              | page           |

Continued on next page.

| No.         Nome         Range         Unit         Setting         Motors         Enabled         fid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Classi-<br>ication<br>Setup<br>When<br>Enable<br>After<br>restar<br>When<br>Enable<br>Mhen<br>Enable<br>Immec<br>ately | ed<br>r<br>rt<br>ed<br>r<br>rt<br>ed               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| 2       Tuning-less Function-<br>Related Selections       0000h to<br>2711h       -       1401h       All       -       s         n.□□□X       Tuning-less Selection<br>0       Disable tuning-less function.       1       Enable tuning-less function.       1       Use for speed control.       1       Use for speed control.       1       Use for speed control and use host controller for position control.       1       Use for speed control and use host controller for position control.       1       Use for speed control and use host controller for position control.       1       0 to 7       Set the rigidity level.       1       1       Use for speed control and use host controller for position control.       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1                                                                                                                                                                                 | When<br>Enable<br>After<br>restan<br>Enable<br>After<br>restan<br>When<br>Enable<br>Immed                              | n<br>ed<br>r<br>rt<br>ed<br>r<br>r<br>r<br>t<br>ed |
| Image: Pn170       Tuning-less Selection         0       Disable tuning-less function.         1       Enable tuning-less function.         1       Enable tuning-less function.         0       Use for speed control.         0       Use for speed control.         1       Use for speed control.         1       Use for speed control and use host controller for position control.         Rigidity Level       O to 7       Set the rigidity level.         Tuning-less Load Level       Tuning-less Load Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Enable<br>After<br>restar<br>When<br>Enable<br>When<br>Enable                                                          | n<br>ed<br>r<br>rt<br>ed<br>r<br>r<br>r<br>t<br>ed |
| n.□□□X       0       Disable tuning-less function.         1       Enable tuning-less function.         n.□□X□       0       Use for speed control.         0       Use for speed control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host control | Enable<br>After<br>restar<br>When<br>Enable<br>When<br>Enable                                                          | ed<br>r<br>rt<br>ed<br>r<br>rt<br>ed               |
| Pn170       0       Disable tuning-less function.         1       Enable tuning-less function.         1       Enable tuning-less function.         0       Use for speed control.         1       Use for speed control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         1       0 to 7         Set the rigidity level.         Tuning-less Load Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | After<br>restai<br>When<br>Enable<br>After<br>restai<br>When<br>Enable<br>Immed                                        | r<br>rt<br>ed<br>r<br>rt<br>ed                     |
| Pn170       Speed Control Method         0       Use for speed control.         1       Use for speed control and use host controller for position control.         n.□X□□       Rigidity Level         0       to 7         Set the rigidity level.         Tuning-less Load Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | When<br>Enable<br>After<br>restar<br>When<br>Enable<br>Immed                                                           | n<br>ed<br>r<br>rt<br>n<br>ed                      |
| Pn170          n.□X□       0       Use for speed control.         0       Use for speed control and use host controller for position control.         1       Use for speed control and use host controller for position control.         n.□X□□       Rigidity Level         0       to 7         Set the rigidity level.         Tuning-less Load Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Enable<br>After<br>restar<br>When<br>Enable                                                                            | ed<br>r<br>rt<br>n<br>ed                           |
| Pn170     0     Use for speed control.       1     Use for speed control and use host controller for position control.       n.□X□□     Rigidity Level       0 to 7     Set the rigidity level.       Tuning-less Load Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | When<br>Enable                                                                                                         | n<br>ed                                            |
| n.□X□□<br>0 to 7 Set the rigidity level.<br>Tuning-less Load Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Enable                                                                                                                 | ed                                                 |
| n.□X□□<br>0 to 7 Set the rigidity level.<br>Tuning-less Load Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Enable                                                                                                                 | ed                                                 |
| Tuning-less Load Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                        | u-                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                        | /                                                  |
| n.XDDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Wher<br>Enable                                                                                                         |                                                    |
| 0 to 2 Set the load level for the tuning-less function.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Immed                                                                                                                  | di-                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | atery                                                                                                                  | /                                                  |
| Pn181     2     Mode Switching Level<br>for Speed Reference     0 to 10,000     1 mm/s     0     Linear     Immedi-<br>ately     T                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Tuning                                                                                                                 | page<br>8-92                                       |
| Mode Switching Level 1 mm/                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Tuning                                                                                                                 | page<br>8-92                                       |
| Pn205         2         Multiturn Limit         0 to 65,535         1 rev         65535         Rotary         After restart         S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Setup                                                                                                                  | page<br>6-39                                       |
| 2     Position Control Func-<br>tion Selections     0000h to<br>2210h     -     0010h     All     After<br>restart     S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Setup                                                                                                                  | -                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                        |                                                    |
| n.DDDX Reserved parameter (Do not change.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                        |                                                    |
| n.□□X□ Reserved parameter (Do not change.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                        |                                                    |
| n.□X□□ Reserved parameter (Do not change.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                        |                                                    |
| Pn207 /COIN (Positioning Completion Output) Signal Output Timing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Refei<br>ence                                                                                                          |                                                    |
| 0 Output when the absolute value of the position deviation is the same or less than the setting of Pn522 (Positioning Completed Width).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                        |                                                    |
| n.XDDD<br>Output when the absolute value of the position error is the same<br>or less than the setting of Pn522 (Positioning Completed Width)<br>and the reference after the position reference filter is 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | page 6                                                                                                                 | -13                                                |
| 2 Output when the absolute value of the position error is the same<br>or less than the setting of Pn522 (Positioning Completed Width)<br>and the reference input is 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | -                                                                                                                      |                                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1                                                                                                                      |                                                    |
| 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     S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Setup                                                                                                                  | page<br>10-7                                       |
| Electronic Gear Ratio 1 to After                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Setup                                                                                                                  | page<br>5-45                                       |
| Electropic Gear Ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Setup                                                                                                                  | page<br>5-45                                       |
| Number of Encoder 16 to After                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Setup                                                                                                                  | page<br>6-25                                       |

| Continued  | from | previous | page. |
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| 0011111000 |      | proviouo | page. |

|                                           |                                                                                        |                                                                                                                                                                                                      |                                                                                                                                    |                                                                                             |                                                                                                                                                      |                               |                                       | tinued from                                                                                                          | promotio                                           | 1                                                                         |  |
|-------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|---------------------------------------------------------------------------|--|
| 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                                                            |  |
| Pn22A                                     | 2                                                                                      | Fully-closed Control<br>Selections                                                                                                                                                                   |                                                                                                                                    | 0000h to<br>1003h                                                                           | _                                                                                                                                                    | 0000h                         | Rotary                                | After<br>restart                                                                                                     | Setup                                              | page<br>10-9                                                              |  |
|                                           |                                                                                        | n.DDDX Reserved parameter (Do not change.)                                                                                                                                                           |                                                                                                                                    |                                                                                             |                                                                                                                                                      |                               |                                       |                                                                                                                      |                                                    |                                                                           |  |
|                                           |                                                                                        | n.DDXD                                                                                                                                                                                               | XD Reserved parameter (Do not change.)                                                                                             |                                                                                             |                                                                                                                                                      |                               |                                       |                                                                                                                      |                                                    |                                                                           |  |
|                                           |                                                                                        |                                                                                                                                                                                                      |                                                                                                                                    |                                                                                             |                                                                                                                                                      |                               |                                       |                                                                                                                      |                                                    |                                                                           |  |
|                                           |                                                                                        | n.XOOO                                                                                                                                                                                               | Fully-closed Control Speed Feedback Selection         0       Use motor encoder speed.         1       Use external encoder speed. |                                                                                             |                                                                                                                                                      |                               |                                       |                                                                                                                      |                                                    |                                                                           |  |
| Pn230                                     | 2                                                                                      | Position Co<br>sion Funct                                                                                                                                                                            | ontrol Expan-<br>on Selections                                                                                                     | 0000h to<br>0001h                                                                           | -                                                                                                                                                    | 0000h                         | All                                   | After<br>restart                                                                                                     | Setup                                              | page<br>8-75                                                              |  |
|                                           |                                                                                        | Backlash Compensation Direction         0       Compensate forward references.         1       Compensate reverse references.                                                                        |                                                                                                                                    |                                                                                             |                                                                                                                                                      |                               |                                       |                                                                                                                      |                                                    |                                                                           |  |
|                                           | n.<br>N.<br>Reserved parameter (Do not change.)<br>Reserved parameter (Do not change.) |                                                                                                                                                                                                      |                                                                                                                                    |                                                                                             |                                                                                                                                                      |                               |                                       |                                                                                                                      |                                                    |                                                                           |  |
|                                           | n.□X□□ Reserved parameter (Do not change.)                                             |                                                                                                                                                                                                      |                                                                                                                                    |                                                                                             |                                                                                                                                                      |                               |                                       |                                                                                                                      |                                                    |                                                                           |  |
|                                           | n.XDDD Reserved parameter (Do not change.)                                             |                                                                                                                                                                                                      |                                                                                                                                    |                                                                                             |                                                                                                                                                      |                               |                                       |                                                                                                                      |                                                    |                                                                           |  |
| Pn231                                     | 4                                                                                      | Backlash Compensation                                                                                                                                                                                |                                                                                                                                    | -500,000 to                                                                                 | 0.1 ref-<br>erence                                                                                                                                   | _                             | All                                   | Immedi-                                                                                                              | Catur                                              | page                                                                      |  |
|                                           |                                                                                        |                                                                                                                                                                                                      | Joinponoation                                                                                                                      | 500,000                                                                                     | units                                                                                                                                                | 0                             | All                                   | ately                                                                                                                | Setup                                              | 8-75                                                                      |  |
| Pn233                                     | 2                                                                                      | Backlash (<br>tion Time (                                                                                                                                                                            | Compensa-                                                                                                                          | 500,000<br>0 to 65,535                                                                      |                                                                                                                                                      | 0                             | All                                   | ately<br>Immedi-<br>ately                                                                                            | Setup                                              | 8-75<br>page<br>8-76                                                      |  |
| Pn233<br>Pn281                            | 2                                                                                      | Backlash (<br>tion Time (                                                                                                                                                                            | Compensa-                                                                                                                          | ,                                                                                           | units                                                                                                                                                |                               |                                       | Immedi-                                                                                                              |                                                    | 8-75                                                                      |  |
|                                           |                                                                                        | Backlash (<br>tion Time (<br>Encoder O                                                                                                                                                               | Compensa-<br>Constant<br>utput Resolu-                                                                                             | 0 to 65,535                                                                                 | units<br>0.01 ms<br>1 edge/                                                                                                                          | 0                             | All                                   | Immedi-<br>ately<br>After                                                                                            | Setup                                              | 8-75<br>page<br>8-76<br>page                                              |  |
| Pn281                                     | 2                                                                                      | Backlash (<br>tion Time (<br>Encoder O<br>tion<br>Linear Enc                                                                                                                                         | Compensa-<br>Constant<br>utput Resolu-<br>oder Scale                                                                               | 0 to 65,535<br>1 to 4,096<br>0 to                                                           | units<br>0.01 ms<br>1 edge/<br>pitch<br>0.01                                                                                                         | 0 20                          | All                                   | Immedi-<br>ately<br>After<br>restart<br>After                                                                        | Setup<br>Setup                                     | 8-75<br>page<br>8-76<br>page<br>6-26<br>page                              |  |
| Pn281<br>Pn282                            | 2                                                                                      | Backlash (<br>tion Time (<br>Encoder O<br>tion<br>Linear Enc<br>Pitch<br>Jogging St                                                                                                                  | Compensa-<br>Constant<br>utput Resolu-<br>oder Scale                                                                               | 0 to 65,535<br>1 to 4,096<br>0 to<br>6,553,600                                              | units<br>0.01 ms<br>1 edge/<br>pitch<br>0.01<br>μm<br>Rotary:<br>1 min <sup>-1</sup><br>Direct<br>Drive:<br>0.1                                      | 0 20 0                        | All<br>All<br>Linear                  | Immedi-<br>ately<br>After<br>restart<br>After<br>restart                                                             | Setup<br>Setup<br>Setup                            | 8-75<br>page<br>8-76<br>page<br>6-26<br>page<br>5-18                      |  |
| Pn281<br>Pn282<br>Pn304                   | 2 4 2                                                                                  | Backlash (<br>tion Time (<br>Encoder O<br>tion<br>Linear Enc<br>Pitch<br>Jogging Sp<br>Soft Start /<br>Time                                                                                          | Compensa-<br>Constant<br>utput Resolu-<br>oder Scale                                                                               | 0 to 65,535<br>1 to 4,096<br>0 to<br>6,553,600<br>0 to 10,000                               | units<br>0.01 ms<br>1 edge/<br>pitch<br>0.01<br>µm<br>Rotary:<br>1 min <sup>-1</sup><br>Direct<br>Drive:<br>0.1<br>min <sup>-1</sup>                 | 0 20 0 500                    | All<br>All<br>Linear<br>Rotary        | Immedi-<br>ately<br>After<br>restart<br>After<br>restart<br>Immedi-<br>ately                                         | Setup<br>Setup<br>Setup<br>Setup                   | 8-75<br>page<br>8-76<br>page<br>6-26<br>page<br>5-18<br>page<br>7-7       |  |
| Pn281<br>Pn282<br>Pn304<br>Pn305          | 2<br>4<br>2<br>2                                                                       | Backlash (<br>tion Time (<br>Encoder O<br>tion<br>Linear Enc<br>Pitch<br>Jogging Sp<br>Soft Start /<br>Time<br>Soft Start I<br>Time                                                                  | Compensa-<br>Constant<br>utput Resolu-<br>oder Scale<br>Deeed<br>Acceleration<br>Deceleration<br>dback Filter                      | 0 to 65,535<br>1 to 4,096<br>0 to<br>6,553,600<br>0 to 10,000<br>0 to 10,000                | units<br>0.01 ms<br>1 edge/<br>pitch<br>0.01<br>μm<br>Rotary:<br>1 min <sup>-1</sup><br>Direct<br>Drive:<br>0.1<br>min <sup>-1</sup><br>1 ms         | 0<br>20<br>0<br>500           | All<br>All<br>Linear<br>Rotary<br>All | Immedi-<br>ately<br>After<br>restart<br>After<br>restart<br>Immedi-<br>ately<br>Immedi-<br>ately<br>Immedi-          | Setup<br>Setup<br>Setup<br>Setup<br>Setup          | 8-75<br>page<br>8-76<br>page<br>6-26<br>page<br>5-18<br>page<br>7-7<br>*1 |  |
| Pn281<br>Pn282<br>Pn304<br>Pn305<br>Pn306 | 2<br>4<br>2<br>2<br>2<br>2                                                             | Backlash (<br>tion Time (<br>Encoder O<br>tion<br>Linear Enc<br>Pitch<br>Jogging Sp<br>Soft Start /<br>Time<br>Soft Start /<br>Time<br>Soft Start I<br>Time<br>Speed Fee<br>Time Cons<br>Deceleratio | Compensa-<br>Constant<br>utput Resolu-<br>oder Scale<br>Deed<br>Acceleration<br>Deceleration<br>dback Filter<br>tant               | 0 to 65,535<br>1 to 4,096<br>0 to<br>6,553,600<br>0 to 10,000<br>0 to 10,000<br>0 to 10,000 | units<br>0.01 ms<br>1 edge/<br>pitch<br>0.01<br>µm<br>Rotary:<br>1 min <sup>-1</sup><br>Direct<br>Drive:<br>0.1<br>min <sup>-1</sup><br>1 ms<br>1 ms | 0<br>20<br>0<br>500<br>0<br>0 | All All Linear Rotary All All All     | Immedi-<br>ately<br>After<br>restart<br>After<br>restart<br>Immedi-<br>ately<br>Immedi-<br>ately<br>Immedi-<br>ately | Setup<br>Setup<br>Setup<br>Setup<br>Setup<br>Setup | 8-75<br>page<br>8-76<br>page<br>6-26<br>page<br>5-18<br>page<br>7-7<br>*1 |  |

Parameter Lists

|                  |      |                                           |                                     |                          |                     |                    | Con                  | tinued from      | previous            | s page.        |  |
|------------------|------|-------------------------------------------|-------------------------------------|--------------------------|---------------------|--------------------|----------------------|------------------|---------------------|----------------|--|
| Parameter<br>No. | Size | Nar                                       | ne                                  | Setting<br>Range         | Setting<br>Unit     | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |
| Pn310            | 2    | Vibration Detection<br>Selections         |                                     | 0000h to<br>0002h        | -                   | 0000h              | All                  | Immedi-<br>ately | Setup               | page<br>6-51   |  |
|                  |      |                                           |                                     |                          |                     |                    |                      |                  |                     |                |  |
|                  |      | V                                         | Vibration Detection Selection       |                          |                     |                    |                      |                  |                     |                |  |
|                  | r    | n.000X                                    | 0 Do i                              | not detect vibr          | ation.              |                    |                      |                  |                     |                |  |
|                  |      |                                           | 1 Out                               | put a warning            | (A.911) if v        | vibration is       | detected.            |                  |                     |                |  |
|                  |      |                                           | 2 Out                               | put an alarm (A          | 4.520) if vil       | oration is c       | letected.            |                  |                     |                |  |
|                  | r    | n.DDXD F                                  | leserved par                        | rameter (Do not change.) |                     |                    |                      |                  |                     |                |  |
|                  | r    | n.OXOO F                                  | Reserved parameter (Do not change.) |                          |                     |                    |                      |                  |                     |                |  |
|                  | r    | n.XOOO F                                  | Reserved par                        | ameter (Do no            | ot change.          | )                  |                      |                  |                     |                |  |
|                  |      |                                           |                                     | ( )                      |                     |                    |                      |                  |                     |                |  |
|                  |      | Vibration D-                              | tastian Car                         |                          |                     |                    |                      | Inomo d'         |                     | noge           |  |
| Pn311            | 2    | Vibration Detection Sen-<br>sitivity      |                                     | 50 to 500                | 1%                  | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>6-51   |  |
| Pn312            | 2    | Vibration Det<br>Level                    | tection                             | 0 to 5,000               | 1 min <sup>-1</sup> | 50                 | Rotary               | Immedi-<br>ately | Tuning              | page<br>6-51   |  |
| Pn316            | 2    | Maximum Me                                | otor Speed                          | 0 to 65,535              | 1 min <sup>-1</sup> | 10000              | Rotary               | After<br>restart | Setup               | page<br>6-19   |  |
| Pn324            | 2    | Moment of Ir<br>culation Star             |                                     | 0 to 20,000              | 1%                  | 300                | All                  | Immedi-<br>ately | Setup               | page<br>8-31   |  |
| Pn383            | 2    | Jogging Spe                               | ed                                  | 0 to 10,000              | 1 mm/s              | 50                 | Linear               | Immedi-<br>ately | Setup               | page<br>7-7    |  |
| Pn384            | 2    | Vibration Det<br>Level                    | tection                             | 0 to 5,000               | 1 mm/s              | 10                 | Linear               | Immedi-<br>ately | Tuning              | page<br>6-51   |  |
| Pn385            | 2    | Maximum Mo                                | otor Speed                          | 1 to 100                 | 100<br>mm/s         | 50                 | Linear               | After<br>restart | Setup               | page<br>6-19   |  |
| Pn401            | 2    | First Stage F<br>Reference Fi<br>Constant |                                     | 0 to 65,535              | 0.01 ms             | 100                | All                  | Immedi-<br>ately | Tuning              | page<br>8-84   |  |
| Pn402            | 2    | Forward Torque Limit                      |                                     | 0 to 800                 | 1% <sup>*2</sup>    | 800                | Rotary               | Immedi-<br>ately | Setup               | page<br>6-28   |  |
| Pn403            | 2    | Reverse Torque Limit                      |                                     | 0 to 800                 | 1% <sup>*2</sup>    | 800                | Rotary               | Immedi-<br>ately | Setup               | page<br>6-28   |  |
| Pn404            | 2    | Forward Exte                              | ernal Torque                        | 0 to 800                 | 1% <sup>*2</sup>    | 100                | All                  | Immedi-<br>ately | Setup               | page<br>6-29   |  |
| Pn405            | 2    | Reverse Exte                              | ernal Torque                        | 0 to 800                 | 1%*2                | 100                | All                  | Immedi-<br>ately | Setup               | page<br>6-29   |  |
| Pn406            | 2    | Emergency S                               | Stop Torque                         | 0 to 800                 | 1% <sup>*2</sup>    | 800                | All                  | Immedi-<br>ately | Setup               | page<br>5-31   |  |
| Pn407            | 2    | Speed Limit<br>Torque Contr               |                                     | 0 to 10,000              | 1 min <sup>-1</sup> | 10000              | Rotary               | Immedi-<br>ately | Setup               | page<br>6-15   |  |

Continued from previous 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        |
|------------------|------|--------------------------------------|------------|-------------------|----------------------------------------------------------------------|---------------------------------------|----------------------------------------|-----------------------------|------------------|---------------------|--------------|
|                  | 2    | Torque-Rel<br>tion Select            |            | C-                | 0000h to<br>1111h                                                    | -                                     | 0000h                                  | All                         | _                | Setup               | -            |
|                  |      | I                                    |            |                   | l                                                                    | 1                                     |                                        | 11                          |                  | 1                   | 1            |
|                  |      |                                      | Notch Fi   | lter S            | Selection 1                                                          |                                       |                                        |                             | When<br>Enabled  | Refere              | nce          |
|                  |      | n.□□□X                               | 0<br>1     |                   | able first stage<br>able first stage                                 |                                       |                                        |                             | Immedi-<br>ately | page 8              | 8-84         |
|                  |      |                                      | Speed L    | imit \$           | Selection                                                            |                                       |                                        |                             | When<br>Enabled  | Refere              | nce          |
|                  |      | n.DDXD                               | 0          | sett<br>Use       | the smaller of<br>ing of Pn407 a<br>the smaller of<br>ing of Pn480 a | is the spee<br>the maxim              | ed limit.<br>Ium motor                 | •                           | 9                |                     |              |
| Pn408            | n408 |                                      | 1          | Use<br>spe<br>Use | the smaller of<br>ed and the set<br>the smaller of<br>ed and the set | the overs<br>ting of Pn4<br>the overs | peed alarn<br>407 as the<br>peed alarn | speed limit.<br>n detection | After<br>restart | page 6              | 6-15         |
|                  |      |                                      | Notch Fi   | · ·               | Selection 2                                                          |                                       |                                        |                             | When<br>Enabled  | Refere              | nce          |
|                  |      | n.¤X¤¤                               | 0<br>1     |                   | able second sta<br>able second sta                                   | 0                                     |                                        |                             | Immedi-<br>ately | page 8              | 3-84         |
|                  |      |                                      | Friction   | Com               | pensation Fun                                                        | ction Sele                            | ction                                  |                             | When<br>Enabled  | Refere              | nce          |
|                  |      | n.X000                               | 0<br>1     |                   | able friction co<br>able friction cor                                | •                                     |                                        |                             | Immedi-<br>ately | page 8              | 8-70         |
|                  |      |                                      |            |                   | I                                                                    | 1                                     |                                        | 1                           |                  | 1                   | I            |
| Pn409            | 2    | First Stage<br>Frequency             |            | ter               | 50 to 5,000                                                          | 1 Hz                                  | 5000                                   | All                         | Immedi-<br>ately | Tuning              | page<br>8-84 |
| Pn40A            | 2    | First Stage<br>Q Value               | Notch Fil  | ter               | 50 to 1,000                                                          | 0.01                                  | 70                                     | All                         | Immedi-<br>ately | Tuning              | page<br>8-84 |
| Pn40B            | 2    | First Stage<br>Depth                 | Notch Fil  | ter               | 0 to 1,000                                                           | 0.001                                 | 0                                      | All                         | Immedi-<br>ately | Tuning              | page<br>8-84 |
| Pn40C            | 2    | Second Stater Frequer                |            | ו Fil-            | 50 to 5,000                                                          | 1 Hz                                  | 5000                                   | All                         | Immedi-<br>ately | Tuning              | page<br>8-84 |
| Pn40D            | 2    | Second Stater Q Value                |            | ר Fil-            | 50 to 1,000                                                          | 0.01                                  | 70                                     | All                         | Immedi-<br>ately | Tuning              | page<br>8-84 |
| Pn40E            | 2    | Second Stater Depth                  | age Notch  | ר Fil-            | 0 to 1,000                                                           | 0.001                                 | 0                                      | All                         | Immedi-<br>ately | Tuning              | page<br>8-84 |
| Pn40F            | 2    | Second St<br>Torque Ref<br>Frequency | ference Fi | nd<br>Iter        | 100 to 5,000                                                         | 1 Hz                                  | 5000                                   | All                         | Immedi-<br>ately | Tuning              | page<br>8-84 |
| Pn410            | 2    | Second St<br>Torque Ref<br>Q Value   |            |                   | 50 to 100                                                            | 0.01                                  | 50                                     | All                         | Immedi-<br>ately | Tuning              | page<br>8-84 |
| Pn412            | 2    | First Stage<br>Torque Ref            |            | lter              | 0 to 65,535                                                          | 0.01 ms                               | 100                                    | All                         | Immedi-<br>ately | Tuning              | page<br>8-66 |

Continued on next page.

|                  |      |                           |                            |                   |                 |                    | Con                  | tinued from      | n previous          | s 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 |
|                  | 2    | Torque-Re                 | lated Func-                | 0000h to<br>1111h | _               | 0000h              | All                  | Immedi-<br>ately | Setup               | page<br>8-86   |
|                  |      |                           |                            |                   |                 |                    |                      |                  |                     |                |
|                  |      |                           | Notch Filter               | Selection 3       |                 |                    |                      |                  |                     |                |
|                  | 1    | n.000X                    | 0 D                        | sable third stage | e notch filt    | er.                |                      |                  |                     |                |
|                  |      |                           | 1 E                        | hable third stage | notch filte     | er.                |                      |                  |                     |                |
| Pn416            |      |                           |                            | Selection 4       | na matala fi    | lter               |                      |                  |                     |                |
|                  |      | n.□□X□                    |                            | sable fourth stag | 5               |                    |                      |                  |                     |                |
|                  |      |                           | Notch Filter               | Selection 5       |                 |                    |                      |                  |                     |                |
|                  | 1    | n.¤X¤¤                    |                            | sable fifth stage | notch filte     | er.                |                      |                  |                     |                |
|                  |      |                           | 1 Ei                       | hable fifth stage | notch filte     | r.                 |                      |                  |                     |                |
|                  | I    | n.X000                    | Reserved p                 | arameter (Do no   | ot change.      | )                  |                      |                  |                     |                |
| D. 417           |      | Third Stag                | e Notch Filte              |                   |                 | 5000               | A 11                 | Immedi-          | - ·                 | page           |
| Pn417            | 2    | Frequency                 | 1                          | 50 10 5,000       | 1 Hz            | 5000               | All                  | ately            | Tuning              | page<br>8-86   |
| Pn418            | 2    | Q Value                   | e Notch Filte              | 50 10 1,000       | 0.01            | 70                 | All                  | Immedi-<br>ately | Tuning              | page<br>8-86   |
| Pn419            | 2    | Third Stag<br>Depth       | e Notch Filter             | 0 to 1,000        | 0.001           | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-86   |
| Pn41A            | 2    | Fourth Sta<br>ter Freque  | ige Notch Fil-<br>ncy      | 50 to 5,000       | 1 Hz            | 5000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-86   |
| Pn41B            | 2    | Fourth Stater Q Value     | ige Notch Fil-<br>e        | 50 to 1,000       | 0.01            | 70                 | All                  | Immedi-<br>ately | Tuning              | page<br>8-86   |
| Pn41C            | 2    | Fourth Stater Depth       | ige Notch Fil-             | 0 to 1,000        | 0.001           | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-86   |
| Pn41D            | 2    | Fifth Stage<br>Frequency  | e Notch Filter             | 50 to 5,000       | 1 Hz            | 5000               | All                  | Immedi-<br>ately | Tuning              | page<br>8-86   |
| Pn41E            | 2    | Fifth Stage<br>Q Value    | e Notch Filter             | 50 to 1,000       | 0.01            | 70                 | All                  | Immedi-<br>ately | Tuning              | page<br>8-86   |
| Pn41F            | 2    | Fifth Stage<br>Depth      | e Notch Filter             | 0 to 1,000        | 0.001           | 0                  | All                  | Immedi-<br>ately | Tuning              | page<br>8-86   |
|                  | 2    | Speed Rip<br>sation Sele  | ple Compen-<br>ections     | 0000h to<br>1111h | -               | 0000h              | Rotary               | -                | Setup               | page<br>8-64   |
|                  |      |                           |                            |                   |                 |                    |                      |                  |                     |                |
|                  |      |                           | Speed Ripp                 | le Compensatio    | on Functio      | n Selectio         | n                    |                  | Whe<br>Enab         |                |
|                  | I    | n.🗆 🗆 🗆 X                 | 0 D                        | sable speed ripp  | ole compe       | nsation.           |                      |                  | Imme                |                |
|                  |      |                           | 1 E                        | nable speed ripp  | le comper       | nsation.           |                      |                  | atel                |                |
|                  |      |                           | Speed Ripp<br>tion Selecti | le Compensatio    | on Informa      | tion Disag         | reement War          | ning Detec-      | Whe<br>Enab         |                |
| Pn423            | 1    | n.DDXD                    |                            | etect A.942 aları | ms.             |                    |                      |                  | Afte                |                |
|                  |      |                           | 1 D                        | o not detect A.9  | 42 alarms.      |                    |                      |                  | resta               |                |
|                  |      |                           | Speed Ripp                 | le Compensatio    | on Enable       | Condition          | Selection            |                  | Whe<br>Enabl        |                |
|                  | 1    | n.¤X¤¤                    | 0 S                        | peed reference    |                 |                    |                      |                  | Afte                |                |
|                  |      |                           | 1 M                        | otor speed        |                 |                    |                      |                  | resta               |                |
|                  | 1    | n.XDDD                    | Reserved p                 | arameter (Do no   | ot change.      | )                  |                      |                  |                     |                |
|                  |      |                           |                            |                   |                 |                    |                      |                  |                     |                |
| Pn424            | 2    | Torque Lin<br>cuit Voltag | nit at Main Ciu<br>e Drop  | - 0 to 100        | 1%*2            | 50                 | All                  | Immedi-<br>ately | Setup               | page<br>6-18   |
| Pn425            | 2    | Limit at Ma               |                            | e 0 to 1,000      | 1 ms            | 100                | All                  | Immedi-<br>ately | Setup               | page<br>6-18   |
|                  |      | Voltage Dr                | op                         |                   |                 |                    |                      | Continue         | d on nev            |                |

|                                           |                                                                                                                                                                                                                                                                                                                        |                                                                                                                |                                                                                                                                                                                                 |                                                                                                                               |                                                                                                                 |                                       | Con                                            | inued from                                                                                       | previous                                    | paye.                                                  |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------|
| 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                                         |
| Pn426                                     | 2                                                                                                                                                                                                                                                                                                                      | Torque Fee<br>Average M<br>Time                                                                                |                                                                                                                                                                                                 | 0 to 5,100                                                                                                                    | 0.1 ms                                                                                                          | 0                                     | All                                            | Immedi-<br>ately                                                                                 | Setup                                       | -                                                      |
| Pn427                                     | 2                                                                                                                                                                                                                                                                                                                      | Speed Rip<br>sation Ena                                                                                        | ple Compen-<br>ble Speed                                                                                                                                                                        | 0 to 10,000                                                                                                                   | 1 min <sup>-1</sup>                                                                                             | 0                                     | Rotary                                         | Immedi-<br>ately                                                                                 | Tuning                                      | page<br>8-64                                           |
| Pn456                                     | 2                                                                                                                                                                                                                                                                                                                      | Sweep Tor<br>ence Amp                                                                                          | rque Refer-<br>litude                                                                                                                                                                           | 1 to 800                                                                                                                      | 1%                                                                                                              | 15                                    | All                                            | Immedi-<br>ately                                                                                 | Tuning                                      | page<br>8-100                                          |
|                                           | 2                                                                                                                                                                                                                                                                                                                      | Notch Filte<br>Selections                                                                                      | er Adjustment<br>1                                                                                                                                                                              | 0000h to<br>0101h                                                                                                             | -                                                                                                               | 0101h                                 | All                                            | Immedi-<br>ately                                                                                 | Tuning                                      | page<br>8-15,<br>page<br>8-32                          |
|                                           | -                                                                                                                                                                                                                                                                                                                      |                                                                                                                | Notch Filter                                                                                                                                                                                    | Adjustment Sel                                                                                                                | lection 1                                                                                                       |                                       |                                                |                                                                                                  |                                             | _                                                      |
|                                           |                                                                                                                                                                                                                                                                                                                        | n.000X                                                                                                         | 0 tun                                                                                                                                                                                           | not adjust the f<br>ing without a he<br>ing.                                                                                  | irst stage                                                                                                      |                                       |                                                |                                                                                                  |                                             |                                                        |
|                                           |                                                                                                                                                                                                                                                                                                                        |                                                                                                                |                                                                                                                                                                                                 | ust the first sta<br>hout a host refe                                                                                         |                                                                                                                 |                                       |                                                |                                                                                                  |                                             |                                                        |
| Pn460                                     |                                                                                                                                                                                                                                                                                                                        | n.🗆 🗆 X 🗆                                                                                                      | Reserved pa                                                                                                                                                                                     | rameter (Do no                                                                                                                | t change.                                                                                                       | )                                     |                                                |                                                                                                  |                                             |                                                        |
|                                           | Notch Filter Adjustment Selection 2           Do not adjust the second stage notch filter automatically when the tuning-less                                                                                                                                                                                           |                                                                                                                |                                                                                                                                                                                                 |                                                                                                                               |                                                                                                                 |                                       |                                                |                                                                                                  |                                             |                                                        |
|                                           | n.□X□□       Do not adjust the second stage notch filter automatically when the tuning-less function is enabled or during execution of autotuning without a host reference, autotuning with a host reference, and custom tuning.         Adjust the second stage notch filter automatically when the tuning-less func- |                                                                                                                |                                                                                                                                                                                                 |                                                                                                                               |                                                                                                                 |                                       |                                                |                                                                                                  |                                             |                                                        |
|                                           |                                                                                                                                                                                                                                                                                                                        |                                                                                                                | 1 tior                                                                                                                                                                                          | ust the second<br>is enabled or o<br>otuning with a l                                                                         | during exe                                                                                                      | cution of a                           | autotuning wit                                 | hout a host i                                                                                    |                                             | IC-                                                    |
|                                           |                                                                                                                                                                                                                                                                                                                        | n.XOOO                                                                                                         | Reserved pa                                                                                                                                                                                     | rameter (Do no                                                                                                                | t change.                                                                                                       | )                                     |                                                |                                                                                                  |                                             |                                                        |
|                                           | 2                                                                                                                                                                                                                                                                                                                      | Gravity Co<br>Related Se                                                                                       | mpensation-<br>elections                                                                                                                                                                        | 0000h to<br>0001h                                                                                                             | -                                                                                                               | 0000h                                 | All                                            | After<br>restart                                                                                 | Setup                                       | page<br>8-72                                           |
|                                           |                                                                                                                                                                                                                                                                                                                        | n.000X                                                                                                         | 0 Dis                                                                                                                                                                                           | pensation Selec<br>able gravity cor                                                                                           | mpensatio                                                                                                       |                                       |                                                |                                                                                                  |                                             |                                                        |
| Pn475                                     |                                                                                                                                                                                                                                                                                                                        |                                                                                                                |                                                                                                                                                                                                 | able gravity con                                                                                                              |                                                                                                                 |                                       |                                                |                                                                                                  |                                             |                                                        |
|                                           |                                                                                                                                                                                                                                                                                                                        | n.DDXD                                                                                                         |                                                                                                                                                                                                 | ameter (Do not                                                                                                                | •                                                                                                               | 1.                                    |                                                |                                                                                                  |                                             |                                                        |
|                                           | -                                                                                                                                                                                                                                                                                                                      | n.00X0                                                                                                         | Reserved par                                                                                                                                                                                    | ameter (Do not                                                                                                                | change.)                                                                                                        | 1.                                    |                                                |                                                                                                  |                                             |                                                        |
|                                           |                                                                                                                                                                                                                                                                                                                        |                                                                                                                | Reserved par                                                                                                                                                                                    | ameter (Do not<br>ameter (Do not<br>ameter (Do not                                                                            | change.)<br>change.)                                                                                            | <u>).</u>                             |                                                |                                                                                                  |                                             |                                                        |
| Pn476                                     |                                                                                                                                                                                                                                                                                                                        | n.DXDD                                                                                                         | Reserved par                                                                                                                                                                                    | ameter (Do not                                                                                                                | change.)<br>change.)                                                                                            | 0                                     | All                                            | Immedi-<br>ately                                                                                 | Tuning                                      | page 8-72                                              |
| Pn476<br>Pn480                            | I                                                                                                                                                                                                                                                                                                                      | n.0X00                                                                                                         | Reserved par<br>Reserved par<br>Reserved par<br>mpensation<br>nit during                                                                                                                        | ameter (Do not<br>ameter (Do not<br>-1,000 to                                                                                 | change.)<br>change.)<br>change.)                                                                                |                                       | All                                            | ately<br>Immedi-                                                                                 | Tuning<br>Setup                             | page<br>8-72<br>page<br>6-15                           |
| -                                         | 2                                                                                                                                                                                                                                                                                                                      | n. DXDD<br>n. XDDD<br>Gravity Co<br>Torque<br>Speed Lim                                                        | Reserved par<br>Reserved par<br>Reserved par<br>mpensation<br>nit during<br>trol                                                                                                                | ameter (Do not<br>ameter (Do not<br>-1,000 to<br>1,000                                                                        | change.)<br>change.)<br>change.)<br>0.1%                                                                        | 0                                     |                                                | ately                                                                                            | 0                                           | page<br>8-72<br>page<br>6-15                           |
| Pn480                                     | 2                                                                                                                                                                                                                                                                                                                      | n.<br>Gravity Co<br>Torque<br>Speed Lim<br>Force Con<br>Polarity De                                            | Reserved par<br>Reserved par<br>Reserved par<br>mpensation<br>hit during<br>trol<br>etection<br>pp Gain<br>etection<br>pp Integral                                                              | ameter (Do not<br>ameter (Do not<br>-1,000 to<br>1,000<br>0 to 10,000                                                         | change.)<br>change.)<br>change.)<br>0.1%<br>1 mm/s                                                              | 0                                     | Linear                                         | ately<br>Immedi-<br>ately<br>Immedi-                                                             | Setup                                       | page<br>6-15                                           |
| Pn480<br>Pn481                            | 2 2 2 2                                                                                                                                                                                                                                                                                                                | RAVITY Co<br>Torque<br>Speed Lim<br>Force Con<br>Polarity De<br>Speed Loc<br>Polarity De<br>Speed Loc          | Reserved par<br>Reserved par<br>Reserved par<br>mpensation<br>nit during<br>trol<br>etection<br>op Gain<br>etection<br>op Integral<br>stant                                                     | ameter (Do not<br>ameter (Do not<br>-1,000 to<br>1,000<br>0 to 10,000<br>10 to 20,000                                         | change.)<br>change.)<br>change.)<br>0.1%<br>1 mm/s<br>0.1 Hz                                                    | 0<br>10000<br>400                     | Linear                                         | ately<br>Immedi-<br>ately<br>Immedi-<br>ately<br>Immedi-                                         | Setup<br>Tuning                             | page<br>6-15                                           |
| Pn480<br>Pn481<br>Pn482                   | 2<br>2<br>2<br>2<br>2                                                                                                                                                                                                                                                                                                  | A.DXDD<br>Gravity Co<br>Torque<br>Speed Lim<br>Force Con<br>Polarity De<br>Speed Loo<br>Time Cons              | Reserved par<br>Reserved par<br>Reserved par<br>mpensation<br>nit during<br>trol<br>etection<br>op Gain<br>etection<br>op Integral<br>stant<br>orce Limit                                       | ameter (Do not<br>ameter (Do not<br>-1,000 to<br>1,000<br>0 to 10,000<br>10 to 20,000<br>15 to 51,200                         | change.)<br>change.)<br>change.)<br>0.1%<br>1 mm/s<br>0.1 Hz<br>0.01 ms                                         | 0<br>10000<br>400<br>3000             | Linear<br>Linear<br>Linear                     | ately<br>Immedi-<br>ately<br>Immedi-<br>ately<br>Immedi-                                         | Setup<br>Tuning<br>Tuning                   | page<br>6-15<br>–<br>–<br>page                         |
| Pn480<br>Pn481<br>Pn482<br>Pn483          | 2<br>2<br>2<br>2<br>2<br>2                                                                                                                                                                                                                                                                                             | Reverse For                                                                                                    | Reserved par<br>Reserved par<br>Reserved par<br>mpensation<br>hit during<br>trol<br>stection<br>pp Gain<br>stection<br>pp Integral<br>stant<br>orce Limit<br>orce Limit<br>etection Refer-      | ameter (Do not<br>ameter (Do not<br>-1,000 to<br>1,000<br>0 to 10,000<br>10 to 20,000<br>15 to 51,200<br>0 to 800             | change.)<br>change.)<br>change.)<br>0.1%<br>1 mm/s<br>0.1 Hz<br>0.01 ms<br>1%* <sup>2</sup>                     | 0<br>10000<br>400<br>3000<br>30       | Linear<br>Linear<br>Linear<br>Linear           | ately<br>Immedi-<br>ately<br>Immedi-<br>ately<br>Immedi-<br>ately<br>Immedi-                     | Setup<br>Tuning<br>Tuning<br>Setup          | page<br>6-15<br>–<br>–<br>page<br>6-28                 |
| Pn480<br>Pn481<br>Pn482<br>Pn483<br>Pn484 | 2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2                                                                                                                                                                                                                                                                              | Reverse For<br>Polarity De<br>Speed Loc<br>Polarity De<br>Speed Loc<br>Time Cons<br>Forward For<br>Reverse For | Reserved par<br>Reserved par<br>Reserved par<br>mpensation<br>it during<br>trol<br>etection<br>pp Gain<br>etection<br>pp Integral<br>stant<br>orce Limit<br>orce Limit<br>etection Refer-<br>ed | ameter (Do not<br>ameter (Do not<br>-1,000 to<br>1,000<br>0 to 10,000<br>10 to 20,000<br>15 to 51,200<br>0 to 800<br>0 to 800 | change.)<br>change.)<br>change.)<br>0.1%<br>1 mm/s<br>0.1 Hz<br>0.01 ms<br>1%* <sup>2</sup><br>1%* <sup>2</sup> | 0<br>10000<br>400<br>3000<br>30<br>30 | Linear<br>Linear<br>Linear<br>Linear<br>Linear | ately<br>Immedi-<br>ately<br>Immedi-<br>ately<br>Immedi-<br>ately<br>Immedi-<br>ately<br>Immedi- | Setup<br>Tuning<br>Tuning<br>Setup<br>Setup | page<br>6-15<br>–<br>–<br>page<br>6-28<br>page<br>6-28 |

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|                  |      |                                |                              |                                                    |                     |                    | Con                  | tinued from      | n previous          | s 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 |
| Pn488            | 2    | Polarity De<br>ence Waiti      | etection Refer-<br>ng Time   | 50 to 500                                          | 1 ms                | 100                | Linear               | Immedi-<br>ately | Tuning              | _              |
| Pn48E            | 2    | Polarity De<br>Range           | etection                     | 1 to 65,535                                        | 1 mm                | 10                 | Linear               | Immedi-<br>ately | Tuning              | -              |
| Pn490            | 2    | Polarity De<br>Level           | etection Load                | 0 to 20,000                                        | 1%                  | 100                | Linear               | Immedi-<br>ately | Tuning              | -              |
| Pn495            | 2    |                                | etection Con-<br>orce Refer- | 0 to 200                                           | 1%                  | 100                | Linear               | Immedi-<br>ately | Tuning              | -              |
| Pn498            | 2    | Polarity De<br>able Error      | etection Allow-<br>Range     | 0 to 30                                            | 1 deg               | 10                 | Linear               | Immedi-<br>ately | Tuning              | -              |
| Pn49F            | 2    | Speed Rip<br>sation Ena        | ple Compen-<br>ble Speed     | 0 to 10,000                                        | 1 mm/s              | 0                  | Linear               | Immedi-<br>ately | Tuning              | page<br>8-64   |
| Pn502            | 2    | Rotation D                     | etection Level               | 1 to 10,000                                        | 1 min <sup>-1</sup> | 20                 | Rotary               | Immedi-<br>ately | Setup               | page<br>6-9    |
| Pn503            | 2    | Speed Co<br>Detection<br>Width | ncidence<br>Signal Output    | 0 to 100                                           | 1 min <sup>-1</sup> | 10                 | Rotary               | Immedi-<br>ately | Setup               | page<br>6-11   |
| Pn506            | 2    | Brake Refe<br>OFF Delay        | erence-Servo<br>Time         | 0 to 50                                            | 10 ms               | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>5-34   |
| Pn507            | 2    | Brake Refe<br>put Speed        | erence Out-<br>Level         | 0 to 10,000                                        | 1 min <sup>-1</sup> | 100                | Rotary               | Immedi-<br>ately | Setup               | page<br>5-34   |
| Pn508            | 2    | Servo OFF<br>mand Wai          | -Brake Com-<br>ting Time     | 10 to 100                                          | 10 ms               | 50                 | All                  | Immedi-<br>ately | Setup               | page<br>5-34   |
| Pn509            | 2    | Momentar<br>ruption Ho         | y Power Inter-<br>Id Time    | 20 to 50,000                                       | 1 ms                | 20                 | All                  | Immedi-<br>ately | Setup               | page<br>6-16   |
|                  | 2    | Input Sign<br>1                | al Selections                | 0000h to<br>FFF2h                                  | -                   | 1881h              | All                  | After<br>restart | Setup               | -              |
|                  | r    | n.000X<br>n.00X0<br>n.0X00     | Reserved pa                  | rameter (Do no<br>rameter (Do no<br>rameter (Do no | ot change.          | )                  |                      |                  |                     |                |
|                  |      |                                | P-OT (Forwa                  | rd Drive Prohib                                    | oit) Signal         | Allocation         | 1                    |                  | Refere              | nce            |
|                  |      |                                |                              | forward drive                                      |                     |                    | 0 1                  | ,                |                     |                |
|                  |      |                                |                              | forward drive                                      |                     |                    | <b>o</b>             |                  |                     |                |
|                  |      |                                |                              | forward drive                                      |                     |                    |                      |                  | _                   |                |
| Pn50A            |      |                                |                              | forward drive                                      |                     |                    | • ·                  |                  | _                   |                |
|                  |      |                                |                              | forward drive                                      |                     |                    | ÷ :                  | -                | _                   |                |
|                  |      |                                |                              | forward drive                                      |                     |                    | 0 (                  | ,                | _                   |                |
|                  |      | n.X000                         |                              | forward drive                                      |                     |                    |                      | Joseu).          | _                   |                |
|                  |      |                                |                              | e signal to alwa                                   |                     |                    |                      |                  | page 5              | 5-30           |
|                  |      |                                |                              | Signa to aiva                                      | ,5 010010           |                    |                      |                  | _                   |                |

Enable forward drive when CN1-13 input signal is OFF (open).

Enable forward drive when CN1-7 input signal is OFF (open).

Enable forward drive when CN1-8 input signal is OFF (open).

Enable forward drive when CN1-9 input signal is OFF (open).

Enable forward drive when CN1-10 input signal is OFF (open).

Enable forward drive when CN1-11 input signal is OFF (open).

9 A

В

С

D

Е

F

Enable forward drive when CN1-12 input signal is OFF (open).
Continued on next page.

Continued from previous page.

| arameter<br>No. | Size    | Name                                                                                                                                                                  | Setting<br>Range                                                                                                                                                 | Setting<br>Unit                                                                                                                | Default<br>Setting                                                                                                   | Applicable<br>Motors                                                                | When<br>Enabled | Classi-<br>fication | Ret<br>en |  |  |  |
|-----------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------|---------------------|-----------|--|--|--|
| 110.            |         | nal Selections                                                                                                                                                        | 0000h to                                                                                                                                                         | _                                                                                                                              | 8882h                                                                                                                | All                                                                                 | After           | Setup               | -         |  |  |  |
|                 | 2       |                                                                                                                                                                       | FFFFh                                                                                                                                                            |                                                                                                                                |                                                                                                                      |                                                                                     | restart         |                     |           |  |  |  |
|                 |         | N-OT (Rev                                                                                                                                                             | erse Drive Prohit                                                                                                                                                | oit) Signal                                                                                                                    | Allocation                                                                                                           |                                                                                     |                 | Refere              | ence      |  |  |  |
|                 |         |                                                                                                                                                                       | nable reverse dri                                                                                                                                                | , 0                                                                                                                            |                                                                                                                      |                                                                                     | N (closed).     |                     |           |  |  |  |
|                 |         | 1 E                                                                                                                                                                   | nable reverse dri                                                                                                                                                | ve when C                                                                                                                      | N1-7 inpu                                                                                                            | t signal is ON                                                                      | l (closed).     |                     |           |  |  |  |
|                 |         | 2 E                                                                                                                                                                   | nable reverse dri                                                                                                                                                | ve when C                                                                                                                      | N1-8 inpu                                                                                                            | t signal is ON                                                                      | l (closed).     |                     |           |  |  |  |
|                 |         | 3 E                                                                                                                                                                   | nable reverse dri                                                                                                                                                | ve when C                                                                                                                      | N1-9 inpu                                                                                                            | t signal is ON                                                                      | l (closed).     |                     |           |  |  |  |
|                 |         | 4 E                                                                                                                                                                   | nable reverse dri                                                                                                                                                | ve when C                                                                                                                      | N1-10 inp                                                                                                            | ut signal is O                                                                      | N (closed).     |                     |           |  |  |  |
|                 |         | 5 E                                                                                                                                                                   | nable reverse dri                                                                                                                                                | ve when C                                                                                                                      | N1-11 inp                                                                                                            | ut signal is O                                                                      | N (closed).     |                     |           |  |  |  |
|                 |         | 6 E                                                                                                                                                                   | nable reverse dri                                                                                                                                                | ve when C                                                                                                                      | N1-12 inp                                                                                                            | ut signal is O                                                                      | N (closed).     |                     |           |  |  |  |
|                 | n.□□□X  | 7 5                                                                                                                                                                   | set the signal to a                                                                                                                                              | lways proł                                                                                                                     | nibit revers                                                                                                         | e drive.                                                                            |                 | — page 5            | 5-30      |  |  |  |
|                 |         | 8 5                                                                                                                                                                   | set the signal to a                                                                                                                                              | lways ena                                                                                                                      | ble reverse                                                                                                          | e drive.                                                                            |                 | pagot               |           |  |  |  |
|                 |         |                                                                                                                                                                       |                                                                                                                                                                  |                                                                                                                                |                                                                                                                      |                                                                                     |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       | A Enable reverse drive when CN1-7 input signal is OFF (open).                                                                                                    |                                                                                                                                |                                                                                                                      |                                                                                     |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       | B Enable reverse drive when CN1-8 input signal is OFF (open).                                                                                                    |                                                                                                                                |                                                                                                                      |                                                                                     |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       | C Enable reverse drive when CN1-9 input signal is OFF (open).                                                                                                    |                                                                                                                                |                                                                                                                      |                                                                                     |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       | D Enable reverse drive when CN1-10 input signal is OFF (open).<br>E Enable reverse drive when CN1-11 input signal is OFF (open).                                 |                                                                                                                                |                                                                                                                      |                                                                                     |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       |                                                                                                                                                                  |                                                                                                                                |                                                                                                                      | 0                                                                                   | · · · /         |                     |           |  |  |  |
|                 |         | F E                                                                                                                                                                   | nable reverse dri                                                                                                                                                | ve when C                                                                                                                      | N1-12 inp                                                                                                            | ut signal is O                                                                      | FF (open).      |                     |           |  |  |  |
| 150B            | n.□□X□  | Reserved                                                                                                                                                              | parameter (Do no                                                                                                                                                 | ot change.                                                                                                                     | )                                                                                                                    |                                                                                     |                 |                     |           |  |  |  |
|                 |         | /P-CL (For                                                                                                                                                            | ward External To                                                                                                                                                 | rque Limit                                                                                                                     | t Input) Sig                                                                                                         | gnal Allocatio                                                                      | 'n              | Refere              | ence      |  |  |  |
|                 |         | 0 A                                                                                                                                                                   | ctive when CN1-                                                                                                                                                  | 13 input s                                                                                                                     | ignal is ON                                                                                                          | l (closed).                                                                         |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       | ctive when CN1-                                                                                                                                                  | 7 input sig                                                                                                                    | gnal is ON                                                                                                           | (closed).                                                                           |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       | ctive when CN1-                                                                                                                                                  |                                                                                                                                |                                                                                                                      |                                                                                     |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       | ctive when CN1-                                                                                                                                                  |                                                                                                                                |                                                                                                                      |                                                                                     |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       | ctive when CN1-                                                                                                                                                  |                                                                                                                                | 0                                                                                                                    | , ,                                                                                 |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       | ctive when CN1-                                                                                                                                                  | 11 input s                                                                                                                     | ignal is ON                                                                                                          | l (closed).                                                                         |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       |                                                                                                                                                                  |                                                                                                                                |                                                                                                                      |                                                                                     |                 |                     |           |  |  |  |
|                 |         |                                                                                                                                                                       | ctive when CN1-                                                                                                                                                  |                                                                                                                                | ignal is ON                                                                                                          | l (closed).                                                                         |                 |                     |           |  |  |  |
|                 | n.¤X¤¤  | 7 T                                                                                                                                                                   | he signal is alwa                                                                                                                                                | ys active.                                                                                                                     |                                                                                                                      | l (closed).                                                                         |                 | page 6              | 6-29      |  |  |  |
|                 | n.¤X¤¤  | 7 T<br>8 T                                                                                                                                                            | he signal is alwa<br>he signal is alwa                                                                                                                           | ys active.<br>ys inactive                                                                                                      |                                                                                                                      |                                                                                     |                 | page 6              | 6-29      |  |  |  |
|                 | n.🗆X🗆 🗆 | 7 1<br>8 1<br>9 <i>A</i>                                                                                                                                              | he signal is alwa<br>he signal is alwa<br>active when CN1-                                                                                                       | ys active.<br>ys inactive<br>13 input s                                                                                        | ignal is OF                                                                                                          | F (open).                                                                           |                 | page 6              | 6-29      |  |  |  |
|                 | n.DXDD  | 7 1<br>8 1<br>9 <i>A</i><br>A                                                                                                                                         | he signal is alwa<br>he signal is alwa<br>active when CN1-<br>active when CN1-                                                                                   | ys active.<br>ys inactive<br>13 input s<br>7 input sig                                                                         | ignal is OF<br>gnal is OFF                                                                                           | F (open).<br>(open).                                                                |                 | page 6              | 6-29      |  |  |  |
|                 | n.¤X¤¤  | 7 1<br>8 1<br>9 4<br>A 4<br>B 4                                                                                                                                       | he signal is alwa<br>he signal is alwa<br>ctive when CN1-<br>ctive when CN1-<br>ctive when CN1-                                                                  | ys active.<br>ys inactive<br>13 input s<br>7 input sig<br>8 input sig                                                          | ignal is OF<br>gnal is OFF<br>gnal is OFF                                                                            | F (open).<br>(open).<br>(open).                                                     |                 | page 6<br>          | 6-29      |  |  |  |
|                 | n.0X00  | 7 1<br>8 1<br>9 4<br>A 4<br>B 4<br>C 4                                                                                                                                | he signal is alway<br>he signal is alway<br>active when CN1-<br>active when CN1-<br>active when CN1-<br>active when CN1-                                         | ys active.<br>ys inactive<br>13 input s<br>7 input sig<br>8 input sig<br>9 input sig                                           | ignal is OF<br>gnal is OFF<br>gnal is OFF<br>gnal is OFF                                                             | F (open).<br>(open).<br>(open).<br>(open).                                          |                 | page 6              | 6-29      |  |  |  |
|                 | n.□X□□  | 7 1<br>8 1<br>9 4<br>A 4<br>B 4<br>C 4<br>D 4                                                                                                                         | he signal is alwa<br>he signal is alwa<br>active when CN1-<br>active when CN1-<br>active when CN1-<br>active when CN1-<br>active when CN1-                       | ys active.<br>ys inactive<br>13 input s<br>7 input sig<br>8 input sig<br>9 input sig<br>10 input s                             | ignal is OF<br>gnal is OFF<br>gnal is OFF<br>gnal is OFF<br>ignal is OFF                                             | F (open).<br>(open).<br>(open).<br>F (open).                                        |                 | page 6              | 6-29      |  |  |  |
|                 | n.□X□□  | 7 1<br>8 1<br>9 4<br>A 4<br>B 4<br>C 4<br>D 4<br>E 4                                                                                                                  | he signal is alway<br>he signal is alway<br>active when CN1-<br>active when CN1-<br>active when CN1-<br>active when CN1-<br>active when CN1-<br>active when CN1- | ys active.<br>ys inactive<br>13 input s<br>7 input sig<br>8 input sig<br>9 input sig<br>10 input s<br>11 input s               | ignal is OF<br>gnal is OFF<br>gnal is OFF<br>gnal is OFF<br>ignal is OF<br>ignal is OF                               | F (open).<br>(open).<br>(open).<br>(open).<br>F (open).<br>F (open).                |                 | page 6              | 3-29      |  |  |  |
|                 | n.□X□□  | 7 1<br>8 7<br>9 4<br>A 4<br>B 4<br>C 4<br>D 4<br>E 4                                                                                                                  | he signal is alwa<br>he signal is alwa<br>active when CN1-<br>active when CN1-<br>active when CN1-<br>active when CN1-<br>active when CN1-                       | ys active.<br>ys inactive<br>13 input s<br>7 input sig<br>8 input sig<br>9 input sig<br>10 input s<br>11 input s               | ignal is OF<br>gnal is OFF<br>gnal is OFF<br>gnal is OFF<br>ignal is OF<br>ignal is OF                               | F (open).<br>(open).<br>(open).<br>(open).<br>F (open).<br>F (open).                |                 | page 6              | 5-29      |  |  |  |
|                 | n.□X□□  | 7         1           8         1           9         4           A         4           B         4           C         4           D         4           F         4 | he signal is alway<br>he signal is alway<br>active when CN1-<br>active when CN1-<br>active when CN1-<br>active when CN1-<br>active when CN1-<br>active when CN1- | ys active.<br>ys inactive<br>13 input s<br>7 input sig<br>8 input sig<br>9 input sig<br>10 input s<br>11 input s<br>12 input s | ignal is OF<br>gnal is OFF<br>gnal is OFF<br>gnal is OFF<br>ignal is OF<br>ignal is OF<br>ignal is OF<br>ignal is OF | F (open).<br>(open).<br>(open).<br>F (open).<br>F (open).<br>F (open).<br>F (open). |                 | page 6              |           |  |  |  |

Continued on next page.

|                  |      |                       |                                                                                                     |                                      |                                                        |                        |                    |                      | tinued from      | previous            | s page        |
|------------------|------|-----------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------------------------|------------------------|--------------------|----------------------|------------------|---------------------|---------------|
| 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 |
|                  | 2    | Output Sig<br>tions 1 | gnal Selec-                                                                                         |                                      | 0000h to<br>6666h                                      | -                      | 0000h              | All                  | After<br>restart | Setup               | -             |
|                  |      |                       | /COIN (P                                                                                            | ositio                               | oning Comple                                           | tion Outp              | ut) Signal /       | Allocation           |                  | Refere              | ence          |
|                  |      |                       | 0                                                                                                   |                                      | abled (the abov                                        |                        | , 0                |                      |                  |                     |               |
|                  |      | n.DDDX                | 1                                                                                                   |                                      | put the signal                                         | Ũ                      |                    | ,                    | terminal.        |                     |               |
|                  |      | /                     | 2                                                                                                   | Out                                  | put the signal                                         | from the C             | N1-23 or           | CN1-24 outpu         | ut terminal.     | page 6              | 6-12          |
|                  |      |                       | 3                                                                                                   | Out                                  | put the signal                                         | from the C             | N1-25 or           | CN1-26 outpu         | ut terminal.     |                     |               |
|                  |      |                       | 4 to 6                                                                                              | Res                                  | erved paramet                                          | ters (Do no            | ot change.)        |                      |                  |                     |               |
| Pn50E            |      |                       | /V-CMP                                                                                              | (Spe                                 | ed Coincidend                                          | e Detecti              | on Output          | ) Signal Alloc       | ation            | Refere              | ence          |
|                  |      | n.□□X□                | 0 to 6                                                                                              | page 6                               | 6-11                                                   |                        |                    |                      |                  |                     |               |
|                  |      |                       | /TGON (F                                                                                            | Refere                               | ence                                                   |                        |                    |                      |                  |                     |               |
|                  |      | n.¤X¤¤                | 0 to 6 The allocations are the same as the /COIN (Positioning Comple-<br>tion) signal allocations.  |                                      |                                                        |                        |                    |                      |                  | page                | 6-9           |
|                  |      |                       | /S-RDY (                                                                                            | Serv                                 | o Ready) Sign                                          | al Allocat             | ion                |                      |                  | Reference           |               |
|                  |      | n.XDDD                | 0 to 6 The allocations are the same as the /COIN (Positioning Comple-<br>tion) signal allocations.  |                                      |                                                        |                        |                    |                      |                  |                     | 6-10          |
|                  |      |                       |                                                                                                     |                                      |                                                        |                        |                    | 1                    |                  |                     | 1             |
|                  | 2    | tions 2               | gnal Selec-                                                                                         |                                      | 0000h to<br>6666h                                      | -                      | 0100h              | All                  | After<br>restart | Setup               | -             |
|                  |      |                       |                                                                                                     |                                      |                                                        |                        |                    |                      |                  |                     |               |
|                  |      |                       | /CLT (Tor                                                                                           | que                                  | Limit Detectio                                         | n Output)              | Signal All         | ocation              |                  | Refere              | ence          |
|                  |      |                       | 0                                                                                                   | Disa                                 | abled (the abov                                        | /e signal o            | utput is no        | ot used).            |                  |                     |               |
|                  |      | n.000X                | 1                                                                                                   | Out                                  | put the signal                                         | from the C             | N1-1 or C          | N1-2 output f        | terminal.        |                     |               |
|                  |      | /                     | 2                                                                                                   |                                      | put the signal                                         |                        |                    |                      |                  | page 6              | 6-32          |
|                  |      |                       | 3                                                                                                   |                                      | put the signal                                         |                        |                    |                      | ut terminal.     |                     |               |
|                  |      |                       | 4 to 6                                                                                              | Res                                  | erved paramet                                          | ters (Do no            | ot change.)        |                      |                  |                     |               |
| Pn50F            |      |                       | /VLT (Spe                                                                                           | eed L                                | imit Detectio                                          | n) Signal A            | Allocation         |                      |                  | Refere              | ence          |
|                  |      | n.□□X□                | 0 to 6 The allocations are the same as the /CLT (Torque Limit Detection Output) signal allocations. |                                      |                                                        |                        |                    |                      |                  |                     | 6-14          |
|                  |      |                       |                                                                                                     | /BK (Brake Output) Signal Allocation |                                                        |                        |                    |                      |                  |                     |               |
|                  |      |                       | /BK (Bral                                                                                           | ke O                                 | utput) Signal A                                        | Allocation             |                    |                      |                  | Refere              | ence          |
|                  |      | n.0X00                | /BK (Bral<br>0 to 6                                                                                 | The                                  | utput) Signal A<br>allocations are<br>put) signal allo | e the same             | e as the /C        | LT (Torque Lii       | mit Detectior    |                     |               |
|                  |      | n.🗆X🗆 🗆               | 0 to 6                                                                                              | The<br>Out                           | allocations are                                        | e the same<br>cations. |                    | LT (Torque Lii       | mit Detection    | ,                   | 5-35          |

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Continued from previous page.

| Parameter | Ū.   |                       | lama         |              | Setting                      | Setting     | Default     | Applicable    | tinued from<br>When | Classi-     | Refe       |
|-----------|------|-----------------------|--------------|--------------|------------------------------|-------------|-------------|---------------|---------------------|-------------|------------|
| No.       | Size |                       | lame         |              | Range                        | Unit        | Setting     | Motors        | Enabled             | fication    | enc        |
|           | 2    | Output Sig<br>tions 3 | gnal Selec-  |              | 0000h to<br>0666h            | -           | 0000h       | All           | After<br>restart    | Setup       | -          |
|           |      |                       | /NEAR (N     | Joar (       | Output) Signa                |             | n           |               |                     | Refere      | nce        |
|           |      |                       | 0            |              | bled (the abov               |             |             | ot used).     |                     |             | ince       |
|           |      |                       | 1            |              | out the signal               | Ŭ           |             | ,             | terminal.           |             |            |
|           |      | n.🗆 🗆 🗆 X             | 2            |              | out the signal               |             |             | •             |                     | page 6      | 3-13       |
| Pn510     |      |                       | 3            |              | out the signal               |             |             |               |                     |             |            |
|           |      |                       | 4 to 6       | Rese         | erved parame                 | ters (Do no | ot change.  | )             |                     |             |            |
|           |      | n.🗆 🗆 X 🗆             | Reserved     | d para       | ameter (Do no                | ot change   | )           |               |                     |             |            |
|           |      | n.¤X¤¤                | Reserved     | d para       | ameter (Do no                | ot change.  | )           |               |                     |             |            |
|           |      | n.XDDD                | Reserved     | d para       | ameter (Do no                | ot change.  | )           |               |                     |             |            |
|           |      | Input Sign            |              | no           | 0000h to                     |             |             |               | Aftor               |             | 000        |
|           | 2    | 5                     | al Selection | ns           | 0000h to<br>FFFFh            | -           | 6543h       | All           | After<br>restart    | Setup       | pag<br>6-4 |
|           |      |                       |              | · · · ·      |                              |             | ·           | 0             | - 1                 |             |            |
|           |      |                       | -            | -            | Return Decele                |             |             | -             | ation               |             |            |
|           |      |                       | 0            |              | ve when CN1-                 | •           | 0           | . ,           |                     |             |            |
|           |      |                       | 2            |              | ve when CN1-                 |             |             |               |                     |             |            |
|           |      |                       | 3            |              | ve when CN1-                 |             | ,           | ,             |                     |             |            |
|           |      |                       | 4            |              | ve when CN1-                 |             |             |               |                     |             |            |
|           |      |                       | 5            |              | ve when CN1-                 |             | -           |               |                     |             |            |
|           |      |                       | 6            |              | /e when CN1-                 |             | U U         | . ,           |                     |             |            |
|           |      | n.DDDX                | 7            |              | signal is alway              |             | 0           | ()            |                     |             |            |
|           |      |                       | 8            |              | signal is alway              |             |             |               |                     |             |            |
|           |      |                       | 9            |              | /e when CN1-                 |             |             | F (open).     |                     |             |            |
|           |      |                       | A            | Activ        | ve when CN1-                 | 7 input sig | gnal is OFF | (open).       |                     |             |            |
|           |      |                       | В            | Activ        | ve when CN1-                 | 8 input się | gnal is OFF | (open).       |                     |             |            |
|           |      |                       | С            | Activ        | ve when CN1-                 | 9 input się | gnal is OFF | (open).       |                     |             |            |
|           |      |                       | D            | Activ        | ve when CN1-                 | 10 input s  | ignal is OF | F (open).     |                     |             |            |
| Pn511     |      |                       | E            | Activ        | ve when CN1-                 | 11 input s  | ignal is OF | F (open).     |                     |             |            |
|           |      |                       | F            | Activ        | ve when CN1-                 | 12 input s  | ignal is OF | F (open).     |                     |             |            |
|           |      |                       |              |              | al Latch Inpu                | , 0         |             | l             |                     |             |            |
|           |      |                       | 0 to 3       |              | signal is alway              |             |             |               |                     |             |            |
|           |      |                       | 4            |              | ve when CN1-                 | · · · ·     | 0           | ( )           |                     |             |            |
|           |      | n.□□X□                | 5            |              | /e when CN1-<br>/e when CN1- |             | -           |               |                     |             |            |
|           |      |                       |              |              | /e when CN1-                 |             | -           |               |                     |             |            |
|           |      |                       | D<br>E       |              | /e when CN1-                 |             | ÷           |               |                     |             |            |
|           |      |                       | F            |              | ve when CN1-                 |             | -           |               |                     |             |            |
|           |      |                       | 7 to C       |              | signal is alway              |             | -           |               |                     |             |            |
|           |      |                       | /EXT2 (E     | xtern        | al Latch Inpu                | t 2) Signal | Allocation  | 1             |                     |             |            |
|           |      | n.🗆X🗆 🗆               | 0 to F       | The<br>catio | allocations are              | e the same  | e as the /E | XT1 (External | Latch Input         | 1) signal a | allo-      |
|           |      |                       | /EXT3 (E     | xtern        | al Latch Inpu                | t 3) Signal | Allocation  | 1             |                     |             |            |
|           |      | n.XDDD                | 0 to F       |              | allocations are              | e the same  | e as the /E | XT1 (External | Latch Input         | 1) signal a | allo-      |
|           |      | n.XDDD                | /EXT3 (E     |              | allocations are              |             |             |               | Latch Input         | 1) signa    | .l e       |

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|                  |      |                        |              |                                                                       |                   |                 |                    | Con                  | tinued from      | n previous          | s page.        |  |
|------------------|------|------------------------|--------------|-----------------------------------------------------------------------|-------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|--|
| Parameter<br>No. | Size | ٩                      | lame         |                                                                       | Setting<br>Range  | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |  |
|                  | 2    | Output Sig<br>Settings | gnal Inverse |                                                                       | 0000h to<br>1111h | _               | 0000h              | All                  | After<br>restart | Setup               | page<br>6-5    |  |
|                  |      |                        |              |                                                                       |                   |                 |                    |                      |                  |                     |                |  |
|                  |      |                        | Output Sig   | gnal                                                                  | I Inversion for   | CN1-1 ar        | d CN1-2 1          | Ferminals            |                  |                     |                |  |
|                  |      | n.🗆 🗆 🗆 X              | 0            | The                                                                   | signal is not ir  | nverted.        |                    |                      |                  |                     |                |  |
|                  |      |                        | 1            | The                                                                   | signal is inver   | ted.            |                    |                      |                  |                     |                |  |
|                  |      |                        | Output Si    | ana                                                                   | I Inversion for   | CN1-23 a        | nd CN1-2           | 4 Terminals          |                  |                     |                |  |
| Pn512            |      | n.🗆🗆 X 🗆               |              | -                                                                     | signal is not ir  |                 |                    |                      |                  |                     |                |  |
|                  |      |                        |              |                                                                       | signal is inver   |                 |                    |                      |                  |                     |                |  |
|                  |      |                        |              | _                                                                     |                   | 0.14.05         |                    | o <b>T</b> · · ·     |                  |                     |                |  |
|                  |      |                        | -            | -                                                                     | I Inversion for   |                 | ind CN1-2          | 6 Terminals          |                  |                     |                |  |
|                  |      | n.¤X¤¤                 |              | 0     The signal is not inverted.       1     The signal is inverted. |                   |                 |                    |                      |                  |                     |                |  |
|                  |      |                        | I            | Ine                                                                   | signal is inver   | ied.            |                    |                      |                  |                     |                |  |
|                  |      | n.XDDD                 | Reserved     | par                                                                   | ameter (Do no     | ot change.      | )                  |                      |                  |                     |                |  |
|                  |      |                        |              |                                                                       |                   |                 |                    |                      |                  |                     |                |  |
|                  | 2    | Output Sig<br>tions 4  | gnal Selec-  |                                                                       | 0000h to<br>0666h | -               | 0000h              | All                  | After<br>restart | Setup               | -              |  |
|                  |      |                        |              |                                                                       |                   |                 |                    |                      |                  |                     |                |  |
|                  |      | n.DDDX                 | Reserved     | par                                                                   | ameter (Do no     | t change.       | )                  |                      |                  |                     |                |  |
|                  |      | n.🗆 🗆 X 🗆              | Reserved     | par                                                                   | ameter (Do no     | ot change.      | )                  |                      |                  |                     |                |  |
|                  |      |                        | /PM (Prev    | enta                                                                  | ative Maintena    | ance Outp       | ut) Signal         | Allocation           |                  | Refere              | ence           |  |
| Pn514            |      |                        | 0            | Disa                                                                  | abled (the abov   | /e signal o     | utput is no        | ot used).            |                  |                     |                |  |
|                  |      | n.¤X¤¤                 | 1            | Out                                                                   | put the signal    | from the C      | N1-1 or C          | N1-2 output t        | erminal.         |                     |                |  |
|                  |      |                        | 2            | Out                                                                   | put the signal    | from the C      | N1-23 or (         | CN1-24 outpu         | ut terminal.     | page 9              | 9-17           |  |
|                  |      |                        | 3            | Out                                                                   | put the signal    | from the C      | N1-25 or (         | CN1-26 outpu         | ut terminal.     |                     |                |  |
|                  |      |                        | 4 to 6       | Res                                                                   | erved paramet     | ers (Do no      | ot change.)        |                      |                  |                     |                |  |
|                  |      | n.XDDD                 | Reserved     | par                                                                   | ameter (Do no     | t change.       | )                  |                      |                  |                     |                |  |
|                  |      |                        |              |                                                                       | (= - 114          |                 | ,                  |                      |                  |                     |                |  |
|                  |      |                        |              |                                                                       |                   |                 |                    |                      |                  |                     |                |  |

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|                     |      |                                     |                                                                                                                                                        |                                                                                  |                                                                                                                                                                                                  |                                                                                                                                                                                                 | Con                                                                                                                                                                                                                                                                                | tinued from                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | n previous          | s page.                      |
|---------------------|------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------------|
| Parameter<br>No.    | Size | I                                   | Name                                                                                                                                                   | Setting<br>Range                                                                 | Setting<br>Unit                                                                                                                                                                                  | Default<br>Setting                                                                                                                                                                              | Applicable<br>Motors                                                                                                                                                                                                                                                               | When<br>Enabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Classi-<br>fication | Refer-<br>ence               |
|                     | 2    | Input Sigr<br>7                     | nal Selections                                                                                                                                         | s 0000h to<br>FFFFh                                                              | -                                                                                                                                                                                                | 8888h                                                                                                                                                                                           | All                                                                                                                                                                                                                                                                                | After<br>restart                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Setup               | -                            |
| Pn516               |      | X                                   | FSTP (Forc         0         1         2         3         4         5         6         7         8         9         A         B         C         D |                                                                                  | n CN1-13<br>n CN1-7 ir<br>n CN1-8 ir<br>n CN1-9 ir<br>n CN1-10<br>n CN1-11<br>n CN1-11<br>n CN1-12<br>always pro<br>always ena<br>n CN1-13<br>n CN1-7 ir<br>n CN1-8 ir<br>n CN1-9 ir<br>n CN1-10 | ation<br>input signal<br>aput signal<br>aput signal<br>input signal<br>input signal<br>input signa<br>hibit drive<br>able drive (a<br>aput signal<br>aput signal<br>aput signal<br>input signal | al is ON (close<br>is ON (closed<br>is ON (closed<br>is ON (closed<br>al is ON (closed<br>al is ON (closed<br>al is ON (closed<br>al is ON (closed<br>(always force<br>always disabled<br>al is OFF (open<br>is OFF (open<br>al is OFF (open<br>al is OFF (open<br>al is OFF (open | restart         ad).         d).         d).         ad).         bd).         bd).         bd).         bd).      < |                     | ence                         |
|                     | n    | .00X0<br>.0X00                      | Reserved p                                                                                                                                             | Enable drive when<br>parameter (Do not<br>parameter (Do not<br>parameter (Do not | t change.)<br>t change.)                                                                                                                                                                         |                                                                                                                                                                                                 | al is OFF (ope                                                                                                                                                                                                                                                                     | n).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                     |                              |
|                     |      |                                     |                                                                                                                                                        | , , , , , , , , , , , , , , , , , , ,                                            |                                                                                                                                                                                                  |                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |                              |
| Pn518 <sup>*3</sup> | -    | Safety Mo<br>Paramete               | odule-Related                                                                                                                                          | – k                                                                              | -                                                                                                                                                                                                | -                                                                                                                                                                                               | All                                                                                                                                                                                                                                                                                | _                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | -                   | -                            |
| Pn51B               | 4    | Motor-Loa<br>Deviation<br>Detection |                                                                                                                                                        | 0 to<br>1,073,741,824                                                            | 1 refer-<br>ence<br>unit                                                                                                                                                                         | 1000                                                                                                                                                                                            | Rotary                                                                                                                                                                                                                                                                             | Immedi-<br>ately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Setup               | page<br>10-8                 |
| Pn51E               | 2    | Position I<br>flow Warr             | Deviation Ove                                                                                                                                          | er- 10 to 100                                                                    | 1%                                                                                                                                                                                               | 100                                                                                                                                                                                             | All                                                                                                                                                                                                                                                                                | Immedi-<br>ately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Setup               | page<br>8-9                  |
| Pn520               | 4    | Position [<br>flow Alarr            | Deviation Ove<br>n Level                                                                                                                               | er- 1 to<br>1,073,741,823                                                        | 1 refer-<br>ence<br>unit                                                                                                                                                                         | 524288<br>0                                                                                                                                                                                     | All                                                                                                                                                                                                                                                                                | Immedi-<br>ately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Setup               | page<br>8-8,<br>page<br>8-90 |
| Pn522               | 4    | Positionin<br>Width                 | ig Completed                                                                                                                                           | d 0 to<br>1,073,741,824                                                          | 1 refer-<br>ence<br>unit                                                                                                                                                                         | 7                                                                                                                                                                                               | All                                                                                                                                                                                                                                                                                | Immedi-<br>ately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Setup               | page<br>6-12                 |
| Pn524               | 4    | Near Sigr                           | nal Width                                                                                                                                              | 1 to<br>1,073,741,824                                                            | 1 refer-<br>ence<br>unit                                                                                                                                                                         | 107374<br>1824                                                                                                                                                                                  | All                                                                                                                                                                                                                                                                                | Immedi-<br>ately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Setup               | page<br>6-13                 |
| Pn526               | 4    |                                     | Deviation Ove<br>n Level at<br>I                                                                                                                       | er- 1 to<br>1,073,741,823                                                        | 1 refer-<br>ence<br>unit                                                                                                                                                                         | 524288<br>0                                                                                                                                                                                     | All                                                                                                                                                                                                                                                                                | Immedi-<br>ately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Setup               | page<br>8-10                 |
| Pn528               | 2    | Position I<br>flow Warr<br>Servo ON | Deviation Ove<br>hing Level at                                                                                                                         | er-<br>10 to 100                                                                 | 1%                                                                                                                                                                                               | 100                                                                                                                                                                                             | All                                                                                                                                                                                                                                                                                | Immedi-<br>ately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Setup               | page<br>8-10                 |
| Pn529               | 2    | Speed Lir<br>Servo ON               | mit Level at<br>I                                                                                                                                      | 0 to 10,000                                                                      | 1 min <sup>-1</sup>                                                                                                                                                                              | 10000                                                                                                                                                                                           | Rotary                                                                                                                                                                                                                                                                             | Immedi-<br>ately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Setup               | page<br>8-10                 |
| D 504               | 2    | Multiplier<br>closed Ro             | per Fully-                                                                                                                                             | 0 to 100                                                                         | 1%                                                                                                                                                                                               | 20                                                                                                                                                                                              | Rotary                                                                                                                                                                                                                                                                             | Immedi-<br>ately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Tuning              | page<br>10-8                 |
| Pn52A               |      |                                     | Julion                                                                                                                                                 |                                                                                  | 1                                                                                                                                                                                                |                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                    | · ·                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1                   |                              |
| Pn52A<br>Pn52B      | 2    | Overload                            | Warning Lev                                                                                                                                            | el 1 to 100                                                                      | 1%                                                                                                                                                                                               | 20                                                                                                                                                                                              | All                                                                                                                                                                                                                                                                                | Immedi-<br>ately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Setup               | page<br>5-42                 |

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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                |  |  |
|                  | 2    | Program J<br>Related Se         | ogging-                  |                                                                                                                                                                                                       | 0000h to<br>0005h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | _                                                                              | 0000h              | All                  | Immedi-<br>ately | Setup               | page<br>7-14                  |  |  |
|                  |      | Tiolated et                     |                          |                                                                                                                                                                                                       | 000011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                |                    |                      | atory            |                     | 7 14                          |  |  |
|                  |      |                                 | Program                  | Jog                                                                                                                                                                                                   | ging Operatior                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | n Pattern                                                                      |                    |                      |                  |                     |                               |  |  |
|                  |      |                                 | 0                        |                                                                                                                                                                                                       | iiting time in Pr<br>vements in Pn5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                | orward by t        | ravel distance       | e in Pn531) >    | < Number            | of                            |  |  |
|                  |      |                                 | 1                        |                                                                                                                                                                                                       | iiting time in Pr<br>vements in Pn5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                | everse by t        | ravel distance       | e in Pn531) >    | < Number            | of                            |  |  |
|                  |      |                                 |                          | `<br>mov<br>(Wa                                                                                                                                                                                       | iting time in Pr<br>vements in Pn5<br>iting time in Pr<br>vements in Pn5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 536<br>1535 → Re                                                               | ,                  |                      | ,                |                     |                               |  |  |
| Pn530            |      | n.□□□X                          | 3                        | mov<br>(Wa                                                                                                                                                                                            | iting time in Provements in Pr | 536<br>1535 → Fo                                                               |                    |                      | ,                |                     |                               |  |  |
|                  |      |                                 | 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                        |                                                                                                                                                                                                       | iiting time in Pn<br>n535 → Forwa<br>536                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                |                    |                      |                  |                     |                               |  |  |
|                  |      | n.DDXD                          | Reserved                 | par                                                                                                                                                                                                   | rameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | t change.                                                                      | )                  |                      |                  |                     |                               |  |  |
|                  | 1    | n.¤X¤¤                          | Reserved                 | par                                                                                                                                                                                                   | rameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | t change.                                                                      | )                  |                      |                  |                     |                               |  |  |
|                  |      | n.XDDD                          | Reserved                 | ed parameter (Do not change.)                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                |                    |                      |                  |                     |                               |  |  |
|                  |      |                                 |                          |                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                |                    |                      |                  |                     |                               |  |  |
| Pn531            | 4    | Program J<br>Distance           | ogging Trav              | /el                                                                                                                                                                                                   | 1 to<br>1,073,741,824                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 refer-<br>ence<br>unit                                                       | 32768              | All                  | Immedi-<br>ately | Setup               | page<br>7-14                  |  |  |
| Pn533            | 2    | Program J<br>ment Spee          |                          | ve-                                                                                                                                                                                                   | 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>7-14                  |  |  |
| Pn534            | 2    | Program J<br>eration/De<br>Time | ogging Acc<br>celeration | el-                                                                                                                                                                                                   | 2 to 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 ms                                                                           | 100                | All                  | Immedi-<br>ately | Setup               | page<br>7-14                  |  |  |
| Pn535            | 2    | Program J<br>ing Time           | ogging Wa                | t-                                                                                                                                                                                                    | 0 to 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 ms                                                                           | 100                | All                  | Immedi-<br>ately | Setup               | page<br>7-14                  |  |  |
| Pn536            | 2    | Program J<br>ber of Mov         |                          | n-                                                                                                                                                                                                    | 0 to 1,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Times                                                                          | 1                  | All                  | Immedi-<br>ately | Setup               | page<br>7-14                  |  |  |
| Pn550            | 2    | Analog Mo<br>Voltage            | nitor 1 Offs             | set                                                                                                                                                                                                   | -10,000 to<br>10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.1 V                                                                          | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>9-11                  |  |  |
| Pn551            | 2    | Analog Mo<br>Voltage            | nitor 2 Offs             | set                                                                                                                                                                                                   | -10,000 to<br>10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.1 V                                                                          | 0                  | All                  | Immedi-<br>ately | Setup               | page<br>9-11                  |  |  |
| Pn552            | 2    | Analog Mo<br>nification         | nitor 1 Ma               | 9-                                                                                                                                                                                                    | -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 Ma               | g-                                                                                                                                                                                                    | -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         |                          |                                                                                                                                                                                                       | 1 to 3,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.1%                                                                           | 400                | All                  | Immedi-<br>ately | Setup               | page<br>8-56                  |  |  |
| Pn561            | 2    | Overshoot<br>Level              | Detection                |                                                                                                                                                                                                       | 0 to 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1%                                                                             | 100                | All                  | Immedi-<br>ately | Setup               | page<br>8-31,<br>page<br>8-41 |  |  |

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|                  |      |                                      |                                           |                           |                      |                        | Con                  | tinued from      | n previous          | s 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 |
|                  | 2    | Output Sig<br>Method Se              | nal Referenc<br>elections 1               | e 0000h to<br>1111h       | _                    | 0000h                  | All                  | After<br>restart | Setup               | page<br>6-7   |
|                  |      |                                      |                                           |                           |                      |                        |                      |                  |                     |               |
|                  |      |                                      | <u> </u>                                  | t Signal Referen          |                      |                        |                      |                  |                     |               |
|                  |      | n.🗆🗆 🗆 X                             |                                           | utput parameter           | Ũ                    | Ũ                      |                      |                  |                     |               |
|                  |      |                                      | 1 C                                       | utput OR of para          | ameter-ass           | signed SO <sup>-</sup> | signal and s         | ignal set by     | SVCMD_I             | Э.            |
|                  |      |                                      | SO2 Outpu                                 | t Signal Referen          | ce Metho             | d Selectio             | n                    |                  |                     |               |
| Pn56A            |      | n.🗆🗆 X 🗆                             |                                           | utput parameter           | Ũ                    | 0                      |                      |                  |                     |               |
|                  |      |                                      | 1 C                                       | utput OR of para          | ameter-ass           | signed SO2             | 2 signal and s       | ignal set by     | SVCMD_I             | Э.            |
|                  |      |                                      | SO3 Outpu                                 | t Signal Referen          | ce Metho             | d Selectio             | n                    |                  |                     |               |
|                  |      | n.🗆X🗆                                | 0 C                                       | utput parameter           | -assigned            | SO3 signa              | Ι.                   |                  |                     |               |
|                  |      |                                      | 1 C                                       | utput OR of para          | ameter-ass           | signed SO3             | 3 signal and s       | ignal set by     | SVCMD_I             | Э.            |
|                  |      | n.XDDD                               | Reserved p                                | arameter (Do no           | ot change.           | )                      |                      |                  |                     |               |
| Pn56B            | 2    | Reserved<br>(Do not ch               | parameters                                | _                         | _                    | 0000h                  | All                  | _                | _                   | _             |
| Pn581            | 2    | Zero Spee                            | - 5-7                                     | 1 to 10,000               | 1 mm/s               | 20                     | Linear               | Immedi-<br>ately | Setup               | pag<br>6-9    |
| Pn582            | 2    | Speed Coi<br>Detection<br>Width      | incidence<br>Signal Outpu                 | t 0 to 100                | 1 mm/s               | 10                     | Linear               | Immedi-<br>ately | Setup               | page<br>6-1   |
| Pn583            | 2    | Brake Refe<br>put Speed              | erence Out-<br>I Level                    | 0 to 10,000               | 1 mm/s               | 10                     | Linear               | Immedi-<br>ately | Setup               | pag<br>5-34   |
| Pn584            | 2    | Speed Lim<br>Servo ON                |                                           | 0 to 10,000               | 1 mm/s               | 10000                  | Linear               | Immedi-<br>ately | Setup               | pag<br>8-1(   |
| Pn585            | 2    | Program J<br>ment Spee               | logging Move<br>ed                        | <sup>;-</sup> 1 to 10,000 | 1 mm/s               | 50                     | Linear               | Immedi-<br>ately | Setup               | page<br>7-14  |
| Pn586            | 2    | Motor Run<br>Ratio                   | ning Cooling                              | 0 to 100                  | 1%/<br>Max.<br>speed | 0                      | Linear               | Immedi-<br>ately | Setup               | -             |
|                  | 2    |                                      | etection<br>Selection for<br>inear Encode |                           | -                    | 0000h                  | Linear               | Immedi-<br>ately | Setup               | _             |
|                  |      |                                      |                                           |                           |                      |                        |                      |                  |                     |               |
|                  |      |                                      |                                           | tection Selection         |                      | lute Linea             | r Encoder            |                  | Refere              | nce           |
|                  |      | n.🗆 🗆 🗆 X                            |                                           | o not detect pola         | arity.               |                        |                      |                  | page 5              | -26           |
| Pn587            |      |                                      | 1 D                                       | etect polarity.           |                      |                        |                      |                  |                     |               |
|                  |      | n.DDXD                               | Reserved p                                | arameter (Do no           | t change.            | )                      |                      |                  |                     |               |
|                  |      | n.¤X¤¤                               | Reserved p                                | arameter (Do no           | t change.            | )                      |                      |                  |                     |               |
|                  |      | n.XDDD                               | Reserved p                                | arameter (Do no           | t change.            | )                      |                      |                  |                     |               |
| Pn600            | 2    | Regenerat<br>Capacity <sup>*4</sup>  | ive Resistor                              | Depends on model.*5       | 10 W                 | 0                      | All                  | Immedi-<br>ately | Setup               | pag<br>5-56   |
| Pn601            | 2    | Dynamic E<br>tor Allowal<br>Consumpt |                                           | 0 to 65,535               | 10 J                 | 0                      | All                  | After<br>restart | Setup               | *6            |
| Pn603            | 2    | Regenerat<br>tance                   |                                           | 0 to 65,535               | 10 mΩ                | 0                      | All                  | Immedi-<br>ately | Setup               | page<br>5-56  |
|                  | 2    | Dynamic E                            | Brake Resis-                              | 0 to 65,535               | 10 mΩ                | 0                      | All                  | After            | Setup               | *6            |

|                                 |                                                                                                                                                                                                                                                                                                             |                          |                   |                   |                 |                    | Con                  | tinued from      | n previous          | s page.        |
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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 |
|                                 | 2                                                                                                                                                                                                                                                                                                           | Overheat F<br>Selections |                   | 0000h to<br>0003h | -               | 0000h              | All                  | After<br>restart | Setup               | page<br>6-62   |
|                                 | r                                                                                                                                                                                                                                                                                                           | n.000X                   | 0 Dis             | tection Selectic  | protection.     |                    |                      | . *7             |                     |                |
| Pn61A                           | 1         Use overheat protection in the Yaskawa Linear Servomotor.*7           2         Monitor a negative voltage input from a sensor attached to the machine and use overheat protection.           Monitor a positive voltage input from a sensor attached to the machine and use overheat protection. |                          |                   |                   |                 |                    |                      |                  |                     | nd             |
| 111017                          | 3 Monitor a positive voltage input from a sensor attached to the machine and use overheat protection.                                                                                                                                                                                                       |                          |                   |                   |                 |                    |                      |                  |                     | d              |
|                                 | r                                                                                                                                                                                                                                                                                                           | n.00X0                   | Reserved par      | ameter (Do not    | change.)        |                    |                      |                  |                     |                |
|                                 | r                                                                                                                                                                                                                                                                                                           | n.0X00                   | Reserved par      | ameter (Do not    | change.)        |                    |                      |                  |                     |                |
|                                 | r                                                                                                                                                                                                                                                                                                           | n.X000                   | Reserved par      | ameter (Do not    | change.)        |                    |                      |                  |                     |                |
| Pn61B<br>*8                     | 2                                                                                                                                                                                                                                                                                                           | Overheat A               | Alarm Level       | 0 to 500          | 0.01 V          | 250                | All                  | Immedi-<br>ately | Setup               | page<br>6-63   |
| Pn61C<br>*8                     | 2                                                                                                                                                                                                                                                                                                           | Overheat V               | Varning Level     | 0 to 100          | 1%              | 100                | All                  | Immedi-<br>ately | Setup               | page<br>6-63   |
| Pn61D<br>*8                     |                                                                                                                                                                                                                                                                                                             |                          |                   |                   |                 |                    |                      |                  | page<br>6-63        |                |
| Pn621 to<br>Pn628 <sup>*3</sup> | _                                                                                                                                                                                                                                                                                                           | Safety Moo<br>Parameter  | dule-Related<br>s | -                 | -               | _                  | All                  | _                | -                   | _              |

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| Parameter<br>No. | Size | N                                      | ame                                                                                            | Setting<br>Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Applicable<br>Motors                                             | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence   |
|                  | 2    | Communic<br>trols                      | cations Con-                                                                                   | 0000h to<br>1FF3h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | All                                                              | Immedi-<br>ately | Setup               | -                |
| Pn800            |      | nX                                     | 0Do n1Ignor2Ignor3Ignor0Do n1Ignor2Ignor3Ignor4Ignor5Ignor6Ignor7Ignor8Ignor9IgnorAIgnorCIgnor | IFF3h<br>INK Communi<br>ot mask.<br>e MECHATROL<br>e WDT errors ( <i>i</i><br>e both MECHA<br>s (A.E50).<br>ck Masks<br>ot mask.<br>e data setting v<br>e command wa<br>e both A.94<br>e communicatii<br>e both A.94<br>a e communicatii<br>e e communicatii<br>e e communicatii<br>e e communicatii<br>e e communic | LINK comr<br>A.E50).<br>TROLINK<br>warnings (A.<br>and A.95E<br>ons warning<br>and A.96E<br>and A | heck Masl<br>munication<br>communic<br>communic<br>A.94□).<br>95□).<br>I warnings<br>gas (A.96⊑<br>I warnings<br>gas (A.96⊑<br>I warnings<br>gas (A.96⊑<br>I warnings<br>gas (A.96⊑<br>I warnings<br>gas (A.96⊑<br>I warnings<br>gas (A.97k<br>and A.97k<br>gas (A.97k)<br>gas | k for Debugg<br>s errors (A.E6<br>ations errors<br>ations errors | ing<br>0).       |                     |                  |
|                  |      | n.=X===<br>n.X====<br>M3 <sup>*9</sup> | E Ignor<br>F Ignor<br>Reserved pa<br>Automatic W<br>0 Retai                                    | e A.94 , A.96<br>e A.95 , A.96<br>e A.94 , A.95<br>rameter (Do no<br>arning Clear So<br>n warnings for<br>matically clear v                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | □, A.97A,<br>□, A.96□<br>t change.<br>election for<br>debugging                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | and A.97k<br>, A.97A, ar<br>)<br>or Debugg<br>g.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | warnings.<br>nd A.97b war<br>ing <sup>*9</sup>                   |                  |                     | -<br>-<br>-<br>- |
|                  | 2    | Application<br>Selections<br>Limits)   |                                                                                                | 0000h to<br>0103h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | All                                                              | Immedi-<br>ately | Setup               | page<br>6-27     |
| Pn801            |      | n.000X                                 | 1 Disak<br>2 Disak                                                                             | it Selection<br>le both forward<br>ole forward soft<br>ole reverse soft<br>ole both forward                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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|                  |      | n.🗆 🗆 X 🗆                              | Reserved pa                                                                                    | rameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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|                  |      | n.0X00                                 | Software Lim                                                                                   | it Check for Re<br>ot perform softw<br>rrm software lin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            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|                  |      | n.XDDD                                 | Reserved pa                                                                                    | rameter (Do no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| Pn803            | 2    | Origin Ran                             | ge                                                                                             | 0 to 250                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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| Pn804            | 4    | Forward S                              | oftware Limit                                                                                  | -1,073,741,823<br>to<br>1,073,741,823                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | All                                                              | Immedi-<br>ately | Setup               | page<br>6-27     |
|                  |      |                                        |                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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|-------------------|------|---------------------------------------|-----------------------------|---------------------------------------------------|--------------------------------------------------|--------------------|----------------------|---------------------------------|---------------------|----------------|
| 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 |
| Pn806             | 4    | Reverse Sc                            | oftware Limit               | -1,073,741,823<br>to<br>1,073,741,823             | 1 refer-<br>ence<br>unit                         | -10737<br>41823    | All                  | Immedi-<br>ately                | Setup               | page<br>6-27   |
| Pn808             | 4    | Absolute Er<br>Offset                 | ncoder Origin               | -1,073,741,823<br>to<br>1,073,741,823             | 1 refer-<br>ence<br>unit                         | 0                  | All                  | Immedi-<br>ately <sup>*10</sup> | Setup               | page<br>5-53   |
| Pn80A             | 2    | First Stage<br>eration Cor            | Linear Accel-<br>nstant     | 1 to 65,535                                       | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup> | 100                | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn80B             | 2    | Second Sta<br>Acceleratio             | age Linear<br>In Constant   | 1 to 65,535                                       | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup> | 100                | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn80C             | 2    | Acceleratio<br>Switching \$           | n Constant<br>Speed         | 0 to 65,535                                       | 100 ref-<br>erence<br>units/s                    | 0                  | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn80D             | 2    | First Stage<br>Deceleratic            | Linear<br>on Constant       | 1 to 65,535                                       | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup> | 100                | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn80E             | 2    | Second Sta<br>Deceleratic             | age Linear<br>on Constant   | 1 to 65,535                                       | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup> | 100                | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn80F             | 2    | Deceleration<br>Switching S           | on Constant<br>Speed        | 0 to 65,535                                       | 100 ref-<br>erence<br>units/s                    | 0                  | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn810             | 2    | Exponentia<br>tion/Decele             |                             | 0 to 65,535                                       | 100 ref-<br>erence<br>units/s                    | 0                  | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
| Pn811             | 2    | Exponentia<br>tion/Decele<br>Constant | I Accelera-<br>eration Time | 0 to 5,100                                        | 0.1 ms                                           | 0                  | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
| Pn812             | 2    | Movement<br>Time                      | Average                     | 0 to 5,100                                        | 0.1 ms                                           | 0                  | All                  | Immedi-<br>ately <sup>*12</sup> | Setup               | *1             |
| Pn814             | 4    | External Po<br>Final Travel           |                             | -1,073,741,823<br>to<br>1,073,741,823             | 1 refer-<br>ence<br>unit                         | 100                | All                  | Immedi-<br>ately                | Setup               | *1             |
|                   | 2    | Origin Retu<br>tings                  | ırn Mode Set-               | 0000h to<br>0001h                                 | _                                                | 0000h              | All                  | Immedi-<br>ately                | Setup               | *13            |
| Pn816             | r    | n.000X                                |                             | Direction<br>n in forward dia<br>n in reverse dir |                                                  |                    |                      |                                 |                     | _              |
| M2 <sup>*14</sup> | r    | n.00X0                                | Reserved par                | rameter (Do no                                    | t change.                                        | )                  |                      |                                 |                     | Ī              |
|                   | r    | n.0X00                                | Reserved par                | ameter (Do no                                     | t change.                                        | )                  |                      |                                 |                     | Ī              |
|                   | r    | n.XOOO                                | Reserved par                | rameter (Do no                                    | ot change.                                       | )                  |                      |                                 |                     | Ι              |
| Pn817<br>*15      | 2    | Origin Appi<br>1                      | roach Speed                 | 0 to 65,535                                       | 100 ref-<br>erence<br>units/s                    | 50                 | All                  | Immedi-<br>ately *11            | Setup               | *1             |
| Pn818<br>*16      | 2    | Origin Appi<br>2                      | roach Speed                 | 0 to 65,535                                       | 100 ref-<br>erence<br>units/s                    | 5                  | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn819             | 4    | Final Travel<br>Origin Retu           | Distance for                | -1,073,741,823<br>to<br>1,073,741,823             | 1 refer-<br>ence<br>unit                         | 100                | All                  | Immedi-<br>ately                | Setup               | *1             |
|                   |      |                                       |                             |                                                   |                                                  |                    |                      | · ·                             |                     |                |

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|                  |      |                          |               |                                       |                          |                    |                      | tinued from      | · ·                 | s 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 |
|                  | 2    | Input Sign<br>Selections | al Monitor    | 0000h to<br>7777h                     | -                        | 0000h              | All                  | Immedi-<br>ately | Setup               | *13            |
|                  |      |                          | IO12 Signal N | Mapping<br>ot map.                    |                          |                    |                      |                  |                     | 1              |
|                  |      |                          | 1 Moni        | tor CN1-13 inp                        | ut termina               | Ι.                 |                      |                  |                     | _              |
|                  |      |                          |               | tor CN1-7 inpu                        |                          |                    |                      |                  |                     | -              |
|                  |      | n.DDDX                   |               | tor CN1-8 inpu<br>tor CN1-9 inpu      |                          |                    |                      |                  |                     | -              |
| Pn81E            |      |                          |               | tor CN1-9 lipu                        |                          | Ι.                 |                      |                  |                     | -              |
| M2 *14           |      |                          |               | tor CN1-11 inp                        |                          |                    |                      |                  |                     | -              |
|                  |      |                          | 7 Moni        | tor CN1-12 inp                        | ut termina               | Ι.                 |                      |                  |                     | _              |
|                  |      |                          | IO13 Signal M | Mapping                               |                          |                    |                      |                  |                     | [              |
|                  |      | n.□□X□                   | 0 to 7 The r  | mappings are th                       | ne same a                | s the IO12         | signal mappi         | ngs.             |                     | _              |
|                  |      |                          | IO14 Signal M | Mapping                               |                          |                    |                      |                  |                     |                |
|                  |      | n.¤X¤¤                   | 0 to 7 The r  | mappings are th                       | ne same a                | s the IO12         | signal mappi         | ngs.             |                     | _              |
|                  |      | n.XDDD                   | IO15 Signal M | Mapping                               |                          |                    |                      |                  |                     |                |
|                  |      |                          | 0 to 7 The r  | nappings are th                       | ne same a                | s the IO12         | signal mappi         | ngs.             |                     | _              |
|                  |      | Command                  | Data Alloca-  | 0000h to                              |                          |                    |                      | After            |                     |                |
|                  | 2    | tions                    | Data Alloca-  | 1111h                                 | -                        | 0010h              | All                  | restart          | Setup               | *13            |
|                  |      |                          |               |                                       |                          |                    |                      |                  |                     |                |
|                  |      |                          | Option Field  | Allocation                            |                          |                    |                      |                  |                     |                |
|                  |      | n.🗆 🗆 🗆 X                | 0 Disab       | ole option field a                    | allocation.              |                    |                      |                  |                     | -              |
| Pn81F            |      |                          | 1 Enab        | le option field a                     | llocation.               |                    |                      |                  |                     | _              |
| M2 *14           |      |                          | Position Con  | trol Command                          | TFF/TLIN                 | I Allocatio        | n                    |                  |                     |                |
|                  |      | n.🗆🗆 X 🗆                 |               | ble allocation.                       |                          |                    |                      |                  |                     | _              |
|                  |      |                          | 1 Enab        | le allocation.                        |                          |                    |                      |                  |                     | -              |
|                  |      | n.¤X¤¤                   | Reserved par  | rameter (Do no                        | t change.                | )                  |                      |                  |                     |                |
|                  |      | n.XDDD                   | Reserved par  | rameter (Do no                        | t change.                | )                  |                      |                  |                     |                |
|                  |      |                          |               |                                       |                          |                    |                      |                  |                     | _              |
| Pn820            | 4    | Forward L                | atching Area  | -2,147,483,648<br>to<br>2,147,483,647 | 1 refer-<br>ence<br>unit | 0                  | All                  | Immedi-<br>ately | Setup               | *1             |
| Pn822            | 4    | Reverse La               | atching Area  | -2,147,483,648<br>to<br>2,147,483,647 | 1 refer-<br>ence<br>unit | 0                  | All                  | Immedi-<br>ately | Setup               | *1             |
|                  | L    |                          |               | ,,,,,                                 |                          |                    | <u> </u>             | Continue         |                     |                |

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|---------------------------------------|------|---------------------|-----------------------------------------------------|--------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
| 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    | Option N<br>tion    | Ionitor 1 Selec-                                    | 0000h to<br>FFFFh        | -               | 0000h              | -                    | Immedi-<br>ately | Setup               | *1             |
|                                       |      |                     |                                                     |                          |                 |                    |                      |                  |                     |                |
|                                       |      | Setting             |                                                     |                          | Monitor         |                    |                      | Арр              | licable Mo          | otors          |
|                                       | Н    | igh-Speed           | d Monitor Regior                                    | 1                        |                 |                    |                      |                  |                     |                |
|                                       | 0    | 000h                | Motor speed [o                                      | verspeed dete            | ction spee      | d/100000           | Dh]                  |                  | All                 |                |
|                                       | 0    | 001h                | Speed referenc                                      |                          |                 | peed/100           | 0000h]               |                  | All                 |                |
|                                       |      | 002h                | Torque [maximu                                      |                          |                 |                    |                      |                  | All                 |                |
|                                       |      | 003h                | Position deviation                                  | ,                        |                 |                    |                      |                  | All                 |                |
|                                       |      | 004h                | Position deviati                                    |                          | <i>,</i> .      |                    |                      |                  | All                 |                |
|                                       |      | 00Ah                | Encoder count                                       | ,                        | -               |                    |                      |                  | All                 |                |
|                                       |      | 00Bh                | Encoder count                                       |                          |                 |                    |                      |                  | All                 |                |
|                                       |      | 00Ch                | FPG count (low                                      | , ι                      |                 |                    |                      |                  | All                 |                |
|                                       |      | 00Dh                | FPG count (upp<br>Estimated vibra                   | , 1                      |                 |                    | 200000hl             |                  | All                 |                |
|                                       |      | 055h <sup>*17</sup> |                                                     |                          |                 |                    | ,                    | 0011             |                     |                |
|                                       | _    | 056h <sup>*17</sup> | Estimated exter                                     |                          | e torque [I     | maximum            | orque/10000          | 000h]            | All                 | _              |
|                                       |      |                     | Monitor Region                                      |                          |                 |                    |                      |                  |                     |                |
|                                       | —    | 010h                | Un000: Motor s                                      |                          |                 |                    |                      |                  | All                 |                |
|                                       | 0    | 011h                | Un001: Speed                                        |                          | <sup>-1</sup> ] |                    |                      |                  | All                 |                |
|                                       | 0    | 012h                | Un002: Torque                                       |                          |                 |                    |                      |                  | All                 |                |
|                                       | 0    | 013h                | Un003: Rotatio<br>Number of enco<br>displayed in de | oder pulses fro<br>cimal | om origin v     | vithin one e       | encoder rotati       | ion              | All                 |                |
|                                       |      |                     | Un003: Rotatio<br>Linear encoder                    |                          |                 |                    | layed in decir       | nal              |                     |                |
| <sup>-</sup> n824<br>M3 <sup>*9</sup> | 0    | 014h                | Un004: Rotatio<br>Electrical angle                  | from polarity of         | origin          |                    |                      |                  | All                 |                |
| 1013                                  |      | -                   | Un004: Electric<br>Electrical angle                 | from polarity of         |                 |                    |                      |                  |                     |                |
|                                       |      | 015h                | Un005: Input S                                      | 0                        |                 |                    |                      |                  | All                 |                |
|                                       |      | 016h                | Un006: Output                                       | 0                        |                 |                    |                      |                  | All                 |                |
|                                       |      | 017h                | Un007: Input R                                      |                          |                 |                    |                      |                  | All                 |                |
|                                       |      | 018h                | Un008: Positior                                     |                          |                 | its]               |                      |                  | All                 |                |
|                                       |      | 019h                | Un009: Accum                                        |                          |                 |                    |                      |                  | All                 |                |
|                                       |      | 01Ah                | Un00A: Regene                                       |                          |                 | 0                  | iana [0/]            |                  | All                 |                |
|                                       |      | 01Bh<br>01Ch        | Un00B: Dynam<br>Un00C: Input F                      |                          |                 |                    |                      |                  | All                 |                |
|                                       |      | 01Dh                | Un00D: Feedba                                       |                          |                 |                    | -                    |                  | All                 |                |
|                                       |      | 01Eh                | Un00E: Fully-cl<br>resolution]                      |                          | •               |                    |                      | coder            | Rotary              |                |
|                                       | 0    | 023h                | Initial multiturn                                   | data [Rev]               |                 |                    |                      |                  | Rotary              |                |
|                                       |      | 024h                | Initial increment                                   |                          | sl              |                    |                      |                  | Rotary              |                |
|                                       |      | 025h                | Initial absolute                                    |                          |                 | its) [pulses       | ]                    |                  | Linear              |                |
|                                       | 0    | 026h                | Initial absolute                                    | position data (          | upper 32 b      | oits) [pulse:      | s]                   |                  | Linear              |                |
|                                       | 0    | 040h                | Un025: SERVO                                        | PACK Installat           | ion Enviro      | nment Mor          | nitor                |                  | All                 |                |
|                                       | 0    | 041h                | Un026: Servorr                                      | otor Installatio         | n Environr      | nent Monit         | or                   |                  | All                 |                |
|                                       | 0    | 042h                | Un027: Built-in                                     | Fan Remainin             | g Life Ratio    | C                  |                      |                  | All                 |                |
|                                       | 0    | 043h                | Un028: Capacit                                      | or Remaining             | Life Ratio      |                    |                      |                  | All                 |                |
|                                       | 0    | 044h                | Un029: Surge F                                      | Prevention Circ          | uit Remair      | ning Life R        | atio                 |                  | All                 |                |
|                                       | 0    | 045h                | Un02A: Dynam                                        | c Brake Circui           | t Remainir      | ng Life Rat        | 0                    |                  | All                 |                |
|                                       | 0    | 046h                | Un032: Instanta                                     | aneous Power             |                 |                    |                      |                  | All                 |                |
|                                       | 0    | 047h                | Un033: Power                                        | Consumption              |                 |                    |                      |                  | All                 |                |
|                                       | 0    | 048h                | Un034: Cumula                                       | tive Power Co            | nsumptior       | 1                  | -                    |                  | All                 |                |

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| Devementer       | 0    |                        |                                  | Catting           | Catting                      | Default            |                      |                    |                            |                     | 1 0            |
|------------------|------|------------------------|----------------------------------|-------------------|------------------------------|--------------------|----------------------|--------------------|----------------------------|---------------------|----------------|
| Parameter<br>No. | Size | Ν                      | lame                             | Setting<br>Range  | Setting<br>Unit              | Default<br>Setting | Applicable<br>Motors |                    | hen<br>abled               | Classi-<br>fication | Refer-<br>ence |
|                  |      | Setting                |                                  |                   | Monitor                      |                    |                      |                    | Applic                     | able Moto           | ors            |
|                  |      | Low-Speed              | Monitor Regio                    | n                 |                              |                    |                      |                    |                            |                     |                |
|                  | _    | 0070h <sup>*17</sup>   | Un078: Maxim                     | num value of ar   | mplitude o                   | f estimated        | d vibration [m       | in <sup>-1</sup> ] |                            | All                 |                |
|                  | _    | 0071h <sup>*17</sup>   | Un07A: Maxim<br>[%]              | num value of e    | stimated e                   | external dis       | turbance Toro        | que                |                            | All                 |                |
|                  |      | 0072h <sup>*17</sup>   | Un07B: Minim<br>[%]              | um value of es    | timated e                    | xternal dist       | urbance Torc         | que                |                            | All                 |                |
|                  |      | 0073h <sup>*17</sup>   | Un147: Numb<br>[times]           | er of MECHAT      | ROLINK c                     | ommunica           | tions errors         |                    |                            | All                 |                |
|                  |      | 0074h <sup>*17</sup>   | Un104: Numb                      | er of serial enc  | oder com                     | municatior         | s errors [time       | es]                |                            | All                 |                |
|                  |      | 0075h <sup>*17</sup>   | Un105: Settlin                   | ig time [0.1 ms   | ]                            |                    |                      |                    |                            | All                 |                |
|                  |      | 0076h <sup>*17</sup>   | Un106: Amou                      | nt of overshoo    | t [referenc                  | e units]           |                      |                    |                            | All                 |                |
| Pn824            | _    | 0077h <sup>*17</sup>   | Un107: Residu                    | ual vibration fre | equency [0                   | .1 Hz]             |                      |                    |                            | All                 |                |
| M3 *9            | _    | 0079h <sup>*17</sup>   | Un174: Tempe                     | erature margin    | until Servo                  | omotor ove         | rheats [°C]          |                    |                            | All                 |                |
|                  | _    | 007Ah <sup>*17</sup>   | Un145: Maxim                     | num value of a    | ccumulate                    | d load ratio       | o [%]                |                    |                            | All                 |                |
|                  | _    | 007Bh <sup>*17</sup>   | Un14E: Margir                    | n until overload  | I [0.01%]                    |                    |                      |                    |                            | All                 |                |
|                  |      | Low-Speed              | Monitor Regio                    | n (Communica      | ations mo                    | dule only)         |                      |                    |                            |                     |                |
|                  |      | 0080h                  | Previous value<br>units]         | e of latched fee  | dback po:                    | sition (LPO        | S1) [reference       | e                  |                            | All                 |                |
|                  | _    | 0081h                  | Previous value<br>units]         | e of latched fee  | dback po:                    | sition (LPO        | S2) [reference       | е                  |                            | All                 |                |
|                  |      | 0084h                  | Continuous La                    | atch Status (EX   | STATUS)                      |                    |                      |                    |                            | All                 |                |
|                  | _    | All Areas              | ſ                                |                   |                              |                    |                      |                    |                            |                     |                |
|                  |      | Other<br>values        | Reserved para                    | ameters (Do no    | t change.)                   |                    |                      |                    |                            | All                 |                |
|                  |      |                        |                                  | 00001             | 1                            | 1                  |                      | 1.                 |                            | 1                   |                |
|                  | 2    | tion                   | onitor 2 Selec-                  | 0000h to<br>FFFFh | -                            | 0000h              | All                  |                    | nedi-<br>tely              | Setup               | *1             |
| Pn825            | _    | 0000h to               | The estinge                      | are the same      | aa thaaa f                   | or the Opti        | on Monitor 1         | Color              | tion                       |                     |                |
|                  | _    | 0084h                  | The settings                     | are the same      | as 11050 10                  |                    |                      | Selec              |                            |                     | _              |
|                  |      | Linoar Da              |                                  |                   | 10,000<br>refer-             |                    |                      | Imr                | nedi-                      |                     |                |
| Pn827            | 2    | Linear Deo<br>Constant | 1 for Stopping                   | 1 to 65,535       | ence<br>units/s <sup>2</sup> | 100                | All                  |                    | ly *11                     | Setup               | *1             |
| Pn829            | 2    |                        | aiting Time (for<br>Deceleration | 0 to 65,535       | 10 ms                        | 0                  | All                  | Imr<br>ate         | nedi-<br>ly <sup>*11</sup> | Setup               | *1             |

|                  |      |                 |            |        |                             |                 |                    | Con                  | tinued from      | n previous          | s 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 |
|                  | 2    | Option Fie<br>1 | ld Allocat | tions  | 0000h to<br>1E1Eh           | -               | 1813h              | All                  | After<br>restart | Setup               | *13            |
|                  |      |                 |            |        |                             |                 |                    |                      |                  |                     |                |
|                  |      |                 | ACCFIL     | Alloc  | ation (Option)              |                 |                    |                      |                  |                     |                |
|                  |      |                 | 0          | Alloca | ate bits 0 and <sup>-</sup> | 1 to ACCF       | IL.                |                      |                  |                     | _              |
|                  |      |                 | 1          | Alloca | ate bits 1 and 2            | 2 to ACCF       | IL.                |                      |                  |                     |                |
|                  |      |                 | 2          | Alloca | ate bits 2 and 3            | 3 to ACCF       | IL.                |                      |                  |                     |                |
|                  |      |                 | 3          | Alloca | ate bits 3 and 4            | 4 to ACCF       | IL.                |                      |                  |                     | _              |
|                  |      |                 | 4          | Alloca | ate bits 4 and 8            | 5 to ACCF       | IL.                |                      |                  |                     | _              |
|                  |      |                 | 5          |        | ate bits 5 and 6            |                 |                    |                      |                  |                     | _              |
|                  |      | n.DDDX          | 6          |        | ate bits 6 and 7            |                 |                    |                      |                  |                     | _              |
|                  |      |                 | 7          |        | ate bits 7 and 8            |                 |                    |                      |                  |                     | _              |
|                  |      |                 | 8          |        | ate bits 8 and 9            |                 |                    |                      |                  |                     | _              |
|                  |      |                 | 9          |        | ate bits 9 and <sup>-</sup> |                 |                    |                      |                  |                     | _              |
| Pn82A            |      |                 | A          |        | ate bits 10 and             |                 | -                  |                      |                  |                     | _              |
| M2 *14           |      |                 | В          |        | ate bits 11 and             |                 | -                  |                      |                  |                     | _              |
|                  |      |                 | C          |        | ate bits 12 and             |                 |                    |                      |                  |                     | _              |
|                  |      |                 | D          |        | ate bits 13 and             |                 |                    |                      |                  |                     | _              |
|                  |      |                 | E          | Alloca | ate bits 14 and             | 15 to AC        | JHL.               |                      |                  |                     | _              |
|                  |      |                 | ACCFIL     | Alloc  | ation Enable/[              | Disable Se      | lection            |                      |                  |                     |                |
|                  |      | n.🗆🗆 X 🗆        | 0          | Disab  | le ACCFIL allo              | cation.         |                    |                      |                  |                     | _              |
|                  |      |                 | 1          | Enabl  | e ACCFIL alloc              | cation.         |                    |                      |                  |                     | _              |
|                  | -    |                 | 1          |        |                             |                 |                    |                      |                  |                     | -              |
|                  |      | n.🗆X🗆           |            |        | tion (Option)               |                 |                    |                      |                  |                     |                |
|                  |      |                 | 0 to E     | The s  | ettings are the             | same as f       | or the AC          | CFIL allocation      | ns.              |                     | _              |
|                  |      |                 | G_SEL      | Alloca | tion Enable/D               | isable Sel      | ection             |                      |                  |                     |                |
|                  |      | n. X000         | 0          | Disab  | le G_SEL alloc              | ation.          |                    |                      |                  |                     | _              |
|                  |      |                 | 1          | Enabl  | e G_SEL alloc               | ation.          |                    |                      |                  |                     | _              |
|                  | -    |                 | u I        |        |                             |                 |                    |                      |                  |                     | _              |
|                  |      |                 |            |        |                             |                 |                    |                      |                  |                     |                |

|                   |      |            |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    | Con                  | tinued from      | n 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 |
|                   | 2    | Option Fie | eld Allocations | 0000h to<br>1F1Fh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -               | 1D1Ch              | All                  | After<br>restart | Setup               | *13            |
|                   |      |            |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     |                |
|                   |      |            | V_PPI Alloca    | tion (Option)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                    |                      |                  |                     |                |
|                   |      |            |                 | ate bit 0 to V_F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | PPI.            |                    |                      |                  |                     |                |
|                   |      |            | 1 Alloc         | ate bit 1 to V_F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | PPI.            |                    |                      |                  |                     | _              |
|                   |      |            | 2 Alloc         | ate bit 2 to V_F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | PPI.            |                    |                      |                  |                     | _              |
|                   |      |            |                 | ate bit 3 to V_F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                    |                      |                  |                     | _              |
|                   |      |            |                 | ate bit 4 to V_F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                    |                      |                  |                     | _              |
|                   |      |            |                 | ate bit 5 to V_F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                    |                      |                  |                     | _              |
|                   |      |            |                 | ate bit 6 to V_F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                    |                      |                  |                     | _              |
|                   |      | n.🗆 🗆 🛛 X  |                 | ate bit 7 to V_F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                    |                      |                  |                     | _              |
|                   |      |            |                 | ate bit 8 to $V_F$<br>ate bit 9 to $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                    |                      |                  |                     | _              |
|                   |      |            |                 | ate bit 9 to v_r                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                    |                      |                  |                     | -              |
| Pn82B             |      |            |                 | ate bit 10 to V_                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                    |                      |                  |                     | -              |
| M2 <sup>*14</sup> |      |            |                 | ate bit 12 to V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     | _              |
|                   |      |            |                 | <br>_ate bit 13 to V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | -               |                    |                      |                  |                     | _              |
|                   |      |            | E Alloc         | ate bit 14 to V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | _PPI.           |                    |                      |                  |                     | _              |
|                   |      |            | F Alloc         | ate bit 15 to V_                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | PPI.            |                    |                      |                  |                     | _              |
|                   |      |            |                 | tion Enable/Di                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | cabla Sala      | oction             |                      |                  |                     |                |
|                   |      | n.🗆 🗆 X 🗆  | _               | ble V_PPI alloca                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CION               |                      |                  |                     |                |
|                   |      |            |                 | le V_PPI alloca                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     | _              |
|                   |      |            |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     | _              |
|                   |      | n.¤X¤¤     | P_PI_CLR AI     | location (Optic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | on)             |                    |                      |                  |                     |                |
|                   |      |            | 0 to F The s    | settings are the                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | same as         | for the V_F        | PPI allocations      |                  |                     | _              |
|                   |      |            | P PL CL B AL    | location Enabl                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | e/Disable       | Selection          |                      |                  |                     |                |
|                   |      | n.X000     |                 | ble P_PI_CLR a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                    |                      |                  |                     |                |
|                   |      |            | 1 Enab          | le P_PI_CLR al                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | llocation.      |                    |                      |                  |                     | _              |
|                   |      |            |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     | _              |
|                   |      | Option Fig | eld Allocations | 0000h to                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                    |                      | Aftor            |                     |                |
|                   | 2    | 3          | an Anocations   | 1F1Fh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | -               | 1F1Eh              | All                  | After<br>restart | Setup               | *13            |
|                   |      |            |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     |                |
|                   |      | n.🗆 🗆 🗆 X  | P_CL Allocat    | ion (Option)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                    |                      |                  |                     |                |
|                   |      |            | 0 to F The s    | settings are the                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | same as         | for the V_F        | PPI allocations      |                  |                     | _              |
|                   |      |            |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     | -              |
|                   |      |            |                 | ion Enable/Dis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | ction              |                      |                  |                     |                |
| Pn82C             |      | n.□□X□     |                 | ble P_CL allocate P_CL allocat |                 |                    |                      |                  |                     | _              |
| M2 *14            |      |            | I LIIdu         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     | _              |
|                   |      |            | N_CL Allocat    | ion (Option)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                    |                      |                  |                     |                |
|                   |      | n.¤X¤¤     | 0 to F The s    | settings are the                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | same as         | for the V_F        | PPI allocations      | 5.               |                     | _              |
|                   |      |            |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     |                |
|                   |      |            |                 | ion Enable/Dis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | ction              |                      |                  |                     |                |
|                   |      | n.XDDD     |                 | ble N_CL alloca                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     | _              |
|                   |      |            | 1 Enab          | le N_CL alloca                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | uon.            |                    |                      |                  |                     | _              |
|                   |      |            |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                    |                      |                  |                     |                |

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|------------------|------|-----------------|------------|--------|--------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No. | Size | Ν               | lame       |        | Setting<br>Range                     | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|                  | 2    | Option Fie<br>4 | eld Alloca | tions  | 0000h to<br>1F1Ch                    | -               | 0000h              | All                  | After<br>restart | Setup               | *13            |
|                  |      |                 |            |        |                                      |                 |                    |                      |                  |                     |                |
|                  |      |                 | BANK_      | SEL1   | Allocation (Op                       | tion)           |                    |                      |                  |                     |                |
|                  |      |                 | 0          | Alloca | ate bits 0 to 3 t                    | to BANK_S       | SEL1.              |                      |                  |                     |                |
|                  |      |                 | 1          | Alloca | ate bits 1 to 4 t                    | to BANK_S       | SEL1.              |                      |                  |                     | _              |
|                  |      |                 | 2          |        | ate bits 2 to 5 t                    | -               |                    |                      |                  |                     |                |
|                  |      |                 | 3          |        | ate bits 3 to 6 t                    | _               |                    |                      |                  |                     |                |
|                  |      |                 | 4          |        | ate bits 4 to 7 t                    |                 |                    |                      |                  |                     | _              |
|                  |      | n.DDDX          | 5          |        | ate bits 5 to 8                      |                 |                    |                      |                  |                     |                |
|                  |      |                 | 6          |        | ate bits 6 to 9                      | -               |                    |                      |                  |                     |                |
|                  |      |                 | 7          |        | ate bits 7 to 10                     |                 | -                  |                      |                  |                     | _              |
|                  |      |                 | 8          |        | ate bits 8 to 11                     |                 | _                  |                      |                  |                     |                |
| Pn82D            |      |                 | 9          |        | ate bits 9 to 12                     |                 |                    |                      |                  |                     | _              |
| M2 *14           |      |                 | AB         |        | ate bits 10 to 1<br>ate bits 11 to 1 |                 | -                  |                      |                  |                     |                |
|                  |      |                 | C          |        | ate bits 12 to 1                     |                 | _                  |                      |                  |                     |                |
|                  |      |                 | 0          | Alloca |                                      |                 | \_OLL1.            |                      |                  |                     |                |
|                  |      |                 | BANK_      | SEL1   | Allocation Ena                       | able/Disab      | le Selectio        | on                   |                  |                     |                |
|                  |      | n.🗆🗆 X          | 0          | Disab  | le BANK_SEL <sup>-</sup>             | 1 allocatio     | n.                 |                      |                  |                     | _              |
|                  |      |                 | 1          | Enabl  | e BANK_SEL1                          | allocation      | ۱.                 |                      |                  |                     |                |
|                  |      |                 |            |        |                                      | 1 )             |                    |                      |                  |                     | -              |
|                  |      | n.¤X¤¤          | 0 to F     | 1      | Allocation (Op                       |                 |                    |                      |                  |                     | _              |
|                  |      |                 | 0 to F     | The s  | ettings are the                      | same as         | for the V_F        | Pr allocations       | 5.               |                     | _              |
|                  |      |                 | LT_DIS     | ABLE   | Allocation Ena                       | able/Disab      | le Selectio        | on                   |                  |                     |                |
|                  |      | n.XDDD          | 0          | Disab  | le LT_DISABLE                        | E allocation    | n.                 |                      |                  |                     |                |
|                  |      |                 | 1          | Enabl  | e LT_DISABLE                         | allocation      | ۱.                 |                      |                  |                     |                |
|                  |      |                 |            |        |                                      |                 |                    |                      |                  |                     |                |
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|------------------|------|------------------------|-----------|--------|----------------------------------------|----------------------|--------------------|----------------------|----------------------|---------------------|----------------|
| 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 |
|                  | 2    | Option Fie<br>5        | ld Alloca | tions  | 0000h to<br>1D1Fh                      | -                    | 0000h              | All                  | After<br>restart     | Setup               | *13            |
|                  | -    | n.DDDX                 | Reserv    | ed nar | ameter (Do no                          | ot change            | )                  |                      |                      |                     |                |
|                  | 1.   | n.00X0                 |           |        | rameter (Do no                         |                      |                    |                      |                      |                     | -              |
|                  |      |                        | -         |        |                                        |                      | )                  |                      |                      |                     | _              |
|                  |      |                        |           |        | Allocation (O                          | . ,                  |                    |                      |                      |                     |                |
|                  |      |                        | 0         |        | ate bits 0 to 2 t<br>ate bits 1 to 3 t |                      |                    |                      |                      |                     | _              |
|                  |      |                        | 2         |        | ate bits 1 to 3 t                      | -                    |                    |                      |                      |                     | -              |
|                  |      |                        | 3         |        | ate bits 2 to $=$ 1                    | _                    |                    |                      |                      |                     | _              |
|                  |      |                        | 4         |        | ate bits 4 to 6 t                      |                      |                    |                      |                      |                     | -              |
| Pn82E            |      |                        | 5         |        | ate bits 5 to 7 t                      |                      |                    |                      |                      |                     | -              |
| M2 *14           |      | n.¤X¤¤                 | 6         |        | ate bits 6 to 8 t                      | _                    |                    |                      |                      |                     | -              |
|                  |      |                        | 7         |        | ate bits 7 to 9 t                      |                      |                    |                      |                      |                     | _              |
|                  |      |                        | 8         |        | ate bits 8 to 10                       | _                    |                    |                      |                      |                     | _              |
|                  |      |                        | 9         |        | ate bits 9 to 11                       |                      |                    |                      |                      |                     | _              |
|                  |      |                        | A         |        | ate bits 10 to 1                       | _                    |                    |                      |                      |                     | -              |
|                  |      |                        | В         |        | ate bits 11 to 1                       |                      | -                  |                      |                      |                     | -              |
|                  |      |                        | С         |        | ate bits 12 to 1                       |                      | -                  |                      |                      |                     | -              |
|                  |      |                        | D         |        | ate bits 13 to 1                       |                      | -                  |                      |                      |                     | -              |
|                  |      |                        |           |        |                                        |                      |                    |                      |                      |                     | -              |
|                  |      |                        |           |        | Allocation En                          |                      |                    | ion                  |                      |                     |                |
|                  |      | n.XDDD                 | 0         |        | e OUT_SIGNA                            |                      |                    |                      |                      |                     | _              |
|                  |      |                        | 1         | Enabl  | le OUT_SIGNA                           | L allocatio          | n.                 |                      |                      |                     | _              |
|                  |      |                        |           |        |                                        |                      |                    |                      |                      |                     |                |
|                  | 2    | Motion Se              | ttinas    |        | 0000h to                               | _                    | 0000h              | All                  | After                | Setup               | *1             |
|                  | _    |                        |           |        | 0001h                                  |                      |                    |                      | restart              |                     |                |
|                  |      |                        |           |        |                                        |                      |                    |                      |                      |                     |                |
|                  |      |                        | Lincor    | Accel  | eration/Deceler                        | votion Cor           | atant Cal          | ation                |                      |                     | ī              |
|                  |      |                        | Linear    |        | Pn80A to Pn80                          |                      |                    |                      | 221 to Dn81          | ) aro               | L              |
|                  |      | n.🗆 🗆 🗆 X              | 0         | ignore |                                        |                      | 527. (THE S        | ettings of File      | 554 10 511040        | Jale                |                |
| Pn833            |      |                        | 1         | Use F  | n834 to Pn84                           | 0. (The se           | ttings of Pi       | n80A to Pn80         | F and Pn82           | 7 are               | -              |
|                  |      |                        |           | ignore | ed.)                                   |                      |                    |                      |                      |                     | -              |
|                  | I    | n.DDXD                 | Reserv    | ed par | ameter (Do no                          | ot change.           | )                  |                      |                      |                     | 1              |
|                  | lī   | n.¤X¤¤                 | Reserv    | ed par | ameter (Do no                          | ot change.           | )                  |                      |                      |                     |                |
|                  |      |                        | 1         |        |                                        |                      | ,                  |                      |                      |                     | -              |
|                  |      | n.XDDD                 | Reserv    | ed par | ameter (Do no                          | t change.            | )                  |                      |                      |                     |                |
|                  |      |                        |           |        |                                        |                      |                    |                      |                      |                     |                |
|                  |      |                        |           |        |                                        | 10,000               |                    |                      |                      |                     |                |
| Pn834            | 4    | First Stage            |           |        | 1 to<br>20,971,520                     | refer-<br>ence       | 100                | All                  | Immedi-<br>ately *11 | Setup               | *1             |
|                  |      | eration Co             | instant 2 |        | 20,971,520                             | units/s <sup>2</sup> |                    |                      | ately "              |                     |                |
|                  |      |                        |           |        |                                        | 10,000               |                    |                      |                      |                     |                |
| Pn836            | 4    | Second St              |           |        | 1 to                                   | refer-<br>ence       | 100                | All                  | Immedi-              | Setup               | *1             |
|                  |      | Acceleration           | on Consi  | ant 2  | 20,971,520                             | units/s <sup>2</sup> |                    |                      | ately *11            |                     |                |
|                  |      | Appeloret              | on Con-   | opt    | 0 to                                   | 1 refer-             |                    |                      | Immedi-              |                     |                |
| Pn838            | 4    | Acceleration Switching | Speed 2   | ant    | 2,097,152,0                            | ence                 | 0                  | All                  | ately *11            | Setup               | *1             |
|                  |      |                        | •         |        | 00                                     | unit/s<br>10,000     |                    |                      |                      |                     |                |
| Pn83A            | 4    | First Stage            |           |        | 1 to                                   | refer-               | 100                | ΛII                  | Immedi-              | Satura              | *1             |
| PIIOSA           | 4    | Decelerati             |           | tant 2 | 20,971,520                             | ence                 | 100                | All                  | ately *11            | Setup               | *1             |
|                  |      |                        |           |        |                                        | units/s <sup>2</sup> |                    |                      |                      |                     |                |

|                  |      |                                       |                                                              |                                                                                       |                                                                                                                                                                      |                                                        |                    | 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 |
| Pn83C            | 4    | Second St<br>Deceleratio              |                                                              |                                                                                       | 1 to<br>20,971,520                                                                                                                                                   | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup>       | 100                | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn83E            | 4    | Deceleration<br>Switching             |                                                              |                                                                                       | 0 to<br>2,097,152,0<br>00                                                                                                                                            | 1 refer-<br>ence<br>unit/s                             | 0                  | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn840            | 4    | Linear Dec<br>Constant 2              |                                                              |                                                                                       | 1 to<br>20,971,520                                                                                                                                                   | 10,000<br>refer-<br>ence<br>units/s <sup>2</sup>       | 100                | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn842<br>*15     | 4    | Second Or<br>Approach                 | rigin<br>Speed 1                                             |                                                                                       | 0 to<br>20,971,520                                                                                                                                                   | 100 ref-<br>erence<br>units/s                          | 0                  | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn844<br>*16     | 4    | Second Or<br>Approach                 |                                                              | )                                                                                     | 0 to<br>20,971,520                                                                                                                                                   | 100 ref-<br>erence<br>units/s                          | 0                  | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | *1             |
| Pn846            | 2    | POSING C<br>Scurve Ac<br>Deceleration | celeratio                                                    |                                                                                       | 0 to 50                                                                                                                                                              | 1%                                                     | 0                  | All                  | Immedi-<br>ately <sup>*11</sup> | Setup               | -              |
| Pn850            | 2    | Number of<br>Sequences                |                                                              |                                                                                       | 0 to 8                                                                                                                                                               | -                                                      | 0                  | All                  | Immedi-<br>ately                | Setup               | *1             |
| Pn851            | 2    | Continuou<br>Sequence                 |                                                              |                                                                                       | 0 to 255                                                                                                                                                             | _                                                      | 0                  | All                  | Immedi-<br>ately                | Setup               | *1             |
|                  | 2    | Latch Seq<br>Settings                 | uence 1                                                      | to 4                                                                                  | 0000h to<br>3333h                                                                                                                                                    | -                                                      | 0000h              | All                  | Immedi-<br>ately                | Setup               | *1             |
| Pn852            | 1    | n                                     | 0<br>1<br>2<br>3<br>Latch \$<br>0 to 3<br>Latch \$<br>0 to 3 | Phase<br>EXT1<br>EXT2<br>EXT3<br>Sequer<br>The s<br>tion.<br>Sequer<br>The s<br>tion. | nce 1 Signal S<br>e C<br>signal<br>signal<br>signal<br>nce 2 Signal S<br>ettings are the<br>nce 3 Signal S<br>settings are the<br>nce 4 Signal S<br>settings are the | election<br>same as<br>election<br>same as<br>election | those for t        | he Latch Sequ        | uence 1 Sigr                    | nal Selec-          |                |

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| Parameter<br>No. | Size | N                      | lame                                                                                                                                                                           | Setting<br>Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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                                                                                                                                                                                                                                                              | Default<br>Setting                                                                                                                                                                                    | Applicable<br>Motors                                                                                                                                                                                                                       | When<br>Enabled                                                               | Classi-<br>fication | Refer<br>ence |
|------------------|------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------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|                  | 2    | Latch Seq<br>Settings  | uence 5 to 8                                                                                                                                                                   | 0000h to<br>3333h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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|                  | -    | Settings               |                                                                                                                                                                                | 000011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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|                  |      |                        | Latch Sequ                                                                                                                                                                     | ence 5 Signal S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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|                  |      |                        | 0 Ph                                                                                                                                                                           | ase C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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|                  |      | n.🗆🗆🛛 X                | 1 EX                                                                                                                                                                           | 1 signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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|                  |      |                        |                                                                                                                                                                                | 2 signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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|                  |      |                        | 3 EX                                                                                                                                                                           | 3 signal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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| Pn853            |      |                        | Latch Sequ                                                                                                                                                                     | ence 6 Signal S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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|                  |      | n.□□X□                 | 0 to 3 The tion                                                                                                                                                                | e settings are the                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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|                  |      |                        | Latch Sequ                                                                                                                                                                     | ence 7 Signal S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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|                  | 2    | SVCMD_IC<br>Monitor Al | llocations 1                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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|                  | 2    | SVCMD_I<br>Monitor Al  | Ilocations 1                                                                                                                                                                   | 1717h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              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|                  | 2    | SVCMD_IC<br>Monitor Al | Input Signa<br>0 Allo<br>1 Allo                                                                                                                                                | I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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|                  | 2    | Monitor Al             | Input Signa<br>0 Allo<br>1 Allo<br>2 Allo                                                                                                                                      | I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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|                  | 2    | n.DDX                  | Input Signa<br>0 Allo<br>1 Allo<br>2 Allo<br>3 Allo                                                                                                                            | I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S<br>cate bit 27 (IO_S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               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|                  | 2    | Monitor Al             | Input Signa<br>0 Allo<br>1 Allo<br>2 Allo<br>3 Allo<br>4 Allo                                                                                                                  | 1717h<br>I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S<br>cate bit 27 (IO_S<br>cate bit 28 (IO_S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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|                  | 2    | Monitor Al             | Input Signa<br>0 Allo<br>1 Allo<br>2 Allo<br>3 Allo<br>4 Allo<br>5 Allo                                                                                                        | I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S<br>cate bit 27 (IO_S<br>cate bit 28 (IO_S<br>cate bit 28 (IO_S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| Pn860            | 2    | Monitor Al             | Input Signa<br>0 Allo<br>1 Allo<br>2 Allo<br>3 Allo<br>4 Allo<br>5 Allo<br>6 Allo                                                                                              | 1717h<br>I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S<br>cate bit 27 (IO_S<br>cate bit 28 (IO_S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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| Pn860<br>M3 *9   | 2    | Monitor Al             | Input Signa<br>0 Allo<br>1 Allo<br>2 Allo<br>3 Allo<br>4 Allo<br>5 Allo<br>6 Allo<br>7 Allo<br>7 Allo                                                                          | I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S<br>cate bit 27 (IO_S<br>cate bit 29 (IO_S<br>cate bit 29 (IO_S<br>cate bit 30 (IO_S<br>cate bit 31 (IO_S<br>cate bit 31 (IO_S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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| <b>—</b> + 0     | 2    | Monitor Al             | Input Signa<br>0 Allo<br>1 Allo<br>2 Allo<br>3 Allo<br>4 Allo<br>5 Allo<br>6 Allo<br>7 Allo<br>7 Allo<br>0 Dis                                                                 | 1717h<br>I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S<br>cate bit 27 (IO_S<br>cate bit 28 (IO_S<br>cate bit 29 (IO_S<br>cate bit 30 (IO_S<br>cate bit 30 (IO_S<br>cate bit 31 (IO_S<br>out Signal Monite                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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| <b>—</b> + 0     | 2    | nX                     | Input Signa<br>0 Allo<br>1 Allo<br>2 Allo<br>3 Allo<br>4 Allo<br>5 Allo<br>6 Allo<br>7 Allo<br>7 Allo<br>0 Dis                                                                 | I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S<br>cate bit 27 (IO_S<br>cate bit 29 (IO_S<br>cate bit 29 (IO_S<br>cate bit 30 (IO_S<br>cate bit 31 (IO_S<br>cate bit 31 (IO_S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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| <b>—</b> + 0     | 2    | n                      | Input Signa<br>0 Allo<br>1 Allo<br>2 Allo<br>3 Allo<br>4 Allo<br>5 Allo<br>6 Allo<br>7 Allo<br>0 Dis<br>1 Ena                                                                  | 1717h<br>I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S<br>cate bit 27 (IO_S<br>cate bit 28 (IO_S<br>cate bit 29 (IO_S<br>cate bit 30 (IO_S<br>cate bit 30 (IO_S<br>cate bit 31 (IO_S<br>out Signal Monite                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | GTS1) to C<br>GTS2) to C<br>GTS3) to C<br>GTS4) to C<br>GTS5) to C<br>GTS5) to C<br>GTS6) to C<br>GTS7) to C<br>GTS8) to C<br>GTS9, to C                                                     | N1-13 (SV<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br><b>(Disable S</b><br>input signa                                                 | CMD_IO)<br>ut signal mon<br>ut signal mon<br>ut signal mon<br>ut signal mon<br>ut signal mon<br>ut signal mon<br>ut signal mon<br>election<br>al monitor.                                                                                  | ately<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor. | Setup               | *1            |
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                                                                                                                                                                          | N1-13 (SV<br>N1-13 inp<br>N1-13 inp       | CMD_IO)<br>ut signal mon<br>ut signal mon<br>al monitor.<br>I monitor.<br>:MD_IO)                                                    | ately<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor. | Setup               | *1            |
| <b>—</b> + 0     | 2    | Monitor Al             | Input Signa<br>0 Allo<br>1 Allo<br>2 Allo<br>3 Allo<br>4 Allo<br>5 Allo<br>6 Allo<br>7 Allo<br>0 Dis<br>1 Ena<br>1 Ena<br>0 to 7 The<br>CN1-7 Input                            | 1717h<br>I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S<br>cate bit 26 (IO_S<br>cate bit 27 (IO_S<br>cate bit 28 (IO_S<br>cate bit 29 (IO_S<br>cate bit 30 (IO_S<br>cate bit 30 (IO_S<br>cate bit 31 (IO_S<br>able allocation for<br>bible allocation for<br>a settings are the<br>t Signal Monitor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | GTS1) to C<br>GTS2) to C<br>GTS3) to C<br>GTS3) to C<br>GTS4) to C<br>GTS5) to C<br>GTS6) to C<br>GTS7) to C<br>GTS7) to C<br>GTS8) to C<br>or Enable/<br>or CN1-13<br>r CN1-13<br>tion for C<br>same as                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | N1-13 (SV<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-7 (SVC<br>the CN1-1                                 | CMD_IO)<br>ut signal mon<br>ut signal mon<br>election<br>al monitor.<br>I monitor.<br>SMD_IO)<br>3 allocations.<br>ection            | ately<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor. | Setup               | *1            |
| <b>—</b> + 0     | 2    | n                      | Input Signa<br>0 Allo<br>1 Allo<br>2 Allo<br>3 Allo<br>4 Allo<br>5 Allo<br>6 Allo<br>7 Allo<br>7 Allo<br>0 Dis<br>1 Ena<br>0 Dis<br>1 Ena<br>0 to 7 The<br>CN1-7 Inpu<br>0 Dis | 1717h<br>I Monitor Alloca<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S<br>cate bit 27 (IO_S<br>cate bit 28 (IO_S<br>cate bit 29 (IO_S<br>cate bit 30 (IO_S<br>cate bit 30 (IO_S<br>cate bit 31 (IO_S)<br>cate b | GTS1) to C<br>GTS2) to C<br>GTS3) to C<br>GTS3) to C<br>GTS4) to C<br>GTS5) to C<br>GTS6) to C<br>GTS6) to C<br>GTS7) to C<br>GTS8) to C<br>GTS9 to C<br>GT | N1-13 (SV<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>N1-13 inp<br>input signa<br>N1-7 (SVC<br>the CN1-1<br>Disable Sel<br>nput signal | CMD_IO)<br>ut signal mon<br>ut signal mon<br>tor.<br>al monitor.<br>SMD_IO)<br>3 allocations.<br>ection<br>monitor. | ately<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor.<br>itor. | Setup               | *1            |

Continued on next page.

|                  |      |                        |                                |                                      |                 |                    | Con                  | tinued from      | n previous          | s page.        |
|------------------|------|------------------------|--------------------------------|--------------------------------------|-----------------|--------------------|----------------------|------------------|---------------------|----------------|
| Parameter<br>No. | Size | Ν                      | lame                           | Setting<br>Range                     | Setting<br>Unit | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication | Refer-<br>ence |
|                  | 2    | SVCMD_IC<br>Monitor Al | O Input Signal<br>llocations 2 | 0000h to<br>1717h                    | -               | 0000h              | All                  | Immedi-<br>ately | Setup               | *1             |
|                  |      |                        |                                |                                      |                 |                    | I                    |                  |                     |                |
|                  |      | n.DDDX                 |                                | Monitor Alloca                       |                 | •                  | - ,                  |                  |                     | I              |
|                  |      |                        | 0 to 7 The s                   | ettings are the                      | same as t       | the CN1-1          | 3 allocations.       |                  |                     | -              |
|                  |      | n.DDXD                 |                                | Signal Monitor<br>le allocation fo   |                 |                    |                      |                  |                     |                |
| Pn861<br>M3 *9   |      | 11.0070                |                                | e allocation for                     |                 |                    |                      |                  |                     | -              |
|                  |      |                        | Input Signal N                 | Anitor Alloca                        | tion for CI     | V1-9 (SVC          | MD_IO)               |                  |                     | Ī              |
|                  |      | n.¤X¤¤                 | 0 to 7 The s                   | ettings are the                      | same as t       | the CN1-1          | 3 allocations.       |                  |                     | _              |
|                  |      |                        | CN1-9 Input S                  | Signal Monitor                       | Enable/D        | isable Sel         | ection               |                  |                     | I              |
|                  |      | n.XDDD                 |                                | le allocation fo                     |                 |                    |                      |                  |                     | _              |
|                  |      |                        | 1 Enabl                        | e allocation for                     | CN1-9 IN        | put signai         | monitor.             |                  |                     | -              |
|                  | 2    | SVCMD_I                | O Input Signal                 | 0000h to                             | _               | 0000h              | All                  | Immedi-          | Setup               | *1             |
|                  | -    | Monitor Al             | llocations 3                   | 1717h                                |                 | 000011             | 7.41                 | ately            | ootap               |                |
|                  | Ī    |                        | Input Signal M                 | /Ionitor Alloca                      | tion for CI     | N1-10 (SV          | CMD_IO)              |                  |                     | Ī              |
|                  |      | n.DDDX                 | 0 to 7 The s                   | ettings are the                      | same as t       | the CN1-1          | 3 allocations.       |                  |                     | _              |
|                  |      |                        |                                | Signal Monito                        |                 |                    |                      |                  |                     | I              |
| Pn862            |      | n.□□X□                 |                                | le allocation fo                     |                 |                    |                      |                  |                     | _              |
| M3 *9            | l    |                        |                                |                                      |                 |                    |                      |                  |                     | -              |
|                  |      | n.¤X¤¤                 |                                | Monitor Allocate the ettings are the |                 |                    |                      |                  |                     | L              |
|                  |      |                        | CN1-11 Input                   | Signal Monito                        | or Enable/      | Disable Se         | election             |                  |                     | Ī              |
|                  |      | n.XDDD                 | 0 Disab                        | le allocation fo                     |                 |                    |                      |                  |                     | _              |
|                  | _    |                        | 1 Enabl                        | e allocation for                     | CN1-11 i        | nput signa         | I monitor.           |                  |                     | -              |
|                  | 2    |                        | O Input Signal                 | 0000h to                             |                 | 0000h              | All                  | Immedi-          | Setup               | *1             |
|                  | 2    | Monitor Al             | llocations 4                   | 1717h                                | -               | 000011             | All                  | ately            | Setup               | •              |
|                  | 1    |                        | Input Signal N                 | /Ionitor Alloca                      | tion for Cl     | N1-12 (SV          | CMD IO)              |                  |                     | 1              |
|                  |      | n.□□□X                 |                                | ettings are the                      |                 |                    |                      |                  |                     | _              |
| Pn863            |      |                        | CN1-12 Input                   | Signal Monito                        | or Enable/      | Disable Se         | election             |                  |                     | I              |
| M3 *9            |      | n.🗆 🗆 X 🗆              |                                | le allocation fo                     |                 | 1 0                |                      |                  |                     | _              |
|                  |      |                        |                                | e allocation for                     |                 |                    |                      |                  |                     | -              |
|                  |      | n.¤X¤¤                 | Reserved par                   | ameter (Do no                        | t change.       | )                  |                      |                  |                     | _              |
|                  |      | n.XDDD                 | Reserved par                   | ameter (Do no                        | t change.       | )                  |                      |                  |                     | 1              |
|                  |      |                        |                                |                                      |                 |                    |                      |                  |                     |                |

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|                                           | -                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                        | 1                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                   |                                                                                                                                 |                                                                                                                                                                                                               |                                                                                                                                                                         |                     |               |  |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------|--|
| 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 |  |
|                                           | 2                                                                                                                                                                                                                                                                                                                                                                                         | SVCMD_l<br>nal Monito<br>1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | O Output Sig-<br>or Allocations                                                                                                                                                                                                                        | 0000h to<br>1717h                                                                                                                                                                                                                                                                                   | -                                                                                                                                                                                 | 0000h                                                                                                                           | All                                                                                                                                                                                                           | Immedi-<br>ately                                                                                                                                                        | Setup               | *1            |  |
| 2n868<br>M3 *9                            |                                                                                                                                                                                                                                                                                                                                                                                           | n.000X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0         Alloa           1         Alloa           2         Alloa           3         Alloa           4         Alloa           5         Alloa           6         Alloa           7         Alloa           0         Disa           1         Ena | al Monitor Alloc<br>cate bit 24 (IO_S<br>cate bit 25 (IO_S<br>cate bit 26 (IO_S<br>cate bit 26 (IO_S<br>cate bit 27 (IO_S<br>cate bit 29 (IO_S<br>cate bit 29 (IO_S<br>cate bit 30 (IO_S<br>cate bit 31 (IO_S<br>cate bit 31 (IO_S<br>cate bit 31 (IO_S<br>cate bit 31 (IO_S)<br>cate bit 31 (IO_S) | GTS1) to C<br>GTS2) to C<br>GTS3) to C<br>GTS4) to C<br>GTS5) to C<br>GTS5) to C<br>GTS6) to C<br>GTS7) to C<br>GTS8) to C<br>GTS8) to C<br>al Monitor<br>or CN1-1/C<br>r CN1-1/C | N1-1/CN1<br>N1-1/CN1<br>N1-1/CN1<br>N1-1/CN1<br>N1-1/CN1<br>N1-1/CN1<br>N1-1/CN1<br><b>Enable/Di</b><br>CN1-2 outp<br>N1-2 outp | -2 output sig<br>-2 output sig<br>sable Selection<br>out signal more<br>ut signal more | CMD_IO)<br>nal monitor.<br>nal monitor.<br>nal monitor.<br>nal monitor.<br>nal monitor.<br>nal monitor.<br>nal monitor.<br>nal monitor.<br>nal monitor.<br>nal monitor. |                     | <br>          |  |
|                                           | Output Signal Monitor Allocation for CN1-23 and CN1-24 (SVCMD_IO)         0 to 7       The settings are the same as the CN1-1/CN1-2 allocations.         n.XDDD       CN1-23/CN1-24 Output Signal Monitor Enable/Disable Selection         0       Disable allocation for CN1-23/CN1-24 output signal monitor.         1       Enable allocation for CN1-23/CN1-24 output signal monitor. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                   |                                                                                                                                 |                                                                                                                                                                                                               |                                                                                                                                                                         |                     |               |  |
|                                           | -                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1 Ena                                                                                                                                                                                                                                                  | ole allocation for                                                                                                                                                                                                                                                                                  | r CN1-23/                                                                                                                                                                         | CN1-24 ou                                                                                                                       | itput signal m                                                                                                                                                                                                | ionitor.                                                                                                                                                                | 1                   | _             |  |
|                                           | 2                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0 Output Sig-<br>or Allocations                                                                                                                                                                                                                        | 0000h to<br>1717h                                                                                                                                                                                                                                                                                   | r CN1-23/                                                                                                                                                                         | СN1-24 от<br>0000h                                                                                                              | All                                                                                                                                                                                                           | Immedi-<br>ately                                                                                                                                                        | Setup               | *1            |  |
| 20869                                     | 2                                                                                                                                                                                                                                                                                                                                                                                         | nal Monito                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | O Output Sig-<br>or Allocations                                                                                                                                                                                                                        | 0000h to                                                                                                                                                                                                                                                                                            | -<br>cation for                                                                                                                                                                   | 0000h<br>CN1-25 ar                                                                                                              | All<br>nd CN1-26 (S                                                                                                                                                                                           | Immedi-<br>ately                                                                                                                                                        | Setup               | - *1          |  |
|                                           | 2                                                                                                                                                                                                                                                                                                                                                                                         | nal Monito<br>2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | O Output Sig-<br>or Allocations<br>Output Sign<br>0 to 7 The<br>CN1-25/CN<br>0 Disa                                                                                                                                                                    | 0000h to<br>1717h<br>al Monitor Alloc                                                                                                                                                                                                                                                               | -<br>cation for<br>same as s<br>gnal Monit<br>or CN1-25/                                                                                                                          | 0000h<br>CN1-25 ar<br>the CN1-1,<br>or Enable,<br>(CN1-26 o                                                                     | All<br>All<br>(CN1-26 (S<br>(CN1-2 alloca<br>(Disable Sele<br>utput signal n                                                                                                                                  | Immedi-<br>ately<br>SVCMD_IO)<br>ations.<br>ection<br>nonitor.                                                                                                          | Setup               | *1            |  |
|                                           | 2                                                                                                                                                                                                                                                                                                                                                                                         | nal Monito<br>2<br>n.□□□X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | O Output Sig-<br>or Allocations<br>O to 7 The<br>CN1-25/CN<br>O Disa<br>1 Ena                                                                                                                                                                          | 0000h to<br>1717h<br>al Monitor Alloo<br>settings are the<br>1-26 Output Sig<br>ble allocation fc                                                                                                                                                                                                   | -<br>cation for<br>same as a<br>gnal Monit<br>or CN1-25/                                                                                                                          | 0000h<br>CN1-25 ar<br>the CN1-1,<br>cor Enable,<br>/CN1-26 o<br>CN1-26 o                                                        | All<br>All<br>(CN1-26 (S<br>(CN1-2 alloca<br>(Disable Sele<br>utput signal n                                                                                                                                  | Immedi-<br>ately<br>SVCMD_IO)<br>ations.<br>ection<br>nonitor.                                                                                                          | Setup               | -<br>*1       |  |
|                                           |                                                                                                                                                                                                                                                                                                                                                                                           | n.DDXD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | O Output Sig-<br>or Allocations<br>O to 7 The<br>CN1-25/CN<br>O Disa<br>1 Ena<br>Reserved pa                                                                                                                                                           | 0000h to<br>1717h<br>al Monitor Alloo<br>settings are the<br>1-26 Output Sig<br>ble allocation for<br>ole allocation for                                                                                                                                                                            | -<br>cation for<br>same as<br>gnal Monit<br>or CN1-25/<br>r CN1-25/<br>ot change.                                                                                                 | 0000h<br><b>CN1-25 ar</b><br>the CN1-1,<br><b>for Enable</b> ,<br>(CN1-26 or<br>CN1-26 or<br>)                                  | All<br>All<br>(CN1-26 (S<br>(CN1-2 alloca<br>(Disable Sele<br>utput signal n                                                                                                                                  | Immedi-<br>ately<br>SVCMD_IO)<br>ations.<br>ection<br>nonitor.                                                                                                          | Setup               | - *1          |  |
| M3 *9                                     |                                                                                                                                                                                                                                                                                                                                                                                           | n.□□□X<br>n.□□X<br>n.□X□<br>n.2X□<br>n.X□□<br>Station Ac                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | O Output Sig-<br>or Allocations<br>O to 7 The<br>O to 7 The<br>CN1-25/CN<br>O Disa<br>1 Ena<br>Reserved pa<br>ddress Moni-<br>aintenance,                                                                                                              | 0000h to<br>1717h<br>al Monitor Alloc<br>settings are the<br>1-26 Output Sig<br>ble allocation for<br>ble allocation for<br>arameter (Do no                                                                                                                                                         | -<br>cation for<br>same as<br>gnal Monit<br>or CN1-25/<br>r CN1-25/<br>ot change.                                                                                                 | 0000h<br><b>CN1-25 ar</b><br>the CN1-1,<br><b>for Enable</b> ,<br>(CN1-26 or<br>CN1-26 or<br>)                                  | All<br>All<br>(CN1-26 (S<br>(CN1-2 alloca<br>(Disable Sele<br>utput signal n                                                                                                                                  | Immedi-<br>ately<br>SVCMD_IO)<br>ations.<br>ection<br>nonitor.                                                                                                          | Setup               | pag           |  |
| M3 *9<br>Pn880                            |                                                                                                                                                                                                                                                                                                                                                                                           | n. I Monito<br>2<br>n. IIIIX<br>n. IIIIX<br>n. IIIIIX<br>n. IIIII<br>n. IIIIIIII<br>n. IIIII<br>n. IIIIII<br>n. IIIII<br>n. IIIIII<br>n. IIIII<br>n. IIIII<br>n. IIIII<br>n. IIIII<br>n. IIIII<br>n. IIIII<br>n. IIIII<br>n. IIIII<br>n. IIIII<br>n. IIIIII<br>n. IIIII<br>n. IIIIII<br>n. IIIIII<br>n. IIIIII<br>n. IIIIII<br>n. IIIIII<br>n. IIIIIIII<br>n. IIIIIIII<br>n. IIIIIII<br>n. IIIIIIIII<br>n. IIIIIIIII<br>n. IIIIIIIIII | O Output Sig-<br>or Allocations<br>O to 7 The<br>O to 7 The<br>CN1-25/CN<br>O Disa<br>1 Ena<br>Reserved pa<br>ddress Moni-<br>aintenance,                                                                                                              | 0000h to<br>1717h<br>al Monitor Alloc<br>settings are the<br>1-26 Output Sig<br>ble allocation fo<br>ble allocation for<br>arameter (Do no                                                                                                                                                          | -<br>cation for<br>same as<br>gnal Monit<br>or CN1-25/<br>r CN1-25/<br>ot change.                                                                                                 | 0000h<br><b>CN1-25 ar</b><br>the CN1-1,<br><b>for Enable</b> ,<br>(CN1-26 or<br>CN1-26 or<br>)                                  | All<br>All<br>CN1-26 (S<br>CN1-2 alloca<br>Disable Sele<br>utput signal m                                                                                                                                     | Immedi-<br>ately<br>SVCMD_IO)<br>ations.<br>ection<br>nonitor.                                                                                                          |                     | pag<br>5-1:   |  |
| Pn869<br>M3 *9<br>Pn880<br>Pn881<br>Pn882 | 2                                                                                                                                                                                                                                                                                                                                                                                         | nal Monito<br>2<br>n.□□□X<br>n.□□□X<br>n.□□X□<br>n.□X□<br>n.□X□<br>n.X□□<br>n.X□□<br>n.X□□<br>n.X□□<br>n.X□□<br>n.X□<br>n.<br>x□<br>n.□<br>x□<br>n.<br>x□<br>n.□<br>x□<br>n.<br>x□<br>n.<br>x□<br>n.<br>x□<br>x□<br>n.<br>x□<br>x□<br>n.<br>x□<br>x□<br>n.<br>x□<br>x□<br>n.<br>x□<br>x□<br>n.<br>x□<br>x□<br>n.<br>x□<br>x□<br>x□<br>n.<br>x□<br>x□<br>x□<br>x□<br>x□<br>x□<br>x□<br>x□<br>x□<br>x□<br>x□<br>x□<br>x□                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | O Output Sig-<br>or Allocations                                                                                                                                                                                                                        | 0000h to<br>1717h<br>al Monitor Alloc<br>settings are the<br>1-26 Output Sig<br>ble allocation for<br>ole allocation for<br>arameter (Do no<br>arameter (Do no<br>03h to EFh<br>17, 32, 48                                                                                                          | -<br>cation for<br>same as<br>gnal Monit<br>or CN1-25/<br>r CN1-25/<br>ot change.                                                                                                 | 0000h<br><b>CN1-25 ar</b><br>the CN1-1,<br><b>for Enable</b> ,<br>(CN1-26 or<br>CN1-26 or<br>)                                  | All All All CN1-26 (S CN1-2 alloca CDisable Sele Utput signal m Tput signal m All All                                                                                                                         | Immedi-<br>ately<br>SVCMD_IO)<br>ations.<br>ection<br>nonitor.                                                                                                          | Setup               | - *1<br>      |  |

|                   |      | Continued from previous 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    | Communication trols 2                                                 | ns Con-    | 0000h to<br>0001h                               | _               | 0000h              | All                  | Immedi-<br>ately | Setup               | *1             |
| Pn884             | n.   | MEC<br>DDDX 0                                                         | Mainta     | NK Communic<br>in the status se<br>ATROLINK con | et by the E     | BRK_ON o           | BRK_OFF co           |                  | en a                |                |
| M3 *9             |      | 1                                                                     | Apply t    | he holding bra                                  | ke when a       | a MECHAT           | ROLINK com           | munications      | error occu          | irs.           |
|                   | n.   |                                                                       | erved para | meter (Do not                                   | change.)        |                    |                      |                  |                     |                |
|                   | n.   | DXDD Rese                                                             | erved para | meter (Do not                                   | change.)        |                    |                      |                  |                     |                |
|                   | n.   | XDDD Rese                                                             | erved para | meter (Do not                                   | change.)        |                    |                      |                  |                     |                |
|                   |      |                                                                       |            |                                                 | 1               | 1                  |                      |                  | 1                   |                |
| Pn88A             | 2    | MECHATROLIN<br>Receive Error C<br>Monitor<br>(for maintenanc<br>only) | Counter    | 0 to 65,535                                     | -               | 0                  | All                  | _                | Setup               | _              |
| Pn890 to<br>Pn8A6 | 4    | Command Data<br>tor during Alarr<br>ing<br>(for maintenand<br>only)   | n/Warn-    | Oh to<br>FFFFFFFFh                              | _               | 0h                 | All                  | _                | Setup               | *1             |
| Pn8A8 to<br>Pn8BE | 4    | Response Data<br>during Alarm/W<br>(for maintenand<br>only)           | /arning    | Oh to<br>FFFFFFFh                               | -               | 0h                 | All                  | _                | Setup               | *1             |
| Pn900             | 2    | Number of Para<br>Banks                                               | ameter     | 0 to 16                                         | -               | 0                  | All                  | After<br>restart | Setup               | *1             |
| Pn901             | 2    | Number of Para<br>Bank Members                                        |            | 0 to 15                                         | -               | 0                  | All                  | After<br>restart | Setup               | *1             |
| Pn902 to<br>Pn910 | 2    | Parameter Ban<br>ber Definition                                       | k Mem-     | 0000h to<br>08FFh                               | -               | 0000h              | All                  | After<br>restart | Setup               | *1             |
| Pn920 to<br>Pn95F | 2    | Parameter Ban<br>(Not saved in no<br>memory.)                         |            | 0000h to<br>FFFFh                               | _               | 0000h              | All                  | Immedi-<br>ately | Setup               | *1             |

\*1. Refer to the following manual for details.

Ω Σ-7-Series MECHATROLINK-III Communications Standard Servo Profile Command Manual (Manual No.: SIEP S800001 31)

\*2. Set a percentage of the motor rated torque.

\*3. These parameters are for SERVOPACKs with a Safety Module. Refer to the following manual for details.

Σ-V-Series/Σ-V-Series for Large-Capacity Models/Σ-7-Series User's Manual Safety Module (Manual No.: SIEP C720829 06)

\*4. Normally set this parameter to 0. If you use an External Regenerative Resistor, set the capacity (W) of the External Regenerative Resistor.

\*5. The upper limit is the maximum output capacity (W) of the SERVOPACK.

\*6. These parameters are for SERVOPACKs with the dynamic brake option. Refer to the following manual for details.

Σ-7-Series Σ-7S/Σ-7W SERVOPACK with Dynamic Brake Hardware Option Specifications Product Manual (Manual No.: SIEP S800001 73)

\*7. The SGLFW2 is the only Yaskawa Linear Servomotor that supports this function.

\*8. Enabled only when Pn61A is set to n.

\*9. This parameter is valid only when the MECHATROLINK-III standard servo profile is used.

\*10.The parameter setting is enabled after SENS\_ON command execution is completed.

\*11.Change the setting when the reference is stopped (i.e., while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

\*12.The settings are updated only if the reference is stopped (i.e., only if DEN is set to 1).

\*13.Refer to the following manual for details.

Ω Σ-7-Series MECHATROLINK-II Communications Command Manual (Manual No.: SIEP S800001 30)

\*14.This parameter is valid only when the MECHATROLINK-II-compatible profile is used.

\*15.The setting of Pn842 is valid while Pn817 is set to 0.

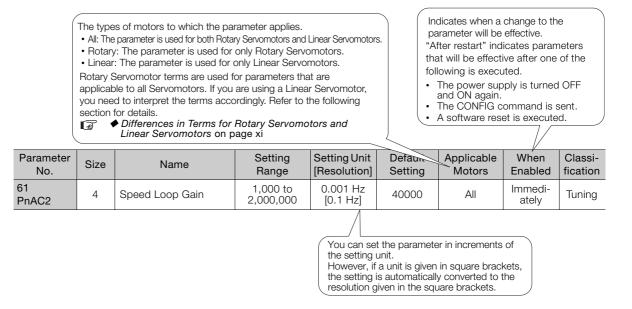
\*16.The setting of Pn844 is valid while Pn818 is set to 0.

\*17. These items can be monitored using SERVOPACKs with software version 002C or higher.

13.2.1 Interpreting the Parameter Lists

## 13.2 List of MECHATROLINK-III Common Parameters

## 13.2.1 Interpreting the Parameter Lists



### 13.2.2 List of MECHATROLINK-III Common Parameters

The following table lists the common MECHATROLINK-III parameters. These common parameters are used to make settings from the host controller via MECHATROLINK communications. Do not change the settings with the Digital Operator or any other device.

| Parameter<br>No. | Size | Nan                                      | Name Setting Range [Resolution] Setting Motors Ena |                    |                                |   |     | When<br>Enabled | Classi-<br>fication |
|------------------|------|------------------------------------------|----------------------------------------------------|--------------------|--------------------------------|---|-----|-----------------|---------------------|
|                  | 4    | Encoder Ty tion (read o                  | pe Selec-<br>nly)                                  | 0h or 1h           | -                              | - | All | Ι               |                     |
| 01               |      |                                          |                                                    |                    |                                |   |     |                 |                     |
| PnA02            |      | 0000h                                    | Absolute                                           | encoder            |                                |   |     |                 |                     |
|                  |      | 0001h                                    | Increment                                          | tal encoder        |                                |   |     |                 |                     |
|                  |      |                                          |                                                    |                    |                                |   |     |                 |                     |
|                  | 4    | Motor Type<br>(read only)                | Selection                                          | 0h or 1h           | -                              | - | All | Ι               |                     |
| 02               |      |                                          |                                                    |                    |                                |   |     |                 |                     |
| PnA04            |      | 0000h                                    | Rotary Se                                          | tary Servomotor    |                                |   |     |                 | rma                 |
|                  |      | 0001h                                    | Linear Se                                          | ervomotor          |                                |   |     |                 | info                |
|                  |      |                                          |                                                    |                    |                                |   |     |                 | Device information  |
|                  | 4    | Semi-close<br>closed Sele<br>(read only) | d/Fully-<br>ection                                 | 0h or 1h           | -                              | - | All | -               | De                  |
| 03               |      |                                          |                                                    |                    |                                |   |     |                 |                     |
| PnA06            |      | 0000h                                    | Semi-clos                                          | sed                |                                |   |     |                 |                     |
|                  |      | 0001h                                    | Fully-clos                                         | sed                |                                |   |     |                 |                     |
|                  |      |                                          |                                                    |                    |                                |   |     |                 |                     |
| 04<br>PnA08      | 4    | Rated Moto<br>(read only)                | or Speed                                           | Oh to<br>FFFFFFFFh | x10^PnA0C<br>min <sup>-1</sup> | - | All | -               |                     |

Continued on next page.

|                  |      |                                                                                                  |                                        |                                                                                                               |                                | (                  | Continued fr         | rom previo                     | us page.               |
|------------------|------|--------------------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------|----------------------|--------------------------------|------------------------|
| Parameter<br>No. | Size | Name                                                                                             |                                        | Setting Range                                                                                                 | Setting Unit<br>[Resolution]   | Default<br>Setting | Applicable<br>Motors | When<br>Enabled                | Classi-<br>fication    |
| 05<br>PnA0A      | 4    | Maximum Outpu<br>Speed (read onl                                                                 |                                        | Oh to<br>FFFFFFFFh                                                                                            | x10^PnA0C<br>min <sup>-1</sup> | -                  | All                  | _                              |                        |
| 06<br>PnA0C      | 4    | Speed Multiplier<br>(read only)                                                                  |                                        | -1,073,741,823<br>to<br>1,073,741,823                                                                         | -                              | -                  | All                  | _                              |                        |
| 07<br>PnA0E      | 4    | Rated Torque<br>(read only)                                                                      |                                        | Oh to<br>FFFFFFFFh                                                                                            | x10^PnA12<br>N∙m               | -                  | All                  | -                              | uo                     |
| 08<br>PnA10      | 4    | Maximum Outpu<br>Torque (read on                                                                 |                                        | Oh to<br>FFFFFFFFh                                                                                            | x10^PnA12<br>N∙m               | -                  | All                  | _                              | ormati                 |
| 09<br>PnA12      | 4    | Torque Multiplier<br>(read only)                                                                 | ſ                                      | -1,073,741,823<br>to<br>1,073,741,823                                                                         | -                              | -                  | All                  | _                              | Device information     |
| 0A<br>PnA14      | 4    | Resolution<br>(read only)                                                                        |                                        | Oh to<br>FFFFFFFFh                                                                                            | 1 pulse/rev                    | -                  | Rotary               | _                              |                        |
| 0B<br>PnA16      | 4    | Scale Pitch                                                                                      |                                        | 0 to 65,536,000                                                                                               | 1 nm<br>[0.01 μm]              | 0                  | Linear               | After<br>restart <sup>*1</sup> |                        |
| 0C<br>PnA18      | 4    | Pulses per Scale<br>Pitch (read only)                                                            |                                        | Oh to<br>FFFFFFFFh                                                                                            | 1 pulse/<br>pitch              | -                  | Linear               | _                              |                        |
| 21<br>PnA42      | 4    | Electronic Gear (<br>(Numerator)                                                                 | ,                                      |                                                                                                               | _                              | 16                 | All                  | After<br>restart               |                        |
| 22<br>PnA44      | 4    | Electronic Gear (<br>(Denominator)                                                               | lectronic Gear Ratio<br>Denominator) 1 |                                                                                                               | _                              | 1                  | All                  | After<br>restart               |                        |
| 23<br>PnA46      | 4    | Absolute Encod<br>Origin Offset                                                                  | er                                     | -1,073,741,823<br>to<br>1,073,741,823                                                                         | 1 reference<br>unit            | 0                  | All                  | Immedi-<br>ately <sup>*1</sup> |                        |
| 24<br>PnA48      | 4    | Multiturn Limit<br>Setting                                                                       |                                        | 0 to 65,535                                                                                                   | 1 Rev                          | 65535              | Rotary               | After<br>restart               | -                      |
|                  | 4    | Limit Setting                                                                                    |                                        | 0h to 33h                                                                                                     | -                              | 0h                 | All                  | After<br>restart               |                        |
| 25<br>PnA4A      |      | Bit 0         Bit 1         Bit 2         Bit 3         Bit 4         Bit 5         Bits 6 to 31 | N-OT<br>Rese<br>Rese<br>P-SC           | (0: Enabled, 1: Di<br>(0: Enabled, 1: Di<br>rved.<br>vrved.<br>(0: Disabled, 1:<br>(0: Disabled, 1:<br>vrved. | Enabled)                       |                    |                      |                                | Machine specifications |
| 26<br>PnA4C      | 4    | Forward Softwa<br>Limit                                                                          | Forward Software                       |                                                                                                               | 1 reference<br>unit            | 10737418<br>23     | All                  | Immedi-<br>ately               |                        |
| 27<br>PnA4E      | 4    | Reserved param<br>(Do not change.                                                                |                                        | -                                                                                                             | -                              | 0                  | All                  | Immedi-<br>ately               |                        |
| 28<br>PnA50      | 4    | Reverse Softwa<br>Limit                                                                          | re                                     | -1,073,741,823<br>to<br>1,073,741,823                                                                         | 1 reference<br>unit            | -1073741<br>823    | All                  | Immedi-<br>ately               |                        |
| 29<br>PnA52      | 4    | Reserved param<br>(Do not change.                                                                |                                        | -                                                                                                             | -                              | 0                  | All                  | Immedi-<br>ately               |                        |

Continued from previous page.

| Parameter<br>No. | Size | Nam                                                                                                                                  | ne                                              | Setting Range                           | Setting Unit<br>[Resolution] | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Class<br>fication |
|------------------|------|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------|------------------------------|--------------------|----------------------|------------------|-------------------|
|                  | 4    | Speed Unit<br>Selection <sup>*2</sup>                                                                                                |                                                 | 0h to 4h                                | -                            | Oh                 | All                  | After<br>restart |                   |
|                  |      | 0000h                                                                                                                                | Reference                                       | e units/s                               |                              |                    |                      |                  |                   |
| 1                |      | 0001h                                                                                                                                | Reference                                       | e units/min                             |                              |                    |                      |                  |                   |
| nA82             |      | 0002h                                                                                                                                | Percenta                                        | ge (%) of rated spe                     | eed*3                        |                    |                      |                  |                   |
|                  |      | 0003h                                                                                                                                | min <sup>-1*3</sup>                             |                                         |                              |                    |                      |                  |                   |
|                  |      | 0004h                                                                                                                                |                                                 | n motor speed/400                       | )00000h*4                    |                    |                      |                  |                   |
|                  |      | Speed Base                                                                                                                           | e Unit                                          |                                         |                              |                    |                      |                  | _                 |
| 42<br>PnA84      | 4    | Selection <sup>*3,</sup><br>(Set the value<br>from the fol<br>formula: Sp<br>selection ( $4 \times 10^{n}$ )                         | *4<br>ue of n<br>lowing<br>eed unit             | -3 to 3                                 | _                            | 0                  | All                  | After<br>restart |                   |
|                  | 4    | Position Un<br>Selection                                                                                                             | it                                              | Oh                                      | -                            | Oh                 | All                  | After<br>restart |                   |
| 43<br>PnA86      |      | 0000h                                                                                                                                | Reference                                       | e units                                 |                              |                    |                      |                  |                   |
| 44<br>PnA88      | 4    | Position Ba<br>Selection<br>(Set the value<br>from the foll<br>formula: Pos<br>selection ( $4^{\circ}$<br>× 10 <sup>n</sup> )        | ue of n<br>lowing<br>sition unit                | 0                                       | _                            | 0                  | All                  | After<br>restart | Unit settings     |
|                  | 4    | Acceleration<br>Selection                                                                                                            | n Unit                                          | Oh                                      | -                            | 0h                 | All                  | After<br>restart |                   |
| 45<br>PnA8A      |      | 0000h                                                                                                                                | Reference                                       | units/s <sup>2</sup>                    |                              |                    |                      |                  |                   |
| 46<br>PnA8C      | 4    | Acceleration<br>Unit Selectii<br>(Set the value<br>from the foll<br>formula: Accurate and the selection<br>PnA8A) × 1                | on<br>ue of n<br>lowing<br>celeration<br>on (45 | 4 to 6                                  | _                            | 4                  | All                  | After<br>restart | _                 |
|                  | 4    | Torque Unit<br>Selection                                                                                                             |                                                 | 1h or 2h                                | -                            | 1h                 | All                  | After<br>restart |                   |
| 47<br>PnA8E      |      | 0001h<br>0002h                                                                                                                       | -                                               | ge (%) of rated toro<br>torque/40000000 |                              |                    |                      |                  |                   |
| 48<br>PnA90      | 4    | Torque Basis<br>Selection <sup>*5</sup><br>(Set the value<br>from the foll<br>formula: Torselection (4<br>$\times$ 10 <sup>n</sup> ) | ue of n<br>Iowing<br>rque unit                  | -5 to 0                                 | _                            | 0                  | All                  | After<br>restart |                   |

| Parameter   |      |                                                          |          |                                       | Setting Unit                       | (<br>Default                                                                                | Continued fr  | om previou<br>When             | us page<br>Classi- |
|-------------|------|----------------------------------------------------------|----------|---------------------------------------|------------------------------------|---------------------------------------------------------------------------------------------|---------------|--------------------------------|--------------------|
| No.         | Size | Name                                                     |          | Setting Range                         | [Resolution]                       | Setting                                                                                     | Motors        | Enabled                        | fication           |
|             | 4    | Supported Unit Sy tems (read only)                       | /S-      | -                                     | -                                  | 0601011F<br>h                                                                               | All           | _                              |                    |
|             |      |                                                          |          |                                       |                                    |                                                                                             |               |                                |                    |
|             |      | Speed Units                                              |          |                                       |                                    |                                                                                             |               |                                |                    |
|             |      | Bit 0                                                    | Ret      | ference units/s (1:                   | Enabled)                           |                                                                                             |               |                                |                    |
|             |      | Bit 1                                                    | Ret      | ference units/min (                   | 1: Enabled)                        |                                                                                             |               |                                |                    |
|             |      | Bit 2                                                    | Per      | centage (%) of rat                    | ed speed (1: E                     | nabled)                                                                                     |               |                                |                    |
|             |      | Bit 3                                                    | mir      | n <sup>-1</sup> (rpm) (1: Enable      | ed)                                |                                                                                             |               |                                |                    |
|             |      | Bit 4                                                    | Ма       | ximum motor spee                      | ed/4000000h (                      | 1: Enabled)                                                                                 |               |                                |                    |
|             |      | Bits 5 to 7                                              | Re       | served (0: Disabled                   | d).                                |                                                                                             |               |                                |                    |
|             |      | Position Units                                           |          |                                       |                                    |                                                                                             |               |                                | sbi                |
| 49          |      | Bit 8                                                    | Ret      | ference units (1: Er                  | nabled)                            |                                                                                             |               |                                | ettir              |
| PnA92       |      | Bits 9 to 15                                             | Res      | served (0: Disabled                   | d).                                |                                                                                             |               |                                | Unit settings      |
|             |      | Acceleration Units                                       | 3        |                                       |                                    |                                                                                             |               |                                | Ľ                  |
|             |      | Bit 16                                                   | Ret      | ference units/s <sup>2</sup> (1:      | : Enabled)                         |                                                                                             |               |                                |                    |
|             |      | Bit 17                                                   | ms       | (acceleration time                    | required to re                     | ach rated sp                                                                                | eed) (0: Disa | bled)                          |                    |
|             |      | Bits 18 to 23                                            | Re       | served (0: Disabled                   | d).                                |                                                                                             |               |                                |                    |
|             |      | Torque Units                                             |          |                                       |                                    |                                                                                             |               |                                |                    |
|             |      | Bit 24                                                   | N∙r      | n (0: Disabled)                       |                                    |                                                                                             |               |                                |                    |
|             |      | Bit 25                                                   | Per      | centage (%) of rat                    | ed torque (1: E                    | Enabled)                                                                                    |               |                                |                    |
|             |      | Bit 26                                                   | Ма       | ximum torque/400                      | )00000h                            | <u> </u>                                                                                    |               |                                |                    |
|             |      | Bits 27 to 31                                            |          | served (0: Disabled                   |                                    |                                                                                             |               |                                |                    |
|             |      |                                                          |          | , , , , , , , , , , , , , , , , , , , | ,                                  |                                                                                             |               |                                |                    |
|             |      |                                                          |          |                                       |                                    |                                                                                             |               |                                |                    |
| 61<br>PnAC2 | 4    | Speed Loop Gain                                          |          | 1,000 to<br>2,000,000                 | 0.001 Hz<br>[0.1 Hz]               | 40000                                                                                       | All           | Immedi-<br>ately               | _                  |
| 62<br>PnAC4 | 4    | Speed Loop Integ<br>Time Constant                        | ral      | 150 to 512,000                        | 1 μs<br>[0.01 ms]                  | 20000                                                                                       | All           | Immedi-<br>ately               |                    |
| 63<br>PnAC6 | 4    | Position Loop Gai                                        | n        | 1,000 to<br>2,000,000                 | 0.001/s<br>[0.1/s]                 | 40000                                                                                       | All           | Immedi-<br>ately               |                    |
| 64<br>PnAC8 | 4    | Feedforward Com<br>pensation                             | -        | 0 to 100                              | 1%                                 | 0                                                                                           | All           | Immedi-<br>ately               | _                  |
| 65<br>PnACA | 4    | Position Loop Integral Time Constar                      | )-<br>nt | 0 to 5,000,000                        | 1 μs<br>[0.1 ms]                   | 0                                                                                           | All           | Immedi-<br>ately               |                    |
| 66<br>PnACC | 4    | Positioning Com-<br>pleted Width                         |          | 0 to<br>1,073,741,824                 | 1 reference<br>unit                | 7                                                                                           | All           | Immedi-<br>ately               | _                  |
| 67<br>PnACE | 4    | Near Signal Width                                        |          | 1 to<br>1,073,741,824                 | 1 reference<br>unit                | 10737418<br>24                                                                              | All           | Immedi-<br>ately               | _                  |
| 81<br>PnB02 | 4    | Exponential Accel<br>ation/Deceleration<br>Time Constant |          | 0 to 510,000                          | 1 μs<br>[0.1 ms]                   | 0                                                                                           | All           | Immedi-<br>ately <sup>*6</sup> | Tuning             |
| 82<br>PnB04 | 4    | Average Movemer<br>Time                                  | nt       | 0 to 510,000                          | 1 μs<br>[0.1 ms]                   | 0                                                                                           | All           | Immedi-<br>ately <sup>*6</sup> |                    |
| 83<br>PnB06 | 4    | External Positionir<br>Final Travel Distan               |          | -1,073,741,823<br>to<br>1,073,741,823 | 1 reference<br>unit                | 100                                                                                         | All           | Immedi-<br>ately               | _                  |
| 84<br>PnB08 | 4    | Origin Approach<br>Speed                                 |          | Oh to<br>3FFFFFFFh                    | 10 <sup>-3</sup> min <sup>-1</sup> | × 5,000h<br>reference<br>units/s<br>con-<br>verted to<br>10 <sup>-3</sup> min <sup>-1</sup> | All           | Immedi-<br>ately               |                    |
| 85<br>PnB0A | 4    | Origin Return Cree<br>Speed                              | əp       | Oh to<br>3FFFFFFFh                    | 10 <sup>-3</sup> min <sup>-1</sup> | × 500h<br>reference<br>units/s<br>con-<br>verted to<br>10 <sup>-3</sup> min <sup>-1</sup>   | All           | Immedi-<br>ately               |                    |

| Parameter<br>No. | Size | Na                          | me          | Setting Range                         | Setting Unit<br>[Resolution] | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication |
|------------------|------|-----------------------------|-------------|---------------------------------------|------------------------------|--------------------|----------------------|------------------|---------------------|
| 86<br>PnB0C      | 4    | Final Trave<br>for Origin F |             | -1,073,741,823<br>to<br>1,073,741,823 | 1 reference<br>unit          | 100                | All                  | Immedi-<br>ately |                     |
|                  | 4    | Fixed Mon<br>tion 1         | itor Selec- | 0h to Fh                              | -                            | 1h                 | All                  | Immedi-<br>ately |                     |
|                  |      |                             | -           |                                       |                              |                    |                      |                  |                     |
|                  |      | 0000h                       | APOS        |                                       |                              |                    |                      |                  |                     |
|                  |      | 0001h                       | CPOS        |                                       |                              |                    |                      |                  |                     |
|                  |      | 0002h                       | PERR        |                                       |                              |                    |                      |                  |                     |
|                  |      | 0003h                       | LPOS1       |                                       |                              |                    |                      |                  |                     |
|                  |      | 0004h                       | LPOS2       |                                       |                              |                    |                      |                  |                     |
|                  |      | 0005h                       | FSPD        |                                       |                              |                    |                      |                  | Tuning              |
| 87               |      | 0006h                       | CSPD        |                                       |                              |                    |                      |                  | Tun                 |
| PnB0E            |      | 0007h                       | TRQ         |                                       |                              |                    |                      |                  |                     |
|                  |      | 0008h                       | ALARM       |                                       |                              |                    |                      |                  |                     |
|                  |      | 0009h                       | MPOS        |                                       |                              |                    |                      |                  |                     |
|                  |      | 000Ah                       | Reserved    | (undefined value).                    |                              |                    |                      |                  |                     |
|                  |      | 000Bh                       | Reserved    | (undefined value).                    |                              |                    |                      |                  |                     |
|                  |      | 000Ch                       | CMN1 (co    | ommon monitor 1)                      |                              |                    |                      |                  |                     |
|                  |      | 000Dh                       | CMN2 (co    | ommon monitor 2)                      |                              |                    |                      |                  |                     |
|                  |      | 000Eh                       | OMN1 (o     | otional monitor 1)                    |                              |                    |                      |                  |                     |
|                  |      | 000Fh                       | OMN2 (o     | otional monitor 2)                    |                              |                    |                      |                  |                     |
|                  |      |                             |             |                                       |                              |                    |                      |                  |                     |

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| Parameter<br>No. | Size | Nan                                                | ne                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Setting Range                                                                                                                                                                                                                                                                                                  | e Setting Unit<br>[Resolution]            | Default<br>Setting                     | Applicable<br>Motors                | When<br>Enabled                                                            | Clas<br>ficati             |
|------------------|------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|----------------------------------------|-------------------------------------|----------------------------------------------------------------------------|----------------------------|
|                  | 4    | Fixed Monit                                        | or Selec-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0h to Fh                                                                                                                                                                                                                                                                                                       | _                                         | 0h                                     | All                                 | Immedi-<br>ately                                                           |                            |
| 8<br>2nB10       |      | 0000h to<br>000Fh                                  | The settin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | gs are the same                                                                                                                                                                                                                                                                                                | as those for Fixe                         | d Monitor S                            | election 1.                         |                                                                            |                            |
|                  | 4    | SEL_MON<br>Monitor Sel                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0h to 9h                                                                                                                                                                                                                                                                                                       | -                                         | Oh                                     | All                                 | Immedi-<br>ately                                                           |                            |
| 9<br>mB12        |      | 0000h<br>0001h<br>0002h<br>0003h<br>0004h<br>0005h | IPOS (ref<br>POS_OF<br>TSPD (ta<br>SPD_LIW<br>TRQ_LIW<br>SV_STAT<br>Monitor I<br>Byte 1: C<br>00h: Ph<br>03h: Ph<br>03h: Ph<br>03h: Ph<br>03h: Ph<br>03h: Ph<br>Byte 2: C<br>00h: Pc<br>00h: P | erence position<br>FSET (offset set<br>rget speed)<br>I (speed limit)<br>I (torque limit)<br>I (torque limit)<br>I (torque limit)<br>I (servo actual o<br>Description<br>Current commun<br>ase 0<br>ase 1<br>ase 2<br>ase 3<br>Current control m<br>sition control m<br>sition control mor<br>rque control mor | ications phase<br>node<br>ode<br>de<br>de | Coordinate<br>Coordinate<br>Coordinate | System) con                         | g<br>g<br>ction<br>g<br>latch<br>n<br>g<br>latch<br>n<br>put<br>put<br>put | Command-related narameters |
|                  |      |                                                    | and 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                |                                           | 2                                      | signal 2<br>External in<br>signal 3 | put                                                                        |                            |
|                  |      |                                                    | Bit 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Reserved (0                                                                                                                                                                                                                                                                                                    | ).                                        | 1                                      | •                                   |                                                                            |                            |
|                  |      | 0007h                                              | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1.                                                                                                                                                                                                                                                                                                             |                                           |                                        |                                     |                                                                            |                            |
|                  |      | 0008h                                              | INIT_PGF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | POS (Low)                                                                                                                                                                                                                                                                                                      | Lower 32 bits verted to 64-I              |                                        |                                     |                                                                            |                            |
|                  |      |                                                    | L                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                |                                           |                                        | 2.0.0.00 000                        |                                                                            |                            |

Continued from previous page.

| Parameter<br>No. | Size | Name                                                                     | Setting Range                          | Setting Unit<br>[Resolution]       | Default<br>Setting | Applicable<br>Motors | When<br>Enabled  | Classi-<br>fication        |
|------------------|------|--------------------------------------------------------------------------|----------------------------------------|------------------------------------|--------------------|----------------------|------------------|----------------------------|
|                  | 4    | SEL_MON (CMN2)<br>Monitor Selection 2                                    | 2 Oh to 9h                             | -                                  | Oh                 | All                  | Immedi-<br>ately |                            |
| 8A<br>PnB14      |      | 0000h to<br>0009h The set                                                | tings are the same as                  | those for SEL                      | _MON Monit         | or Selection         | 1.               |                            |
| 8B<br>PnB16      | 4    | Origin Detection<br>Width                                                | 0 to 250                               | 1 reference<br>unit                | 10                 | All                  | Immedi-<br>ately | _                          |
| 8C<br>PnB18      | 4    | Forward Torque Lir                                                       | nit 0 to 800                           | 1%                                 | 100                | All                  | Immedi-<br>ately |                            |
| 8D<br>PnB1A      | 4    | Reverse Torque Lir                                                       | nit 0 to 800                           | 1%                                 | 100                | All                  | Immedi-<br>ately |                            |
| 8E<br>PnB1C      | 4    | Zero Speed Detec-<br>tion Range                                          | - 1,000 to 10,000,000                  | 10 <sup>-3</sup> min <sup>-1</sup> | 20000              | All                  | Immedi-<br>ately |                            |
| 8F<br>PnB1E      | 4    | Speed Coincidence<br>Signal Detection<br>Width                           | e 0 to 100,000                         | 10 <sup>-3</sup> min <sup>-1</sup> | 10000              | All                  | Immedi-<br>ately | ameters                    |
|                  | 4    | Servo Command<br>Control Field Enab<br>Disable Selections<br>(read only) | e/ _                                   | _                                  | 0FFF3F3F<br>h      | All                  | _                | Command-related parameters |
|                  |      |                                                                          |                                        |                                    |                    |                      |                  | and-r                      |
|                  |      | Bit 0                                                                    | CMD_PAUSE (1: En                       | abled)                             |                    |                      |                  | mm                         |
|                  |      | Bit 1                                                                    | CMD_CANCEL (1: E                       | ,                                  |                    |                      |                  | Col                        |
|                  |      | Bits 2 and 3                                                             | STOP_MODE (1: En                       |                                    |                    |                      |                  |                            |
|                  |      | Bits 4 and 5                                                             | ACCFIL (1: Enabled)                    |                                    |                    |                      |                  |                            |
|                  |      | Bits 6 and 7                                                             | Reserved (0: Disable                   | ,                                  |                    |                      |                  |                            |
| 90<br>PnB20      |      | Bit 8                                                                    | LT_REQ1 (1: Enable                     | ,                                  |                    |                      |                  |                            |
| THEZO            |      | Bit 9                                                                    | LT_REQ2 (1: Enable                     | ,                                  |                    |                      |                  |                            |
|                  |      | Bits 10 and 11                                                           | LT_SEL1 (1: Enabled                    | ,                                  |                    |                      |                  |                            |
|                  |      | Bits 12 and 13                                                           | LT_SEL2 (1: Enabled                    |                                    |                    |                      |                  |                            |
|                  |      | Bits 14 and 15                                                           | Reserved (0: Disable                   | ,                                  |                    |                      |                  |                            |
|                  |      | Bits 16 to 19                                                            | SEL_MON1 (1: Enak                      | ,                                  |                    |                      |                  |                            |
|                  |      | Bits 20 to 23<br>Bits 24 to 27                                           | SEL_MON2 (1: Enak<br>SEL_MON3 (1: Enak | ,                                  |                    |                      |                  |                            |
|                  |      | Bits 24 to 27                                                            | Reserved (0: Disable                   |                                    |                    |                      |                  |                            |
|                  |      | 20 10 31                                                                 | i lesel veu (U. DISADIE                | <del>.</del>                       |                    |                      |                  |                            |

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|                  |      |                                                                   |                      |                              |                    | Continued fr         | rom previo      | us page.                   |
|------------------|------|-------------------------------------------------------------------|----------------------|------------------------------|--------------------|----------------------|-----------------|----------------------------|
| Parameter<br>No. | Size | Name                                                              | Setting Range        | Setting Unit<br>[Resolution] | Default<br>Setting | Applicable<br>Motors | When<br>Enabled | Classi-<br>fication        |
|                  | 4    | Servo Status Field<br>Enable/Disable<br>Selections (read<br>only) | _                    | -                            | 0FFF3F33<br>h      | All                  | _               |                            |
|                  |      |                                                                   |                      |                              | +                  | •                    | •               |                            |
|                  |      | Bit 0                                                             | CMD_PAUSE_CMP        | (1: Enabled)                 |                    |                      |                 |                            |
|                  |      |                                                                   | CMD_CANCEL_CM        | ,                            |                    |                      |                 |                            |
|                  |      |                                                                   | Reserved (0: Disable | ,                            |                    |                      |                 |                            |
|                  |      | Bits 4 and 5                                                      | ACCFIL (1: Enabled)  | ,                            |                    |                      |                 |                            |
|                  |      |                                                                   | Reserved (0: Disable |                              |                    |                      |                 |                            |
|                  |      | Bit 8                                                             | L_CMP1 (1: Enabled   | (k                           |                    |                      |                 |                            |
| 91               |      | Bit 9                                                             | L_CMP2 (1: Enabled   | (k                           |                    |                      |                 |                            |
| PnB22            |      | Bit 10                                                            | POS_RDY (1: Enable   | ed)                          |                    |                      |                 |                            |
|                  |      | Bit 11                                                            | PON (1: Enabled)     |                              |                    |                      |                 |                            |
|                  |      | Bit 12                                                            | M_RDY (1: Enabled)   |                              |                    |                      |                 |                            |
|                  |      | Bit 13                                                            | SV_ON (1: Enabled)   |                              |                    |                      |                 |                            |
|                  |      | Bits 14 and 15                                                    | Reserved (0: Disable | ed).                         |                    |                      |                 | SIS                        |
|                  |      | Bits 16 to 19                                                     | SEL_MON1 (1: Enat    | oled)                        |                    |                      |                 | nete                       |
|                  |      | Bits 20 to 23                                                     | SEL_MON2 (1: Enak    | oled)                        |                    |                      |                 | arar                       |
|                  |      | Bits 24 to 27                                                     | SEL_MON3 (1: Enak    | oled)                        |                    |                      |                 | d<br>p                     |
|                  |      | Bits 28 to 31                                                     | Reserved (0: Disable | ed).                         |                    |                      |                 | late                       |
|                  |      |                                                                   |                      |                              | T                  |                      |                 | Command-related parameters |
|                  | 4    | Output Bit Enable/<br>Disable Selections<br>(read only)           | -                    | -                            | 007F01F0<br>h      | All                  | _               | Comn                       |
|                  |      |                                                                   |                      |                              |                    |                      |                 |                            |
|                  |      | Bits 0 to 3                                                       | Reserved (0: Disable | ed).                         |                    |                      |                 |                            |
|                  |      | Bit 4                                                             | V_PPI (1: Enabled)   |                              |                    |                      |                 |                            |
|                  |      | Bit 5                                                             | P_PPI (1: Enabled)   |                              |                    |                      |                 |                            |
|                  |      | Bit 6                                                             | P_CL (1: Enabled)    |                              |                    |                      |                 |                            |
| 92               |      | Bit 7                                                             | N_CL (1: Enabled)    |                              |                    |                      |                 |                            |
| PnB24            |      | Bit 8                                                             | G_SEL (1: Enabled)   |                              |                    |                      |                 |                            |
|                  |      | Bits 9 to 11                                                      | G_SEL (0: Disabled)  |                              |                    |                      |                 |                            |
|                  |      | Bits 12 to 15                                                     | Reserved (0: Disable | ed).                         |                    |                      |                 |                            |
|                  |      | Bits 16 to 19                                                     | BANK_SEL (1: Enab    | oled)                        |                    |                      |                 |                            |
|                  |      | Bits 20 to 22                                                     | SO1 to SO3 (1: Ena   | ,                            |                    |                      |                 |                            |
|                  |      | Bit 23                                                            | Reserved (0: Disable | ,                            |                    |                      |                 |                            |
|                  |      | Bits 24 to 31                                                     | Reserved (0: Disable | ed).                         |                    |                      |                 |                            |
|                  |      |                                                                   |                      |                              |                    |                      |                 |                            |
|                  |      |                                                                   |                      |                              |                    |                      |                 |                            |

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| Parameter<br>No. | Size | Name                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Setting Range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Setting Unit<br>[Resolution]                                          | Default<br>Setting | Applicable<br>Motors | When<br>Enabled | Classi-<br>fication        |
|------------------|------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|--------------------|----------------------|-----------------|----------------------------|
|                  | 4    | Input Bit Enable/Di<br>able Selections (rea<br>only) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | -                                                                     | FF0FFEFE<br>h      | All                  | -               |                            |
| 93<br>PnB26      | 4    |                                                      | Re           DE           P-           EX           EX | eserved (0: Disable<br>C (1: Enabled)<br>OT (1: Enabled)<br>OT (1: Enabled)<br>OT (1: Enabled)<br>T1 (1: Enabled)<br>T2 (1: Enabled)<br>T2 (1: Enabled)<br>T1 (1: Enabled)<br>T2 (1: Enabled)<br>SOT (1: Enabled)<br>SOT (1: Enabled)<br>SOT (1: Enabled)<br>EN (1: Enabled)<br>EN (1: Enabled)<br>EN (1: Enabled)<br>EN (1: Enabled)<br>DINT (1: Enabled)<br>LIM (1: Enabled)<br>LIM (1: Enabled)<br>CMP (1: Enabled)<br>SPD (1: Enabled)<br>STS1 to IO_STS8 | 2cl).<br>(d).<br>(d)<br>(d)<br>(d)<br>(d)<br>(d)<br>(d)<br>(d)<br>(d) |                    |                      |                 | Command-related parameters |

Continued from previous page.

\*1. The parameter setting is enabled after SENS\_ON command execution is completed.

\*2. When using fully-closed loop control, set the reference units/s.

\*3. If you set the Speed Unit Selection (parameter 41) to either 0002h or 0003h, set the Speed Base Unit Selection (parameter 42) to a number between -3 and 0.

\*4. If you set the Speed Unit Selection (parameter 41) to 0004h, set the Speed Base Unit Selection (parameter 42) to 0.

\*5. If you set the Torque Unit Selection (parameter 47) to 0002h, set the Torque Base Unit Selection (parameter 48) to 0.

\*6. Change the setting when the reference is stopped (i.e., while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

# 13.3 Parameter Recording Table

Use the following table to record the settings of the parameters.

| Pn000         0000h         After restart           Pn001         0000h         Application Function Selections         After restart           Pn002         0011h         Application Function Selections         After restart           Pn006         0002h         Application Function Selections         Immediately           Pn007         0000h         Application Function Selections         Immediately           Pn008         4000h         Application Function Selections         After restart           Pn009         0010h         Application Function Selections         After restart           Pn008         4000h         Application Function Selections         After restart           Pn008         0001h         Application Function Selections         After restart           Pn008         0000h         Application Function Selections         After restart           Pn000         0000h         Application Function Selections         After restart           Pn000         0000h         Application Function Selection Function Selections         Immediately           Pn001         0000h         Application Function Selection Function Selection Function Selection Function Selection Function Selection Selection Function Selection Function Selection Function Selection Function Selection Function Selection Selection Function Selection Selection Selection Function Sel                                                                                                                                                                                                                                                                                                              | Parameter<br>No. | Default<br>Setting |  | Name                        | When<br>Enabled |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|--|-----------------------------|-----------------|
| Prilod 1         Occorn         After restart           Pn002         0011h         Application Function Select<br>tions 2         After restart           Pn006         0002h         Application Function Select<br>tions 6         Immediately           Pn007         0000h         Application Function Select<br>tions 6         Immediately           Pn008         4000h         Application Function Select<br>tions 9         Immediately           Pn009         0010h         Application Function Select<br>tions 9         After restart           Pn008         0001h         Application Function Select<br>tions 9         After restart           Pn008         0000h         Application Function Select<br>tions 0         After restart           Pn008         0000h         Application Function Select<br>tions 0         After restart           Pn000         0000h         Application Function Select<br>tions 0         Immediately           Pn000         0000h         Application Function Select<br>tions 6         Immediately           Pn001         0000h         Application Function Select<br>tions 6         After restart           Pn002         0000h         Application Function Select<br>tions 6         After restart           Pn003         0000h         Application Function Select<br>tions 80         After restart                                                                                                                                                                                                                                                                                                                                                                     | Pn000            | 0000h              |  |                             | After restart   |
| Prilode         OUTIN         Itions 2         Alter restant           Pn006         0002h         Application Function Selections 6         Immediately           Pn007         0000h         Application Function Selections 7         Immediately           Pn008         4000h         Application Function Selections 7         Immediately           Pn009         0010h         Application Function Selections 6         After restart           Pn000         0001h         Application Function Selections 6         After restart           Pn000         0000h         Application Function Selections 6         Immediately           Pn000         0000h         Application Function Selections 6         Immediately           Pn001         0000h         Application Function Selections 6         Immediately           Pn0021         0000h         Reserved parameter         -           Pn040         0000h         Second parameter         -           Pn040         00000h         Applicat                                                                                                                                                                                                                                                                                                                                                                                                                                 | Pn001            | 0000h              |  |                             | After restart   |
| Prilode         0002n         Itime diately           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 8         After restart           Pn009         0001h         Application Function Selec-<br>tions 4         After restart           Pn008         0000h         Application Function Selec-<br>tions 8         After restart           Pn008         0000h         Application Function Selec-<br>tions 6         After restart           Pn000         0000h         Application Function Selec-<br>tions 6         After restart           Pn000         0000h         Application Function Selec-<br>tions 6         After restart           Pn000         0000h         Reserved parameter         -           Pn021         0000h         Reserved parameter         -           Pn022         0000h         Speed Loop Gain         Immediately           Pn080         0000h         Application Function Selec-<br>tions 81         After restart           Pn081         0000h         Application Function Selec-<br>tions 81         After restart           Pn081         0000h         Speed Loop Gain                                                                                                                                                                                                                                                                                                                                                                                                 | Pn002            | 0011h              |  |                             | After restart   |
| Prilod/       Dock       tions 7       Initialization         Pn008       4000h       Application Function Selec-<br>tions 8       After restart         Pn009       0010h       Application Function Selec-<br>tions 9       After restart         Pn008       0001h       Application Function Selec-<br>tions 9       After restart         Pn008       0000h       Application Function Selec-<br>tions A       After restart         Pn000       0000h       Application Function Selec-<br>tions D       After restart         Pn000       0000h       Application Function Selec-<br>tions D       After restart         Pn000       0000h       Application Function Selec-<br>tions D       Immediately         Pn001       0000h       Application Function Selec-<br>tions D       Immediately         Pn002       0000h       Reserved parameter       -         Pn021       0000h       Second parameter       -         Pn040       0000h       Systeh       Application Function Selec-<br>tions 81       After restart         Pn081       0000h       Application Function Selec-<br>tions 81       After restart       -         Pn102       400       Speed Loop Gain       Immediately         Pn103       100       Speed Loop Gain       Immediately         <                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Pn006            | 0002h              |  |                             | Immediately     |
| Prilods       40001       tions 8       Atter restart         Pn009       0010h       Application Function Selections A       After restart         Pn00A       0001h       Application Function Selections A       After restart         Pn00B       0000h       Application Function Selections B       After restart         Pn00C       0000h       Application Function Selections B       After restart         Pn00D       0000h       Application Function Selections C       After restart         Pn00D       0000h       Application Function Selections C       Immediately         Pn00D       0000h       Application Function Selections C       Immediately         Pn00D       0000h       Reserved parameter       -         Pn021       0000h       Reserved parameter       -         Pn080       0000h       Application Function Selections S       After restart         Pn080       0000h       Reserved parameter       -         Pn080       0000h       Application Function Selections S       After restart         Pn080       0000h       Application Function Selections S       After restart         Pn100       400       Speed Loop Gain       Immediately         Pn101       2000       Speed Loop Gain                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Pn007            | 0000h              |  |                             | Immediately     |
| Prilog       Orion       tions 9       Atter restart         Pn00A       0001h       Application Function Selections A       After restart         Pn00B       0000h       Application Function Selections B       After restart         Pn00C       0000h       Application Function Selections B       After restart         Pn00D       0000h       Application Function Selections C       After restart         Pn00D       0000h       Application Function Selections C       Immediately         Pn00F       0000h       Application Function Selections Selectionselections Selections Selections Selections Selections | Pn008            | 4000h              |  |                             | After restart   |
| Pritoda       Oconin       tions A       Atter restart         Pn00B       0000h       Application Function Selections Selections C       After restart         Pn00C       0000h       Application Function Selections C       After restart         Pn00D       0000h       Application Function Selections Selections D       Immediately         Pn00F       0000h       Application Function Selections D       Immediately         Pn021       0000h       Reserved parameter       -         Pn022       0000h       Reserved parameter       -         Pn040       0000h       Reserved parameter       -         Pn040       0000h       Application Function Selections Se                                                                                                           | Pn009            | 0010h              |  |                             | After restart   |
| Philob       Output       Itions B       Atter restart         Pn00C       0000h       Application Function Selections C       After restart         Pn00D       0000h       Application Function Selections C       Immediately         Pn00F       0000h       Application Function Selections F       After restart         Pn021       0000h       Reserved parameter       -         Pn022       0000h       Reserved parameter       -         Pn040       0000h       SV Compatible Function Selections 80       After restart         Pn080       0000h       SV Compatible Function Selections 81       After restart         Pn081       0000h       Application Function Selections 81       After restart         Pn100       400       Speed Loop Gain       Immediately         Pn101       2000       Speed Loop Integral Time Constant       Immediately         Pn102       400       Position Loop Gain       Immediately         Pn103       100       Moment of Inertia Ratio       Immediately         Pn104       400       Second Speed Loop Integral Time Constant       Immediately         Pn105       2000       Second Speed Loop Gain       Immediately         Pn106       400       Second Speed Loop Integral Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Pn00A            | 0001h              |  |                             | After restart   |
| Prilodic       Double       tions C       Atter restart         Pn00D       0000h       Application Function Selec-<br>tions D       Immediately         Pn00F       0000h       Application Function Selec-<br>tions F       After restart         Pn021       0000h       Reserved parameter       -         Pn022       0000h       Reserved parameter       -         Pn020       0000h       Reserved parameter       -         Pn021       0000h       After restart       -         Pn022       0000h       After restart       -         Pn040       0000h       Svet Compatible Function<br>Switch       After restart         Pn080       0000h       Application Function Selec-<br>tions 80       After restart         Pn081       0000h       Speed Loop Gain       Immediately         Pn102       400       Position Loop Gain       Immediately         Pn102       400       Position Loop Gain       Immediately         Pn103       100       Moment of Inertia Ratio       Immediately         Pn104       400       Second Speed Loop Integral       Immediately         Pn105       2000       Second Speed Loop Gain       Immediately         Pn106       400       Second Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Pn00B            | 0000h              |  |                             | After restart   |
| Phoop       cooon       tions D       Infinitediately         Pn00F       0000h       Application Function Selections F       After restart         Pn021       0000h       Reserved parameter       -         Pn022       0000h       Reserved parameter       -         Pn020       0000h       Reserved parameter       -         Pn040       0000h       After restart       -         Pn040       0000h       Application Function Selections Selections 80       After restart         Pn080       0000h       Application Function Selections 81       After restart         Pn081       0000h       Speed Loop Gain       Immediately         Pn100       400       Speed Loop Gain       Immediately         Pn101       2000       Speed Loop Gain       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 Gain       Immediately         Pn106       400       Second Position Loop Gain       Immediately         Pn108       0       Feedforward Fi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Pn00C            | 0000h              |  |                             | After restart   |
| Ph00PC00011tions FAfter restartPn0210000hReserved parameter-Pn0220000hReserved parameter-Pn0400000hS-V Compatible Function<br>SwitchAfter restartPn0800000hApplication Function Selec-<br>tions 80After restartPn0810000hApplication Function Selec-<br>tions 81After restartPn0810000hSpeed Loop GainImmediatelyPn100400Speed Loop GainImmediatelyPn1012000Speed Loop GainImmediatelyPn102400Position Loop GainImmediatelyPn103100Moment of Inertia RatioImmediatelyPn104400Second Speed Loop GainImmediatelyPn1052000Second Speed Loop GainImmediatelyPn106400Second Speed Loop GainImmediatelyPn1090FeedforwardImmediatelyPn1040Second Position Loop GainImmediatelyPn106400Second Position Loop GainImmediatelyPn1080000hGain Application Selections*1Pn1000Second Position Loop GainImmediatelyPn1010Mode Switching Level for<br>Torque ReferenceImmediatelyPn1000Mode Switching Level for<br>Torque ReferenceImmediatelyPn1000Mode Switching Level for<br>Torque ReferenceImmediatelyPn1000Mode Switching Level for<br>Torque ReferenceI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Pn00D            | 0000h              |  |                             | Immediately     |
| Pn0220000hReserved parameter-Pn0400000h\$\sum_vector Compatible Function SwitchAfter restartPn0800000h\$\sum_vector Compatible Function Selections 80After restartPn0810000h\$\sum_vector Compatible Function Selections 80After restartPn0810000h\$\sum_vector Compatible Function Selections 80After restartPn100400\$\sum_vector Compatible Function Selections 81After restartPn1012000\$\sum_vector Compatible Function Compatible Function Selections 81ImmediatelyPn102400\$\sum_vector Compatible Function Compatible Function Compatible Function Compatible Function Compatible Function Selections 81ImmediatelyPn104400\$\sum_vector Compatible Function Compatible Function Compatible Function Compatible Function Function Compatible Function Functio                                                                                                                                                         | Pn00F            | 0000h              |  |                             | After restart   |
| Pn0400000hΣ·V Compatible Function<br>SwitchAfter restartPn0800000hApplication Function Selec-<br>tions 80After restartPn0810000hApplication Function Selec-<br>tions 81After restartPn100400Speed Loop GainImmediatelyPn1012000Speed Loop Integral Time<br>ConstantImmediatelyPn102400Position Loop GainImmediatelyPn103100Moment of Inertia RatioImmediatelyPn104400Second Speed Loop Integral Time<br>ConstantImmediatelyPn1052000Second Speed Loop GainImmediatelyPn106400Second Speed Loop GainImmediatelyPn106400Second Speed Loop GainImmediatelyPn1062000Second Speed Loop GainImmediatelyPn1062000Second Speed Loop GainImmediatelyPn1070Second Position Loop GainImmediatelyPn1080000hGain Application Selections*1Pn1000Mode Switching Level for<br>Torque ReferenceImmediatelyPn1000Mode Switching Level for<br>Torque ReferenceImmediatelyPn1000Mode Switching Level for<br>Torque ReferenceImmediatelyPn1000Mode Switching Level for<br>Torque ReferenceImmediatelyPn1000Mode Switching Level for<br>Torque ReferenceImmediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Pn021            | 0000h              |  | Reserved parameter          | _               |
| PrilodOutputSwitchAfter restartPn0800000hApplication Function Selections 80After restartPn0810000hApplication Function Selections 81After restartPn100400Speed Loop GainImmediatelyPn1012000Speed Loop Integral Time<br>ConstantImmediatelyPn102400Position Loop GainImmediatelyPn103100Moment of Inertia RatioImmediatelyPn104400Second Speed Loop Integral Time<br>ConstantImmediatelyPn1052000Second Speed Loop GainImmediatelyPn106400Second Speed Loop Integral Time ConstantImmediatelyPn106400Second Speed Loop Integral Time ConstantImmediatelyPn106400Second Speed Loop Integral Time ConstantImmediatelyPn106400Second Position Loop GainImmediatelyPn1070FeedforwardImmediatelyPn1080000hGain Application Selections*1Pn1000Mode Switching Level for<br>Torque ReferenceImmediatelyPn1000Mode Switching Level for<br>Speed ReferenceImmediatelyPn1080Second Speed ReferenceImmediatelyPn1000Mode Switching Level for<br>Speed ReferenceImmediatelyPn1000Mode Switching Level for<br>Speed ReferenceImmediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Pn022            | 0000h              |  | Reserved parameter          | _               |
| PrilosOutputInterfestantPn0810000hAfter restantPn100400Speed Loop GainPn1012000Speed Loop Integral Time<br>ConstantImmediatelyPn102400Position Loop GainImmediatelyPn103100Moment of Inertia RatioImmediatelyPn104400Second Speed Loop IntegralImmediatelyPn1052000Second Speed Loop GainImmediatelyPn106400Second Speed Loop IntegralImmediatelyPn106400Second Speed Loop GainImmediatelyPn106400Second Speed Loop GainImmediatelyPn1080Second Position Loop GainImmediatelyPn1080Second Position Loop GainImmediatelyPn1080000hGain Application Selections*1Pn100200Mode Switching Level for<br>Speed ReferenceImmediatelyPn1000Mode Switching Level for<br>Speed ReferenceImmediatelyPn1010Mode Switching Level for<br>Speed ReferenceImmediatelyPn1010Mode Switching Level for<br>Speed ReferenceImmediatelyPn1010Mode Switching Level for<br>Speed ReferenceImmediatelyPn1010Mode Switching Level for<br>Speed ReferenceImmediatelyPn1020Mode Switching Level for<br>Speed ReferenceImmediatelyPn1020Mode Switching Level for<br>Speed ReferenceImmediatelyPn1020Mode Switc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Pn040            | 0000h              |  |                             | After restart   |
| PritosiDocorntions 81After restartPn100400Speed Loop GainImmediatelyPn1012000Speed Loop Integral Time<br>ConstantImmediatelyPn102400Position Loop GainImmediatelyPn103100Moment of Inertia RatioImmediatelyPn104400Second Speed Loop GainImmediatelyPn1052000Second Speed Loop GainImmediatelyPn106400Second Speed Loop GainImmediatelyPn106400Second Position Loop GainImmediatelyPn106400Second Position Loop GainImmediatelyPn106400Second Position Loop GainImmediatelyPn106400Second Position Loop GainImmediatelyPn1080FeedforwardImmediatelyPn1080000hGain Application Selections*1Pn10C200Mode Switching Level for<br>Speed ReferenceImmediatelyPn10D0Mode Switching Level for<br>Speed ReferenceImmediatelyPn10E0Mode Switching Level for<br>Speed ReferenceImmediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Pn080            | 0000h              |  |                             | After restart   |
| Pn1012000Speed Loop Integral Time<br>ConstantImmediatelyPn102400Position Loop GainImmediatelyPn103100Moment of Inertia RatioImmediatelyPn104400Second Speed Loop GainImmediatelyPn1052000Second Speed Loop Integral Time ConstantImmediatelyPn106400Second Position Loop GainImmediatelyPn106400Second Position Loop GainImmediatelyPn1060Second Position Loop GainImmediatelyPn1080FeedforwardImmediatelyPn1080000hGain Application Selections*1Pn10C200Mode Switching Level for<br>Torque ReferenceImmediatelyPn10D0Mode Switching Level for<br>Speed ReferenceImmediatelyPn10E0Mode Switching Level for<br>Speed ReferenceImmediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Pn081            | 0000h              |  |                             | After restart   |
| Priloi2000ConstantImmediatelyPn102400Position Loop GainImmediatelyPn103100Moment of Inertia RatioImmediatelyPn104400Second Speed Loop GainImmediatelyPn1052000Second Speed Loop Integral Time ConstantImmediatelyPn106400Second Position Loop GainImmediatelyPn1070FeedforwardImmediatelyPn10800FeedforwardImmediatelyPn1080000hGain Application Selections*1Pn10C200Mode Switching Level for<br>Torque ReferenceImmediatelyPn10D0Mode Switching Level for<br>Speed ReferenceImmediatelyPn1050Mode Switching Level for<br>Speed ReferenceImmediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Pn100            | 400                |  | Speed Loop Gain             | Immediately     |
| Pn103100Moment of Inertia RatioImmediatelyPn104400Second Speed Loop GainImmediatelyPn1052000Second Speed Loop Integral Time ConstantImmediatelyPn106400Second Position Loop GainImmediatelyPn1090FeedforwardImmediatelyPn10A0FeedforwardImmediatelyPn10B0000hGain Application Selections*1Pn10C200Mode Switching Level for<br>Torque ReferenceImmediatelyPn10D0Mode Switching Level for<br>Speed ReferenceImmediatelyPn10E0Mode Switching Level for<br>Speed ReferenceImmediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Pn101            | 2000               |  |                             | Immediately     |
| Pn104400Second Speed Loop GainImmediatelyPn1052000Second Speed Loop Integral Time ConstantImmediatelyPn106400Second Position Loop GainImmediatelyPn1090FeedforwardImmediatelyPn10A0Feedforward Filter Time<br>ConstantImmediatelyPn10B0000hGain Application Selections*1Pn10C200Mode Switching Level for<br>Torque ReferenceImmediatelyPn10D0Mode Switching Level for<br>Speed ReferenceImmediatelyPn10E0Mode Switching Level for<br>Speed ReferenceImmediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Pn102            | 400                |  | Position Loop Gain          | Immediately     |
| Pn1052000Second Speed Loop Integral Time ConstantImmediatelyPn106400Second Position Loop GainImmediatelyPn1090FeedforwardImmediatelyPn10A0Feedforward Filter Time<br>ConstantImmediatelyPn10B0000hGain Application Selections*1Pn10C200Mode Switching Level for<br>Torque ReferenceImmediatelyPn10D0Mode Switching Level for<br>Speed ReferenceImmediatelyPn10E0Mode Switching Level for<br>Speed ReferenceImmediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Pn103            | 100                |  | Moment of Inertia Ratio     | Immediately     |
| Pn1052000gral Time ConstantImmediatelyPn106400Second Position Loop GainImmediatelyPn1090FeedforwardImmediatelyPn10A0Feedforward Filter Time<br>ConstantImmediatelyPn10B0000hGain Application Selections*1Pn10C200Mode Switching Level for<br>Torque ReferenceImmediatelyPn10D0Mode Switching Level for<br>Speed ReferenceImmediatelyPn10E0Mode Switching Level for<br>Speed ReferenceImmediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Pn104            | 400                |  | Second Speed Loop Gain      | Immediately     |
| Pn1090FeedforwardImmediatelyPn10A0Feedforward Filter Time<br>ConstantImmediatelyPn10B0000hGain Application Selections*1Pn10C200Mode Switching Level for<br>Torque ReferenceImmediatelyPn10D0Mode Switching Level for<br>Speed ReferenceImmediatelyPn10E0Mode Switching Level for<br>Speed ReferenceImmediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Pn105            | 2000               |  |                             | Immediately     |
| Pn10A       0       Feedforward Filter Time<br>Constant       Immediately         Pn10B       0000h       Gain Application Selections       *1         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>Speed Reference       Immediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Pn106            | 400                |  | Second Position Loop Gain   | Immediately     |
| Pn10A       0       Immediately         Pn10B       0000h       Gain Application Selections       *1         Pn10C       200       Mode Switching Level for Torque Reference       Immediately         Pn10D       0       Mode Switching Level for Speed Reference       Immediately         Pn10E       0       Mode Switching Level for Speed Reference       Immediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Pn109            | 0                  |  | Feedforward                 | Immediately     |
| 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>Speed Reference     Immediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Pn10A            | 0                  |  |                             | Immediately     |
| Ph10C     200     Torque Reference     Immediately       Pn10D     0     Mode Switching Level for<br>Speed Reference     Immediately       Pn10E     0     Mode Switching Level for<br>Speed Reference     Immediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Pn10B            | 0000h              |  | Gain Application Selections | *1              |
| Ph10D     0     Speed Reference     Immediately       Pn10E     0     Mode Switching Level for     Immediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Pn10C            | 200                |  |                             | Immediately     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Pn10D            | 0                  |  |                             | Immediately     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Pn10E            | 0                  |  |                             | Immediately     |

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| Parameter<br>No. | Default<br>Setting |                        | Name                                               | When<br>Enabled |
|------------------|--------------------|------------------------|----------------------------------------------------|-----------------|
| Pn10F            | 0                  | Mode<br>Positi         | e Switching Level for<br>on Deviation              | Immediately     |
| Pn11F            | 0                  | Positi<br>stant        | on Integral Time Con-                              | Immediately     |
| Pn121            | 100                | Frictic<br>Gain        | on Compensation                                    | Immediately     |
| Pn122            | 100                |                        | nd Friction Compen-<br>n Gain                      | Immediately     |
| Pn123            | 0                  | Frictic<br>Coeffi      | on Compensation<br>icient                          | Immediately     |
| Pn124            | 0                  |                        | on Compensation Fre-<br>cy Correction              | Immediately     |
| Pn125            | 100                |                        | on Compensation<br>Correction                      | Immediately     |
| Pn131            | 0                  | Gain                   | Switching Time 1                                   | Immediately     |
| Pn132            | 0                  | Gain                   | Switching Time 2                                   | Immediately     |
| Pn135            | 0                  | Gain S<br>Time         | Switching Waiting<br>1                             | Immediately     |
| Pn136            | 0                  | Gain S<br>Time         | Switching Waiting<br>2                             | Immediately     |
| Pn139            | 0000h              |                        | natic Gain Switching<br>tions 1                    | Immediately     |
| Pn13D            | 2000               | Curre                  | nt Gain Level                                      | Immediately     |
| Pn140            | 0100h              |                        | el Following Control-<br>ed Selections             | Immediately     |
| Pn141            | 500                | Mode<br>Gain           | I Following Control                                | Immediately     |
| Pn142            | 1000               |                        | I Following Control<br>Correction                  | Immediately     |
| Pn143            | 1000               |                        | I Following Control<br>n the Forward Direc-        | Immediately     |
| Pn144            | 1000               |                        | I Following Control<br>n the Reverse Direc-        | Immediately     |
| Pn145            | 500                |                        | tion Suppression 1<br>iency A                      | Immediately     |
| Pn146            | 700                |                        | tion Suppression 1<br>iency B                      | Immediately     |
| Pn147            | 1000               | Mode<br>Speed<br>pensa | I Following Control<br>d Feedforward Com-<br>ation | Immediately     |
| Pn148            | 500                |                        | nd Model Following<br>ol Gain                      | Immediately     |
| Pn149            | 1000               |                        | nd Model Following<br>Control Correction           | Immediately     |
| Pn14A            | 800                | Vibrat<br>Frequ        | tion Suppression 2<br>iency                        | Immediately     |
| Pn14B            | 100                | Vibrat<br>Corre        | tion Suppression 2<br>ction                        | Immediately     |
| Pn14F            | 0021h              | Contr                  | ol-Related Selections                              | After restart   |
| Pn160            | 0010h              |                        | Resonance Control-<br>ed Selections                | Immediately     |
| Pn161            | 1000               | Anti-F                 | Resonance Frequency                                | Immediately     |
| Pn162            | 100                | Anti-F<br>rectio       | Resonance Gain Cor-<br>n                           | Immediately     |

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|------------------|-------------------------------|--|--------------------------------------------------------|-----------------|
| Parameter<br>No. | Default<br>Setting            |  | Name                                                   | When<br>Enabled |
| 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            | *1              |
| Pn181            | 0                             |  | Mode Switching Level for Speed Reference               | Immediately     |
| Pn182            | 0                             |  | Mode Switching Level for<br>Acceleration               | Immediately     |
| Pn205            | 65535                         |  | Multiturn Limit                                        | After restart   |
| Pn207            | 0010h                         |  | Position Control Function<br>Selections                | After restart   |
| Pn20A            | 32768                         |  | Number of External Scale<br>Pitches                    | After restart   |
| Pn20E            | 16                            |  | 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   |
| Pn22A            | 0000h                         |  | Fully-closed Control Selec-<br>tions                   | After restart   |
| Pn230            | 0000h                         |  | Position Control Expansion<br>Function Selections      | After restart   |
| Pn231            | 0                             |  | Backlash Compensation                                  | Immediately     |
| Pn233            | 0                             |  | Backlash Compensation<br>Time Constant                 | Immediately     |
| Pn281            | 20                            |  | Encoder Output Resolution                              | After restart   |
| Pn282            | 0                             |  | Linear Encoder Pitch                                   | After restart   |
| Pn304            | 500                           |  | Jogging 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     |
| Pn30C            | 0                             |  | Speed Feedforward Aver-<br>age Movement Time           | Immediately     |
| 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                            |  | Jogging Speed                                          | Immediately     |

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|------------------|-------------------------------|------------------------------------------------------------------|-----------------|--|
| Parameter<br>No. | Default<br>Setting            | Name                                                             | When<br>Enabled |  |
| 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                           | Forward External Torque<br>Limit                                 | Immediately     |  |
| Pn405            | 100                           | Reverse External Torque<br>Limit                                 | Immediately     |  |
| Pn406            | 800                           | Emergency Stop Torque                                            | Immediately     |  |
| Pn407            | 10000                         | Speed Limit during Torque<br>Control                             | Immediately     |  |
| Pn408            | 0000h                         | Torque-Related Function<br>Selections                            | *1              |  |
| 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<br>Depth                                | Immediately     |  |
| 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     |  |

Parameter Lists

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| Continued from previous page. |                    |                                                                       |                 |
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| Parameter<br>No.              | Default<br>Setting | Name                                                                  | When<br>Enabled |
| Pn41F                         | 0                  | Fifth Stage Notch Filter<br>Depth                                     | Immediately     |
| Pn423                         | 0000h              | Speed Ripple Compensa-<br>tion Selections                             | *1              |
| 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                  | Torque Feedforward Aver-<br>age Movement Time                         | Immediately     |
| 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              | Speed Limit during Force<br>Control                                   | Immediately     |
| 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 Refer-<br>ence 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     |
| Pn502                         | 20                 | Rotation Detection Level                                              | Immediately     |
| Pn503                         | 10                 | Speed Coincidence Detec-<br>tion Signal Output Width                  | Immediately     |
| Pn506                         | 0                  | Brake Reference-Servo<br>OFF Delay Time                               | Immediately     |
| Pn507                         | 100                | Brake Reference Output<br>Speed Level                                 | Immediately     |

| Parameter        | Default        |                                                                | When          |
|------------------|----------------|----------------------------------------------------------------|---------------|
| Parameter<br>No. | Setting        | Name                                                           | Enabled       |
| Pn508            | 50             | Servo OFF-Brake Com-<br>mand Waiting Time                      | Immediately   |
| Pn509            | 20             | Momentary Power Interrup-<br>tion Hold Time                    | Immediately   |
| Pn50A            | 1881h          | Input Signal Selections 1                                      | After restart |
| Pn50B            | 8882h          | Input Signal Selections 2                                      | After restart |
| Pn50E            | 0000h          | Output Signal Selections 1                                     | After restart |
| Pn50F            | 0100h          | Output Signal Selections 2                                     | After restart |
| Pn510            | 0000h          | Output Signal Selections 3                                     | After restart |
| Pn511            | 6543h          | Input Signal Selections 5                                      | After restart |
| Pn512            | 0000h          | Output Signal Inverse Set-<br>tings                            | After restart |
| Pn514            | 0000h          | Output Signal Selections 4                                     | After restart |
| Pn516            | 8888h          | Input Signal Selections 7                                      | After restart |
| 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              | Positioning Completed<br>Width                                 | Immediately   |
| Pn524            | 1073741<br>824 | Near Signal Width                                              | Immediately   |
| 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 Jogging-Related<br>Selections                          | Immediately   |
| Pn531            | 32768          | Program Jogging Travel<br>Distance                             | Immediately   |
| Pn533            | 500            | Program Jogging Move-<br>ment Speed                            | Immediately   |
| Pn534            | 100            | Program Jogging Accelera-<br>tion/Deceleration Time            | Immediately   |
| Pn535            | 100            | Program Jogging Waiting<br>Time                                | Immediately   |
| Pn536            | 1              | Program Jogging Number<br>of Movements                         | Immediately   |
| Pn550            | 0              | Analog Monitor 1 Offset<br>Voltage                             | Immediately   |
| Pn551            | 0              | Analog Monitor 2 Offset<br>Voltage                             | Immediately   |

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|                  | Continued from previous page. |  |                                                                            |                 |
|------------------|-------------------------------|--|----------------------------------------------------------------------------|-----------------|
| Parameter<br>No. | Default<br>Setting            |  | Name                                                                       | When<br>Enabled |
| 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     |
| Pn56A            | 0000h                         |  | Output Signal Reference<br>Method Selections 1                             | After restart   |
| Pn56B            | 0000h                         |  | Reserved parameter                                                         | After restart   |
| Pn581            | 20                            |  | Zero Speed Level                                                           | Immediately     |
| Pn582            | 10                            |  | Speed Coincidence Detec-<br>tion Signal Output Width                       | Immediately     |
| Pn583            | 10                            |  | Brake Reference Output<br>Speed Level                                      | Immediately     |
| Pn584            | 10000                         |  | Speed Limit Level at Servo<br>ON                                           | Immediately     |
| Pn585            | 50                            |  | Program Jogging Move-<br>ment Speed                                        | Immediately     |
| Pn586            | 0                             |  | Motor Running Cooling<br>Ratio                                             | Immediately     |
| Pn587            | 0000h                         |  | Polarity Detection Execu-<br>tion Selection for Absolute<br>Linear Encoder | Immediately     |
| 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     |
| Pn800            | 1040h                         |  | Communications Controls                                                    | Immediately     |
| Pn801            | 0003h                         |  | Application Function Selec-<br>tions 6 (Software Limits)                   | Immediately     |
| Pn803            | 10                            |  | Origin Range                                                               | Immediately     |
| Pn804            | 1073741<br>823                |  | Forward Software Limit                                                     | Immediately     |
| Pn806            | -107374<br>1823               |  | Reverse Software Limit                                                     | Immediately     |
| Pn808            | 0                             |  | Absolute Encoder Origin<br>Offset                                          | Immediately*2   |
| Pn80A            | 100                           |  | First Stage Linear Acceler-<br>ation Constant                              | Immediately*3   |
| Pn80B            | 100                           |  | Second Stage Linear<br>Acceleration Constant                               | Immediately*3   |
| Pn80C            | 0                             |  | Acceleration Constant<br>Switching Speed                                   | Immediately*3   |
|                  |                               |  |                                                                            |                 |

| Parameter<br>No. | Default<br>Setting | Name                                                         | When<br>Enabled |
|------------------|--------------------|--------------------------------------------------------------|-----------------|
| Pn80D            | 100                | First Stage Linear Deceler-<br>ation Constant                | Immediately*3   |
| Pn80E            | 100                | Second Stage Linear<br>Deceleration Constant                 | Immediately*3   |
| Pn80F            | 0                  | Deceleration Constant<br>Switching Speed                     | Immediately*3   |
| Pn810            | 0                  | Exponential Acceleration/<br>Deceleration Bias               | Immediately*3   |
| Pn811            | 0                  | Exponential Acceleration/<br>Deceleration Time Con-<br>stant | Immediately*3   |
| Pn812            | 0                  | Movement Average Time                                        | Immediately*3   |
| Pn814            | 100                | External Positioning Final<br>Travel Distance                | Immediately*3   |
| Pn816            | 0000h              | Origin Return Mode Set-<br>tings                             | Immediately*3   |
| Pn817            | 50                 | Origin Approach Speed 1                                      | Immediately*3   |
| Pn818            | 5                  | Origin Approach Speed 2                                      | Immediately*3   |
| Pn819            | 100                | Final Travel Distance for<br>Origin Return                   | Immediately*3   |
| Pn81E            | 0000h              | Input Signal Monitor Selec-<br>tions                         | Immediately     |
| Pn81F            | 0010h              | Command Data Allocations                                     | After restart   |
| Pn820            | 0                  | Forward Latching Area                                        | Immediately     |
| Pn822            | 0                  | Reverse Latching Area                                        | Immediately     |
| Pn824            | 0000h              | Option Monitor 1 Selection                                   | Immediately     |
| Pn825            | 0000h              | Option Monitor 2 Selection                                   | Immediately     |
| Pn827            | 100                | Linear Deceleration Con-<br>stant 1 for Stopping             | Immediately*3   |
| Pn829            | 0                  | SVOFF Waiting Time (for<br>SVOFF at Deceleration to<br>Stop) | Immediately     |
| Pn82A            | 1813h              | Option Field Allocations 1                                   | After restart   |
| Pn82B            | 1D1Ch              | Option Field Allocations 2                                   | After restart   |
| Pn82C            | 1F1Eh              | Option Field Allocations 3                                   | After restart   |
| Pn82D            | 0000h              | Option Field Allocations 4                                   | After restart   |
| Pn82E            | 0000h              | Option Field Allocations 5                                   | After restart   |
| Pn833            | 0000h              | Motion Settings                                              | After restart   |
| Pn834            | 100                | First Stage Linear Acceler-<br>ation Constant 2              | Immediately*3   |
| Pn836            | 100                | Second Stage Linear<br>Acceleration Constant 2               | Immediately*3   |
| Pn838            | 0                  | Acceleration Constant<br>Switching Speed 2                   | Immediately*3   |
| Pn83A            | 100                | First Stage Linear Deceler-<br>ation Constant 2              | Immediately*3   |
| Pn83C            | 100                | Second Stage Linear<br>Deceleration Constant 2               | Immediately*3   |
| Pn83E            | 0                  | Deceleration Constant<br>Switching Speed 2                   | Immediately*3   |
| Pn840            | 100                | Linear Deceleration Con-<br>stant 2 for Stopping             | Immediately*3   |
| Pn842            | 0                  | Second Origin Approach<br>Speed 1                            | Immediately*3   |

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|                   | Continued from previous page. |                                                                                                      |                 |  |
|-------------------|-------------------------------|------------------------------------------------------------------------------------------------------|-----------------|--|
| Parameter<br>No.  | Default<br>Setting            | Name                                                                                                 | When<br>Enabled |  |
| Pn844             | 0                             | Second Origin Approach<br>Speed 2                                                                    | Immediately*3   |  |
| Pn846             | 0                             | POSING Command Scurve<br>Acceleration/Deceleration<br>Rate                                           | Immediately*3   |  |
| Pn850             | 0                             | Number of Latch<br>Sequences                                                                         | Immediately     |  |
| Pn851             | 0                             | Continuous Latch<br>Sequence Count                                                                   | Immediately     |  |
| Pn852             | 0000h                         | Latch Sequence 1 to 4 Set-<br>tings                                                                  | Immediately     |  |
| Pn853             | 0000h                         | Latch Sequence 5 to 8 Set-<br>tings                                                                  | Immediately     |  |
| Pn860             | 0000h                         | SVCMD_IO Input Signal<br>Monitor Allocations 1                                                       | Immediately     |  |
| Pn861             | 0000h                         | SVCMD_IO Input Signal<br>Monitor Allocations 2                                                       | Immediately     |  |
| Pn862             | 0000h                         | SVCMD_IO Input Signal<br>Monitor Allocations 3                                                       | Immediately     |  |
| Pn863             | 0000h                         | SVCMD_IO Input Signal<br>Monitor Allocations 4                                                       | Immediately     |  |
| Pn868             | 0000h                         | SVCMD_IO Output Signal<br>Monitor Allocations 1                                                      | Immediately     |  |
| Pn869             | 0000h                         | SVCMD_IO Output Signal<br>Monitor Allocations 2                                                      | Immediately     |  |
| Pn880             | -                             | Station Address Monitor<br>(for maintenance, read<br>only)                                           | _               |  |
| Pn881             | -                             | Set Transmission Byte<br>Count Monitor [bytes] (for<br>maintenance, read only)                       | _               |  |
| Pn882             | -                             | Transmission Cycle Setting<br>Monitor [× 0.25 μs] (for<br>maintenance, read only)                    | _               |  |
| Pn883             | _                             | Communications Cycle<br>Setting Monitor [transmis-<br>sion cycles] (for mainte-<br>nance, read only) | _               |  |
| Pn884             | 0000h                         | Communications Controls 2                                                                            | Immediately     |  |
| Pn88A             | 0                             | MECHATROLINK Receive<br>Error Counter Monitor (for<br>maintenance, read only)                        | _               |  |
| Pn890 to<br>Pn8A6 | Oh                            | Command Data Monitor<br>during Alarm/Warning (for<br>maintenance, read only)                         | _               |  |
| Pn8A8 to<br>Pn8BE | Oh                            | Response Data Monitor<br>during Alarm/Warning (for<br>maintenance, read only)                        | _               |  |
| Pn900             | 0                             | Number of Parameter<br>Banks                                                                         | After restart   |  |
| Pn901             | 0                             | Number of Parameter Bank<br>Members                                                                  | After restart   |  |
| Pn902 to<br>Pn910 | 0000h                         | Parameter Bank Member<br>Definition                                                                  | After restart   |  |
| Pn920 to<br>Pn95F | 0000h                         | Parameter Bank Data (Not<br>saved in nonvolatile mem-<br>ory.)                                       | Immediately     |  |

|                  | Continued from previous page. |  |                                                   |                 |
|------------------|-------------------------------|--|---------------------------------------------------|-----------------|
| Parameter<br>No. | Default<br>Setting            |  | Name                                              | When<br>Enabled |
| 01<br>PnA02      | -                             |  | Encoder Type Selection<br>(read only)             | _               |
| 02<br>PnA04      | -                             |  | Motor Type Selection<br>(read only)               | _               |
| 03<br>PnA06      | -                             |  | Semi-closed/Fully-closed<br>Selection (read only) | _               |
| 04<br>PnA08      | -                             |  | Rated Motor Speed<br>(read only)                  | _               |
| 05<br>PnA0A      | -                             |  | Maximum Output Speed<br>(read only)               | _               |
| 06<br>PnA0C      | _                             |  | Speed Multiplier (read only)                      | -               |
| 07<br>PnA0E      | _                             |  | Rated Torque (read only)                          | -               |
| 08<br>PnA10      | -                             |  | Maximum Output Torque<br>(read only)              | _               |
| 09<br>PnA12      | -                             |  | Torque Multiplier (read only)                     | _               |
| 0A<br>PnA14      | -                             |  | Resolution (read only)                            | _               |
| 0B<br>PnA16      | 0                             |  | Scale Pitch                                       | After restart   |
| 0C<br>PnA18      | -                             |  | Pulses per Scale Pitch<br>(read only)             | _               |
| 21<br>PnA42      | 16                            |  | Electronic Gear Ratio<br>(Numerator)              | After restart   |
| 22<br>PnA44      | 1                             |  | Electronic Gear Ratio<br>(Denominator)            | After restart   |
| 23<br>PnA46      | 0                             |  | Absolute Encoder Origin<br>Offset                 | Immediately*2   |
| 24<br>PnA48      | 65535                         |  | Multiturn Limit Setting                           | After restart   |
| 25<br>PnA4A      | 0000h                         |  | Limit Setting                                     | After restart   |
| 26<br>PnA4C      | 1073741<br>823                |  | Forward Software Limit                            | Immediately     |
| 27<br>PnA4E      | 0                             |  | Reserved parameter<br>(Do not change.)            | Immediately     |
| 28<br>PnA50      | -107374<br>1823               |  | Reverse Software Limit                            | Immediately     |
| 29<br>PnA52      | 0                             |  | Reserved parameter<br>(Do not change.)            | Immediately     |
| 41<br>PnA82      | Oh                            |  | Speed Unit Selection                              | After restart   |
| 42<br>PnA84      | 0                             |  | Speed Base Unit Selection                         | After restart   |
| 43<br>PnA86      | Oh                            |  | Position Unit Selection                           | After restart   |
| 44<br>PnA88      | 0                             |  | Position Base Unit Selec-<br>tion                 | After restart   |
| 45<br>PnA8A      | Oh                            |  | Acceleration Unit Selection                       | After restart   |
| 46<br>PnA8C      | 4                             |  | Acceleration Base Unit<br>Selection               | After restart   |

Parameter Lists

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|                  |                                                                                                 | Continued                                              | from previous page. |
|------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------|---------------------|
| Parameter<br>No. | Default<br>Setting                                                                              | Name                                                   | When<br>Enabled     |
| 47<br>PnA8E      | 1h                                                                                              | Torque Unit Selection                                  | After restart       |
| 48<br>PnA90      | 0                                                                                               | Torque Base Unit Sele                                  | ction After restart |
| 49<br>PnA92      | 0601011<br>Fh                                                                                   | Supported Unit System<br>(read only)                   | ms _                |
| 61<br>PnAC2      | 40000                                                                                           | Speed Loop Gain                                        | Immediately         |
| 62<br>PnAC4      | 20000                                                                                           | Speed Loop Integral T<br>Constant                      | ime Immediately     |
| 63<br>PnAC6      | 40000                                                                                           | Position Loop Gain                                     | Immediately         |
| 64<br>PnAC8      | 0                                                                                               | Feedforward Compen<br>tion                             | sa- Immediately     |
| 65<br>PnACA      | 0                                                                                               | Position Loop Integral<br>Constant                     | Time Immediately    |
| 66<br>PnACC      | 7                                                                                               | Positioning Completed<br>Width                         | Immediately         |
| 67<br>PnACE      | 1073741<br>824                                                                                  | Near Signal Width                                      | Immediately         |
| 81<br>PnB02      | 0                                                                                               | Exponential Accelerat<br>Deceleration Time Co<br>stant |                     |
| 82<br>PnB04      | 0                                                                                               | Movement Average Ti                                    | me Immediately*3    |
| 83<br>PnB06      | 100                                                                                             | External Positioning F<br>Travel Distance              | nal Immediately     |
| 84<br>PnB08      | × 5,000h<br>refer-<br>ence<br>units/s<br>con-<br>verted to<br>10 <sup>-3</sup> min <sup>-</sup> | Origin Approach Spee                                   | d Immediately       |
| 85<br>PnB0A      | × 500h<br>refer-<br>ence<br>units/s<br>con-<br>verted to<br>10 <sup>-3</sup> min <sup>-</sup>   | Origin Return Creep<br>Speed'                          | Immediately         |
| 86<br>PnB0C      | 100                                                                                             | Final Travel Distance f<br>Origin Return               | or Immediately      |
| 87<br>PnB0E      | 1h                                                                                              | Fixed Monitor Selection                                | on 1 Immediately    |
| 88<br>PnB10      | Oh                                                                                              | Fixed Monitor Selection                                | on 2 Immediately    |
| 89<br>PnB12      | Oh                                                                                              | SEL_MON (CMN1) Mo<br>Selection 1                       | Immediately         |
| 8A<br>PnB14      | 0h                                                                                              | SEL_MON (CMN2) Mo<br>Selection 2                       | Immediately         |
| 8B<br>PnB16      | 10                                                                                              | Origin Detection Widtl                                 | n Immediately       |
| 8C<br>PnB18      | 100                                                                                             | Forward Torque Limit                                   | Immediately         |

|                  |                    |  |                                                                           | protiodio pagor |
|------------------|--------------------|--|---------------------------------------------------------------------------|-----------------|
| Parameter<br>No. | Default<br>Setting |  | Name                                                                      | When<br>Enabled |
| 8D<br>PnB1A      | 100                |  | Reverse Torque Limit                                                      | Immediately     |
| 8E<br>PnB1C      | 20000              |  | Zero Speed Detection<br>Range                                             | Immediately     |
| 8F<br>PnB1E      | 10000              |  | Speed Coincidence Signal<br>Detection Width                               | Immediately     |
| 90<br>PnB20      | 0FFF3F3<br>Fh      |  | Servo Command Control<br>Field Enable/Disable Selec-<br>tions (read only) | _               |
| 91<br>PnB22      | 0FFF3F3<br>3h      |  | Servo Status Field Enable/<br>Disable Selections (read<br>only)           | _               |
| 92<br>PnB24      | 007F01F<br>0h      |  | Output Bit Enable/Disable<br>Selections (read only)                       | _               |
| 93<br>PnB26      | FF0FFEF<br>Eh      |  | Input Bit Enable/Disable<br>Selections (read only)                        | -               |

\*1. The enable timing depends on the digit that is changed. Refer to the following section for details.

\*2. The parameter setting is enabled after SENS\_ON command execution is completed.

\*3. Change the setting when the reference is stopped (i.e., while DEN is set to 1). If you change the setting during operation, the reference output will be affected.

# Appendices

The appendix provides information on interpreting panel displays, and tables of corresponding SERVOPACK and SigmaWin+ function names.

| 14.1 | Interp                     | reting Panel Displays14-2                                                                                                                          |
|------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
|      | 14.1.2<br>14.1.3<br>14.1.4 | Interpreting Status Displays14-2Alarm and Warning Displays14-2Hard Wire Base Block Active Display14-2Overtravel Display14-2Forced Stop Display14-2 |
| 14.2 | Corresp                    | onding SERVOPACK and SigmaWin+ Function Names 14-3                                                                                                 |
|      |                            | Corresponding SERVOPACK Utility FunctionNames14-3Corresponding SERVOPACK Monitor DisplayFunction Names14-5                                         |

14.1.1 Interpreting Status Displays

# 14.1 Interpreting Panel Displays

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.

## 14.1.1 Interpreting Status Displays

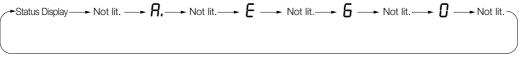
The status is displayed as described below.

| Display   | Meaning                                                                                                                                                                                                                                        | Display | Meaning                                                                          |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------------------------------------------------------------------------------|
|           | /TGON (Rotation Detection) Signal Display<br>Lit if the Servomotor speed is higher than the<br>setting of Pn502 or Pn581 and not lit if the<br>speed is lower than the setting. (The default set-<br>ting is 20 min <sup>-1</sup> or 20 mm/s.) |         | Reference Input Display<br>Lit while a reference is being input.                 |
| $\square$ | Base Block Display<br>Lit during the base block state (servo OFF). Not<br>lit while the servo is ON.                                                                                                                                           |         | Control Power Supply ON Display<br>Lit while the control power is being supplied |

# 14.1.2 Alarm and Warning Displays

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

```
Example: Alarm A.E60
```



# 14.1.3 Hard Wire Base Block Active Display

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

# 14.1.4 Overtravel Display

If overtravel has occurred, the display will change in the following order.

## 14.1.5 Forced Stop Display

During a forced stop, the following display will appear.

Status 
$$\longrightarrow$$
 Not lit.  $\longrightarrow F \longrightarrow$  Not lit.  $\longrightarrow 5 \longrightarrow$  Not lit.  $\longrightarrow E \longrightarrow$  Not lit.  $\longrightarrow P \longrightarrow$  Not lit.  $\longrightarrow P \longrightarrow$  Not lit.

14.2.1 Corresponding SERVOPACK Utility Function Names

# 14.2 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+.

# 14.2.1 Corresponding SERVOPACK Utility Function Names

| SigmaWin+                       |                             |        | SERVOPACK                                                        |  |  |
|---------------------------------|-----------------------------|--------|------------------------------------------------------------------|--|--|
| Button in<br>Menu Dialog<br>Box | Function Name               | Fn No. | Function Name                                                    |  |  |
|                                 | Initialize                  | Fn005  | Initializing Parameters                                          |  |  |
|                                 | Software Reset              | Fn030  | Software Reset                                                   |  |  |
|                                 | Setup Wizard                | -      | -                                                                |  |  |
| Basic Func-                     | I/O Signal Allocation       | -      | -                                                                |  |  |
| tions                           |                             | Fn011  | Display Servomotor Model                                         |  |  |
|                                 |                             | Fn012  | Display Software Version                                         |  |  |
|                                 | Product Information         | Fn01E  | Display SERVOPACK and Servomotor IDs                             |  |  |
|                                 |                             | Fn01F  | Display Servomotor ID from Feedback Option<br>Module             |  |  |
|                                 | Reset Absolute Encoder      | Fn008  | Reset Absolute Encoder                                           |  |  |
|                                 | Multi-turn Limit Setup      | Fn013  | Multiturn Limit Setting after Multiturn Limit Disagreement Alarm |  |  |
| Encoder Set-                    | Search Origin               | Fn003  | Origin Search                                                    |  |  |
| ting                            | Zero Point Position Setting | Fn020  | Set Absolute Linear Encoder Origin                               |  |  |
|                                 | Polarity Detection          | Fn080  | Polarity Detection                                               |  |  |
|                                 | Motor Parameter Scale Write | -      | -                                                                |  |  |
|                                 |                             | Fn000  | Display Alarm History                                            |  |  |
| Translate a la set              | Display Alarm               | Fn006  | Clear Alarm History                                              |  |  |
| Troubleshoot-<br>ing            |                             | Fn014  | Reset Option Module Configuration Error                          |  |  |
|                                 | Alarm Trace                 | _      | -                                                                |  |  |
|                                 | Reset Motor Type Alarm      | Fn021  | Reset Motor Type Alarm                                           |  |  |
| Operation                       | Jog                         | Fn002  | Jog                                                              |  |  |
| Operation                       | Program JOG Operation       | Fn004  | Jog Program                                                      |  |  |
|                                 | Trace                       |        | -                                                                |  |  |
| Monitor                         | Real Time Trace             |        | -                                                                |  |  |
| Monitor                         | Monitor                     |        | -                                                                |  |  |
|                                 | Life Monitor                | -      | -                                                                |  |  |

Continued on next page.

14.2.1 Corresponding SERVOPACK Utility Function Names

Continued from previous page.

| SigmaWin+                       |                                                              |        | SERVOPACK                                                |  |  |
|---------------------------------|--------------------------------------------------------------|--------|----------------------------------------------------------|--|--|
| Button in<br>Menu Dialog<br>Box | Function Name                                                | Fn No. | Function Name                                            |  |  |
|                                 | Tuning -<br>Autotuning without Host Refer-<br>ence           | Fn201  | Advanced Autotuning 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 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                                          | -      | -                                                        |  |  |
| Diagnostic                      | Easy FFT                                                     | Fn206  | Easy FFT                                                 |  |  |
| Diagnostic                      | Ripple Compensation                                          | _      | -                                                        |  |  |
|                                 | Online Vibration Monitor                                     | _      | -                                                        |  |  |
|                                 | Adjust the Analog Monitor Out-                               | Fn00C  | Adjust Analog Monitor Output Offset                      |  |  |
|                                 | put                                                          | Fn00D  | Adjust Analog Monitor Output Gain                        |  |  |
|                                 | Adjust the Motor Current<br>Detection Offsets                | Fn00E  | Autotune Motor Current Detection Signal Offset           |  |  |
|                                 |                                                              | Fn00F  | Manually Adjust Motor Current Detection Signal<br>Offset |  |  |
| Others                          | Initialize Vibration Detection<br>Level                      | Fn01B  | Initialize Vibration Detection Level                     |  |  |
|                                 | Parameter Converter                                          | -      | -                                                        |  |  |
|                                 | SERVOPACK Axis Name Set-<br>ting                             | -      | -                                                        |  |  |
|                                 | Write Prohibited Setting                                     | Fn010  | Write Prohibition Setting                                |  |  |
|                                 | Motor Parameter SERVOPACK<br>Write                           | _      | -                                                        |  |  |

14.2.2 Corresponding SERVOPACK Monitor Display Function Names

# 14.2.2 Corresponding SERVOPACK Monitor Display Function Names

|                                   | SigmaWin+                                                                                                                                                                                                                                                                                               | SERVOPACK |                                                                                                                                                                                                                                                                                                                                           |  |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Button in<br>Menu Dia-<br>log Box | Name [Unit]                                                                                                                                                                                                                                                                                             | Un No.    | Name [Unit]                                                                                                                                                                                                                                                                                                                               |  |
|                                   | Motor Speed [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                        | Un000     | Motor Speed [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                                                          |  |
|                                   | Speed Reference [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                    | Un001     | Speed Reference [min <sup>-1</sup> ]                                                                                                                                                                                                                                                                                                      |  |
|                                   | Torque Reference [%]                                                                                                                                                                                                                                                                                    | Un002     | Torque Reference [%]<br>(percentage of rated torque)                                                                                                                                                                                                                                                                                      |  |
| 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 [encoder pulses]<br/>(number of encoder pulses from origin within<br/>one encoder rotation displayed in decimal)</li> <li>Linear Servomotors:<br/>Electrical Angle 1 [linear encoder pulses]<br/>(linear encoder pulses 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 [deg]<br/>(electrical angle from polarity origin)</li> <li>Linear Servomotors:<br/>Electrical Angle 2 [deg]<br/>(electrical angle from polarity origin)</li> </ul>                                                                                                                    |  |
|                                   | Input Reference Pulse Speed [min <sup>-1</sup> ]                                                                                                                                                                                                                                                        | Un007     | Input Reference Pulse Speed [min <sup>-1</sup> ]<br>(displayed only during position control)                                                                                                                                                                                                                                              |  |
|                                   | Position Deviation [reference units]                                                                                                                                                                                                                                                                    | Un008     | Position Error Amount [reference units]<br>(displayed only during position control)                                                                                                                                                                                                                                                       |  |
|                                   | Accumulated Load Ratio [%]                                                                                                                                                                                                                                                                              | Un009     | Accumulated Load Ratio [%]<br>(percentage of rated torque: effective torque in<br>cycles of 10 seconds)                                                                                                                                                                                                                                   |  |
|                                   | Regenerative Load Ratio [%]                                                                                                                                                                                                                                                                             | Un00A     | Regenerative Load Ratio [%]<br>(percentage of processable regenerative<br>power: regenerative power consumption in<br>cycles of 10 seconds)                                                                                                                                                                                               |  |
|                                   | Dynamic Brake Resistor Power Con-<br>sumption [%]                                                                                                                                                                                                                                                       | Un00B     | Power Consumed by DB Resistance [%]<br>(percentage of processable power at DB acti-<br>vation: displayed in cycles of 10 seconds)                                                                                                                                                                                                         |  |
|                                   | Input Reference Pulse Counter [ref-<br>erence units]                                                                                                                                                                                                                                                    | Un00C     | Input Reference Pulse Counter [reference units                                                                                                                                                                                                                                                                                            |  |
|                                   | Feedback Pulse Counter [encoder pulses]                                                                                                                                                                                                                                                                 | Un00D     | Feedback Pulse Counter [encoder pulses]                                                                                                                                                                                                                                                                                                   |  |

14.2.2 Corresponding SERVOPACK Monitor Display Function Names

Continued from previous page.

|                        | SigmaWin+                                                                                           |                     | SERVOPACK                                                                                            |
|------------------------|-----------------------------------------------------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------|
| Button in<br>Menu Dia- |                                                                                                     | Un No.              |                                                                                                      |
| log Box                | Name [Unit]                                                                                         | UT NO.              | Name [Unit]                                                                                          |
|                        | Fully-closed Loop Feedback Pulse<br>Counter [external encoder resolu-<br>tion]                      | Un00E               | Fully-closed Loop Feedback Pulse Counter<br>[external 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 Motor Maximum Speed/<br>Upper Limit Setting of Encoder Output Resolu-<br>tion |
|                        | Total Operation Time [100 ms]                                                                       | Un012               | Total Operation Time [100 ms]                                                                        |
|                        | Feedback Pulse Counter [reference units]                                                            | Un013               | Feedback Pulse Counter [reference units]                                                             |
|                        | Overheat Protection Input [0.01 V]                                                                  | Un02F               | Overheat Protection Input [0.01 V]                                                                   |
|                        | Current Backlash Compensation<br>Value [0.1 reference units]                                        | Un030               | Current Backlash Compensation Value [0.1 reference units]                                            |
|                        | Backlash Compensation Value<br>Setting Limit [0.1 reference units]                                  | Un031               | Backlash Compensation Value Setting Limit [0.1 reference units]                                      |
|                        | Power Consumption [W]                                                                               | Un032               | Power Consumption [W]                                                                                |
|                        | Consumed Power [0.001 Wh]                                                                           | Un033               | Consumed Power [0.001 Wh]                                                                            |
|                        | Cumulative Power Consumption [Wh]                                                                   | Un034               | Cumulative Power Consumption [Wh]                                                                    |
|                        | Absolute Encoder Multiturn Data                                                                     | Un040               | Absolute Encoder Multiturn Data                                                                      |
|                        | Position within One Rotation of Absolute Encoder [encoder pulses]                                   | Un041               | Position within One Rotation of Absolute<br>Encoder [encoder pulses]                                 |
|                        | Lower Bits of Absolute Encoder<br>Position [encoder pulses]                                         | Un042               | Lower Bits of Absolute Encoder Position [encoder pulses]                                             |
| Motion                 | Upper Bits of Absolute Encoder<br>Position [encoder pulses]                                         | Un043               | Upper Bits of Absolute Encoder Position [encoder pulses]                                             |
| Monitor                | Maximum Value of Amplitude of Estimated Vibration [min <sup>-1</sup> ]*2                            | Un078               | Maximum Value of Amplitude of Estimated Vibration [min <sup>-1</sup> ]                               |
|                        | Estimated External Disturbance<br>Torque [%] <sup>*2</sup>                                          | Un079               | Estimated External Disturbance Torque [%]                                                            |
|                        | Maximum Value of Estimated<br>External Disturbance Torque <sup>*2</sup>                             | Un07A               | Maximum Value of Estimated External Distur-<br>bance Torque Torque [%]                               |
|                        | Minimum Value of Estimated<br>External Disturbance Torque <sup>*2</sup>                             | Un07B               | Minimum Value of Estimated External Distur-<br>bance Torque Torque [%]                               |
|                        | Number of Serial Encoder Communi-<br>cations Errors <sup>*2</sup> [times]                           | Un104               | Number of Serial Encoder Communications<br>Errors [times]                                            |
|                        | Settling Time [0.1 ms] <sup>*2</sup>                                                                | Un105               | Settling Time [0.1 ms]                                                                               |
|                        | Amount of Overshoot [reference<br>units] <sup>*2</sup>                                              | Un106               | Amount of Overshoot [reference units]                                                                |
|                        | Residual Vibration Frequency [0.1<br>Hz] <sup>*2</sup>                                              | Un107               | Residual Vibration Frequency [0.1 Hz]                                                                |
|                        | Estimated Vibration <sup>*2</sup> [min <sup>-1</sup> ]                                              | Un10C               | Estimated Vibration [min <sup>-1</sup> ]                                                             |
|                        | Maximum Value of Accumulated Load Ratio [%] <sup>*2</sup>                                           | Un145               | Maximum Value of Accumulated Load Ratio [%]                                                          |
|                        | Number of MECHATROLINK Com-<br>munications Errors [times] <sup>*2</sup>                             | Un147               | Number of MECHATROLINK Communications<br>Errors [times]                                              |
|                        | Margin Until Overload [0.01%]*2                                                                     | Un14E               | Margin Until Overload [0.01%]                                                                        |
|                        | Temperature Margin Until Servomo-<br>tor Overheats [°C] <sup>*2, *3</sup>                           | Un174               | Temperature Margin Until Servomotor Over-<br>heats [°C]                                              |

#### 14.2.2 Corresponding SERVOPACK Monitor Display Function Names

Continued from previous page

|                                   |                                                                |        | Continued from previous page.                                                |  |  |
|-----------------------------------|----------------------------------------------------------------|--------|------------------------------------------------------------------------------|--|--|
|                                   | SigmaWin+                                                      |        | SERVOPACK                                                                    |  |  |
| Button in<br>Menu Dia-<br>log Box | Name [Unit]                                                    | Un No. | Name [Unit]                                                                  |  |  |
|                                   | Polarity Sensor Signal Monitor                                 | Un011  | Polarity Sensor Signal Monitor                                               |  |  |
| Status<br>Monitor                 | Active Gain Monitor                                            | Un014  | Effective Gain Monitor (gain settings $1 = 1$ , gain settings $2 = 2$ )      |  |  |
|                                   | Safety I/O Signal Monitor                                      | Un015  | Safety I/O Signal Monitor                                                    |  |  |
| Input<br>Signal<br>Monitor        | Input Signal Monitor                                           | Un005  | Input Signal Monitor                                                         |  |  |
| Output<br>Signal<br>Monitor       | Output Signal Monitor                                          | Un006  | Output Signal Monitor                                                        |  |  |
|                                   | Installation Environment Monitor –<br>SERVOPACK                | Un025  | SERVOPACK Installation Environment Monitor [%]                               |  |  |
|                                   | Installation Environment Monitor –<br>Servomotor <sup>*3</sup> | Un026  | Servomotor Installation Environment Monitor [%]                              |  |  |
| Service<br>Life                   | Service Life Prediction Monitor –<br>Built-in Fan              | Un027  | Built-in Fan Remaining Life Ratio [%]                                        |  |  |
| Monitor                           | Service Life Prediction Monitor –<br>Capacitor                 | Un028  | Capacitor Remaining Life Ratio [%]                                           |  |  |
|                                   | Service Life Prediction Monitor –<br>Surge Prevention Circuit  | Un029  | Surge Prevention Circuit Remaining Life Ratio [%]                            |  |  |
|                                   | Service Life Prediction Monitor –<br>Dynamic Brake Circuit     | Un02A  | Dynamic Brake Circuit Remaining Life Ratio [%]                               |  |  |
| Product<br>Informa-               | Motor – Resolution                                             | Un084  | Linear Encoder Pitch (Scale pitch = Un084 $\times$ 10 <sup>Un085</sup> [pm]) |  |  |
| tion                              |                                                                | Un085  | Linear Encoder Pitch Exponent (Scale pitch = $Un084 \times 10^{Un085}$ [pm]) |  |  |
|                                   | -                                                              | Un020  | Rated Motor Speed [min <sup>-1</sup> ]                                       |  |  |
| -                                 | -                                                              | Un021  | Maximum Motor Speed [min-1]                                                  |  |  |
| -                                 |                                                                | -      |                                                                              |  |  |

\*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.X□□□ (Calculation Method for Maximum Speed or Divided Out-

put 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. These items can be monitored using SERVOPACKs with software version 002C or higher.

\*3. 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



### Symbols

| /BK {                                          | 5-35 |
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| /CLT (Torque Limit Detection) signal 6         | 5-32 |
| /COIN 6                                        | 5-12 |
| /COIN (Positioning Completion) signal 6        | 5-12 |
| /HWBB1                                         | 1-43 |
| /HWBB2                                         | 1-43 |
| /N-CL 6                                        | 5-29 |
| /N-CL (Reverse External Torque Limit) signal 6 | 5-29 |
| /NEAR                                          | 5-13 |
| /NEAR (Near) signal 6                          | 5-13 |
| /P-CL 6                                        | 5-29 |
| /P-CL (Forward External Torque Limit) signal 6 | 5-29 |
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| September 2022         | <15>        | 0                  | 6.1.2, 6.1.6,<br>6.1.10, 8.12.1,<br>9.3.3, 10.3.2,<br>12.2.1, 12.2.2,<br>12.2.4, 13.1.2 | Partly revised.                                                                                |
|                        |             |                    | Back cover                                                                              | Revision: Address                                                                              |
| February 2022          | <14>        | 0                  | Preface, 5.16.4,<br>5.17.2, 6.8.9,<br>6.12.2, 7.6.2,<br>12.2.2, 13.2.2                  | Partly revised.                                                                                |
|                        |             |                    | Back cover                                                                              | Revision: Address                                                                              |
| July 2021              | <13>        | 0                  | All chapters                                                                            | Partly revised.                                                                                |
| August 2020            | <12>        | 0                  | 5.15.1, 6.5.2,<br>10.3.4, 13.1.2                                                        | Partly revised.                                                                                |
| February 2020          | <11>        | 0                  | 4.4.3, 5.15.1,<br>5.17.2                                                                | Addition: Information on Linear Encoder from Canon Precision Inc.                              |
|                        |             |                    | Back cover                                                                              | Revision: Address                                                                              |
| October 2019           | <10>        | 0                  | All chapters                                                                            | Partly revised.                                                                                |
| January 2019           | <9>         | 0                  | 5.1.4, 7.6.3                                                                            | Revision: Information in table of restrictions                                                 |
|                        |             |                    | 9.2.2, 9.2.3,<br>12.2.6, 12.2.7,<br>14.2.1, 14.2.2                                      | Partly revised.                                                                                |
|                        |             |                    | 12.2.3                                                                                  | Addition: Reset procedure with the SigmaWin+                                                   |
|                        |             |                    | 13.1.2                                                                                  | Revision: Information on Pn824                                                                 |
|                        |             |                    | Back cover                                                                              | Revision: Address                                                                              |
| September 2018         | <8>         | 0                  | Preface                                                                                 | Partly revised.                                                                                |
|                        |             |                    | 2.1.1                                                                                   | Revision: Built-in regenerative resistor power loss                                            |
|                        |             |                    | 4.4.3, 5.15.1                                                                           | Addition: Absolute linear encoder from Fagor Automation S. Coop.                               |
|                        |             |                    | 5.1.4, 7.6.3                                                                            | Footnote in Origin Search                                                                      |
|                        |             |                    | Back cover                                                                              | Revision: Address                                                                              |
| April 2018             | <7>         | 0                  | Preface                                                                                 | Partly revised.                                                                                |
|                        |             |                    | 4.3.1                                                                                   | Revision: Specifications for L1C and L2C                                                       |
| December 2017          | <6>         | 0                  | Preface                                                                                 | Partly revised.                                                                                |
|                        |             |                    | Preface, 1.4.2,<br>1.5.1, 5.12.1,<br>5.15.1                                             | Addition: Information on Rotary Servomotors (SGM7M)                                            |
|                        |             |                    | 1.2                                                                                     | Revision: Information on nameplate                                                             |
|                        |             |                    | 1.5.3                                                                                   | Addition: Information on SGLFW2-90A200A L, SGLFW2-90A560A,<br>and SGLFW2-1DA560A               |
|                        |             |                    | Chapter 12                                                                              | Deletion: A.F50                                                                                |
|                        |             |                    | Back cover                                                                              | Revision: Address                                                                              |
| March 2017             | <5>         | 0                  | Preface, 12.5                                                                           | Partly revised.                                                                                |
|                        |             |                    | 4.4.3, 5.15.1                                                                           | Addition: Information on SQ47 and SQ57 Linear Encoders from<br>Magnescale Co., Ltd.            |
|                        |             |                    | 5.15.1                                                                                  | Addition: Information on LIC2100-Series and LC415 Linear Encoders from Heidenhain Corporation. |
|                        |             |                    | 5.15.1, 5.17.2                                                                          | Addition: Information on RESOLUTE Linear Encoders from Renishaw PLC.                           |
|                        |             |                    | 5.19                                                                                    | Newly added.                                                                                   |
|                        |             |                    | 6.1.2                                                                                   | Addition: Information on forcing outputs with MECHATROLINK-III commands                        |
|                        |             |                    | 13.1.2                                                                                  | Revisions: Reference information                                                               |
|                        |             |                    | Chapter 13                                                                              | Addition: Pn56A and Pn56B                                                                      |

| Date of<br>Publication | Rev.<br>No. | Web<br>Rev.<br>No. | Section                                       | Revised Contents                                                                                                                                                                                              |
|------------------------|-------------|--------------------|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| December 2016          | <4>         | 0                  | Preface                                       | Partly revised.                                                                                                                                                                                               |
|                        |             |                    | 1.4.2, 4.4.2,<br>4.4.3, 5.16.1,<br>5.17, 6.12 | Addition: Information on Rotary Servomotors with 24-bit batteryless absolute encoders.                                                                                                                        |
|                        |             |                    | Back cover                                    | Revision: Address                                                                                                                                                                                             |
| October 2016           | <3>         | 0                  | All chapters                                  | Addition: Information on SGM7E and SGM7F Direct Drive Servomotors<br>Deletion: Information on SGLC Linear Servomotors<br>Addition: Information on SERVOPACKs with single-phase, 200-VAC power supply<br>input |
|                        |             |                    |                                               | Addition: Information on dynamic brake option                                                                                                                                                                 |
|                        |             |                    | Preface, 9.1, 9.2                             | Partly revised.                                                                                                                                                                                               |
|                        |             |                    | 2.1.1                                         | Addition: Information on input current of control power supply                                                                                                                                                |
|                        |             |                    | 2.1.3, 4.2, 4.5                               | Revision: "Linear Servomotor overheat protection signal input" changed to<br>"overheat protection input."                                                                                                     |
|                        |             |                    | 3.7                                           | Addition: EMC installations for single-phase 200-VAC and single-phase 100-VAC models                                                                                                                          |
|                        |             |                    | 4.4.3, 5.15.1,<br>5.17.2                      | Addition: Absolute linear encoders from Renishaw PLC (models:EL36Y-DDDDDDDD)                                                                                                                                  |
|                        |             |                    | 6.5.1                                         | Revision: Precautions when using an incremental linear encoder from Renishaw PLC                                                                                                                              |
|                        |             |                    | 6.14, 8.12.3                                  | Newly added.                                                                                                                                                                                                  |
|                        |             |                    | Chapter 12                                    | Addition: A.862 and A.93B                                                                                                                                                                                     |
|                        |             |                    | Chapter 13                                    | Addition: Pn022, Pn475, Pn476, Pn61A, Pn61B, Pn61C, and Pn61D Deletion: Pn52D                                                                                                                                 |
|                        |             |                    | 14.2.2                                        | Addition: Un02F                                                                                                                                                                                               |
| December 2015          | <2>         | 0                  | All chapters                                  | Addition: Information on SERVOPACKs with single-phase, 100-VAC power suppl                                                                                                                                    |
|                        |             |                    | Destaur                                       | Revision: Information on SigmaWin+ procedures                                                                                                                                                                 |
|                        |             |                    | Preface                                       | Addition: Information on SGMMV Rotary Servomotors<br>Revision: Information on certification for standards                                                                                                     |
|                        |             |                    | 4.4.3, 5.15.1,<br>6.5.1                       | Addition: Information on SQ10 Linear Encoder from Magnescale Co., Ltd.                                                                                                                                        |
|                        |             |                    | 9.4.1                                         | Partly revised.                                                                                                                                                                                               |
|                        |             |                    | 1.5.2                                         | Addition: Information on Direct Drive Servomotors (SGMCV-16D and -35D)                                                                                                                                        |
|                        |             |                    | 9.5                                           | Addition: Alarm tracing                                                                                                                                                                                       |
|                        |             |                    | Chapter 12                                    | Additions: A.bF5, A.bF6, A.bF7, A.bF8, and FL-6                                                                                                                                                               |
|                        |             |                    | Back cover                                    | Revision: Address                                                                                                                                                                                             |
| May 2015               | <1>         | 0                  | Front cover,<br>back cover                    | Revision: Format                                                                                                                                                                                              |
|                        |             |                    | All chapters                                  | Addition: Information on Safety Modules<br>Addition: Information on dynamic brake                                                                                                                             |
|                        |             |                    | Preface                                       | Revision: Information on certification for standards                                                                                                                                                          |
|                        |             |                    | 2.1.1                                         | Revision: Power loss                                                                                                                                                                                          |
|                        |             |                    | 4.2, 4.4.3, 4.5.3                             | Revision: Diagrams around Battery for absolute encoder                                                                                                                                                        |
|                        |             |                    | 5.15.1, 5.17.2                                | Addition: Information on Linear Encoders (ST1381 and ST1382) from Mitutoyo Corporation                                                                                                                        |
|                        |             |                    | 6.1.10                                        | Revision: Information on speed limit during torque control                                                                                                                                                    |
|                        |             |                    | 7.6.3                                         | Revision: Information on test without a motor                                                                                                                                                                 |
|                        |             |                    | 8.3.3, 8.3.5                                  | Revision: Related Parameters<br>Addition: Related Warnings                                                                                                                                                    |
|                        |             |                    | 8.12.3                                        | Revision: Information on current control mode selection                                                                                                                                                       |
|                        |             |                    | Chapters 12 and 13                            | Revision: Reference information                                                                                                                                                                               |
|                        |             |                    | Chapter 12                                    | Revision: Information on A.900, A.910, and A.911                                                                                                                                                              |
|                        |             |                    | Chapter 13                                    | Revision: Information on Pn601 and Pn604<br>Addition: Pn846                                                                                                                                                   |
| October 2014           | _           | _                  | _                                             | First edition                                                                                                                                                                                                 |

# Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with MECHATROLINK-III Communications References RJ-45 Connectors Product Manual

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