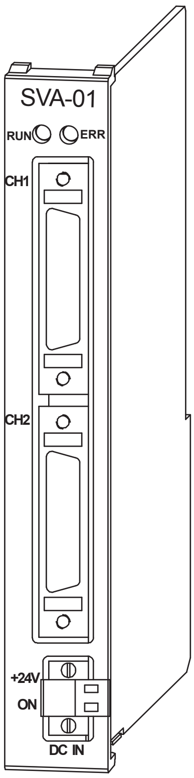
YASKAWA

Machine Controller MP2000 Series

SVA-01 Motion Module

USER'S MANUAL

Model: JAPMC-MC2300 (-E)



MANUAL NO. SIEP C880700 32F

Using this Manual

Read this manual to ensure correct usage of the MP2000-series Machine Controller (hereinafter referred to as Machine Controller unless otherwise specified) and the SVA-01 Module. Keep this manual in a safe place so that it can be referred to whenever necessary.

■ Manual Configuration

Read the chapters of this manual as needed.

Chapter \ Purpose		Selecting Models and Peripheral Devices	System Design	Panel Configuration and Wiring	Trial Operation	Maintenance and Inspection
1	Overview	✓				✓
2	Settings and Installation	✓		✓		✓
3	Setup		✓		✓	✓
4	Operation Modes		✓		✓	
5	Motion Parameters		✓		✓	
6	Motion Parameter Setting Examples		✓		✓	
7	Motion Commands		✓		✓	
8	Switching Commands during Execution		✓		✓	
9	Control Block Diagram		✓		✓	
10	Absolute Position Detection		✓		✓	
11	Utility Functions		✓		✓	✓
12	Troubleshooting		✓		✓	✓

■ Symbols Used in this Manual

The symbols used in this manual indicate the following type of information.

- This symbol is used to indicate important information that should be memorized or minor precautions, such as precautions that will result in alarms if not heeded.

■ Terms Used to Describe "Torque"

Although the term "torque" is commonly used when describing rotary servomotors and "force" or "thrust" are used when describing linear servomotors, this manual uses "torque" when describing both (excluding parameters).

■ Indication of Reverse Signals

In this manual, the names of reverse signals (ones that are valid when low) are written with a forward slash (/) before the signal name, as shown in the following example:

Notation Examples

- $\overline{\text{S-ON}}$ = /S-ON
- $\overline{\text{P-CON}}$ = /P-CON

■ Related Manuals

The following table lists the manuals relating to the SVA-01 Module. Refer to these manuals as required.

Manual Name	Manual Number	Contents
Machine Controller MP2100/MP2100M User's Manual Design and Maintenance	SIEP C880700 01	Describes how to use the MP2100 and MP2100M Machine Controllers.
Machine Controller MP2200 User's Manual	SIEP C880700 14	Describes how to use the MP2200 Machine Controller and the modules that can be connected.
Machine Controller MP2300 Basic Module User's Manual	SIEP C880700 03	Describes how to use the MP2300 Basic Module and the modules that can be connected.
Machine Controller MP2500/MP2500M/ MP2500D/MP2500MD User's Manual	SIEP C880752 00	Describes how to use the MP2500, MP2500M, MP2500D, and MP2500MD Machine Controllers.
Machine Controller MP2000 Series Motion Module User's Manual Built-in SVB/SVB-01 Module	SIEP C880700 33	Provides a detailed description on the MP2000-series Machine Controller built-in SVB Module and slot-mounting optional SVB-01 Module.
Machine Controller MP2000 Series Communication Module User's Manual	SIEP C880700 04	Provides the information on the Communication Module that can be connected to MP2☐00 Machine Controller and the communication methods.
Machine Controller MP900/MP2000 Series User's Manual, Ladder Programming	SIEZ-C887-1.2	Describes the instructions used in MP900/MP2000 ladder programming.
Machine Controller MP900/MP2000 Series User's Manual Motion Programming	SIEZ-C887-1.3	Describes the instructions used in MP900/MP2000 motion programming.
Engineering Tool for MP2000 Series Machine Controller MPE720 Version 6 User's Manual	SIEP C880700 30	Describes how to install and operate the programming tool MPE720 version 6 for MP2000-series Machine Controllers.
Machine Controller MP900/MP2000 Series MPE720 Software for Programming Device User's Manual	SIEP C880700 05	Describes how to install and operate the MP900/MP2000 Series programming system (MPE720).
Σ Series SGM☐/SGD User's Manual	SIE-S800-26.3	Describes the Σ–I Series SERVOPACK models, specifications, and capacity selection methods.
Σ-II Series SGM☐H/SGDH User's Manual	SIEP S800000 05	Describes the installation, wiring, trial operation, function applications methods, maintenance, and inspection of the Σ-II Series SERVOPACKs.
Σ-II Series SGM☐H/SGDM User's Manual	SIEP S800000 15	Describes the installation, wiring, trial operation, function applications methods, maintenance, and inspection of the Σ-II Series SERVOPACKs.
AC Servo Drives Σ-III Series SGM☐☐/SGDS User's Manual	SIEP S800000 00	Describes the models, specifications, wiring, trial operation, adjustment, function application methods, maintenance, and inspection of the Σ-III Series SERVOPACKs and Servomotors.
AC Servodrive Σ-V Series SGM☐☐/SGDV User's Manual Design and Maintenance Rotational Motor Analog Voltage and Pulse Train Reference	SIEP S800000 45	Describes the models, specifications, wiring, trial operation, adjustment, function application methods, maintenance, and inspection of the Σ-V Series SERVOPACKs and Servomotors.
AC Servodrive Σ-V Series User's Manual Design and Maintenance Linear Motor Analog Voltage and Pulse Train Reference	SIEP S800000 47	Describes the models, specifications, wiring, trial operation, adjustment, function application methods, maintenance, and inspection of the Σ-V Series SERVOPACKs and Linear Servomotors.
Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with Analog Voltage/Pulse Train References Product Manual	SIEP S800001 26	Describes the selection of Σ-7-Series SERVOPACKs and the installation, connection, settings, trial operation, tuning, and monitoring of Servo Drives.

(cont'd)

Manual Name	Manual Number	Contents
Σ-III Series SGM□S/SGDS Digital Operator Instructions	TOBP S800000 01	Describes the operating methods of the JUSP-OP05A Digital Operator.
Machine Controller MP900/MP2000 Series User's Manual For Linear Servomotors	SIEP C880700 06	Describes the connection methods, setting methods, and other information for Linear Servomotors.
Machine Controller MP900/MP2000 Series New Ladder Editor Programming Manual	SIEZ-C887-13.1	Describes the programming instructions of the New Ladder Editor, which assists MP900/MP2000 Series design and maintenance.
Machine Controller MP900/MP2000 Series New Ladder Editor User's Manual	SIEZ-C887-13.2	Describes the operating methods of the New Ladder Editor, which assists MP900/MP2000 Series design and maintenance.

■ Copyrights

- 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.

Safety Information

The following conventions are used to indicate precautions in this manual. These precautions are provided to ensure the safe operation of the Machine Controller and connected devices. Information marked as shown below is important for the safety of the user. Always read this information and heed the precautions that are provided.
The conventions are as follows:

WARNING	Indicates precautions that, if not heeded, could possibly result in loss of life, serious injury, or property damage.
CAUTION	Indicates precautions that, if not heeded, could result in relatively serious or minor injury, or property damage. If not heeded, even precautions classified under CAUTION can lead to serious results depending on circumstances.
PROHIBITED	Indicates prohibited actions. Specific prohibitions are indicated inside . For example, indicates prohibition of open flame.
MANDATORY	Indicates mandatory actions. Specific actions are indicated inside . For example, indicates mandatory grounding.

Safety Precautions

The following precautions are for checking products on delivery, storage, transportation, installation, wiring, operation, inspection, and disposal. These precautions are important and must be observed.

■ General Precautions

⚠ WARNING
• Before connecting the machine and starting operation, ensure that an emergency stop procedure has been provided and is working correctly. There is a risk of injury. • Do not touch anything inside the Machine Controller. There is a risk of electrical shock. • Always keep the front cover attached when power is being supplied. There is a risk of electrical shock. • Observe all procedures and precautions given in this manual for trial operation. Operating mistakes while the servomotor and machine are connected may damage the machine or even cause accidents resulting in injury or death. • Do not remove the front cover, cables, connectors, or options while power is being supplied. There is a risk of electrical shock. • Do not damage, pull on, apply excessive force to, place heavy objects on, or pinch cables. There is a risk of electrical shock, operational failure or burning of the Machine Controller. • Do not attempt to modify the Machine Controller in any way. There is a risk of injury or device damage. • Do not approach the machine when there is a momentary interruption to the power supply. When power is restored, the Machine Controller and the device connected to it may start operation suddenly. Provide safety measures in advance to ensure human safety in the event that operation restarts suddenly. There is a risk of injury. • Do not allow installation, disassembly, or repairs to be performed by anyone other than specified personnel. There is a risk of electrical shock or injury.

■ Storage and Transportation

⚠ CAUTION
◆ Do not store or install the Machine Controller in the following locations. There is a risk of fire, electrical shock, or device damage. • Direct sunlight • Ambient temperature exceeds the storage or operating conditions • Ambient humidity exceeds the storage or operating conditions • Rapid changes in temperature or locations subject to condensation • Corrosive or flammable gas • Excessive dust, dirt, salt, or metallic powder • Water, oil, or chemicals • Vibration or shock ◆ Do not overload the Machine Controller during transportation. There is a risk of injury or an accident. ◆ If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, 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.

■ Installation

⚠ CAUTION
◆ Never use the Machine Controller in locations subject to water, corrosive atmospheres, or flammable gas, or near burnable objects. There is a risk of electrical shock or fire. ◆ Do not step on the Machine Controller or place heavy objects on the Machine Controller. There is a risk of injury. ◆ Do not block the air exhaust port or allow foreign objects to enter the Machine Controller. There is a risk of element deterioration inside, an accident, or fire. ◆ Always mount the Machine Controller in the specified orientation. There is a risk of an accident. ◆ Do not subject the Machine Controller to strong shock. There is a risk of an accident.

■ Wiring

⚠ CAUTION

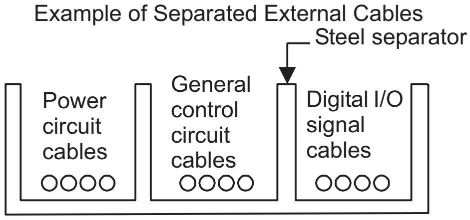
- Check the wiring to be sure it has been performed correctly.
  There is a risk of motor overrun, injury, or an accident.
- Always use a power supply of the specified voltage.
  There is a risk of burning.
- In places with poor power supply conditions, take all steps necessary to ensure that the input power supply is within the specified voltage range.
  There is a risk of device damage.
- Install breakers and other safety measure to provide protection against shorts in external wiring.
  There is a risk of fire.
- Provide sufficient shielding when using the Machine Controller in the following locations.
  There is a risk of device damage.
  - Noise, such as from static electricity
  - Strong electromagnetic or magnetic fields
  - Radiation
  - Near to power lines
- When connecting the battery, connect the polarity correctly.
  There is a risk of battery damage or explosion.
- Only qualified safety-trained personnel should replace the battery.
  If the battery is replaced incorrectly, machine malfunction or damage, electric shock, or injury may result.
- When replacing the battery, do not touch the electrodes.
  Static electricity may damage the electrodes.

■ Selecting, Separating, and Laying External Cables

⚠ CAUTION

- Consider the following items when selecting the I/O signal lines (external cables) to connect the Machine Controller to external devices.
  - Mechanical strength
  - Noise interference
  - Wiring distance
  - Signal voltage, etc.
- Separate the I/O signal lines from the power lines both inside and outside the control box to reduce the influence of noise from the power lines.
  If the I/O signal lines and power lines are not separated properly, malfunctioning may result.

Example of Separated External Cables



Maintenance and Inspection Precautions

⚠ CAUTION
• Do not attempt to disassemble the Machine Controller. There is a risk of electrical shock or injury. • Do not change wiring while power is being supplied. There is a risk of electrical shock or injury. • When replacing the Machine Controller, restart operation only after transferring the programs and parameters from the old Module to the new Module. If the data has not been transferred to the new module before the operation of the machine controller starts, damage to the device may result.

Disposal Precautions

⚠ CAUTION
• Dispose of the Machine Controller as general industrial waste.

General Precautions

Observe the following general precautions to ensure safe application.
• The products shown in illustrations in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual. • The drawings presented in this manual are typical examples and may not match the product you received. • If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual.

Warranty

(1) Details of Warranty

■ Warranty Period

The warranty period for a product that was purchased (hereinafter called “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 warranty period above. 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.

1. 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
2. Causes not attributable to the delivered product itself
3. Modifications or repairs not performed by Yaskawa
4. Abuse of the delivered product in a manner in which it was not originally intended
5. Causes that were not foreseeable with the scientific and technological understanding at the time of shipment from Yaskawa
6. Events for which Yaskawa is not responsible, such as natural or human-made disasters

(2) Limitations of Liability

1. 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.
2. 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.
3. 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.
4. 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.

(3) Suitability for Use

1. 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.
2. The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
3. 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
4. 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.
5. 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.
6. Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

(4) 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.

Contents

1

Overview

This chapter provides an overview and the features of the SVA-01 Module.

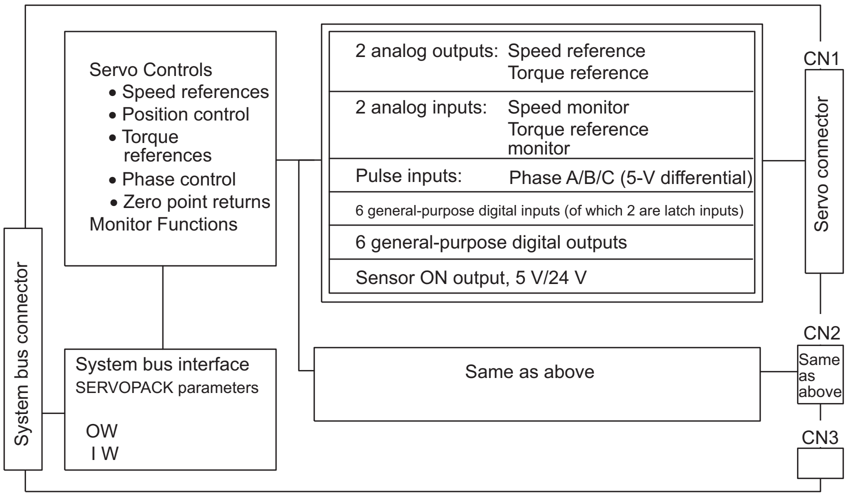
1.1 SVA-01 Module Overview and Features

1.1.1 Overview

The SVA-01 Module is a motion control module with analog outputs. Each Module can control Servos or Inverters for up to 2 axes.

The Module has two connectors (CN1 and CN2) for connecting SERVOPACKs and external I/O. Each connector provides analog outputs for speed references and torque references, analog inputs for feedback speed monitoring and torque monitoring, pulse input phases A, B, and C (5-V differential), and general-purpose digital I/O interfaces.

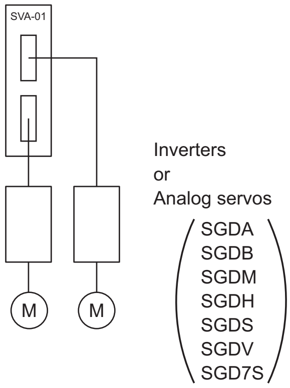
The control cycle is fixed at 500 µs.



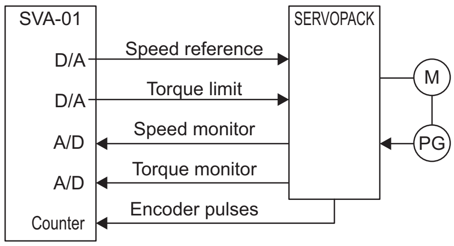
1.1.2 Features

The SVA-01 Module has the following features.

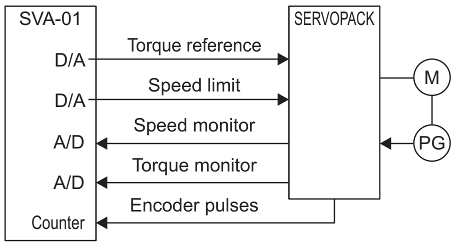
- Servo control module with analog outputs to control up to two axes
- You can connect two axes with an Inverter or Analog Servo Drive (SGDA, SGDB, SGDM, SGDH, SGDS, SGDV, or SGD7S).
- The control cycle is fixed at 500µs, enabling high-precision control without being affected by the high-speed scan cycle.
- Position control, speed reference outputs, torque reference outputs, or phase control can be performed independently for each axis.



Speed, Position, and Phase Control

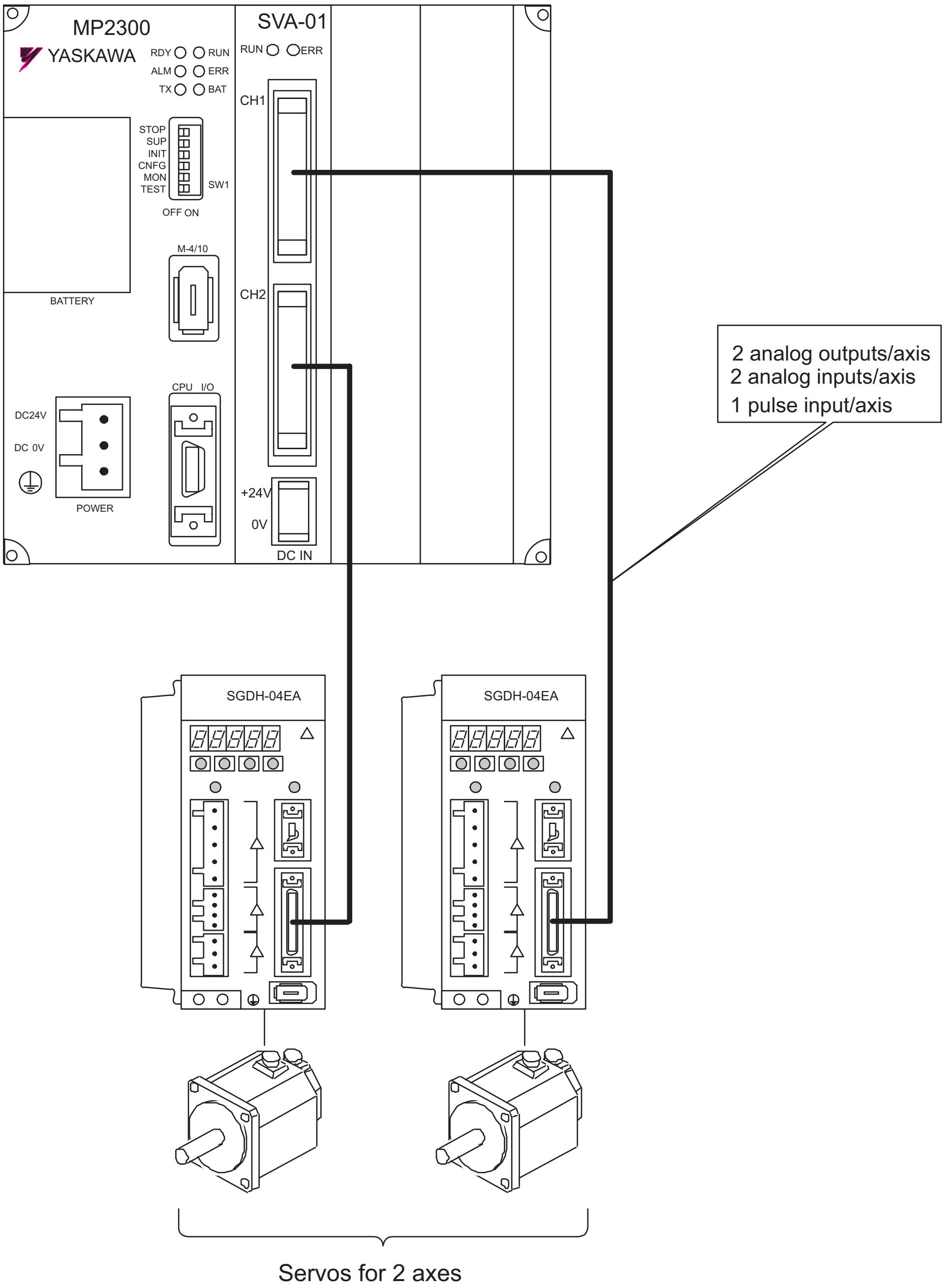


Torque Control



1.1.3 System Configuration Example

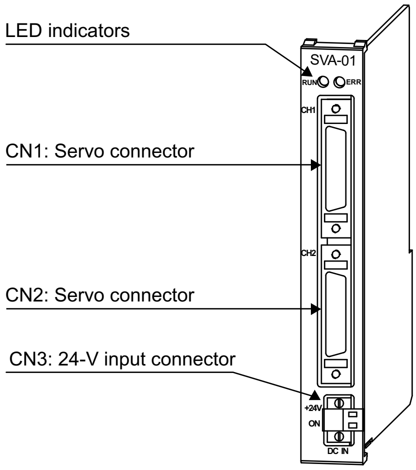
The following diagram shows a system configuration example.



- Use the specified cables and connectors. Refer to *2.5.1 Cables* on page 2-12 to select appropriate cables and connectors to connect each device.

1.2 Specifications

1.2.1 Hardware Specifications

Item		Specifications
Model Number		JAPMC-MC2300 (-E)
Module Appearance		
Max. Number of Modules to be connected		MP2300: 2 Modules MP2200: 16 Modules
Indicators		RUN (green) ERR (red)
Connectors		CN1: Servo connector CN2: Servo connector CN3: 24-V power input connector
Servo Interfaces	Digital Inputs	6 inputs × 2 channels (Sink mode input 24 V/4.3 mA) DI_0: General-purpose input (ALM) DI_1: General-purpose input (RDY) DI_2: General-purpose input (ZERO: External latch signal input) DI_3: General-purpose input DI_4: General-purpose input DI_5: General-purpose input (EXT: External latch signal input)
	Digital Outputs	6 outputs × 2 channels (Sink mode output 24 V/100 mA) DO_0: General-purpose output (SV_ON) DO_1: General-purpose output (ALM_RST) DO_2: General-purpose output (PCON) Used for C-SEL (control mode switching signal) DO_3: General-purpose output DO_4: General-purpose output DO_5: General-purpose output (SEN signal), 5-V and 24-V outputs
	Pulse Inputs	1 input × 2 channels, phase A/B/C, 5-V differential input Pulse input rate: 4 Mpps (16 Mpps for ×4) Phase-C latch input Response time: 95 to 125 ns, ON pulse width: 200 ns min.
	Analog Outputs	2 outputs × 2 channels, -10 V to 10 V, D/A 16-bit, load impedance: 10 kΩ min.
	Analog Inputs	2 outputs × 2 channels, -10 V to 10 V (applicable: -9 V to 9 V), D/A 16-bit, input impedance: approx. 13 kΩ

Item		Specifications
Environment Conditions	Ambient Operating Temperature	0 to +55°C
	Ambient Storage Temperature	–25 to +85°C
	Ambient Operating Humidity	30 to 95% (with no condensation)
	Ambient Storage Humidity	5 to 95% (with no condensation)
	Pollution Level	Pollution level 2 (conforming to JIS B 3502)
	Corrosive Gas	There must be no combustible or corrosive gas.
	Operating Altitude	2,000 m above sea level or lower
Mechanical Operating Conditions	Vibration Resistance	Conforms to JIS B 3502. Vibration amplitude/acceleration: $10 \le f < 57$ Hz, Single-amplitude of 0.075 mm $57 \le f \le 150$ Hz, Fixed acceleration of 9.8 m/s^2 10 sweeps (1 sweep = 1 octave per minute) each in the X, Y, and Z directions
	Shock Resistance	Conforms to JIS B 3502. Peak acceleration of 147 m/s^2 twice for 11 ms each in the X, Y, and Z directions
Electrical Operating Conditions	Noise Resistance	Conforming to EN 61000-6-2, EN 61000-6-4, EN 55011 (Group 1 Class A)
Installation Requirements	Ground	Ground to 100 Ω max.
	Cooling Method	Natural cooling
Dimensions (mm)		125 × 95 (H × D)
Mass		80 g

1.2.2 Functional Specifications

Item		Details: Function	Details: Remarks
Control Functions	Torque Reference (Open-loop)	Torque Reference	According to the torque unit selection parameter
		Speed Limit at Torque Reference	Rated speed percentage designation [0.01%]
	Speed Reference (Open-loop)	Speed Reference	According to the speed unit selection parameter
		Acceleration	According to the acceleration/deceleration unit selection parameter
		Deceleration	According to the acceleration/deceleration unit selection parameter
		Moving Average Filter Time Constant Setting	ms
		Torque Limit	According to the torque unit selection parameter
		Positive Speed Limit	Rated speed percentage designation [0.01%]
		Negative Speed Limit	Rated speed percentage designation [0.01%]
	Position Control	Position Reference	mm, inch, degree, pulse
		Speed Reference	According to the speed unit selection parameter
		Acceleration	According to the acceleration/deceleration unit selection parameter
		Deceleration	According to the acceleration/deceleration unit selection parameter
		Filter Type	Moving average or exponential acceleration/deceleration
		Filter Time Constant	ms
		Position Compensation	mm, inch, degree, pulse
		Speed Compensation	According to the speed unit selection parameter
		Position Loop Gain	1/s
		Position Loop Integration Time Constant	ms
		Speed Feed Forward Gain	Position derivative percentage designation [0.01%]
		Primary Delay Time Constant	ms
		Torque Limit	Rated torque percentage designation [0.01%]
		Positive Speed Limit	Rated speed percentage designation [0.01%]
		Negative Speed Limit	Rated speed percentage designation [0.01%]
	Phase Control	Speed Reference	According to the speed unit selection parameter
		Speed Compensation	According to the speed unit selection parameter
		Phase Compensation	mm, inch, degree, pulse
		Phase Control Proportional Gain	Same as position loop gain parameter
		Phase Control Integration Time Constant	Same as position loop integration time constant parameter
		Torque Limit	Rated torque percentage designation [0.01%]
		Positive Speed Limit	Rated speed percentage designation [0.01%]
		Negative Speed Limit	Rated speed percentage designation [0.01%]

Item		Details	
		Function	Remarks
Motion Functions	Motion Commands	Positioning, external positioning, zero point return, interpolation, interpolation with position detection function, JOG operation, STEP operation, speed reference, torque/thrust reference, phase control, etc.	
	Acceleration/Deceleration Methods	1-step asymmetrical trapezoidal acceleration/deceleration, exponential acceleration/deceleration filter, moving average filter	
	Position Units	pulse, mm, inch, degree	
	Speed Units	Reference unit/sec, 10^n reference unit/min, rated speed percentage designation	
	Acceleration/Deceleration Units	Reference unit/sec^2, ms (acceleration time from 0 to rated speed, deceleration time from rated speed to 0)	
	Torque Units	Rated torque percentage designation	
	Electronic Gear	Supported	
	Position Control Methods	Finite length position control, infinite length position control, absolute infinite length position control, simple absolute infinite length position control	
	Software Limits	One each in forward and reverse directions	
	Zero Point Return Types	17	
	Latch Function	Phase-C latch, external signal input latch	
Self-configuration Function		Modules can be automatically allocated to the Machine Controller. (Axes must be manually allocated.)	

1.2.3 Performance Specifications

Item		Specifications	Remarks
Control Cycle		500 µs	–
D/A	Resolution	16 bits	PWM output
	Output Delay	10 ms*	–
	Accuracy	10 mV max.	–
	Temperature Drift	200 µV/°C max.	–
A/D	Resolution	16 bits	–
	Input Delay	1 ms	–
	Accuracy	10 mV max.	–
	Temperature Drift	100 µV/°C max.	–
DO	OFF → ON	1 ms	–
	ON → OFF	1 ms	–
DI	OFF → ON	1 ms	–
	ON → OFF	1 ms	
Pulse Input Rage		4 Mpps	16 Mpps for input pulse multiplier of 4

* When changing full-scale from -10 V to +10 V

1.2.4 Applicable SERVOPACKs

SERVOPACK Model	Remarks
SGDA -□□□S SGDB -□□AD□-□ -□□DD	Σ-I series AC SERVOPACK
SGDM -□□□DA -□□AD□ SGDH -□□DE -□□AE	Σ-II series SERVOPACK
SGDS -□□□-01□□ -□□□-02□□ -□□□-05□□	Σ-III series SERVOPACK
SGDV -□□□□01 -□□□□05	Σ-V series SERVOPACK
SGD7S -□□□□00	Σ-7 series SERVOPACK

2

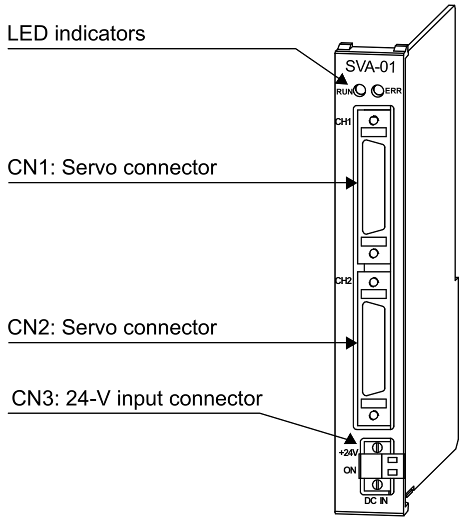
Settings and Installation

This chapter explains the LED indicators of the SVA-01 Module, how to install or remove it, and how to connect SERVOPACKs to it.

2.1 External Appearance and LED Indicators

2.1.1 External Appearance

The following figure illustrates the external appearance of the SVA-01 Module.



2.1.2 LED Indicators

The following table shows the indicators that show the operating status of the SVA-01 Module and error information.

Indicators	Indicator Name	Color	Signification When Lit	Signification When Unlit
RUN ○ ○ ERR	RUN	Green	Lights during normal operation of the microprocessor used for control.	An error has occurred in the microprocessor for control.
	ERR	Red	Lights/blinks for failures. Not lit during normal operation.	Normally operating

2.1.3 SVA-01 Module Status Indication

The SVA-01 Module status is indicated by the combination of LED indicators as shown in the following table.

<table>
<tr><th rowspan="2">Status</th><th colspan="2">Indication</th><th rowspan="2">SVA-01 Module Status</th><th rowspan="2">Description</th></tr>
<tr><th>RUN</th><th>ERR</th></tr>
<tr><td rowspan="5">Normal Operation Status</td><td>○</td><td>○</td><td>Hardware reset status</td><td>Indicates that the hardware is being reset by the Machine Controller.</td></tr>
<tr><td>○</td><td>○</td><td>Not defined</td><td>Indicates that the SVA-01 Module has not been registered in Module Configuration. Refer to 3.2 Module Configuration Definition of Machine Controller on page 3-3 and make the settings to define the module configuration and the SVA Module.</td></tr>
<tr><td>○</td><td>●</td><td>Being initialized</td><td>• Maintains this status for 1 to 6 seconds after the power supply is turned ON or the Module is reset.
• Maintains this status for 30 seconds per axis if fixed parameter No. 30 (Encoder Type) is set to 1 to enable an absolute encoder and if an error occurred in the interface with the absolute encoder.
• This state continues if DWG A is caught in an infinite loop.</td></tr>
<tr><td>★</td><td>○</td><td>CPU being stopped</td><td>Indicates that the Machine Controller's CPU is being stopped. Execute a CPU RUN command to restore normal operation status.</td></tr>
<tr><td>●</td><td>○</td><td>Operating normally</td><td>Indicates that the SVA-01 Module is operating normally.</td></tr>
<tr><td rowspan="3">Error</td><td>●</td><td>★</td><td>A CPU Module error is detected.
2: Watchdog time timeout error
(Number indicates the number of times blinking.)</td><td>If a watchdog time timeout error is detected, the processing time for the user program may exceed the set scan time. Check the settings for the user program and the scan time.</td></tr>
<tr><td>★</td><td>★</td><td>Hardware error
1: -
2: ROM error
3: RAM error
4: CPU error
5: FPU error
6: Shared memory error
7: JL-045 error
8: Internal power supply error*
(Number indicates the number of times blinking.)</td><td>Hardware failure of the SVA-01 Module occurred.
Replace the Module.</td></tr>
<tr><td>○</td><td>★</td><td>Software error
1: -
2: -
3: Address error (reading) exception
4: Address error (writing) exception
5: FPU exception
6: General illegal instruction exception
7: Slot illegal instruction exception
8: General FPU suppression exception
9: Slot FPU suppression exception
(Number indicates the number of times blinking.)</td><td>Software failure of the SVA-01 Module occurred.
Replace the Module.</td></tr>
<tr><td>Alarm/Warning</td><td>●</td><td>●</td><td>Occurrence of alarm or warning</td><td>Use the following monitoring parameters to find out the details of alarm or warning.
IL□□02: Warning
IL□□04: Alarm
IW□□09, bit 3: Command Error Completed Status (FAIL)
IW□□0B, bit 3: Command Error Completed Status (FAIL)</td></tr>
</table>

● : Lit
○ : Unlit
★ : Blinking
- : Not specified
* Detection is possible only with the JAPMC-MC2300-E.

2.2 Applicable Machine Controllers for SVA-01 Modules

The following table lists the MP2000-series Machine Controllers on which the SVA-01 Module can be mounted.

<table>
<tr><th colspan="2" rowspan="2">Name</th><th rowspan="2">Model</th><th rowspan="2">Max. No. of Connectable Modules</th><th colspan="2">Applicable Version</th><th rowspan="2">Remarks</th></tr>
<tr><th>CPU Module</th><th>MPE720</th></tr>
<tr><td colspan="2">MP2300</td><td>JEPMC-MP2300 (-E)</td><td>2 modules</td><td>Ver. 2.20 or later</td><td rowspan="8">Ver. 5.12
Ver. 6.01
Ver. 7.10
or later</td><td>–</td></tr>
<tr><td colspan="2">MP2310</td><td>JEPMC-MP2310 (-E)</td><td>3 modules</td><td rowspan="2">All versions</td><td>–</td></tr>
<tr><td colspan="2">MP2300S</td><td>JEPMC-MP2300S (-E)</td><td>1 module</td><td>–</td></tr>
<tr><td rowspan="4">MP 2200 *1</td><td>CPU-01</td><td>JAPMC-CP2200 (-E)</td><td>30 modules</td><td>Ver. 2.20 or later</td><td rowspan="4">The maximum number of connectable Modules is the total for the maximum expansion to four racks.*2</td></tr>
<tr><td>CPU-02</td><td>JAPMC-CP2210 (-E)</td><td rowspan="3">31 modules</td><td rowspan="3">All versions</td></tr>
<tr><td>CPU-03</td><td>JAPMC-CP2220-E</td></tr>
<tr><td>CPU-04</td><td>JAPMC-CP2230-E</td></tr>
<tr><td colspan="2">MP2100M</td><td>JAPMC-MC2140 (-E)</td><td rowspan="3">14 modules</td><td>Ver. 2.20 or later</td><td rowspan="3">The maximum number of connectable Modules is the total for the maximum expansion to three racks.*2</td></tr>
<tr><td colspan="2">MP2101M</td><td>JAPMC-MC2142-E</td><td rowspan="2">All versions</td><td rowspan="2">Ver. 5.54
Ver. 6.24
Ver. 7.10
or later</td></tr>
<tr><td colspan="2">MP2101TM</td><td>JAPMC-MC2142T-E</td></tr>
</table>

* 1. Mount a CPU module on the following base units.

Name	Model	Remarks
MBU-01	JEPMC-BU2200 (-E)	100/200-VAC input base unit (9 slots)
MBU-02	JEPMC-BU2210 (-E)	24-VDC input base unit (9 slots)
MBU-03	JEPMC-BU2220-E	24-VDC input base unit (4 slots)

* 2. The following module or board is required between racks.

Name	Model	Remarks
EXIOIF	JAPMC-EX2200 (-E)	Inter-rack connection module
MP2100MEX	JAPMC-EX2100 (-E)	I/F board for MP2100M, MP2101M, and MP2101TM

2.3 Mounting/Removing SVA-01 Modules

This section describes how to mount and remove a SVA-01 Module.

2.3.1 Mounting a SVA-01 Module

Mount a SVA-01 Module by using the following procedure.

- Remove the SVA-01 Module to be replaced, in advance of replacement, by referring to *2.3.2 Removing SVA-01 Modules for Replacement* on page 2-7.

(1) Preparation

1. Create a backup file of the programs.

Use the MPE720 to save the Machine Controller programs to a personal computer.

- MPE720 Ver. 5.□□: Right-click the PLC folder and then select ***Transfer*** - ***All Files*** - ***From Controller to MPE720*** from the main menu.
  MPE720 Ver. 6.□□: Open the project file and then select ***Online*** - ***Transfer*** - ***Read from Controller*** from the main menu.

2. Remove the Machine Controller and Expansion Racks.

Turn OFF the power supply, and then disconnect all cables from the Machine Controller and expansion racks (MP2200 base units). After disconnecting all the cables, remove the Machine Controller and expansion racks from the panel or mounting rack, and place them on a sufficiently wide and safe surface, such as working table.

(2) Removing an Optional Cover

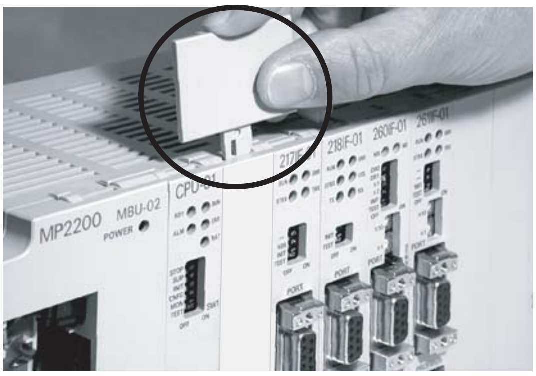
Use the following procedure if the slot has an optional cover installed.

1. Remove the battery cover.

Insert a coin in the notch on the side of the Machine Controller and pry the battery cover off.

2. Remove the cover of the SVA-01 Module.

Insert the tab of the battery cover into the slot on the top of the cover of the SVA-01 Module to release it, as shown in the diagram. Turn the front of the battery cover towards you for this operation.



Release the bottom in the same way.

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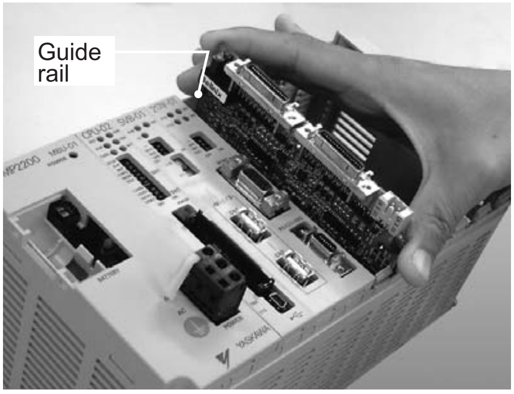
(3) Mounting SVA-01 Modules

1. Insert a SVA-01 Module.

Guide rails can be seen or are located at the top and bottom of the optional module mounting slot, as shown in the following diagram. While holding both the top and bottom of the Module, line up the Module with the guide rails inside the option slot, make sure the Module is straight and insert it.

- If the Module is not lined up with the guide rails, the FG bar on the bottom inside the slot may become damaged.

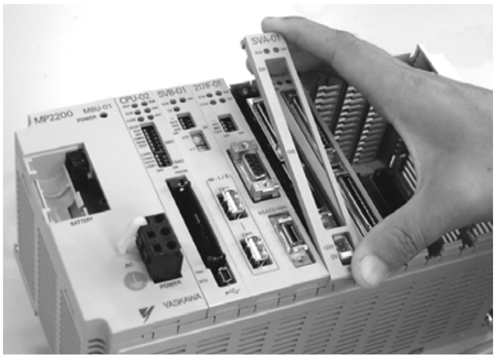


2. Mount onto the mounting base.

After the SVA-01 Module has been completely inserted, firmly push the front of the Module into the mounting-base connectors. If the SVA-01 Module has been installed correctly, the front of the SVA-01 Module and the hook will be aligned.

3. Mount the panel of the SVA-01 Module.

Line up the notch on the bottom of the panel with the tab on the bottom of the Machine Controller.



This completes the installation procedure.

2.3.2 Removing SVA-01 Modules for Replacement

Use the following procedure to remove a SVA-01 Module.

(1) Preparation

1. Create a backup file of the programs.

Use the MPE720 to save the programs of the Machine Controller to a personal computer.

- MPE720 Ver. 5.□□: Right-click the PLC folder and then select ***Transfer*** - ***All Files*** - ***From Controller to MPE720*** from the main menu.
  MPE720 Ver. 6.□□: Open the project file and then select ***Online*** - ***Transfer*** - ***Read from Controller*** from the main menu.

2. Remove the Machine Controller and Expansion Racks.

Turn OFF the power supply, and then disconnect all cables from the Machine Controller and expansion racks (MP2200 base units). After disconnecting all the cables, remove the Machine Controller and expansion racks from the panel or mounting rack, and place them on a sufficiently wide and safe surface, such as working table.

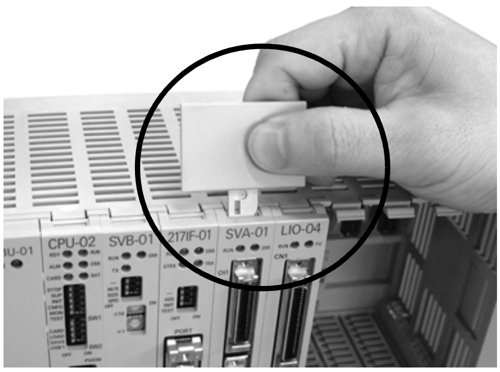
(2) Removing SVA-01 Modules

1. Remove the battery cover.

Insert a coin in the notch on the side of the Machine Controller and pry the battery cover off.

2. Remove the cover of the SVA-01 Module.

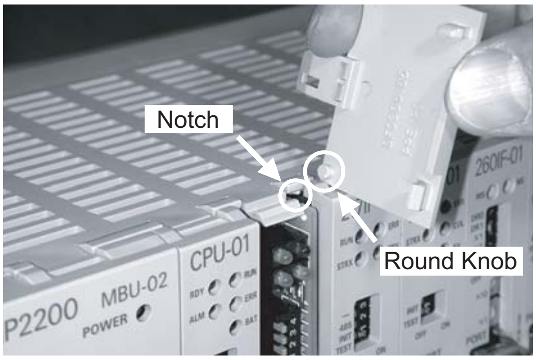
Insert the tab of the battery cover into the slot on the top of the panel of the SVA-01 Module to release it, as shown in the diagram. Turn the front of the battery cover towards you for this operation.



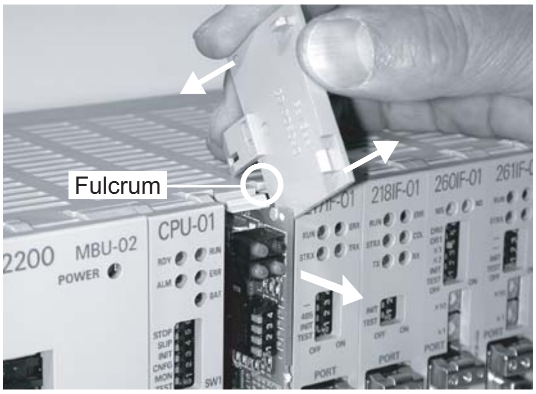
Release the bottom in the same way.

3. Remove the SVA-01 Module from the mounting base.

Pull the top of the panel of the SVA-01 Module towards you to remove it. A notch on the SVA-01 Module will be visible from the gap in the cover. Hook the round knob on the battery cover, shown in the diagram, into the notch in the SVA-01 Module.

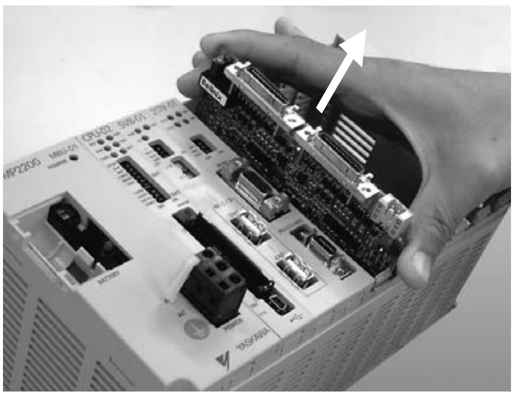


While holding the battery cover as shown in the photograph, tilt the cover back with the knob as the pivot point to disconnect the Module. The Module should move forward out of the case.



4. Pull out the SVA-01 Module.

While holding both the top and bottom of the Module, pull the Module out straight towards you. Hold the Module by its edges and do not touch any components on the Module.



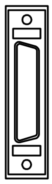
Place the Module in the bag provided with the initial shipment and store it in this bag.

- A optional cover (JEPMC-OP2300) must be installed on the empty slot.

2.4 SVA-01 Module Connections

2.4.1 Connectors

(1) Servo Interface Connectors CN1 and CN2



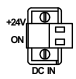
These connectors connect the SVA-01 Module to two SERVOPACKs.
Use the following standard cable to connect each SERVOPACK to the SVA-01 Module.

- JEPMC-W2040-□□-E (for SGDH, SGDM, SGDS, SGDV, and SGD7S SERVOPACKs)
- ♦ The user must provide cables for the SGDA and SGDB SERVOPACKs.

(2) 24-V Input Connector CN3

This connector connects SVA-01 Module to +24 VDC as Servo I/O power supply.

CN3 is a screw type terminal connector model BL3.5/2F-AU manufactured by Weidmuller Inc.



Pin No.	Signal Name	Name
2	24V	+24 VDC input
1	0V	0V

Refer to *2.4.2 Connection Procedure for 24-V Input Cable* on page 2-10 to assemble the cable for +24 VDC power input.

(3) Connector Specifications

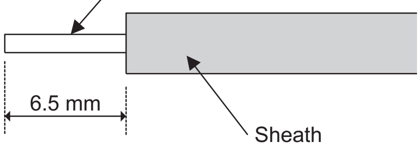
The following table shows the specifications of above three connectors.

Name	Connector Name	No. of Pins	Connector Model			Cable Model
			SVA-01 Module Side	Cable Side	Manufac-turer	
Servo Interface Connectors CN1 and CN2	CN1 CN2	36	10236-52A2PL	• Connector body: 10136-3000PE • Shell: 10336-52A0-008 (Screw locking) 10336-52F0-008 (One-touch lock-ing)	3M Japan Limited	JEPMC-W2040-□□-E (for SGDH, SGDM, SGDS, SGDV, and SGD7S SERVOPACKs)
24-V Input Connector	CN3	2	–	• BL3.5/2F-AU	Weid-muller Inc.	The CN3 connector is included with the SVA-01 Module, but a cable is not included. The user must connect the cable.

2.4.2 Connection Procedure for 24-V Input Cable

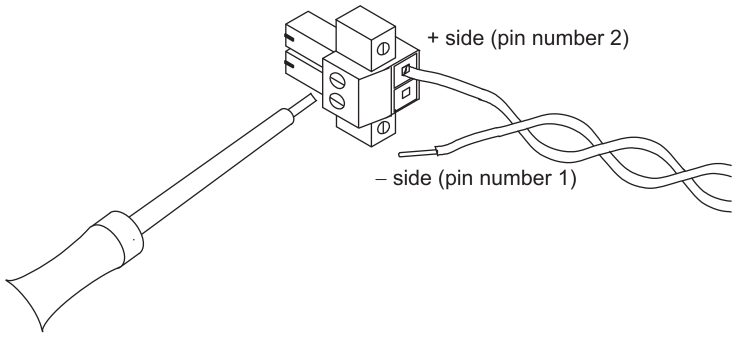
Prepare a 0.2 mm^2 to 0.51 mm^2 (AWG24 to AWG20) twisted-pair cable. Use the following connection procedure.

1. Remove the sheath to approximately 6.5 mm from the cable end.



2. Remove the plug from the CN3 connector on the SVA-01 Module.

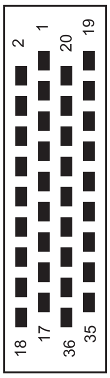
3. Insert the bare core of the cable into the opening of the plug and then tighten the screws to a tightening torque of approximately 0.2 N・m to 0.25 N・m.



Pin No.	Signal Name	Name
2	24V	+24 VDC input
1	0V	0V

2.4.3 CN1 and CN2 Connector Pin Arrangement

The following figures show the 36-pin arrangement, each pin name and assignment for connectors CN1 and CN2.



Pin Arrangement Viewing from the Cable-Side

2	AO_0 (NREF)	General-purpose analog output 0 (Speed reference output)
4	PAL	5-V differential phase-A pulse input (–)
6	PCL	5-V differential phase-C pulse input (–)
8	AI_0	General-purpose analog input 0 (Feedback speed monitor input)
10	0V (For 24 V)	0 V (for 24 V) output
12 ■	DO_2 (PCON)	General-purpose output DO_2 (P action reference output)
14 ○	DO_3	General-purpose output DO_3
16	+24V	+24 V output
18 △	★DI_2 (ZERO/ HOME LS)	General-purpose input DI_2 (ZERO/HOME LS input)

1	SG	Ground (analog)
3	PA	5-V differential phase-A pulse input (+)
5	PC	5-V differential phase-C pulse input (+)
7	SG	Ground
9	AO_1 (TREF)	General-purpose analog output 1 (Torque reference output)
11	0V (For 24 V)	0 V (for 24 V) output
13 ○	DO_4	General-purpose output DO_4
15 △	DI_3 (P-OT)	General-purpose input DI_3 (Positive overtravel input)
17 ■	DI_0 (SVALM)	General-purpose input DI_0 (Servo alarm input)

20	SEN (5 V)	SEN signal (Servo)
22	–	Not connected
24	PBL	5-V differential phase-B pulse input (–)
26	AI-GND	Analog input ground
28	0V (For 24 V)	0 V (for 24 V) output
30 ■	DO_1 (ALMRST)	General-purpose output DO_1 (Alarm reset output)
32 ■	DO_5 (SEN)	General-purpose output DO_5 (VS866 24-V SEN signal)
34	+24V	+24 V output
36 △	★ DI_5 (EXT/DEC)	General-purpose input DI_5 (EXT/DEC signal input)

19	SG	Ground (For SEN signal)
21	AI_1	General-purpose analog input 1 (Torque reference monitor input)
23	PB	5-V differential phase-B pulse input (+)
25	SG	Ground
27	AO-GND	Analog output ground
29	0V (For 24 V)	0 V (for 24 V) output
31 ■	DO_0 (SV ON)	General-purpose output DO_0 (Servo ON output)
33 △	DI_4 (N-OT)	General-purpose input DI_4 (Negative overtravel input)
35 ■	DI_1 (SRDY)	General-purpose input DI_1 (Servo ready input)

- (shaded) : Signal that can be used as a general-purpose I/O signal in the general-purpose I/O mode
- ■ : I/O signal exclusive for the system in the normal operation mode
- ○ : Signal that can be used as a general-purpose output signal in the normal operation mode
- △ : Signal that can be used as a general-purpose I/O signal as long as it is not used by the system for an exclusive function
- ★ : Input signal with latch function
- Either 5 V or 24 V can be selected for the SEN signal. Connect pin 20 or pin 32 according to the application.
  Pin 20 (5 V) is connected in the standard cable.

2.5 Cable Specifications and Connections

2.5.1 Cables

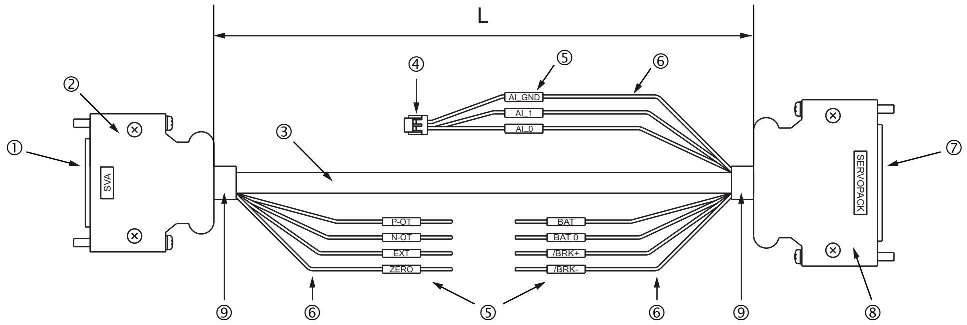
The following standard cables are available for use with the SVA-01 Module. These cables are used to connect the SVA-01 Module to SERVOPACKs, overtravel limit switches, and other machines.

Name	Model	Length	Appearance
Cable for SVA-01 Module	JEPMC-W2040-A5-E	0.5 m	Connector on both ends
	JEPMC-W2040-01-E	1.0 m	
	JEPMC-W2040-03-E	3.0 m	
	JEPMC-W2041-A5-E	0.5 m	Loose wires on one end
	JEPMC-W2041-01-E	1.0 m	
	JEPMC-W2041-03-E	3.0 m	

2.5.2 JEPMC-W2040-□□-E Details

The JEPMC-W2040-□□-E are the standard cables to connect to the following SERVOPACKs: SGDM, SGDH, SGDS-□□□01□, SGDS-□□□02□, SGDV-□□□□01, SGDV-□□□□05, and SGD7S-□□□□00.

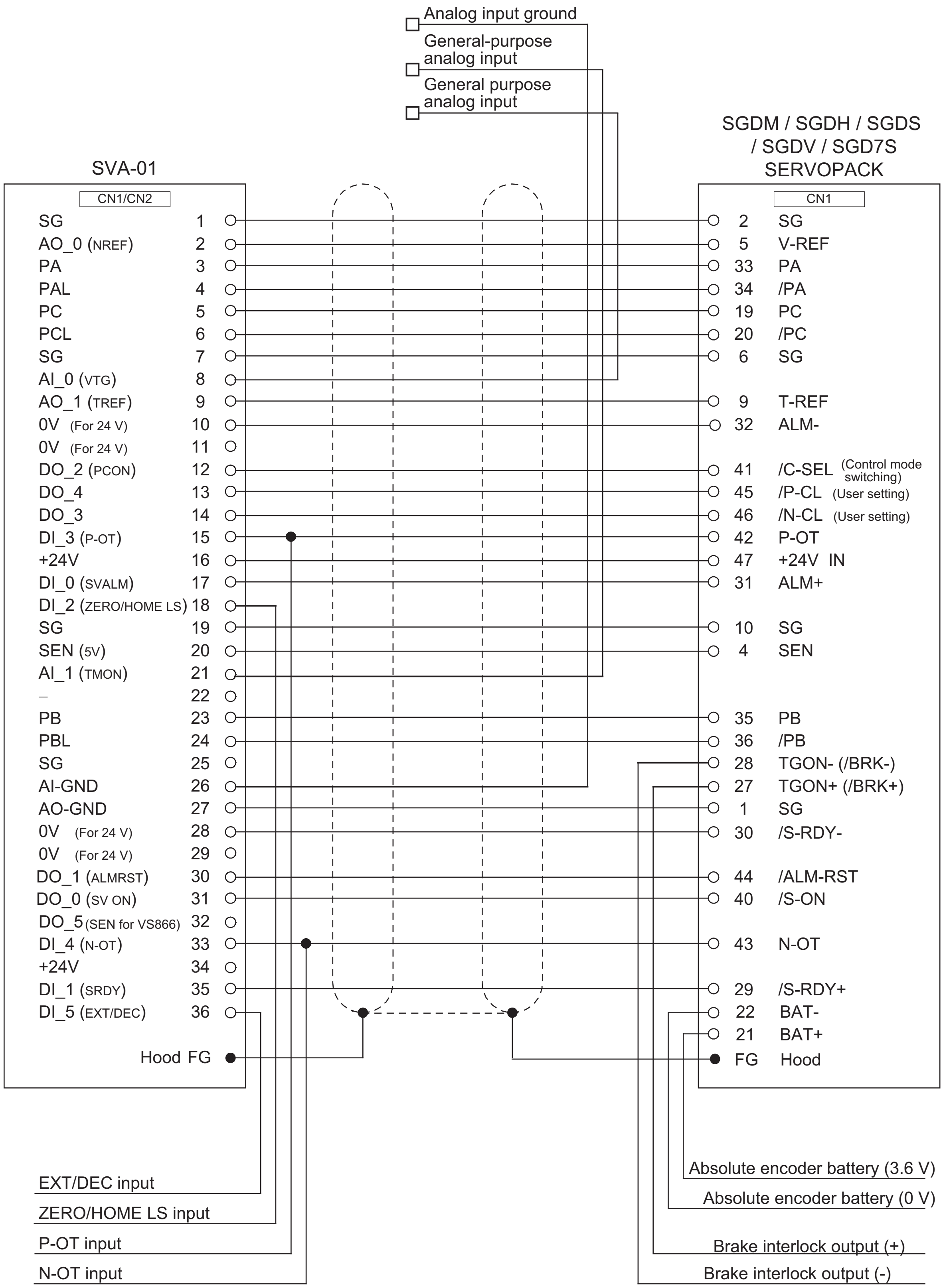
(1) Appearance



(2) Specifications

No. in Above Figure	Name	Model	Qty	Manufacturer	Remarks	
①	Plug on SVA-01 Module end	10136-3000PE	1	3M Japan Limited	Soldering type	
②	Shell on SVA-01 Module end	10336-52A0-008	1	3M Japan Limited	–	
③	Cable	HP-SB/20276SR 26 × 28AWG	–	Taiyo Electric Wire and Cable Co, Ltd.	Shielded wires	
④	Socket	DF11-4DS-2C	1	Hirose Electric Co., Ltd.	–	
	Contact	DF11-2428SCF	1	Hirose Electric Co., Ltd.	–	
⑤	Marking tube	2 mm dia., white	11	–	Printing color: Black	
⑥	Wire	UL1061 28AWG	–	–	P-OT: Brown N-OT: Orange EXT: Black ZERO: Yellow	AI_GND: Black AI_1: White AI_0: Red BAT: Blue BAT0: Purple /BRK+: Gray /BRK-: White
⑦	Plug on SERVOPACK end	10150-3000PE	1	3M Japan Limited	Soldering type	
⑧	Shell on SERVOPACK end	10350-52Z0-008	1	3M Japan Limited		
⑨	Heat-shrinking tube	F2 (Z)	–	Sumitomo Electric Industries, Ltd.	F2 (Z) or the equivalent	

(3) Connections Diagram



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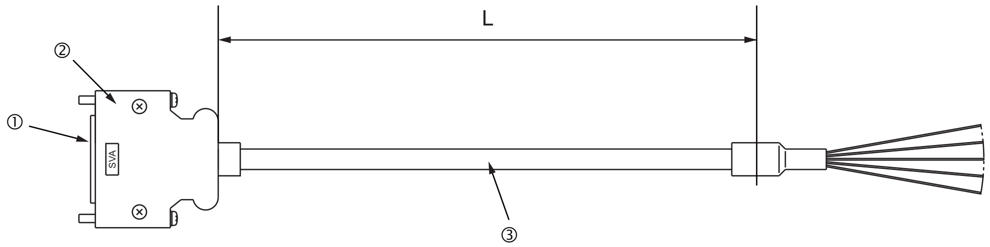
2.5.3 JEPMC-W2041-□□-E Details

The JEPMC-W2041-□□-E are the standard cables to connect to servo drives from other companies and the following SERVOPACKs: SGDA-□□□S and SGDB-□□.

(1) Appearance



(2) Cable Specifications and Wiring Table

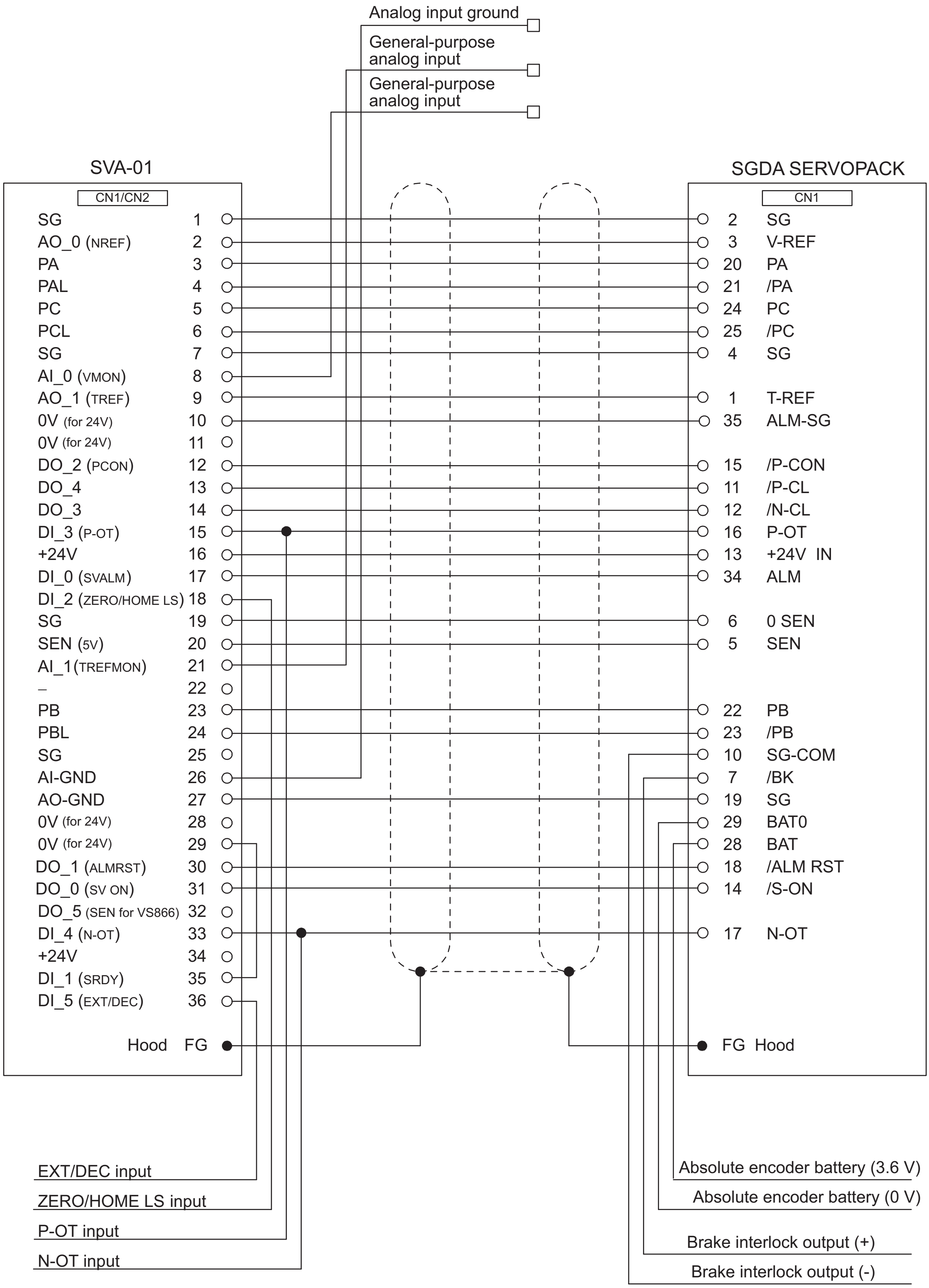
■ Cable Specifications

No. in Above Figure	Name	Model	Qty	Manufacturer	Remarks
①	Plug on SVA-01 Module end	10136-3000PE	1	3M Japan Limited	
②	Shell on SVA-01 Module end	10336-52A0-008	1	3M Japan Limited	
③	Cable	–	–	–	Equivalent to UL20276 AWG28.

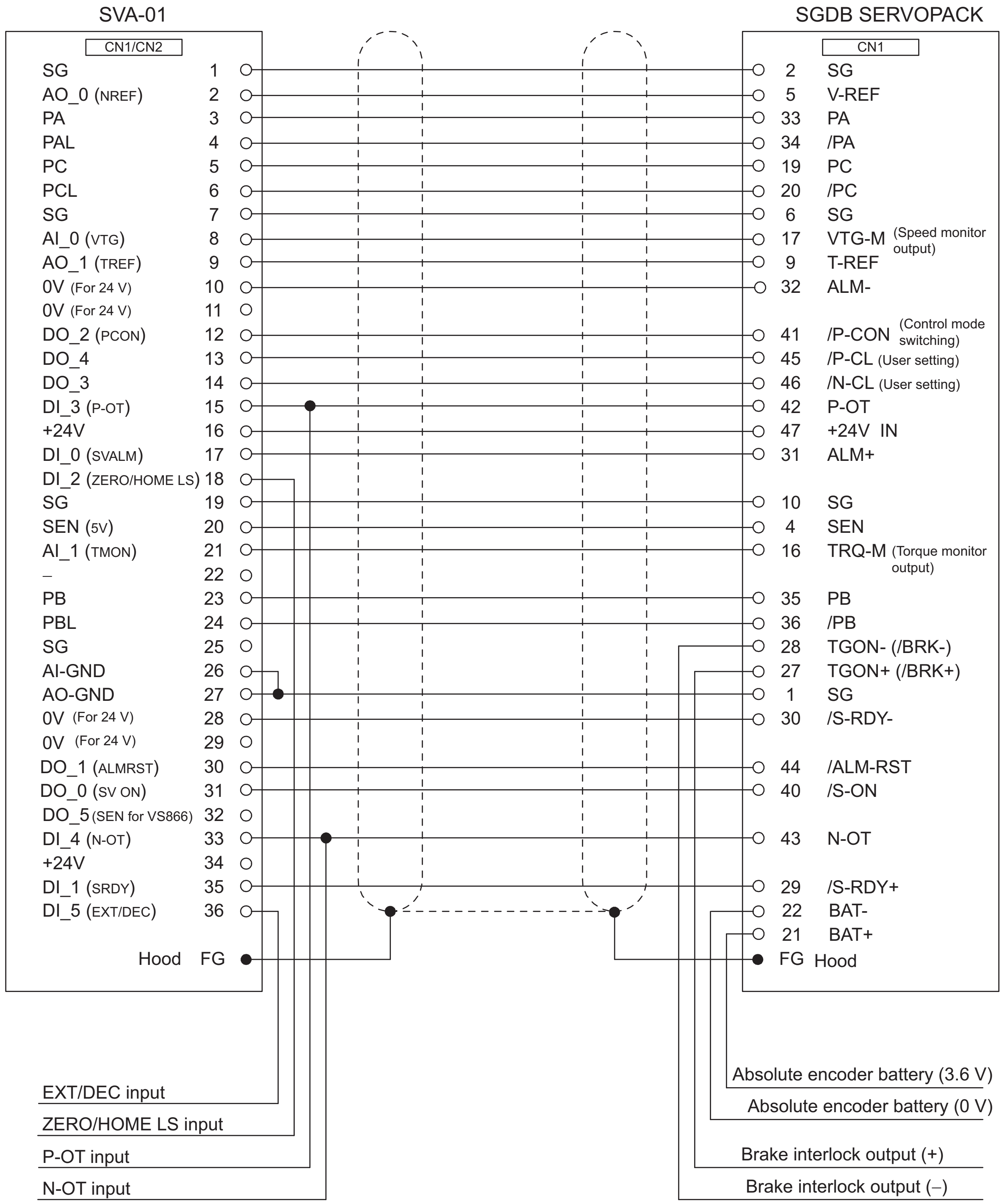
■ Wiring Table

Pin No.	Wire Color	Dot Marks		Pin No.	Wire Color	Dot Marks	
		Color	Number			Color	Number
1	Orange	Red	1	19	Pink	Red	2
2	Orange	Black	1	20	Pink	Black	2
3	Gray	Red	1	21	Orange	Red	3
4	Gray	Black	1	22	Orange	Black	3
5	White	Red	1	23	Gray	Red	3
6	White	Black	1	24	Gray	Black	3
7	Yellow	Red	1	25	White	Red	3
8	Yellow	Black	1	26	White	Black	3
9	Pink	Red	1	27	Yellow	Red	3
10	Pink	Black	1	28	Yellow	Black	3
11	Orange	Red	2	29	Pink	Red	3
12	Orange	Black	2	30	Pink	Black	3
13	Gray	Red	2	31	Orange	Red	4
14	Gray	Black	2	32	Orange	Black	4
15	White	Red	2	33	Gray	Red	4
16	White	Black	2	34	Gray	Black	4
17	Yellow	Red	2	35	White	Red	4
18	Yellow	Black	2	36	White	Black	4

(3) SGDA-□□□S Connection Diagram



(4) SGDB-□□ Connection Diagram



2.6 Restrictions for Feedback Pulse Inputs

2.6.1 Restrictions for SERVOPACK Pulse Output Frequency

The upper limit to the SERVOPACK pulse output frequency is shown below.

Upper limit (actual value) of phase-A/B divided output pulse frequency for Σ-II, Σ-III, Σ-V, or Σ-7 SERVOPACK = 1.6 MHz (before multiplication)

- However; Motor Speed at a Divided Output Pulse Frequency of 1.6 MHz = $1.6 \times 10^6 \times 60 \div$ Pn212 set value

The following tables show the relationship between the number of encoder bits and the maximum speed for a pulse frequency of 1.6 MHz output by a Σ-II, Σ-III, Σ-V, or Σ-7 SERVOPACK.
Application must be within the ranges shown in these tables when a Σ-II, Σ-III, Σ-V, or Σ-7 SERVOPACK is connected to the SVA-01 Module.

■ When connecting a Σ-II SERVOPACK

Encoder Bits	Pn201 Setting Range	Pn201 Setting Example	Motor Speed (min^{-1}) at a Divided Output Pulse Frequency of 1.6 MHz
17 bits	16 to 16384 (in increments of pulses)	16384	6000
20 bits	16 to 16384 (in increments of pulses)	16384	6000

■ When connecting a Σ-III or a Σ-V SERVOPACK

Encoder Bits	Pn212 Setting Range	Pn212 Setting Example	Motor Speed (min^{-1}) at a Divided Output Pulse Frequency of 1.6 MHz
17 bits	16 to 16384 (in increments of pulses)	16384	6000
	16386 to 32768 (in increments of pulses)	32768	3000
20 bits	16 to 16384 (in increments of pulses)	16384	6000
	16386 to 32768 (in increments of pulses)	32768	3000
	32772 to 65536 (in increments of pulses)	65536	1500
	65544 to 131072 (in increments of pulses)	131072	750
	131088 to 262144 (in increments of pulses)	262144	375

■ When connecting a Σ-7 SERVOPACK

Encoder Bits	Pn212 Setting Range	Pn212 Setting Example	Motor Speed (min^{-1}) at a Divided Output Pulse Frequency of 1.6 MHz
20 bits	16 to 16384 (in increments of pulses)	16384	6000
	16386 to 32768 (in increments of pulses)	32768	3000
	32772 to 65536 (in increments of pulses)	65536	1500
	65544 to 131072 (in increments of pulses)	131072	750
	131088 to 262144 (in increments of pulses)	262144	375
22 bits	16 to 16384 (in increments of pulses)	16384	6000
	16386 to 32768 (in increments of pulses)	32768	3000
	32772 to 65536 (in increments of pulses)	65536	1500
	65544 to 131072 (in increments of pulses)	131072	750
	131088 to 262144 (in increments of pulses)	262144	375
	262176 to 524288 (in increments of pulses)	524288	187
	524352 to 1048576 (in increments of pulses)	1048576	93

(cont'd)

Encoder Bits	Pn212 Setting Range	Pn212 Setting Example	Motor Speed (min^{-1}) at a Divided Output Pulse Frequency of 1.6 MHz
24 bits	16 to 16384 (in increments of pulses)	16384	6000
	16386 to 32768 (in increments of pulses)	32768	3000
	32772 to 65536 (in increments of pulses)	65536	1500
	65544 to 131072 (in increments of pulses)	131072	750
	131088 to 262144 (in increments of pulses)	262144	375
	262176 to 524288 (in increments of pulses)	524288	187
	524352 to 1048576 (in increments of pulses)	1048576	93
	1048704 to 2097152 (in increments of pulses)	2097152	46
	2097408 to 4194304 (in increments of pulses)	4194304	23

2.6.2 Restrictions in SVA-01 Module Pulse Input Frequency

The upper limit to the SVA-01 Module pulse input frequency is shown below.

Upper Limit (actual value) to the SVA-01 Module Phase-A/B Input Pulse Frequency =
4 MHz (before multiplication)

Therefore, $\boxed{\text{Motor Speed at a Pulse Input Frequency of 4 MHz} = 4 \times 10^6 \times 60 \div \text{Encoder resolution}}$

The following table shows the relationship between the number of encoder bits and the maximum speed for a pulse input frequency of 4 MHz to the SVA-01 Module. Application must be within the range shown in the table when inputting pulses to the SVA-01 Module.

Encoder Bits *	Encoder Resolution (before multiplication)	Motor Speed (min^{-1})* at a Pulse Input Frequency of 4 MHz
12Bit	1024	234375
13Bit	2048	117187
15Bit	8192	29296
16Bit	16384	14648
17Bit	32768	7324
18Bit	65536	3662
19Bit	131072	1831
20Bit	262144	915
21Bit	524288	457
22Bit	1048576	228

* The above table is used to explain restrictions in the SVA-01 pulse input frequency. It contains some numbers of bits and motor speeds that do not actually exist on the products.

3

Setup

This chapter describes the items that must be set to use the SVA-01 Module.

3.1 Setting Items

The settings in the following definition files are required to control the SERVOPACKs by using the SVA-01 Module mounted on the Machine Controller.

- Module Configuration Definition of Machine Controller
- SVA Definition of SVA-01 Module

Additionally, the parameters of the connected SERVOPACK must be set for the SVA-01 Module.

3.2 Module Configuration Definition of Machine Controller

Define the SVA-01 Module as an optional module of Machine Controller. The details of the definition can be checked in the Module Configuration Window.
Use the self-configuration function of Machine Controller to automatically allocate the SVA-01 Module, or manually allocate the SVA-01 Module in the Module Configuration Window.

3.2.1 How to Execute Self-configuration

There are two ways to execute the self-configuration:

■ Turning ON the Power After Setting the DIP Switch “CNFG”

Set the DIP switch “CNFG” on the Machine Controller to ON, and then turn ON the power to execute self-configuration. After execution of self-configuration, be sure to execute ***Save to Flash*** to save the results of self-configuration in the Machine Controller.

- For MP2100M and MP2500MD Machine Controllers, the DIP switch is not commonly used for self-configuration. Use an MPE720 as described below to execute self-configuration.

■ Using an MPE720

Start the Engineering Manager of MPE720 and open the Module Configuration Window. Select ***Order*** - ***Self Configure All Modules*** from the main menu of the Module Configuration Window, or select a module for which self-configuration is to be executed in the Module Configuration Window (see the next page for information how to open the Module Configuration Window) and then select ***Module Self-configuration***.

3.2.2 Opening the Module Configuration Window

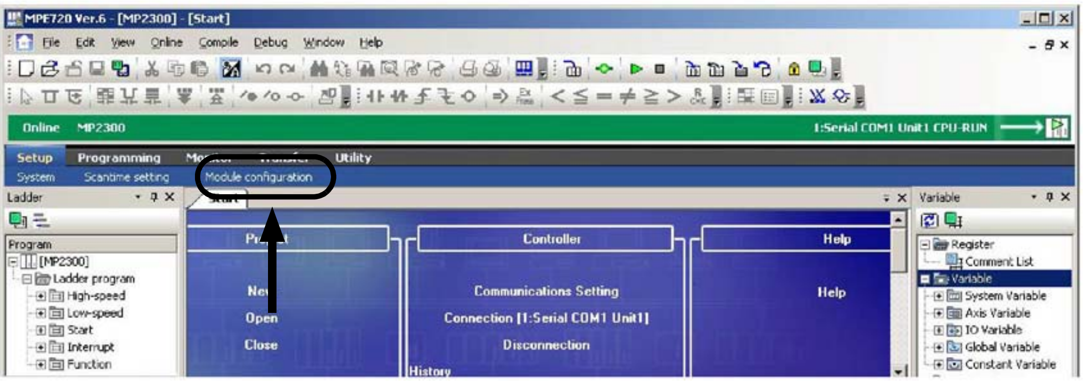
Use the following procedure to open the Module Configuration Window.

■ When Using MPE720 Version 6

1. Start the MPE720 installed in the personal computer that is connected to the Machine Controller, and then open the target project file.

- Refer to *Engineering Tool for MP2000 Series Machine Controller MPE720 Version 6 User's Manual* (Manual No.: SIEP C880700 30) for information on how to start the MPE720.

2. Select ***Setup*** - ***Module Configuration Definition*** from the Launcher.



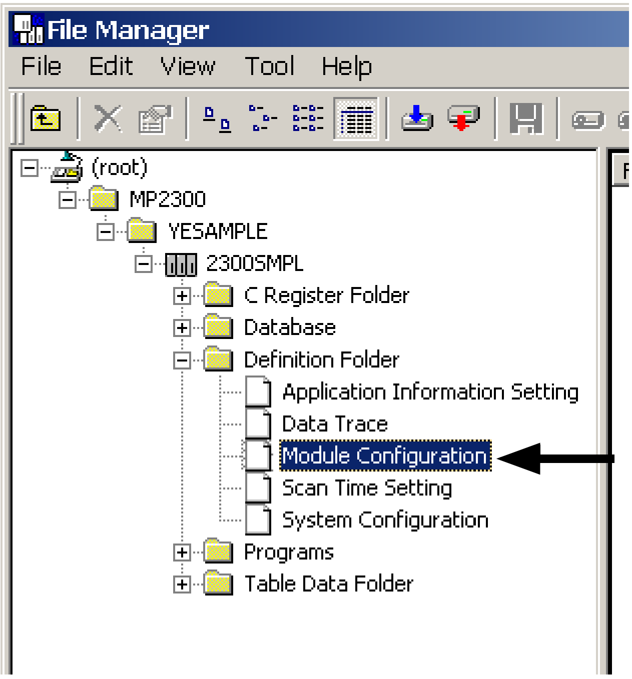
The Module Configuration Window (see the next page) will open.

■ When Using MPE720 Version 5

1. Start the MPE720 installed in the personal computer that is connected to the Machine Controller. Log on online to the application for the target Machine Controller in the File Manager Window.

- Refer to *Machine Controller MP900/MP2000 Series MPE720 Software for Programming Device User's Manual* (Manual No.: SIEP C880700 05) for information on how to start the MPE720 and how to log on to the Machine Controller online.

2. Double-click ***Module Configuration*** in the ***Definition*** folder.

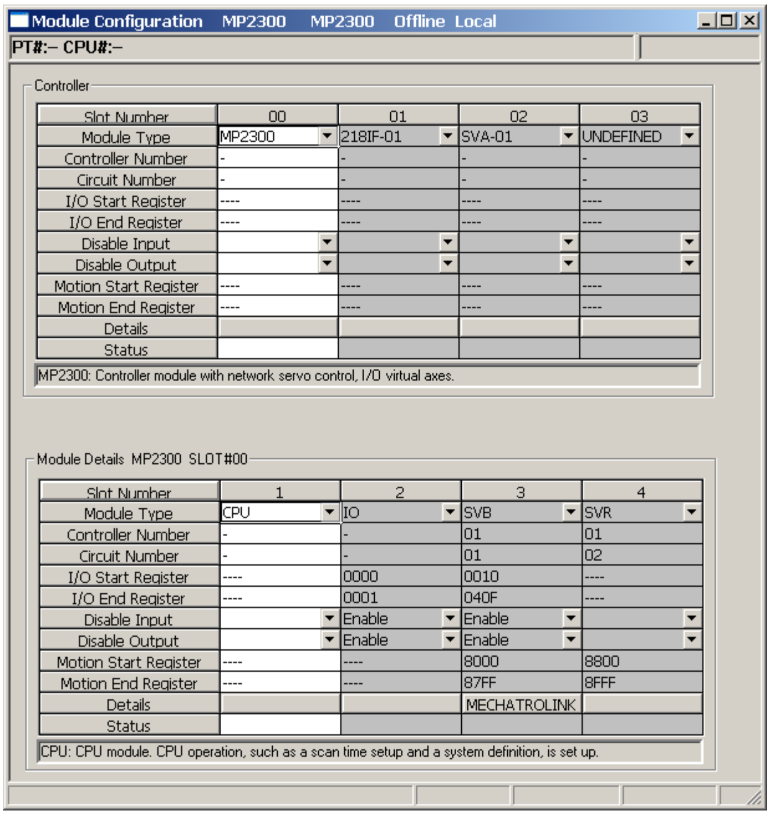


The Module Configuration window (see the next page) will open.

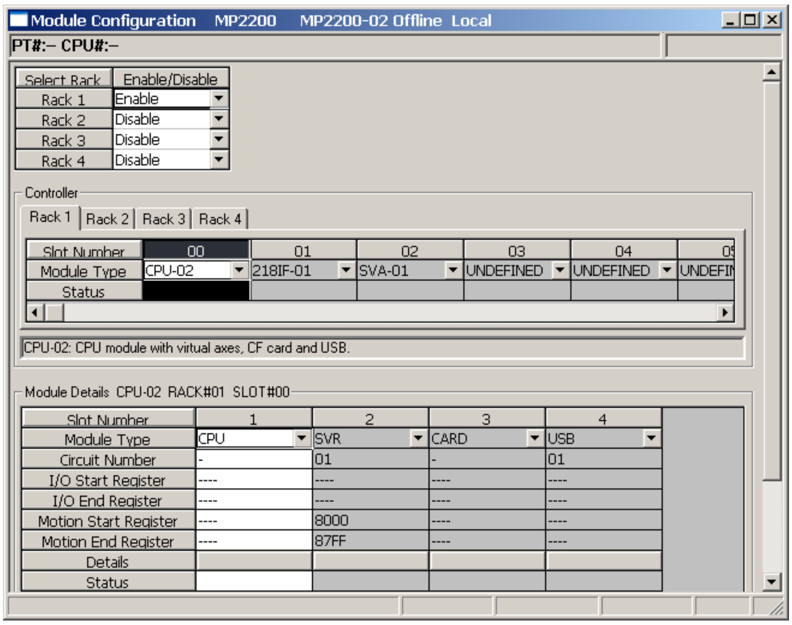
3.2.3 Module Configuration Window

The Module Configuration Window slightly differs depending on the Machine Controller model.

<MP2300>



<MP2100M, MP2200, and MP2500MD>



After executing self-configuration, all the optional modules connected to the Machine Controller will be displayed in the ***Controller*** field. Click an optional module in the ***Controller*** field and its details will be displayed in the ***Module Details*** field.

Setup

3

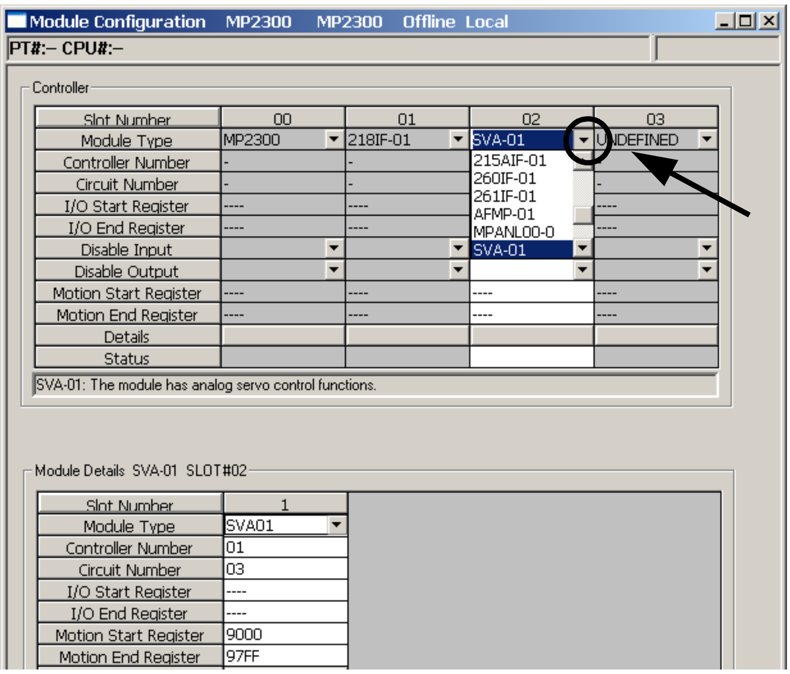
The following table lists the items shown in the Module Configuration Window.

Item	Description	Modification
Select Rack (Only for MP2100M, MP2200, MP2500M, and MP2500MD)	Specifies whether the expansion rack (JEPMC-BU2200 and JEPMC-BU2210) is used or not. • ***Rack 1*** is reserved for the CPU Module and cannot be set to ***Not Use***.	Possible
Slot Number	Slot number	Not possible
Module Type	Module detected in the slot	Possible
Controller Number (Only for MP2100, MP2300, MP2500, and MP2500D)	Fixed to 01	Not possible
Circuit Number	Module circuit number	Possible
I/O Start Register	For the SVA-01 Module, this item is reserved for system.	Not possible
I/O End Register	For the SVA-01 Module, this item is reserved for system.	Not possible
Disable Input	For the SVA-01 Module, this item is reserved for system.	Not possible
Disable Output	For the SVA-01 Module, this item is reserved for system.	Not possible
Motion Start Register	Start register number of the motion parameters (Automatically set according to the circuit number)	Not possible
Motion End Register	Last register number of the motion parameters (Automatically set according to the circuit number)	Not possible
Status	Status of each module in online mode	Not possible

"Possible" in the Modification column in the above table means that it is possible to change the setting of the item. Always save the setting to the flash memory after having changed the setting.

3.2.4 Manually Allocating Modules

In the Module Definition Window, click ▼ of the slot where the SVA-01 Module is to be allocated. Select ***SVA-01*** from the combo box that will appear. The SVA-01 Module is allocated in the slot.
Always save the setting to the flash memory.



3.3 SVA Definition

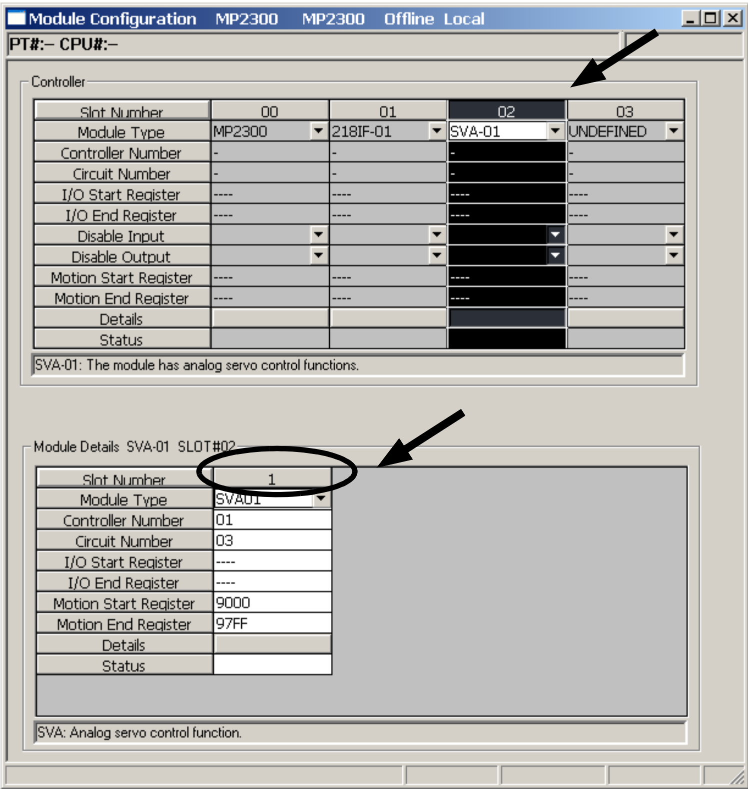
The SVA definition file defines the motion parameters (motion fixed parameters, motion setting parameters, and motion monitoring parameters) to control the motion axes such as the SERVOPACK.

- Refer to *5 Motion Parameters* on page 5-1 for details on the motion parameters.

3.3.1 Opening the SVA Definition Window

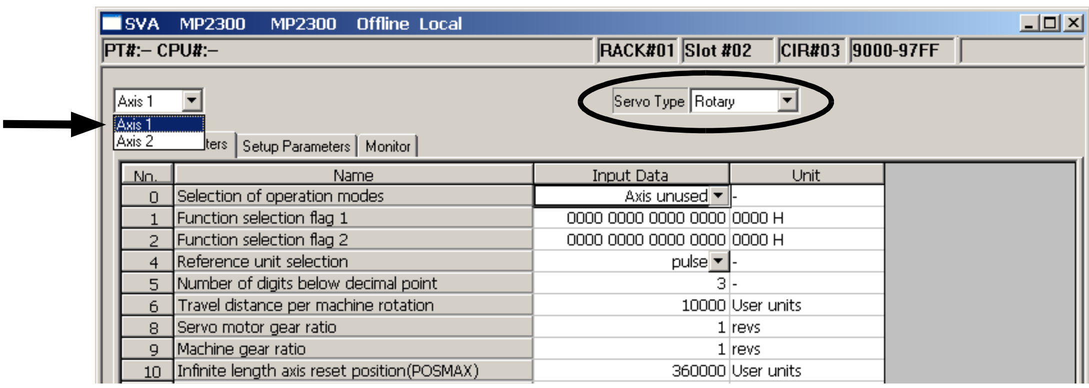
Open the SVA Definition Window by the following procedure.

1. Select ***SVA-01*** in the ***Controller*** field in the Module Configuration Window (refer to *3.2.2 Opening the Module Configuration Window* on page 3-4), and then double-click the slot number cell of the SVA-01 Module in the ***Module Details*** field.



The Create New Confirmation Dialog Box will open. Click OK to display the Fixed Parameters Tab of the SVA Definition Window.

2. Select the axis to be set or monitored from the ***Axis*** pull-down list, and select the connected motor type, rotary type or linear type, from the ***Servo Type*** pull-down list.



- If the setting in ***Servo Type*** is switched from Rotary to Linear, or vice-versa, some of the displayed parameters will change. Refer to *5 Motion Parameters* on page 5-1 for details.

3. Click the ***Fixed Parameters***, ***Setup Parameters***, or ***Monitor*** tab to display the desired page.

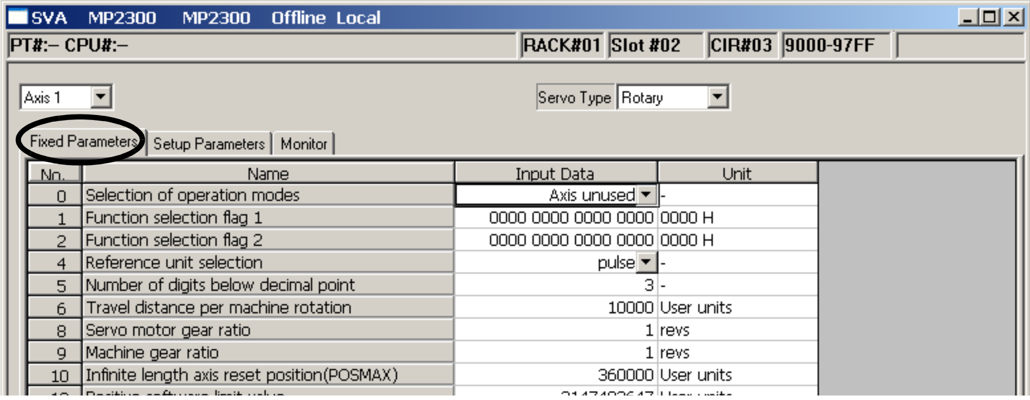


Fig. 3.1 Fixed Parameters Tab

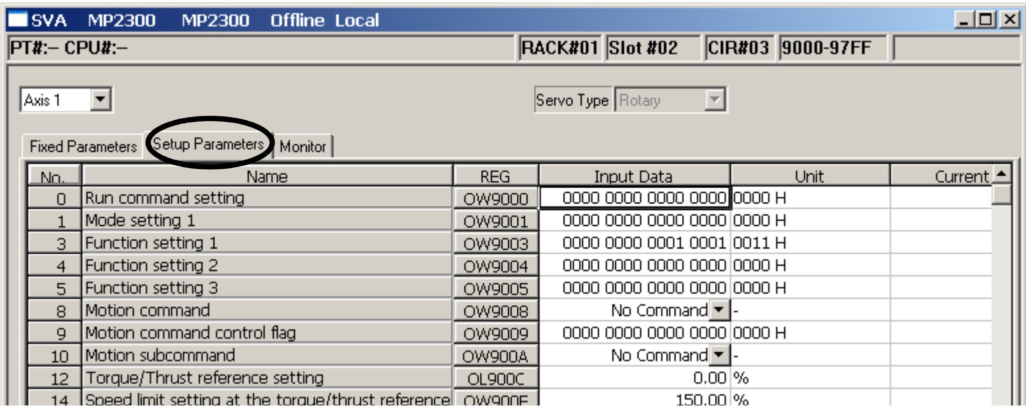


Fig. 3.2 Setup Parameters Tab

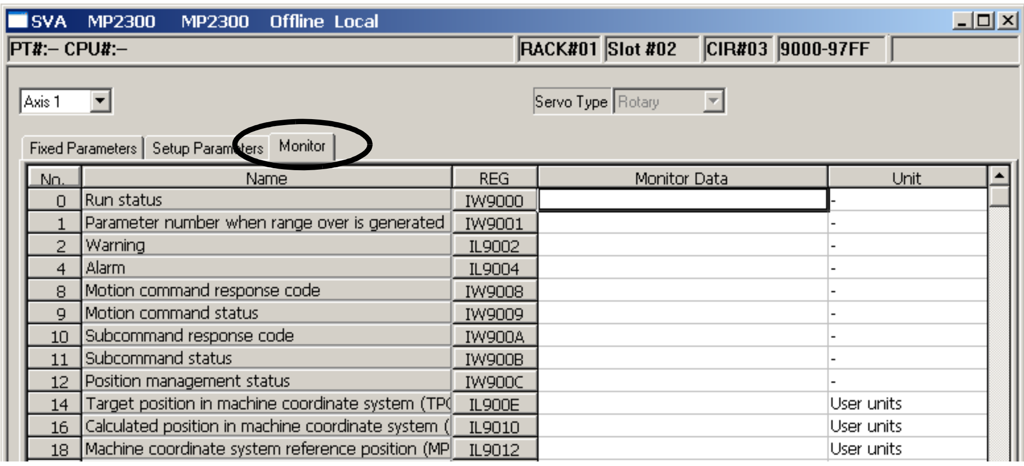


Fig. 3.3 Monitor Parameters Tab (read only)

3.3.2 Setting the SVA-01 Module Fixed Parameters

Set the SVA-01 Module fixed parameters according to the connected SERVOPACK model and parameters and the connected servomotor type as shown in the table below.

■ With a Rotary Servomotor Connected

SVA-01 Fixed Parameter		Settings by Connected SERVOPACK Model			
No.	Name	SGDA	SGDB	SGDM, SGDH	SGDS, SGDV, SGD7S
23	D/A Output Voltage at 100% Speed	Rated speed (min^{-1}) ÷ Cn-03 (Speed Reference Gain) × 1000		Pn300 (Speed Reference Input Gain) × 0.01 × 1000	
24	D/A Output Voltage at 100% Torque Limit	Cn-13 (Torque Reference Gain) × 0.01 × 1000		Pn400 (Torque Reference Input Gain) × 0.01 × 1000	
26	A/D Input Voltage at 100% Torque Monitor	Any	2000 (fixed)	1000 (fixed)	
28	Servo Driver Type Selection	0 (Σ-I)		1 (Σ-II, Σ-III, Σ-V, or Σ-7)	
30	Encoder Selection	0 when Cn-01, bit F = 0 (Incremental encoder) 1 or 2 when Cn-01, bit F = 1 (Absolute encoder)		0 when using an incremental encoder 1 or 2 when using an absolute encoder and Pn002.2 = 0 0 when using an absolute encoder and Pn002.2 = 1	
31	Rotation Direction Selection with an Absolute Encoder	0 when Cn-02, bit 0 = 0 (Forward rotation) 1 when Cn-02, bit 0 = 1 (Reverse rotation)		0 when Pn000.0 = 0 (Forward rotation) 1 when Pn000.0 = 1 (Reverse rotation)	
34	Rated Motor Speed	Rated speed (min^{-1})		Rated speed (min^{-1})	
36	Number of Pulses per Motor Rotation	Number of pulses per motor rotation before multiplication (pulse/rev)		The set value of Pn201 (PG Dividing Ratio) or Pn212 (PG Dividing Ratio (pulse/rev)	The set value of Pn212 (PG Dividing Ratio) (pulse/rev)
38	Maximum Number of Absolute Encoder Turns Rotation	99999 (fixed)		The set value of Pn205 (Multiturn Limit Setting)	
Servo Type		Rotary Type			

■ With a Linear Servomotor Connected

SVA-01 Fixed Parameter		Settings by Connected SERVOPACK Model	
No.	Name	SGDM, SGDH	SGDS, SGDV, SGD7S
6	Linear Scale Pitch	The value converted from Pn280 (Linear Scale Pitch) (μm) to UNIT *1	The value converted from Pn282 (Linear Scale Pitch (0.01μm) to UNIT *1
23	D/A Output Voltage at 100% Speed	Pn300 (Speed Reference Input Gain) × 0.01 × 1000	
24	D/A Output Voltage at 100% Torque Limit	Pn400 (Force Reference Input Gain) × 0.01 × 1000	
26	A/D Input Voltage at 100% Torque Monitor	1000 (fixed)	
28	Servo Driver Type Selection	1 (Σ-II, Σ-III, Σ-V, or Σ-7)	
34	Rated Speed	Rated speed in units of 0.1 m/s	
36	Number of Pulses per Linear Scale Pitch	Pn281 (PG Dividing Ratio) ÷ 4 (pulse/scale pitch) *2	
Servo Type		Linear Type	

* 1. When converting the unit from μm to UNIT, multiply by 10^n and set the results in fixed parameter No.6 so that fractions do not result.

* 2. Multiply the calculated value by 10^n (n = n in *1 above) and set the results in fixed parameter No.36 so that fractions do not result.

3.4 SERVOPACK Parameter Settings

The SERVOPACK parameters must be set as described in this section when using a SERVOPACK in combination with an SVA-01 Module.

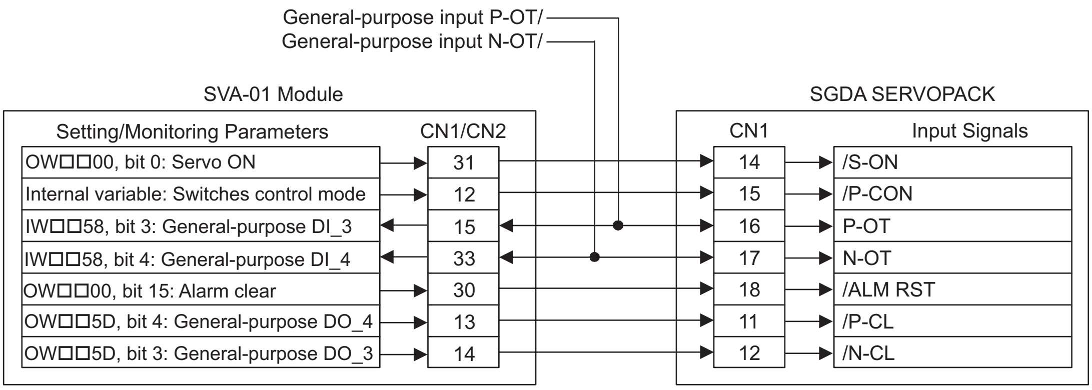
3.4.1 SGDA SERVOPACK Parameter Settings

Set the parameters as shown below.

Parameter No.	Name	Default Value	Set Value	Setting Contents	Remarks
Cn-01, bit 0	Servo ON input (/S-ON) enable/ disable	0	0	Enables the Servo ON input (/S-ON).	
Cn-01, bit 1	SEN signal input enable/disable	0	0	Enables the SEN signal input (SEN).	
Cn-01, bit 2	Forward rotation prohibited input (P-OT) enable/disable	0	0	Enables the forward rotation prohibited input (P-OT).	This input can also be disabled.
Cn-01, bit 3	Reverse rotation prohibited input (N-OT) enable/disable	0	0	Enables the reverse rotation prohibited input (N-OT).	This input can also be disabled.
Cn-01, bit A	Control mode selection	0	1	Torque control II (Torque Control↔ Speed Control)	
Cn-01, bit B		0	1		
Cn-01, bit F	Torque feed forward function	0	0	Disables the torque forward function.	*
Cn-02, bit F	Torque reference input selection	0	1	In speed control mode, TREF is used as the torque limit.	*

* Both CN-01, bit B and Cn-02, bit F cannot be turned ON. If they are both turned ON, Cn-01, bit F takes priority. If Cn-01, bit F is set to 1, the value of OL☐☐14 (Positive Side Limiting Torque/Thrust Setting at the Speed Reference) will be treated as the torque feed forward.

The I/O signals related to the SVA-01 are shown in the following connection diagram.



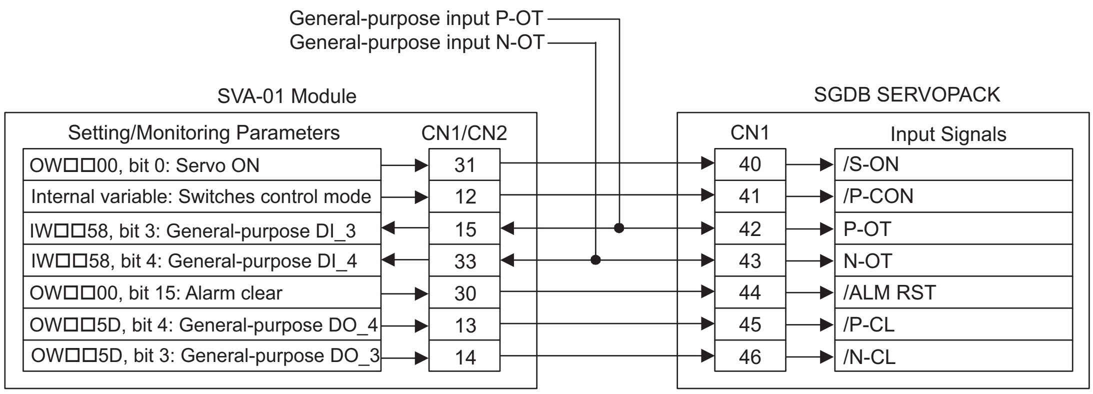
3.4.2 SGDB SERVOPACK Parameter Settings

Set the parameters as shown below.

Parameter No.	Name	Default Value	Set Value	Setting Contents	Remarks
Cn-01, bit 0	Servo ON input (/S-ON) enable/ disable	0	0	Enables the Servo ON input (/S-ON).	Used by SVA-01 system.
Cn-01, bit 1	SEN signal input enable/disable	0	0	Enables the SEN signal input (SEN).	Used by SVA-01 system.
Cn-01, bit 2	Forward rotation prohibited input (P-OT) enable/disable	0	0	Enables the forward rotation prohibited input (P-OT).	This input can also be disabled.
Cn-01, bit 3	Reverse rotation prohibited input (N-OT) enable/disable	0	0	Enables the reverse rotation prohibited input (N-OT).	This input can also be disabled.
Cn-02, bit 2	Analog speed limit function	0	1	In torque control mode, VREF is used as the analog speed limit.	
Cn-02, bit 6	TRQ-M analog monitor selection	0	0	Outputs torque to TRQ-M.	
Cn-02, bit 7	VTG-M analog monitor selection	0	0	Outputs torque to VTG-M.	
Cn-02, bit 8	Analog current limit function	0	1	In speed control mode, TREF is used as the analog current limit (torque limit).	*
Cn-02, bit 9	Torque feed-forward function	0	0	Disables the torque feed forward function.	*
Cn-2B	Control method selection	0	9	Torque control (analog reference) ↔ Speed control (analog reference)	

* Both CN-02, bit 8 and Cn-02, bit 9 cannot be turned ON. If Cn-02, bit 8 is set to 1 and Cn-02, bit 9 is set to 0, the value of OL☐☐14 (Positive Side Limiting Torque/Thrust Setting at the Speed Reference) will be treated as the torque feed forward.

The I/O signals related to the SVA-01 are shown in the following connection diagram.



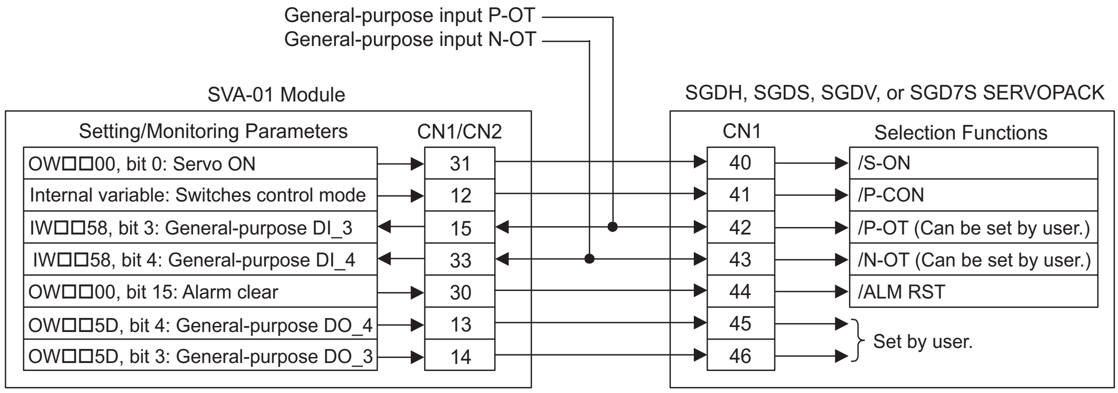
3.4.3 SGDM, SGDH, SGDS, SGDV, and SGD7S SERVOPACK Parameter Settings

Set the parameters as shown below.

Parameter No.	Name	Default Value	Set Value	Setting Contents	Remarks
Pn000.1	Control method selection	0	9	Torque control (analog reference) ↔ Speed control (analog reference)	
Pn002.0	Speed control option	0	1	Use T-REF as external torque limit input.	*1
Pn002.1	Torque control option	0	1	Use V-REF as external speed limit input.	
Pn003.0	Analog monitor 1	2	2	Torque reference monitor	SGDM, SGDH, SGDS
Pn006.0					SGDV, SGD7S
Pn003.1	Analog monitor 2	0	0	Motor speed	SGDM, SGDH, SGDS
Pn007.0					SGDV, SGD7S
Pn50A.0	Input signal allocation mode	0	1	Enables free allocation of input signals.	
Pn50A.1	/S-ON signal mapping	0	0	Input signal from CN1-40 input terminal.	Used by SVA-01 system.
Pn50A.2	/P-CON signal mapping	1	8	Signal always disabled.	*2
Pn50A.3	P-OT signal mapping	2	2	Input signal from CN1-42 input terminal.	*2
Pn50B.0	N-OT signal mapping	3	3	Input signal from CN1-43 input terminal.	*2
Pn50B.1	/ALM-RST signal mapping	4	4	Input signal from CN1-44 input terminal.	Used by SVA-01 system.
Pn50B.2	/P-CL signal mapping	5	8	Signal always disabled.	*2
Pn50B.3	/N-CL signal mapping	6	8	Signal always disabled.	*2
Pn50C.0	/SPD-D signal mapping	8	8	Signal always disabled.	Cannot be used.
Pn50C.1	/SPD-A signal mapping	8	8	Signal always disabled.	Cannot be used.
Pn50C.2	/SPD-B signal mapping	8	8	Signal always disabled.	Cannot be used.
Pn50C.3	/C-SEL signal mapping	8	1	Input signal from CN1-41 input terminal.	Used by SVA-01 system.
Pn50D.0	/ZCLAMP signal mapping	8	8	Signal always disabled.	Cannot be used
Pn50D.1	/INHIBIT signal mapping	8	8	Signal always disabled.	Cannot be used
Pn50D.2	/G-SEL signal mapping	8	8	Signal always disabled.	*2
Pn515.0	/G-SEL2 signal mapping	8	8	Signal always disabled	*2, *3

* 1. If Pn002.0 is set to 2, T-REF can be used as the torque feed forward input. If this is done, the value of OL□□14 (Positive Side Limiting Torque/Thrust Setting at the Speed Reference) will be treated as the torque feed forward.
* 2. The user can freely allocate functions to the following input terminals: CN1-42, CN1-43, CN1-45, and CN1-46. Of these, CN1-42 and CN1-43 are for external input signals. Data is input into CN1-45 and CN1-46 as signals by the SVA-01 setting parameters.
* 3. Pn515.0 is for SGDS SERVOPACKs only.

The I/O signals related to the SVA-01 are shown in the following connection diagram.

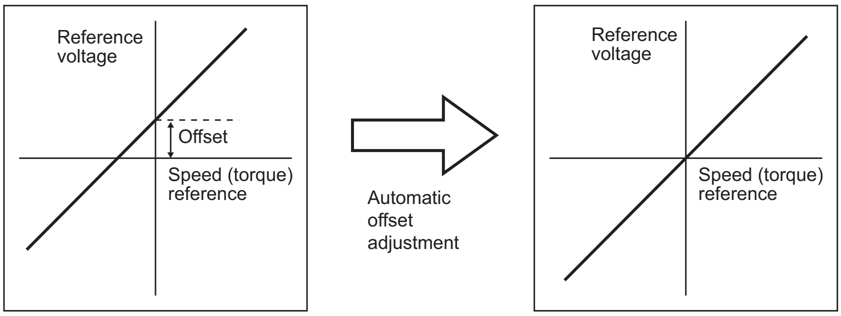


3.5 SERVOPACK Reference Offset Adjustment

When the SVA-01 Module connected SERVOPACK is used for speed control mode, the servomotor may rotate slowly even if 0 V is specified as the analog reference. This happens if the SVA-01 Module has a slight offset in the reference voltage. Adjustments can be done manually or automatically by using the panel operator or digital operator.

3.5.1 Automatic Adjustment of the Analog Reference Offset

The automatic adjustment of the analog (speed/torque) reference offset (Fn009) automatically measures the amount of the offset and adjusts the reference voltage.



After completion of the automatic adjustment, the amount of offset is stored in the SERVOPACK. The amount of offset can be checked in the speed reference offset manual servo tuning (Fn00A).

- When the SVA-01 Module is used to form a position loop, the automatic adjustment of analog reference offset (Fn009) cannot be used. In this case, use the speed reference offset manual servo tuning (Fn00A).
- SERVOPACKs are provided with the zero-clamp speed control function to force the motor to stop while the zero speed reference is given. Refer to the following manuals for details.
  - *AC Servo Drives Σ-III Series SGM☐☐/SGDS User's Manual* (Manual No. SIEP S800000 00)
  - *AC Servodrive Σ-V Series SGM☐☐/SGDV User's Manual Design and Maintenance Rotational Motor Analog Voltage and Pulse Train Reference* (Manual No. SIEP S800000 45)
  - *AC Servodrive Σ-I Series User's Manual Design and Maintenance Linear Motor Analog Voltage and Pulse Train Reference* (Manual No. SIEP S800000 47)
  - *Σ-7-Series AC Servo Drive Σ-7S SERVOPACK with Analog Voltage/Pulse Train References Product Manual* (Manual No.: SIEP S800001 26)

- The speed reference offset must be automatically adjusted with servo OFF.

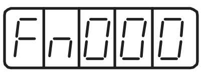
Adjust the speed reference offset automatically using the following procedures.

1. Make sure that the servo is OFF. Set the motion setting parameter OL☐☐10 (Speed Reference Setting) to 0 and then set the motion parameter OW☐☐08 (Motion Command) to 23 to send the VELO (Speed Reference) command. Input 0-V reference voltage from the SVA-01 Module.

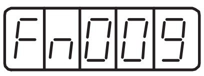
The servomotor will slightly turn.

2. Press the MODE/SET Key on the panel operator to select the utility function mode.

"Fn000" will be displayed.

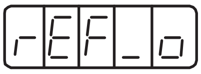


3. Press the ▲ (UP) or ▼ (DOWN) Key to select Fn009 (Automatic tuning of analog (speed, torque) reference offset).



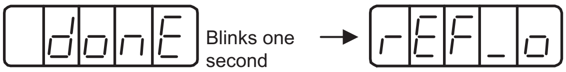
4. Press the DATA/◀ Key for a minimum of one second.

"rEF_o" will be displayed.



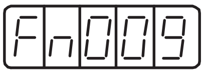
5. Press the MODE/SET Key.

The analog reference offset will be automatically adjusted and the display will change as shown below.



6. Press the DATA/◀ Key for a minimum of one second to return to the utility function mode.

The display will return to "Fn009".

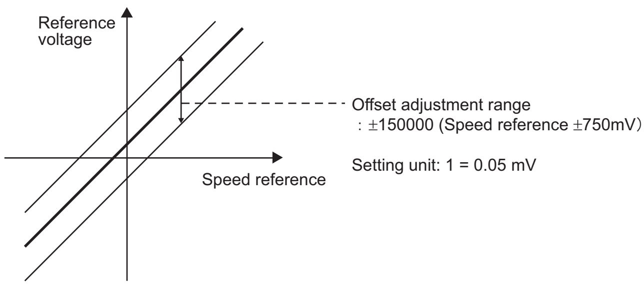


3.5.2 Manual Servo Tuning of the Speed Reference Offset

Use the speed reference offset manual servo tuning (Fn00A) in the following cases:

- If a loop is formed with the SVA-01 Module and the error is zeroed when servolock is stopped.
- To deliberately set the offset to some value
- To check the offset data set in the speed reference offset automatic adjustment mode

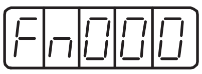
This function operates in the same way as the reference offset automatic adjustment mode (Fn009), but the manual servo tuning (Fn00A), adjust inputting the amount of offset.
The offset adjustment range and setting units are as shown in the figure below.



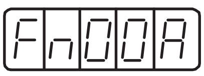
Adjust the speed reference offset using the following procedures.

1. Press the MODE/SET Key on the panel operator to select the utility function mode.

"Fn000" will be displayed.



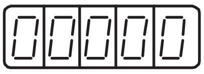
2. Press the ▲ (UP) or ▼ (DOWN) Key to select Fn00A (Manual servo tuning of speed reference offset).



3. Press the DATA/◀ Key for a minimum of one second.

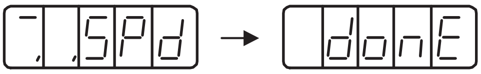
   "= SPd" will be displayed. The manual servo tuning mode for the speed reference offset will be entered.

4. Press the DATA/◀ Key for less than one second to display the speed reference offset amount.



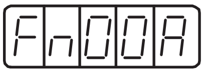
5. Enter the offset amount by pressing the ▲ (UP) or ▼ (DOWN) Key.

6. Press the DATA/◀ Key for less than one second. The display shown on the left in the figure below will appear and then will change to “donE” in a instant. The offset amount is set.



7. Press the DATA/◀ Key for a minimum of one second to return to the utility function mode.

   The display will return to "Fn00A".



4

Operation Modes

This chapter describes three operation modes available with the SVA-01 Module.

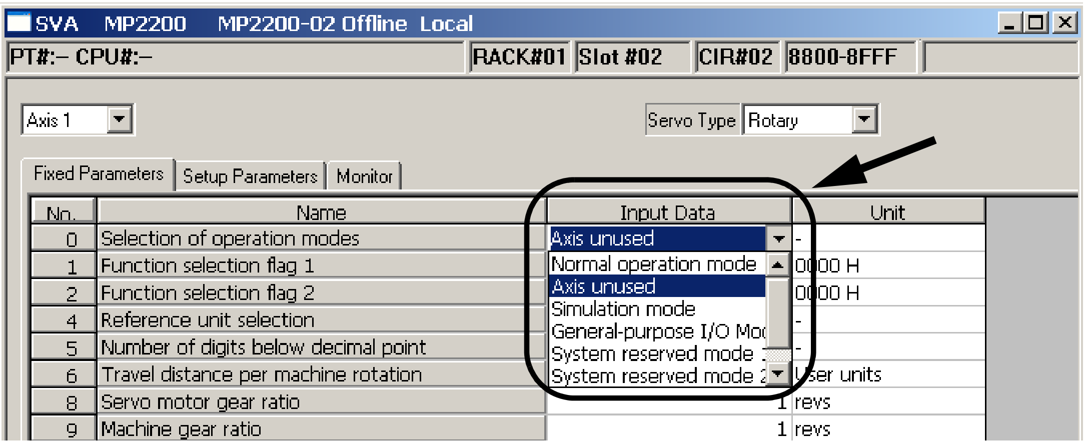
4.1 SVA-01 Module Operation Mode Selection

With the SVA-01, one of the following three operation modes can be selected.

- Normal Operation Mode
- Simulation Mode
- General I/O Mode

Select an operation mode by setting the fixed parameter No. 0 (Selection of Operation Modes) in the Fixed Parameter Tab Page of SVA Definition Window.

Fixed Parameter	Name	Setting	Default Setting
No. 0	Selection of Operation Modes	0: Normal operation mode 1: Axis unused 2: Simulation mode 4: General-purpose I/O mode 5: System reserved mode 1 6: System reserved mode 2	1: Axis unused



- Refer to *3.3.1 Opening the SVA Definition Window* on page 3-7 for information on how to open the SVA Definition Window.

4.2 Normal Operation Mode

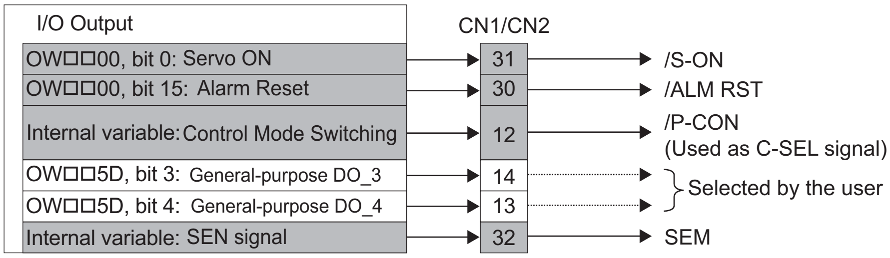
Set the fixed parameter No. 0 (Selection of Operation Modes) to 0 to select the normal operation mode.
In normal operation mode, the SVA-01 Module is used as an ordinary motion module.

4.2.1 Motion Parameters That Can be Used in Normal Operation Mode

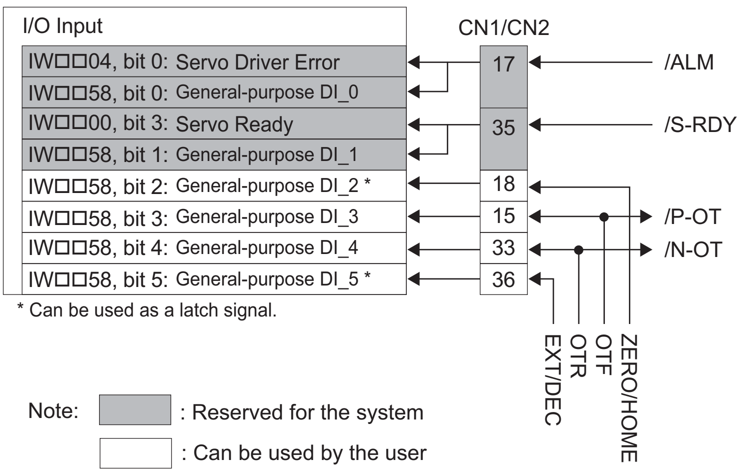
Refer to *5.3 Motion Parameter Lists* on page 5-5 for the motion parameters that can be used in normal operation mode.

4.2.2 DI/DO Signals in Normal Operation Mode

In normal operation mode, some of DI/DO signals can be used as general-purpose signals as shown below.



Pin No.12 of CN1/CN2 can be used only when the General-purpose DO_2 Signal Selection bit (fixed parameter No.21, bit 5) is set to 1(Use as a general-purpose signal). Refer to *11.4.4 General-purpose DO_2 Signal Selection* on page 11-17 for details.



The input signals DI_2 to DI_5 can be used by the user unless they are already used by the system. These signals are referred to as shared signals.

4.3 Simulation Mode

Set the fixed parameter No. 0 (Selection of Operation Modes) to 2 to select the simulation mode.
In simulation mode, the normal operation can be simulated.
A simulation of operation processes using the feedback position and speed of the actual operation is carried out and the result will be written in the monitoring parameters. And, motion commands can be executed without actually connecting a SERVOPACK and servomotor.

4.3.1 Motion Parameters That Can be Used in Simulation Mode

Refer to *5.3 Motion Parameter Lists* on page 5-5 for information on the motion parameters that can be used in simulation mode.

4.3.2 Position and Speed in Simulation Mode

Position and speed is simulated by converting the speed used immediately before D/A output into incremental pulses and returning the incremental pulses to the feedback pulse counter.
For all motion commands other than the TRQ command, the speed reference output will be returned.
For TRQ, the speed limit output will be returned.

4.3.3 Torque in Simulation Mode

Torque reference are not monitored in simulation mode.
Therefore, 0 (zero) is always stored in the following monitoring parameter.

Register No.	Name	Unit	Remarks
IL☐☐42	Feedback Torque/Thrust	0.01%, 0.0001%	The unit depends on the setting of OW☐☐03, bits C to F.

4.3.4 Functions That Cannot be Simulated

The following functions cannot be simulated.

- DI inputs
- AI inputs
- Latch detection
- Absolute Read Request
- OT processing
- PG disconnection detection

The details of the above functions in simulation mode are described below.

(1) DI Inputs

All DI inputs are treated as 0 (zero). Therefore, 0 (zero) will be always stored in all bits of the following monitoring parameter.

Register No.	Name	Description	
IW☐☐58	General-purpose DI	Bit 0	General-purpose DI_0
		Bit 1	General-purpose DI_1
		Bit 2	General-purpose DI_2
		Bit 3	General-purpose DI_3
		Bit 4	General-purpose DI_4
		Bit 5	General-purpose DI_5

(2) AI Inputs

All AI inputs are treated as 0 (zero). Therefore, 0 (zero) will be always stored in the following monitoring parameters.

Register No.	Name	Range	Unit
IW□□59	General-purpose AI monitor 1	−32768 to 32767	1 = 0.001 V
IW□□5A	General-purpose AI monitor 2	−32768 to 32767	1 = 0.001 V

(3) Latch Detection

The motion commands that use the latch function are disabled in simulation mode. Some operation examples are given below.

<Example 1: Zero Point Return (ZRET) command>

The zero point return operation will never complete since the Latch Completed signal will never turn ON.

<Example 2: External Positioning (EX_POSING) command>

Executed as Positioning (POSING) command since no latch operation will be implemented.

<Example 3: Latch (LATCH) command>

Executed as Interpolation (INTERPOLATE) command since no latch operation will be implemented.

<Example 4: Modal Latch Request>

The latch operation will never be completed.

- Refer to *11.4.1 Modal Latch Function* on page 11-15 for information on modal latch.

(4) Absolute Read Request

The Absolute Read Request will be ignored.

(5) OT Processing

Disabled since DI inputs are disabled.

(6) PG Disconnection Detection

The PG disconnection detection processing is masked.

4.3.5 Output Signals in Simulation Mode

Both DO and AO output 0 (zero) in simulation mode.

4.4 General-purpose I/O Mode

Set the fixed parameter No. 0 (Selection of Operation Modes) to 4 to select the general-purpose I/O mode.
In general-purpose I/O mode, the following functions are enabled.

- General-purpose DO outputs (6 points/axis)
- General-purpose AO outputs (2 channels/axis)
- General-purpose DI inputs (6 points/axis)
- General-purpose AI inputs (2 channels/axis)
- Counter input (1 channel/axis)

4.4.1 Motion Parameters That Can be Used in General-purpose I/O Mode

In general-purpose I/O mode, the following motion parameters can be used.

■ Fixed Parameters

No.	Name	Description	Default Value
0	Selection of Operation Modes	4: General-purpose I/O mode	1
2	Function Selection Flag 2	Bit 3: Analog Adjust Not Ready Warning Mask (0: Disable/1: Enable)	0
		Bit 4: PG Wire Breaking Down Status Mask (0: Disable/1: Enable)	0
20	Hardware Signal Selection 1	Bit 0: A/B Pulse Input Signal Polarity Selection (0: Positive logic/1: Negative logic)	0
		Bit 1: C Pulse Input Signal Polarity Selection (0: Positive logic/1: Negative logic)	0
22	Pulse Counting Mode Selection	0: Sign mode ∗1 1: Sign mode ∗2 2: Up/Down mode ∗1 3: Up/Down mode ∗2 4: A/B mode ∗1 5: A/B mode ∗2 6: A/B mode ∗4	6

■ Setting Parameters

Register No.	Name	Description	Default Value
OW☐☐00	Run Command Setting	Bit 4: Latch Detection Demand (0: OFF/1: ON) Used to set or cancel latch detection	0
		Bit F: Alarm Clear (0: OFF/1: ON)	0
OW☐☐04	Function Setting 2	Bits 0 to 3: Latch Detection Signal Selection 0: DI_5 (DEC/EXT) 1: DI_2 (ZERO/HOME LS) 2: Phase-C Pulse input signal	0
OW☐☐1A	General-purpose AO1	Setting range: –32768 to 32767 Setting unit: 1 = 0.001 V	0
OW☐☐1B	General-purpose AO2	Setting range: –32768 to 32767 Setting unit: 1 = 0.001 V	0
OL☐☐48	Zero Point Position in Machine Coordinate System Offset	Used as the counter current position offset. Setting unit: 1 = 1 reference unit (pulse only)	0
OW☐☐5D	General-purpose DO	Bit 0: General-purpose DO_0 (0: OFF/1: ON)	0
		Bit 1: General-purpose DO_1 (0: OFF/1: ON)	0
		Bit 2: General-purpose DO_2 (0: OFF/1: ON)	0
		Bit 3: General-purpose DO_3 (0: OFF/1: ON)	0
		Bit 4: General-purpose DO_4 (0: OFF/1: ON)	0
		Bit 5: General-purpose DO_5 (0: OFF/1: ON)	0

■ Monitoring Parameters

Register No.	Name	Description
IW□□00	Run Status	Bit 0: Motion Controller Operation Ready
IW□□01	Parameter Number When Range Over is Generated	Setting parameters: 0 and onward Fixed parameters: 1000 and onward
IL□□02	Warning	Bit B: Analog Adjust Not Ready Warning
IL□□04	Alarm	Bit 14: PG Disconnection Error
IW□□0C	Position Management Status	Bit 2: ON at Latch Completed (LCOMP)
IL□□16	Machine Coordinate System Feedback Position (APOS)	Used as the counter current position. Range: -2^{31} to $2^{31}-1$ Unit: 1 = 1 reference unit (pulse only)
IL□□18	Machine Coordinate System Latch Position (LPOS)	Used as the counter latch position. Range: -2^{31} to $2^{31}-1$ Unit: 1 = 1 reference unit (pulse only)
IL□□1C	Target Position Difference Monitor	Used as the number of incremental pulses of feedback. Range: -2^{31} to $2^{31}-1$ Unit: 1 = 1 reference unit (pulse only)
IW□□58	General-purpose DI Monitor	Bit 0: General-purpose DI_0
		Bit 1: General-purpose DI_1
		Bit 2: General-purpose DI_2
		Bit 3: General-purpose DI_3
		Bit 4: General-purpose DI_4
		Bit 5: General-purpose DI_5
		Bit 6: Reserved for system use
		Bit 7: PG Wire Breaking Down Status (ON: Connected/1: Disconnected)
IW□□59	General-purpose AI Monitor 1	Range: –32768 to 32767 Unit: 1 = 0.001 V
IW□□5A	General-purpose AI Monitor 2	Range: –32768 to 32767 Unit: 1 = 0.001 V

4.4.2 Correspondence Between Motion Parameter and Connector Pin Number

Each motion parameter for general-purpose DO/DI and AO/AI corresponds to the connector pin number as shown below.

■ General-purpose DO Outputs (6 Points/Axis)

Setting Parameter							
Register No.	Name	Description			CN1/CN2 Pin No.		
OW□□5D	General-purpose DO	Bit 0	General-purpose DO_0	→	31	→	Output
		Bit 1	General-purpose DO_1	→	30	→	Output
		Bit 2	General-purpose DO_2	→	12	→	Output
		Bit 3	General-purpose DO_3	→	14	→	Output
		Bit 4	General-purpose DO_4	→	13	→	Output
		Bit 5	General-purpose DO_5	→	32	→	Output

■ General-purpose DI Inputs (6 Points/Axis)

Monitoring Parameter							
Register No.	Name	Description			CN1/CN2 Pin No.		
IW□□58	General-purpose DI	Bit 0	General-purpose DI_0	←	17	←	Input
		Bit 1	General-purpose DI_1	←	35	←	Input
		Bit 2	General-purpose DI_2	←	18	←	Input
		Bit 3	General-purpose DI_3	←	15	←	Input
		Bit 4	General-purpose DI_4	←	33	←	Input
		Bit 5	General-purpose DI_5	←	36	←	Input

■ General-purpose AO Outputs (2 Channels/Axis)

Setting Parameter							
Register No.	Name	Setting Range	Setting Unit		CN1/CN2 Pin No.		
OW□□1A	General-purpose AO1	–32768 to 32767	1 = 0.001 V	→	2	→	Output
OW□□1B	General-purpose AO2	–32768 to 32767	1 = 0.001 V	→	9	→	Output

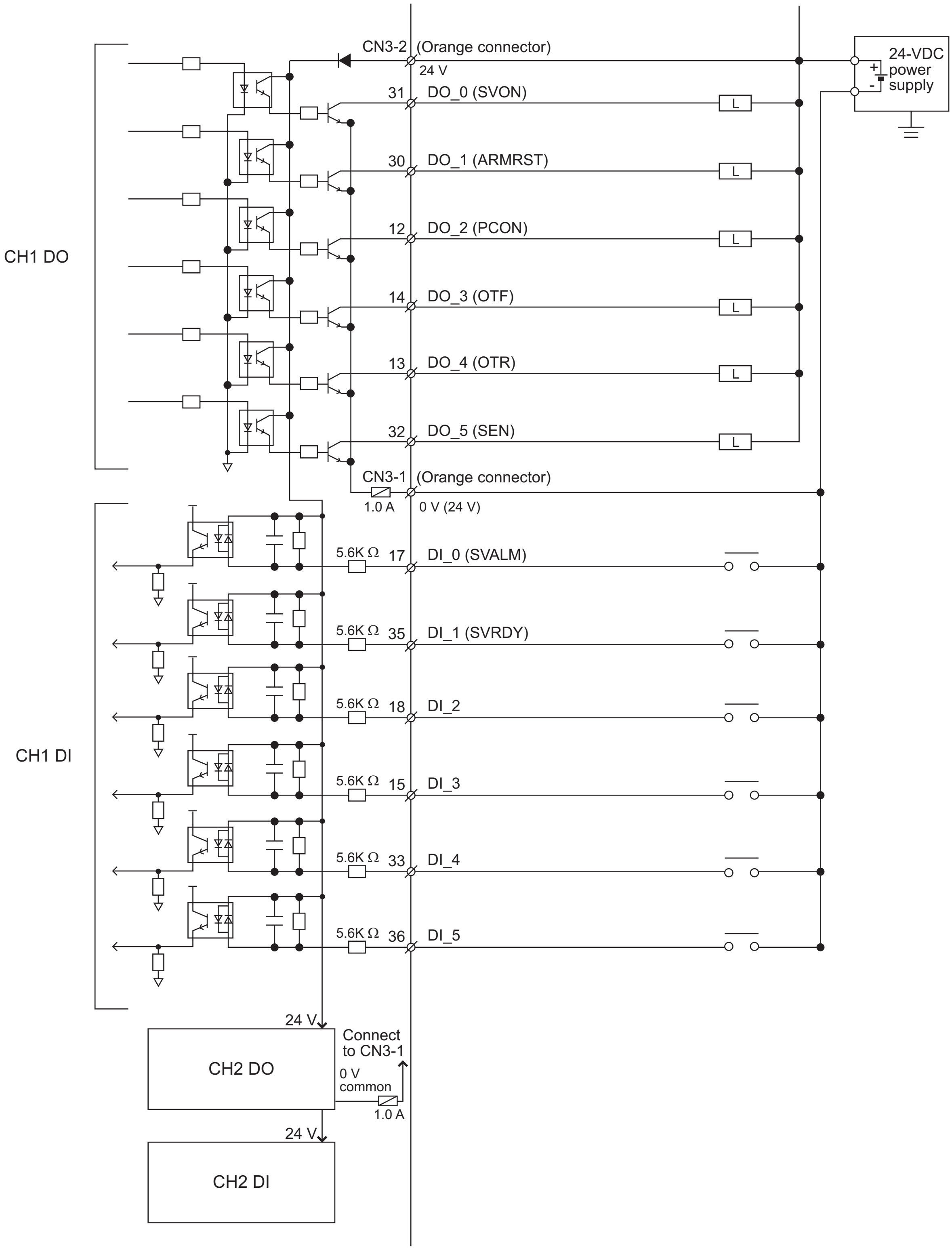
■ General-purpose AI Inputs (2 Channels/Axis)

Setting Parameter							
Register No.	Name	Setting Range	Setting Unit		CN1/CN2 Pin No.		
IW□□59	General-purpose AI Monitor 1	–32768 to 32767	1 = 0.001 V	←	8	←	Input
IW□□5A	General-purpose AI Monitor 2	–32768 to 32767	1 = 0.001 V	←	21	←	Input

4.4.3 General-purpose I/O Signal Connection Example

The following diagram illustrates an example of general-purpose I/O signal connection.

- The CH2 pin assignment is the same as of CH1.
- The connector CN3 for external 24-V power supply is commonly used.



Operation Modes

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4.4.4 Pulse Input Modes

The following three pulse input modes are supported in general-purpose I/O mode of the SVA-01 Module.

- Sign mode
- Up/Down mode
- Pulse A/B mode

Each pulse input mode is explained below.

(1) Sign Mode

In sign mode, the counter counts pulses in the following manner.

Polarity: Positive logic

When pulse B is at High, the counter counts up upon pulse A input.

When pulse B is at Low, the counter counts down upon pulse A input.

Polarity: Negative logic

When pulse B is at Low, the counter counts up upon pulse A input.

When pulse B is at High, the counter counts down upon pulse A input.

The table below shows different pulse counting operations by combination of multiplier and polarity.

Pulse Counting Method	Polarity	Count Up (Forward Rotation)	Count Down (Reverse Rotation)
Sign mode (Input pulse multiplier: 1)	Positive logic	Pulse A Pulse B HIGH	Pulse A Pulse B LOW
	Negative logic	Pulse A Pulse B LOW	Pulse A Pulse C HIGH
Sign mode (Input pulse multiplier: 2)	Positive logic	Pulse A Pulse B HIGH	Pulse A Pulse B LOW
	Negative logic	Pulse A Pulse B LOW	Pulse A Pulse B LOW

(2) Up/Down Mode

In up/down mode, the counter counts pulses in the following manner no matter whether the polarity is positive or negative logic.

The counter counts up upon pulse A input.

The counter counts down upon pulse B input.

The table below shows different pulse counting operations by combination of multiplier and polarity.

Pulse Counting Method	Polarity	Count Up (Forward Rotation)	Count Down (Reverse Rotation)
Up/Down mode (Input pulse multiplier: 1)	Positive logic	Pulse A Pulse B Fixed to LOW or HIGH	Pulse A Fixed to LOW or HIGH Pulse B
	Negative logic	Pulse A Pulse B Fixed to LOW or HIGH	Pulse A Fixed to LOW or HIGH Pulse B
Up/Down mode (Input pulse multiplier: 2)	Positive logic	Pulse A Pulse B Fixed to LOW or HIGH	Pulse A Fixed to LOW or HIGH Pulse B
	Negative logic	Pulse A Pulse B Fixed to LOW or HIGH	Pulse A Fixed to LOW or HIGH Pulse B

- When pulse A and B are input at the same time, the count will not change (±0).

(3) Pulse A/B Mode

In pulse A/B mode, the counter counts pulses in the following manner.

Polarity: Positive logic

The counter counts up when the phase of pulse A input is delayed from pulse B.

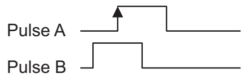
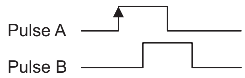
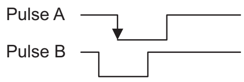
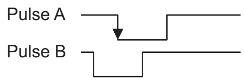
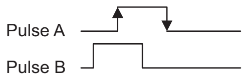
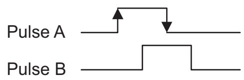
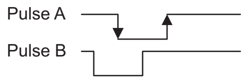
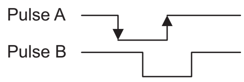
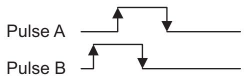
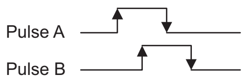
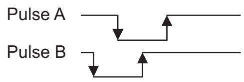
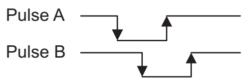
The counter counts down when the phase of pulse A input is advanced to pulse B.

Polarity: Negative logic

The counter counts up when the phase of pulse A input is delayed from pulse B.

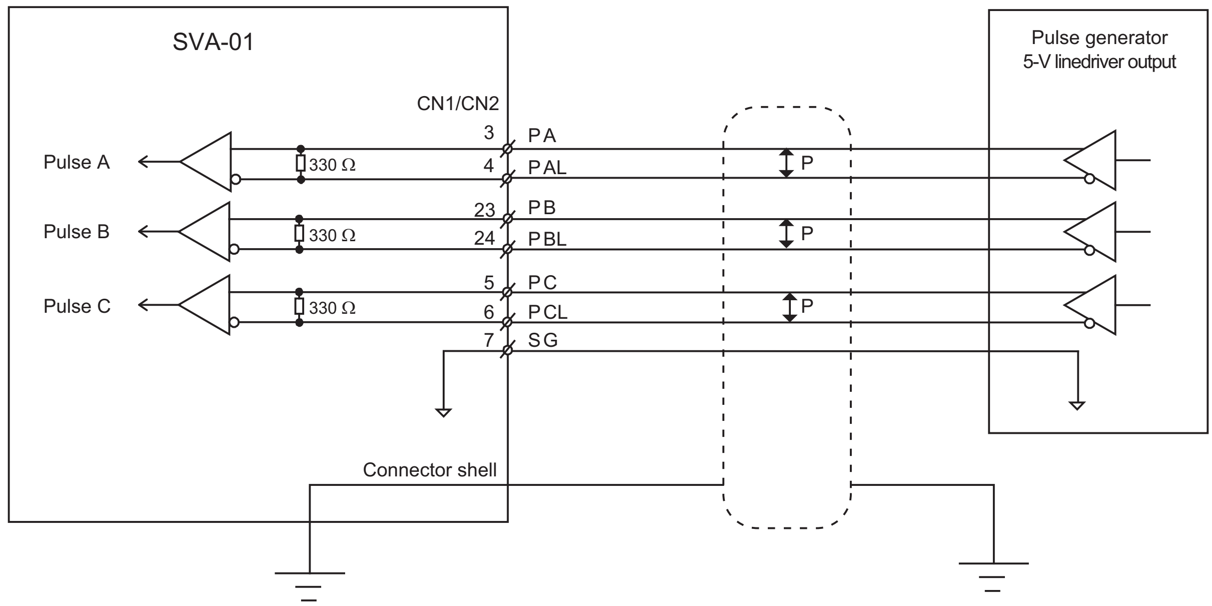
The counter counts down when the phase of pulse A input is advanced to pulse B.

The table below shows different pulse counting operations by combination of multiplier and polarity.

Pulse Counting Method	Polarity	Count Up (Forward Rotation)	Count Down (Reverse Rotation)
Pulse A/B mode (Input pulse multiplier: 1)	Positive logic		
	Negative logic		
Pulse A/B mode (Input pulse multiplier: 2)	Positive logic		
	Negative logic		
Pulse A/B mode (Input pulse multiplier: 4)	Positive logic		
	Negative logic		

4.4.5 Pulse Counter Connection Example

The following diagram illustrates an example of pulse counter connection.



5

Motion Parameters

This chapter explains each of the motion parameters.

5.1 Motion Parameters Register Numbers

5.1.1 Motion Parameter Register Numbers for MP2000 Series Machine Controllers

The leading motion parameter register numbers (I or O register numbers) are determined by the module number and axis number.
The leading register numbers for each axis's motion parameters can be obtained using the following equation.

> Leading motion parameter register number
> = I (or O)W8000 + (module number - 1) × 800h + (axis number - 1) × 80h

The following tables lists the motion parameters register numbers.

Module No.	Axis No. 1	Axis No. 2
1	8000 to 807F	8080 to 80FF
2	8800 to 887F	8880 to 88FF
3	9000 to 907F	9080 to 90FF
4	9800 to 987F	9880 to 98FF
5	A000 to A07F	A080 to A0FF
6	A800 to A87F	A880 to A8FF
7	B000 to B07F	B080 to B0FF
8	B800 to B87F	B880 to B8FF
9	C000 to C07F	C080 to C0FF
10	C800 to C87F	C880 to C8FF
11	D000 to D07F	D080 to D0FF
12	D800 to D87F	D880 to D8FF
13	E000 to E07F	E080 to E0FF
14	E800 to E87F	E880 to E8FF
15	F000 to F07F	F080 to F0FF
16	F800 to F87F	F880 to F8FF

5.2 Motion Parameters Setting Window

Set or monitor the motion parameters in the Fixed Parameters, Setup Parameters, and Monitor tabs of the SVA Definition Window.

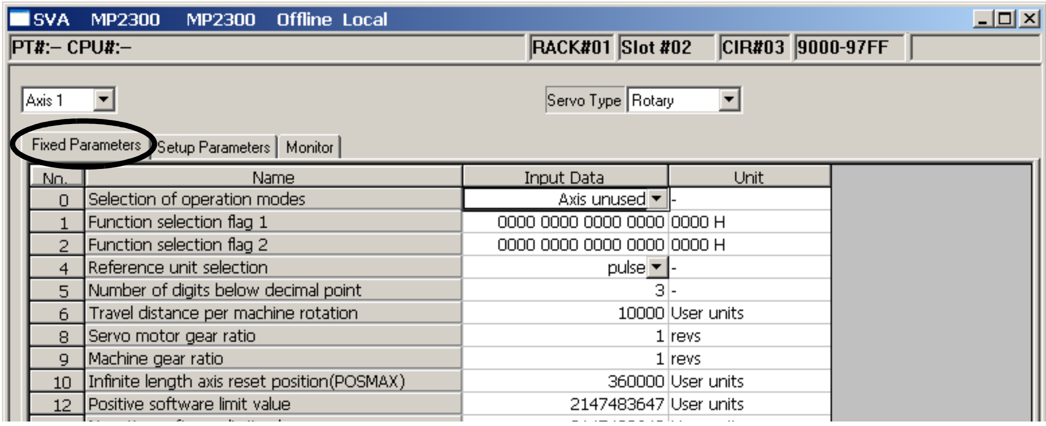


Fig. 5.1 Fixed Parameters Tab Page

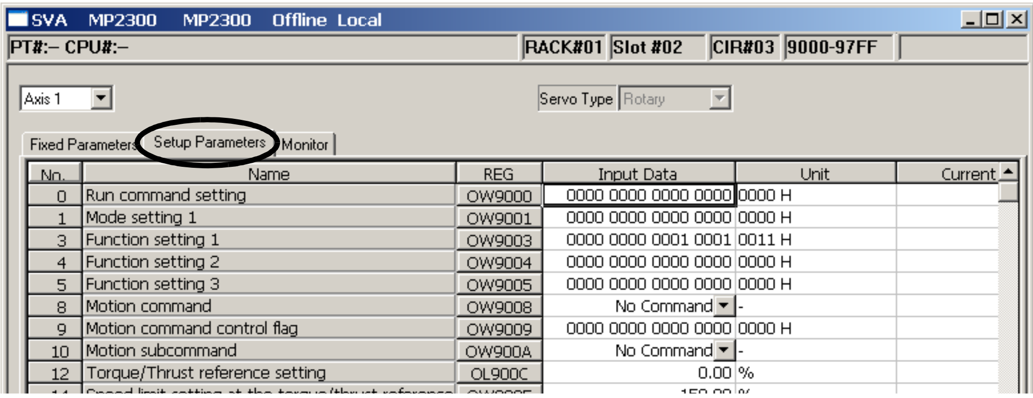


Fig. 5.2 Setup Parameters Tab Page

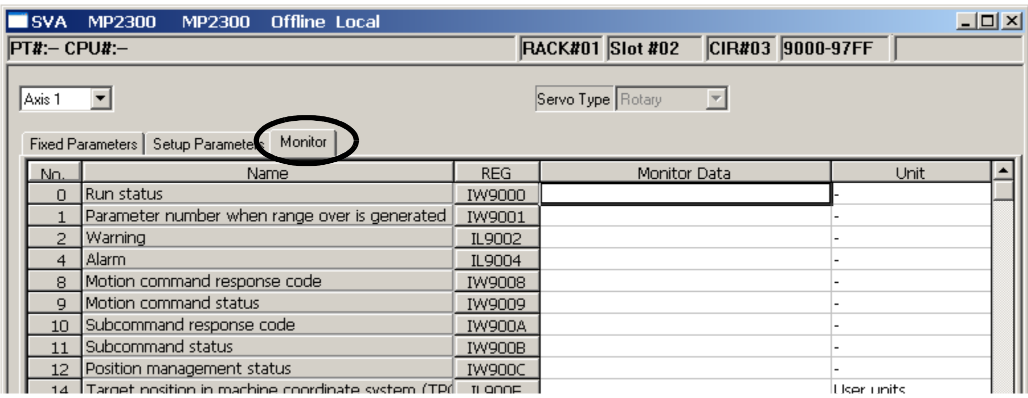


Fig. 5.3 Monitor Parameters Tab Page (Read-Only)

5.2.1 How to Open the Motion Parameter Setting Windows

Refer to *3.3.1 Opening the SVA Definition Window* on page 3-7 for information on how to open motion parameter setting windows.

Motion Parameters
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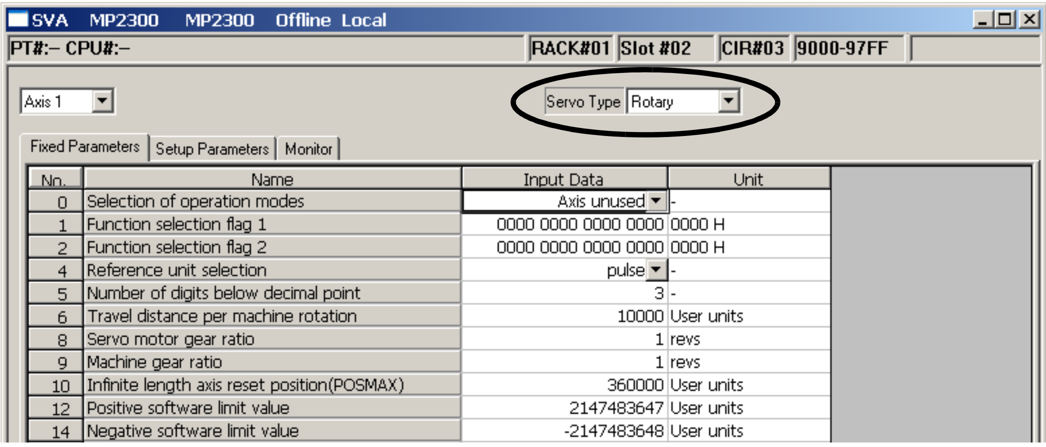
5.2.2 Selecting a Motor Type

The motor type, rotary or linear, can be selected from the ***Servo Type*** pull-down list in the SVA Definition Window. Some of the fixed parameters will differ and some of the setting parameters will be disabled depending on the selected motor type.



5.3 Motion Parameter Lists

5.3.1 Fixed Parameter List

The following table provides a list of SVA motion fixed parameters.

- The commands marked with ✓ in the Normal Operation Mode, Simulation Mode, and General-purpose I/O Mode columns can be used in the corresponding operation mode. The operation mode can be selected by setting the fixed parameter No. 0 (Selection of Operation Modes) to 0 for normal operation mode, to 2 for simulation mode, or to 4 for general-purpose I/O mode.
- Refer to the pages listed in the Reference Page for details of each fixed parameter.

No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Refer-ence Page
0	Selection of Operation Modes	0: Normal Operation Mode 1: Axis unused 2: Simulation Mode 3: Reserved for system use 4: General-purpose I/O Mode	✓	✓	✓	P.5-17
		5 to 7: Reserved for system use	-	-	-	
1	Function Selection Flag 1	Bit 0: Axis Selection (0: Finite length axis/1: Infinite length axis) Set to 0 for linear type.	✓	✓		P.5-18
		Bit 1: Soft Limit (positive direction) (0: Disabled/1: Enabled)	✓	✓		
		Bit 2: Soft Limit (negative direction) (0: Disabled/1: Enabled)	✓	✓		
		Bit 3: Overtravel Positive Direction (0: Disabled/1: Enabled)	✓			
		Bit 4: Overtravel Negative Direction (0: Disabled/1: Enabled)	✓			
		Bit 5: Deceleration LS Inversion Selection (0: Not invert/1: Invert)	✓			
		Bit 6: Reserved for system use	-	-	-	
		Bit 7: Absolute Position Data Read-out at Power ON (0: Execute/1: Not execute)	✓			
		Bit 8: Reserved for system use	-	-	-	
		Bit 9: Simple ABS Rotary Pos. Mode (Simple absolute infinite axis position control) (0: Disabled/1:Enabled) Set to 0 for linear type.	✓			
		Bits A to F: Reserved for system use	-	-	-	
2	Function Selection Flag 2	Bits 0 to 2: Reserved for system use	-	-	-	P.5-19
		Bit 3: Analog Adjust Not Ready Warning Mask (0: Disabled/1: Enabled)	✓		✓	
		Bit 4: PG Wire Breaking Down Status Mask (0: Disabled/1: Enabled)			✓	
		Bits 5 to F: Reserved for system use	-	-	-	
3	-	Reserved for system use	-	-	-	-

No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Reference Page
4	Reference Unit Selection	0: pulse 1: mm 2: deg 3: inch For linear type, either 0 (pulse) or 1 (mm) can be selected. If 2 (deg) or 3 (inch) is selected, the selected unit will be converted to mm.	✓	✓		P.5-19
5	Number of Digits Below Decimal Point	1 = 1 digit	✓	✓		
6	Travel Distance per Motor Revolution (rotary type)	1 = 1 user unit	✓	✓		
	Linear Scale Pitch (linear type)	1 = 1 user unit	✓	✓		
8	Servo Motor Gear Ratio	1 = 1 rev Invalid for linear type	✓	✓		
9	Machine Gear Ratio	1 = 1 rev Invalid for linear type	✓	✓		
10	Infinite Length Axis Reset Position (POSMAX)	1 = 1 user unit Invalid for linear type	✓	✓		P.5-20
12	Positive Software Limit Value	1 = 1 user unit	✓	✓		P.5-21
14	Negative Software Limit Value	1 = 1 user unit	✓	✓		
16	Backlash Compensation Amount	1 = 1 user unit	✓	✓		P.5-21
18 to 19	-	Reserved for system use	-	-	-	-
20	Hardware Signal Selection 1	Bit 0: A/B Pulse Input Signal Polarity Selection (0: Positive logic/1: Negative logic)	✓		✓	P.5-22
		Bit 1: C Pulse Input Signal Polarity Selection (0: Positive logic/1: Negative logic)	✓		✓	
		Bits 2 to F: Reserved for system use	-	-	-	
21	Hardware Signal Selection 2	Bit 0: Deceleration LS Signal Selection (0: Use the setting parameter./1: Use the DI signal.)	✓	✓		
		Bits 1 to 4: Reserved for system use	-	-	-	
		Bit 5: General-Purpose DO_2 Signal Selection (0: Use as a system exclusive signal./ 1: Use as a general-purpose signal.)	✓			
		Bits 6 to F: Reserved for system use	-	-	-	
22	Pulse Counting Mode Selection	0: Sign mode ∗1 1: Sign mode ∗2 2: Up/Down mode ∗1 3: Up/Down mode ∗2 4: A/B mode ∗1 5: A/B mode ∗2 6: A/B mode ∗4	✓		✓	P.5-22
23	D/A Output Voltage at 100% Speed	1 = 0.001 V	✓			P.5-22
24	D/A Output Voltage at 100% Torque Limit	1 = 0.001 V	✓			P.5-23
25	-	Reserved for system use	-	-	-	-
26	A/D Input Voltage at 100% Torque Monitor	1 = 0.001 V	✓			P.5-23

No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Reference Page
27	-	Reserved for system use	-	-	-	-
28	Servo Driver Type Selection	0: Σ-I series 1: Σ-II, Σ-III, Σ-V, or Σ-7 series 2: Reserved for system use	✓			P.5-23
30	Encoder Selection	0: Incremental encoder 1: Absolute encoder 2: Absolute encoder (Incremental encoder is used.) 3: Reserved for system use	✓	✓		
31	Rotation Direction Selection with an Absolute Encoder	0: Forward 1: Reverse	✓			
32	-	Reserved for system use	-	-	-	-
34	Rated Motor Speed (rotary type)	1 = 1 min^{-1}	✓	✓		P.5-24
	Rated Speed (linear type)	1 = 0.1 m/s	✓	✓		
36	Number of Pulses per Motor Rotation (rotary type)	1 = 1 pulse/rev Set the value before multiplication.	✓	✓		
	Number of Pulses per Linear Scale Pitch (linear type)	1 = 1 pulse/linear scale pitch Set the value before multiplication.	✓	✓		P.5-24
38	Maximum Number of Absolute Encoder Turns Rotation	1 = 1 rev Set to 0 when using a direct drive motor. Invalid for linear type	✓			
40	-	Reserved for system use	-	-	-	
42	Feedback Speed Movement Averaging Time Constant	1 = 1 ms	✓	✓		

5.3.2 Setting Parameter List

The following table provides a list of SVA motion setting parameters.

- The register number “OW□□00” indicates the leading output register number + 00. Refer to *5.1.1 Motion Parameter Register Numbers for MP2000 Series Machine Controllers* on page 5-2 for information on how to obtain the leading output register number.
- The commands marked with ✓ in the Normal Operation Mode, Simulation Mode, and General-purpose I/O Mode columns can be used in the corresponding operation mode. The operation mode can be selected by setting the fixed parameter No. 0 (Selection of Operation Modes) to 0 for normal operation mode, to 2 for simulation mode, or to 4 for general-purpose I/O mode.
- Refer to the pages listed in the Reference Page for details of each setting parameter.

Register No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Refer-ence Page
OW□□00	Run Command Setting	Bit 0: Servo ON (0: OFF/1: ON)	✓	✓		P.5-25
		Bit 1: Machine Lock (0: Normal operation/1: Machine locked)	✓	✓		
		Bits 2 and 3: Reserved for system use	-	-	-	
		Bit 4: Latch Detection Demand (0: OFF/1: ON)	✓		✓	
		Bit 5 Absolute Position Reading Demand (0: OFF/1: ON)	✓			
		Bit 6: POSMAX Turn Number Presetting Demand (0: OFF/1:ON) Set to 0 for linear type.	✓	✓		
		Bit 7: Request ABS Rotary Pos. Load (Absolute system infinite length position information LOAD) (0: OFF/1: ON) Set to 0 for linear type.	✓	✓		
		Bits 8 to A: Reserved for system use	-	-	-	
		Bit B: Integration Reset (0: OFF/1:ON)	✓	✓		
		Bits C to E: Reserved for system use	-	-	-	
		Bit F: Alarm Clear (0: OFF/1: ON)	✓	✓	✓	
OW□□01	Mode Setting 1	Bit 0: Excessive Deviation Error Level Setting (0: Alarm/1: Warning)	✓	✓		P.5-27
		Bit 1: Reserved for system use	-	-	-	
		Bit 2: Speed Compen. in Pos. Mode (Speed compensation in position mode) (0: Disabled/1: Enabled)	✓	✓		
		Bits 3 to F: Reserved for system use	-	-	-	
OW□□02	-	Reserved for system use	-	-	-	-
OW□□03	Function Setting 1	Bits 0 to 3: Speed Unit Selection 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1: 0.01%) 3: Percentage of rated speed (1: 0.0001%)	✓	✓		P.5-27
		Bits 4 to 7: Acceleration/Deceleration Degree Unit Selection 0: Reference unit/s^2 1: ms	✓	✓		
		Bits 8 to B: Filter Type Selection 0: Filter none 1: Exponential acceleration/deceleration filter 2: Moving average filter	✓	✓		
		Bits C to F: Torque Unit Selection 0: Percentage of rated torque (1: 0.01%) 1: Percentage of rated torque (1: 0.0001%)	✓	✓		

Register No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Reference Page
OW☐☐04	Function Setting 2	Bits 0 to 3: Latch Detection Signal Selection 0: DI_5 (DEC/EXT) 1: DI_2 (ZERO/HOME LS) 2: Phase-C pulse input signal	✓		✓	P.5-28
		Bits 4 to 7: External Positioning Signal Setting 0: DI_5 (DEC/EXT) 1: DI_2 (ZERO/HOME LS) 2: Phase-C pulse input signal	✓			
		Bits 8 to F: Reserved for system use	-	-	-	
OW☐☐05	Function Setting 3	Bit 0: Reserved for system use	-	-	-	P.5-28
		Bit 1: Phase Reference Creation Calculation Disable (0: Enabled/1:Disabled)	✓	✓		
		Bits 2 to 7: Reserved for system use	-	-	-	
		Bit 8: Zero Point Return Deceleration LS Signal (0: OFF/1: ON)	✓	✓		
		Bit 9: Zero Point Return Reverse Run Side Limit Signal (0: OFF/1: ON)	✓	✓		
		Bit A: Zero Point Return Forward Run Side Limit Signal (0: OFF/1:ON)	✓	✓		
		Bit B: Zero Point Return Input Signal (0: OFF/1:ON)	✓	✓		
		Bits C to F: Reserved for system use	-	-	-	
OL☐☐06	-	Reserved for system use	-	-	-	-
OW☐☐08	Motion Command	0: NOP (No Command) 1: POSING (Position Mode) (Positioning) 2: EX_POSING (Latch Target Positioning) (External Positioning) 3: ZRET (Zero Point Return) 4: INTERPOLATE (Interpolation) 5: ENDOF_INTERPOLATE (For system use) 6: LATCH (Interpolation Mode with Latch Input) 7: FEED (JOG Mode) 8: STEP (Relative Position Mode) (Step Mode) 9: ZSET (Set Zero Point) 23: VELO (Speed Reference) 24: TRQ (Torque Reference) 25: PHASE (Phase Reference)	✓	✓		P.5-29
OW☐☐09	Motion Command Control Flag	Bit 0: Holds a Command (0: OFF/1: ON)	✓	✓		P.5-29
		Bit 1: Interrupt a Command (0: OFF/1: ON)	✓	✓		
		Bit 2: Moving Direction (JOG/STEP) (0: Forward rotation/1: Reverse rotation)	✓	✓		
		Bit 3: Zero Point Return Direction Selection (0: Reverse rotation/1: Forward rotation)	✓	✓		
		Bit 4: Latch Zone Effective Selection (0: Disabled/1: Enabled)	✓	✓		
		Bit 5: Position Reference Type (0: Incremental value add method/1: Absolute value set method)	✓	✓		
		Bit 6: Phase Compensation Type (0: Incremental value add method/1: Absolute value set method))	✓	✓		
		Bits 7 to F: Reserved for system use	-	-	-	
OW☐☐0A	Motion Subcommand	0: NOP (No Command) 1 to 4: Reserved for system use 5: FIXPRM_RD (Read Fixed Parameter)	✓	✓		P.5-30
OW☐☐0B	-	Reserved for system use	-	-	-	-

Register No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Reference Page
OL□□0C	Torque/Thrust Reference Setting	Unit depends on OW□□03, bits C to F (Torque Unit Selection).	✓	✓		P.5-31
OW□□0E	Speed Limit Setting at the Torque/Thrust Reference	1 = 0.01% (percentage of rated speed)	✓	✓		
OW□□0F	Torque Reference 1st-order Lag Filter	1 = 1 ms	✓	✓		
OL□□10	Speed Reference Setting	Unit depends on OW□□03, bits 0 to 3 (Speed Unit Selection).	✓	✓		P.5-32
OW□□12	Positive Side Speed Limiter Value	1 = 0.01% (percentage of rated speed)	✓	✓		
OW□□13	Negative Side Speed Limiter Value	1 = 0.01% (percentage of rated speed)	✓	✓		
OL□□14	Positive Side Limiting Torque/Thrust Setting at the Speed Reference	Unit depends on OW□□03, bits C to F (Torque Unit Selection).	✓	✓		P.5-32
OL□□16	Secondly Speed Compensation	Unit depends on OW□□03, bits 0 to 3 (Speed Unit Selection).	✓	✓		P.5-32
OW□□18	Override	1 = 0.01%	✓	✓		P.5-33
OW□□19	-	Reserved for system use	-	-	-	-
OW□□1A	General-purpose AO1	1 = 0.001 V			✓	P.5-33
OW□□1B	General-purpose AO2	1 = 0.001 V			✓	
OL□□1C	Position Reference Setting	1 = 1 reference unit	✓	✓		P.5-33
OL□□1E	Width of Positioning Completed	1 = 1 reference unit	✓	✓		P.5-34
OL□□20	NEAR Signal Output Width	1 = 1 reference unit	✓	✓		P.5-34
OL□□22	Error Count Alarm Detection	1 = 1 reference unit	✓	✓		P.5-35
OL□□24	Position Correction Setting	1 = 1 reference unit	✓	✓		P.5-35
OW□□26	Position Completion Check Time	1 = 1 ms (No check when 0 is set)	✓	✓		P.5-35
OW□□27	-	Reserved for system use	-	-	-	-
OL□□28	Phase Correction Setting	1 = 1 reference unit	✓	✓		P.5-35
OL□□2A	Latch Zone Lower Limit Setting	1 = 1 reference unit	✓	✓		P.5-36
OL□□2C	Latch Zone Upper Limit Setting	1 = 1 reference unit	✓	✓		
OW□□2E	Position Loop Gain	1 = 0.1/s	✓	✓		
OW□□2F	-	Reserved for system use	-	-	-	-

Register No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Refer-ence Page
OW□□30	Speed Feedforward Amends	1 = 0.01% (percentage of distribution segment)	✓	✓		P.5-36
OW□□31	Speed Compensa-tion	1 = 0.01% (percentage of rated speed)	✓	✓		
OW□□32	Position Integra-tion Time Constant	1 = 1 ms	✓	✓		
OW□□33	1st-order Lag Time Constant	1 = 1 ms	✓	✓		
OW□□34 OW□□35	–	Reserved for system use	-	-	-	-
OL□□36	Straight Line Acceleration/ Acceleration Time Constant	Unit depends on OW□□03, bits 4 to 7 (Acceleration/Decelera-tion Degree Unit Selection).	✓	✓		P.5-37
OL□□38	Straight Line Decel-eration/Decelera-tion Time Constant	Unit depends on OW□□03, bits 4 to 7 (Acceleration/Decelera-tion Degree Unit Selection).	✓	✓		
OW□□3A	Filter Time Constant	1 = 0.1 ms	✓	✓		P.5-38
OW□□3B	Bias Speed for In-dex Acceleration/ Deceleration Filter	Unit depends on OW□□03, bits 0 to 3 (Speed Unit Selection).	✓	✓		
OW□□3C	Zero Point Return Method	0: DEC1 and Phase C 1: ZERO Signal 2: DEC1 and ZERO Signal 3: C-pulse 4: DEC2 and ZERO Signal 5: DEC1and Limit and ZERO Signal 6: DEC2 and C-phase 7: DEC1 and Limit and C-phase 8 to 10: Reserved for system use 11: C-pulse Only 12: P-OT and C-pulse 13: P-OT Only 14: HOME LS and C-pulse 15: HOME Only 16: N-OT and C-pulse 17: N-OT Only 18: INPUT and C-pulse 19: INPUT Only	✓	✓		P.5-39
OW□□3D	Width of Starting Point Position Output	1 = 1 reference unit	✓	✓		
OL□□3E	Approach Speed	Unit depends on OW□□03, bits 0 to 3 (Speed Unit Selection).	✓	✓		
OL□□40	Creep Rate	Unit depends on OW□□03, bits 0 to 3 (Speed Unit Selection).	✓	✓		
OL□□42	Zero Point Return Travel Distance	1 = 1 reference unit	✓	✓		
OL□□44	STEP Travel Distance	1 = 1 reference unit	✓	✓		P.5-40
OL□□46	External Position-ing Final Travel Distance	1 = 1 reference unit	✓	✓		P.5-40

Register No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Refer-ence Page
OL□□48	Zero Point Position in Machine Coordi-nate System Offset	1 = 1 reference unit	✓	✓	✓	P.5-40
OL□□4A	Work Coordinate System Offset	1 = 1 reference unit	✓	✓		
OL□□4C	Number of POSMAX Turns Presetting Data	1 = 1 turn • Invalid for linear type	✓	✓		P.5-40
OW□□4E to OW□□5B	-	Reserved for system use	-	-	-	-
OW□□5C	Fixed Parameter Number	Set the number of the fixed parameter to read with the FIX-PRM_RD motion subcommand.	✓	✓		P.5-41
OW□□5D	General-purpose DO	Bit 0: General-purpose DO_0 (0: OFF/1: ON)			✓	P.5-41
		Bit 1: General-purpose DO_1 (0: OFF/1: ON)			✓	
		Bit 2: General-purpose DO_2 (0: OFF/1: ON) • In normal operation mode, a specific condition is required.	✓		✓	
		Bit 3: General-purpose DO_3 (0: OFF/1: ON)	✓		✓	
		Bit 4: General-purpose DO_4 (0: OFF/1: ON)	✓		✓	
		Bit 5: General-purpose DO_5 (0: OFF/1: ON)			✓	
		Bits 6 to F: Reserved for system use	-	-	-	
OL□□5E	Encoder Position when Power is OFF (Lower 2 words)	1 = 1 pulse • For linear type, do not set this register.	✓			P.5-42
OL□□60	Encoder Position when Power is OFF (Upper 2 words)	1 = 1 pulse • For linear type, do not set this register.	✓			P.5-42
OL□□62	Pulse Position when Power is OFF (Lower 2 words)	1 = 1 pulse • For linear type, do not set this register.	✓			
OL□□64	Pulse Position when Power is OFF (Upper 2 words)	1 = 1 pulse • For linear type, do not set this register.	✓			
OL□□66	Monitor Data Com-mand	Reserved for system use	-	-	-	P.5-42
OL□□68	Writing Data Type	Reserved for system use	-	-	-	
OL□□6A	Monitor Address	Reserved for system use	-	-	-	
OL□□6C	Writing Data	Reserved for system use	-	-	-	
OL□□6E	System Reservation (Stop Distance)	Used in combination with MPOS as the software limit detection condition.	✓	✓		
OL□□70 to OL□□7F	-	Reserved for system use	-	-	-	-

5.3.3 Monitoring Parameter List

The following table provides a list of SVA motion monitoring parameters.

- The register number “IW□□00” indicates the leading input register number + 00. Refer to *5.1.1 Motion Parameter Register Numbers for MP2000 Series Machine Controllers* on page 5-2 for information on how to obtain the leading input register number.
- The commands marked with ✓ in the Normal Operation Mode, Simulation Mode, and General-purpose I/O Mode columns can be used in the corresponding operation mode. The operation mode can be selected by setting the fixed parameter No. 0 (Selection of Operation Modes) to 0 for normal operation mode, to 2 for simulation mode, or to 4 for general-purpose I/O mode.
- Refer to the pages listed in the Reference Page for details of each monitoring parameter.

Register No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Reference Page
IW□□00	RUN Status	Bit 0: Motion Controller Operation Ready	✓	✓	✓	P.5-43
		Bit 1: Running (Servo ON)	✓	✓		
		Bit 2: Reserved for system use	-	-	-	
		Bit 3: Servo Ready	✓	✓		
		Bits 4 to F: Reserved for system use	-	-	-	
IW□□01	Parameter Number when Range Over is Generated	Setting parameters: 0 or higher Fixed parameters: 1000 or higher	✓	✓	✓	P.5-43
IL□□02	Warning	Bit 0: Excessive Deviation	✓	✓		P.5-44
		Bit 1: Set Parameter Error (Setting parameter error)	✓	✓		
		Bit 2: Fixed Parameter Error	✓	✓		
		Bit 3: Reserved for system use	-	-	-	
		Bit 4: Motion Command Set Error	✓	✓		
		Bits 5 to A: Reserved for system use	-	-	-	
		Bit B: Analog Adjust Not Ready Warning	✓		✓	
		Bits C to 1F: Reserved for system use				
IL□□04	Alarm	Bit 0: Servo Driver Error	✓			P.5-45
		Bit 1: Positive Direction Overtravel	✓			
		Bit 2: Negative Direction Overtravel	✓			
		Bit 3: Positive Direction Software Limit	✓	✓		
		Bit 4: Negative Direction Software Limit	✓	✓		
		Bit 5: Servo OFF	✓	✓		
		Bit 6: Positioning Time Over	✓			
		Bit 7: Reserved for system use	-	-	-	
		Bit 8: Excessive Speed	✓	✓		
		Bit 9: Excessive Deviation	✓			
		Bits A to C: Reserved for system use	-	-	-	
		Bit D: Zero Point Unsetting • Invalid for linear type	✓	✓		
		Bit E to 12: Reserved for system use	-	-	-	
		Bit 13: Excessive ABS Encoder Rotations • Invalid for linear type	✓			
		Bit 14: PG Disconnection Error	✓		✓	
		Bit 15: ABS Total Rev. Receive Error	✓			
		Bits 16 to 1F: Reserved for system use	-	-	-	
IL□□06	-	Reserved for system use	-	-	-	-
IW□□08	Motion Command Response Code	Same as OW□□08 (Motion Command)	✓	✓		P.5-46

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Register No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Refer-ence Page
IW□□09	Motion Command Status	Bit 0: Command Execution Flag (BUSY)	✓	✓		P.5-46
		Bit 1: Command Hold Completed (HOLD)	✓	✓		
		Bit 2: Reserved for system use	-	-	-	
		Bit 3: Command Error Completed Status (Command Error Occurrence) (FAIL)	✓	✓		
		Bits 4 to 7: Reserved for system use	-	-	-	
		Bit 8: Command Execution Completed (COMPLETE)	✓	✓		
		Bits 9 to F: Reserved for system use				
IW□□0A	Motion Subcommand Response Code	Same as OW□□0A (Motion Subcommand)	✓	✓		P.5-47
IW□□0B	Subcommand Status	Bit 0: Command Execution Flag	✓	✓		P.5-47
		Bits 1 and 2: Reserved for system use	-	-	-	
		Bit 3: Command Error Completed Status (Command Error Occurrence)	✓	✓		
		Bits 4 to 7: Reserved for system use	-	-	-	
		Bit 8: Command Execution Completed	✓	✓		
		Bits 9 to F: Reserved for system use	-	-	-	
IW□□0C	Position Management Status	Bit 0: Discharging Completed (DEN)	✓	✓		
		Bit 1: Positioning Completed (POSCOMP)	✓	✓		
		Bit 2: Latch Completed (LCOMP)	✓	✓	✓	
		Bit 3: NEAR Position (NEAR)	✓	✓		
		Bit 4: Zero Point Position (ZERO)	✓	✓		
		Bit 5: Zero Point Return (Setting) Completed (ZRNC)	✓	✓		
		Bit 6: During Machine Lock (MLKL)	✓	✓		
		Bit 7: Absolute Position Read-out Completed	✓	✓		
		Bit 8: ABS Rotary Pos. LOAD Complete (ABS system infinite length position control information load completed) (ABSLDE) • Invalid for linear type	✓	✓		
		Bit 9: POSMAX Turn Preset Complete (TPRSE) • Invalid for linear type	✓	✓		
		Bit A: ABS Encoder Rotating Direction	✓	✓		
		Bits B to F: Reserved for system use	-	-	-	
IW□□0D	-	Reserved for system use	-	-	-	-

Register No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Refer-ence Page
IL□□0E	Target Position in Machine Coordinate System (TPOS)	1 = 1 reference unit	✓	✓		P.5-48
IL□□10	Calculated Position in Machine Coordinate System (CPOS)	1 = 1 reference unit	✓	✓		
IL□□12	Machine Coordinate System Reference Position (MPOS)	1 = 1 reference unit	✓	✓		
IL□□14	CPOS for 32 bit (DPOS)	1 = 1 reference unit	✓	✓		
IL□□16	Machine Coordinate System Feedback Position (APOS)	1 = 1 reference unit	✓	✓	✓	
IL□□18	Machine Coordinate System Latch Position (LPOS)	1 = 1 reference unit	✓	✓	✓	
IL□□1A	Position Error (PERR)	1 = 1 reference unit	✓	✓		
IL□□1C	Target Position Difference Monitor	1 = 1 reference unit	✓	✓	✓	
IL□□1E	Number of POSMAX Turns	1 = 1 turn Invalid for linear type	✓	✓		
IL□□20	Speed Reference Output Monitor	Unit depends on OW□□03, bits 0 to 3 (Speed Unit Selection).	✓	✓		P.5-50
IL□□22	-	Reserved for system use	-	-	-	-
IL□□24	Integral Output Monitor	Unit depends on OW□□03, bits 0 to 3 (Speed Unit Selection).	✓	✓		P.5-50
IL□□26	Primary Lag Monitor	Unit depends on OW□□03, bits 0 to 3 (Speed Unit Selection). Stores the result of "IL□□24 – (Output from primary delay element)".	✓	✓		
IL□□28	Position Loop Output Monitor	Unit depends on OW□□03, bits 0 to 3 (Speed Unit Selection).	✓	✓		P.5-50
IL□□2A to IW□□3F	-	Reserved for system use	-	-	-	-
IL□□40	Feedback Speed	Unit depends on OW□□03, bits 0 to 3 (Speed Unit Selection).	✓	✓		P.5-50
IL□□42	Feedback Torque/ Thrust	Unit depends on OW□□03, bits C to F (Torque Unit Selection).	✓			P.5-50
IW□□44 to IW□□49	-	Reserved for system use	-	-	-	-
IL□□4A	The Number of Accumulated Rota-tions of Absolute Value Encoder	1 = 1 rev	✓			P.5-50
IL□□4C	The Number Initial Incremental Pulses	1 = 1 pulse	✓			P.5-50
IW□□4E to IW□□55	-	Reserved for system use	-	-	-	-

Register No.	Name	Description	Normal Operation Mode	Simulation Mode	General-purpose I/O Mode	Refer-ence Page
IL□□56	Fixed Parameter Monitor	Stores the result of execution of the motion subcommand FIXPRM_RD.	✓	✓		P.5-51
IW□□58	General-purpose DI Monitor	Bit 0: General-purpose DI_0	✓		✓	–
		Bit 1: General-purpose DI_1	✓		✓	
		Bit 2: General-purpose DI_2	✓		✓	
		Bit 3: General-purpose DI_3	✓		✓	
		Bit 4: General-purpose DI_4	✓		✓	
		Bit 5: General-purpose DI_5	✓		✓	
		Bit 6: Reserved for system use	✓		✓	
		Bit 7: PG Wire Breaking Down status (ON: Normal/OFF: Disconnected)	✓		✓	
		Bits 8 to F: Reserved for system use	-	-	-	
IW□□59	General-purpose AI Monitor 1	1 = 0.001 V	✓		✓	
IW□□5A	General-purpose AI Monitor 2	1 = 0.001 V	✓		✓	
IW□□5B to IW□□5C	-	Reserved for system use	-	-	-	-
IL□□5E	Encoder Position when Power is OFF (Lower 2 words)	1 = 1 pulse	✓			P.5-52
IL□□60	Encoder Position when Power is OFF (Upper 2 words)	1 = 1 pulse	✓			
IL□□62	Pulse Position when Power is OFF (Lower 2 words)	1 = 1 pulse	✓			
IL□□64	Pulse Position when Power is OFF (Upper 2 words)	1 = 1 pulse	✓			
IL□□66	Monitor Data Status	Reserved for system use	-	-	-	-
IL□□68	Monitor Data	Reserved for system use	-	-	-	-
IW□□6A to IW□□7F	-	Reserved for system use	-	-	-	-

5.4 MP2000 Series Machine Controller Parameter Details

This section provides details for each motion parameter (fixed parameters, setting parameters, and monitoring parameters).

5.4.1 Motion Fixed Parameter Details

The following tables provide details of motion fixed parameters.

- Refer to *5.3.1 Fixed Parameter List* on page 5-5 for a list of motion fixed parameters.

(1) Run Mode

<table>
<tr><td colspan="2" rowspan="2">No. 0
Selection of Operation Modes</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>0 to 4</td><td>–</td><td>1</td></tr>
<tr><td>Description</td><td colspan="4">Specify the application method of the axis.
0: Normal Operation Mode
Use this setting when actually using an axis.
1: Axis Unused (default)
No control will be performed for an axis set to this mode, and monitoring parameters will not be updated. If an axis is changed from any other run mode to this mode, the monitoring parameters will be held at the current status except for the RUN Status (monitoring parameter IW□□00), which will be cleared to zeros.
Set any axis that is not being used to this mode (Axis Unused) to reduce the processing time.
2: Simulation Mode
In Simulation Mode, position information will be stored in the monitoring parameters even if a Servo Driver is not connected.
This mode is used to virtually check the operation of the applications program.
3: General-purpose I/O Mode
In General-purpose I/O Mode, the following functions are enabled.
• General-purpose DO output
• General-purpose AO output
• General-purpose DI input
• General-purpose AI input
• Counter input
• Use the General-purpose I/O Mode when connecting SVA-01 Module to an inverter.</td></tr>
</table>

■ Terminology: Store

The use of "store" here refers to information that is automatically transferred by the CPU system without any action by the user. This term is mainly used with this meaning in describing motion monitoring parameters.

(2) Function Selection 1

No. 1 Function Selection Flag 1		Setting Range	Setting Unit	Default Value
		–	–	0000H
Description	Bit 0	Axis Selection Set whether or not there is a limit on controlled axis travel. 0: Finite length axis (default); The axis will have limited movement. The software limit function is enabled. 1: Infinite length axis; The axis will have unlimited movement. The software limit function is disabled. If an infinite length axis is set, the position information will be reset each time the position exceeds the value set for the Infinite Length Axis Reset Position (fixed parameter 10). • Set to 0 for linear type.		
	Bit 1	Soft Limit (Positive Direction) Enable/Disable Set whether or not to use the software limit function in the positive direction. Set the software limit as the Positive Software Limit Value (fixed parameter 12). This setting is disabled if the axis is set as an infinite length axis. The software limit function is enabled only after completing a Zero Point Return or Zero Point Setting operation (IW□□0C, bit 5 is ON). 0: Disabled (default) 1: Enabled • Refer to *11.3 Software Limit Function* on page 11-13 for details of the software limit function.		
	Bit 2	Soft Limit (Negative Direction) Enable/Disable Set whether or not to use the software limit function in the negative direction. Set the software limit as the Negative Software Limit Value (fixed parameter 14). This setting is disabled if the axis is set as an infinite length axis. The software limit function is enabled only after completing a Zero Point Return or Zero Point Setting operation (IW□□0C, bit 5 is ON). 0: Disabled (default) 1: Enabled • Refer to *11.3 Software Limit Function* on page 11-13 for details of the software limit function.		
	Bit 3	Overtravel Positive Direction Enable/Disable Set whether or not to use the overtravel detection function in the positive direction. A setting must also be made in the SERVOPACK. 0: Disabled (default) 1: Enabled • Refer to *11.2 Overtravel Function* on page 11-8 on details of the overtravel function.		
	Bit 4	Overtravel Negative Direction Enable/Disable Set whether or not to use the overtravel detection function in the negative direction. A setting must also be made in the SERVOPACK. 0: Disabled (default) 1: Enabled • Refer to *11.2 Overtravel Function* on page 11-8 for details of the overtravel function.		
	Bit 5	Deceleration LS Inversion Selection Set whether or not to invert the polarity of DI_5 signal that is used for DEC1. 0: Not invert (default) 1: Invert When it is set to 1, however, "Zero Point Return Deceleration LS Signal" (OW□□05, bit 8) will not be inverted.		
	Bit 7	Absolute Position Data Read-out at Power ON Set whether or not to execute reading of the data from the absolute encoder when the power turns ON and when the fixed parameters are saved. 0: Execute 1: Not execute When this bit is set to 1, "ABS Total Rev. Receive Error" is stored in the bit 21 of IL□□04. In this case, clear the alarm, and then read out the absolute data. • Refer to *11.4.2 Reading Absolute Data After Power is Turned ON* on page 11-16 and *11.4.3 Reading Absolute Data Online* on page 11-16 for details.		

<table>
<tr><td colspan="3" rowspan="2">No. 1
Function Selection Flag 1 (cont'd)</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>–</td><td>–</td><td>0000H</td></tr>
<tr><td>Description</td><td>Bit 9</td><td colspan="4">Simple ABS Rotary Pos. Mode
Set whether or not the infinite length position control function is used, on the condition that the number of turns that the encoder can count is a multiple of the number of turns corresponding to the reference unit reset frequency.
With this function, it is not necessary to save and load absolute infinite axis information, eliminating the need for a ladder program and thus simplifying handling. It is recommended that the ABS infinite length axis is set to Enabled.
0: Disabled (default)
1: Enabled
• Refer to 10.4.1 Simple Absolute Infinite Length Position Control on page 10-14 and 10.4.2 Parameters Setting for Simple Absolute Infinite Length Position Control on page 10-16 for details.
• Set to 0 for linear type.</td></tr>
</table>

(3) Function Selection 2

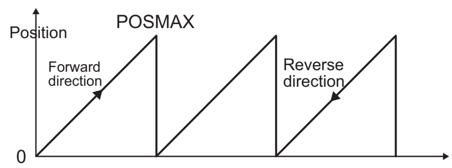
<table>
<tr><td colspan="3" rowspan="2">No. 2
Function Selection Flag 2</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>–</td><td>–</td><td>0000H</td></tr>
<tr><td rowspan="2">Description</td><td>Bit 3</td><td colspan="4">Analog Adjust Not Ready Mask
0: Disabled (default)
1: Enabled</td></tr>
<tr><td>Bit 4</td><td colspan="4">PG Wire Breaking Down Status Mask
Set whether or not to detect by hardware that the PG is not connected to the counter input pin in the General-purpose I/O Mode.
0: Disabled (default)
1: Enabled</td></tr>
</table>

(4) Reference Unit

<table>
<tr><td colspan="2" rowspan="2">No. 4
Reference Unit Selection</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>0 to 3</td><td>–</td><td>0</td></tr>
<tr><td>Description</td><td colspan="4">Set the unit for the reference.
The minimum reference unit is determined by this parameter and the Number of Digits Below Decimal Point setting (fixed parameter No.5). If pulse is selected, the Electronic Gear Ratio (fixed parameters 8 and 9) will be disabled.
0: pulse (electronic gear disabled)
1: mm
2: deg
3: inch
• Refer to 6.1.1 Reference Unit on page 6-2 for details.
• For linear type, either 0 (pulse) or 1 (mm) can be selected. If 2 (deg) or 3 (inch) is selected, the selected unit will be converted to mm.</td></tr>
</table>

<table>
<tr><td colspan="2" rowspan="2">No. 5
Number of Digits Below Decimal Point</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>0 to 5</td><td>–</td><td>3</td></tr>
<tr><td>Description</td><td colspan="4">Set the number of digits below the decimal point in the reference unit.
The minimum reference unit is determined by this parameter and the Reference Unit Selection (fixed parameter 4).
Example: When the Reference Unit is set to mm and the Number of Digits Below Decimal Point is set to 3, a reference unit of 1 will be 0.001 mm.
The setting of this parameter is disabled if the Reference Unit is set to pulse in fixed parameter 4.
• Refer to 6.1.1 Reference Unit on page 6-2 for details.</td></tr>
<tr><td colspan="2" rowspan="2">No. 6 (Rotary Motors)
Travel Distance per Motor Revolution</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>1 to 2^{31}-1</td><td>user units</td><td>10000</td></tr>
<tr><td>Description</td><td colspan="4">Specify the amount of travel in the load as the number of reference units for each turn of the load shaft.
• Refer to 6.1.2 Electronic Gear on page 6-2 for details.</td></tr>
<tr><td colspan="2" rowspan="2">No. 6 (Linear Motors)
Linear Scale Pitch</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>1 to 2^{31}-1</td><td>user units</td><td>10000</td></tr>
<tr><td>Description</td><td colspan="4">Set a value in accordance with the linear scale specifications.
• Refer to 6.1.8 Linear Scale Pitch and Rated Motor Speed on page 6-15 for details.</td></tr>
<tr><td colspan="2" rowspan="2">No. 8
Servo Motor Gear Ratio
No. 9
Machine Gear Ratio</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>1 to 65535</td><td>revs
(revolutions)</td><td>1</td></tr>
<tr><td>Description</td><td colspan="4">Set the gear ratio between the motor and the load.
The following two values are set for a configuration in which the load shaft will turn n times in response to m turns of the motor shaft.
• Gear ratio at Servomotor: m
• Gear ratio at load: n
The setting of this parameter is disabled if the Reference Unit is set to pulse in fixed parameter 4.
• Refer to 6.1.2 Electronic Gear on page 6-2 for details.
• Invalid for linear type.</td></tr>
</table>

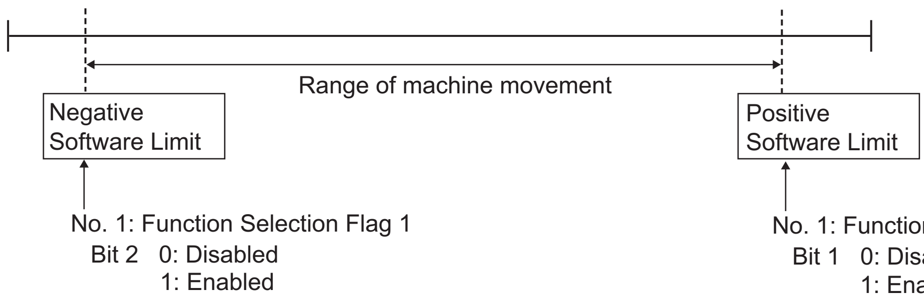
(5) Infinite Axis Reset Position

<table>
<tr><td colspan="2" rowspan="2">No. 10
Infinite Length Axis Reset Position</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>1 to 2^{31}-1</td><td>user units</td><td>360000</td></tr>
<tr><td>Description</td><td>Set the reset position when an infinite length axis is used.
Enabled when bit 0 of the Function Selection Flag 1 (fixed parameter 1) is set to infinite axis. The position data for infinite axes is controlled in the range from 0 to POSMAX.</td><td colspan="3">
</td></tr>
</table>

(6) Software Limits

No. 12 Positive Software Limit Value		Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	user units	$2^{31}-1$
Description	Set the position to be detected for the software limit in the positive direction at the Machine Controller. If an axis attempts to move in the positive direction past the position set here, a positive direction software limit alarm (IL□□04, bit 3) will occur. Enabled when the Soft Limit (Positive Direction) bit (fixed parameter 1, bit 1) is set to 1 (enabled).			
No. 14 Negative Software Limit Value		Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	user units	-2^{31}
Description	Set the position to be detected for the software limit in the negative direction at the Machine Controller. If an axis attempts to move in the negative direction past the position set here, a negative direction software limit alarm (IL□□04, bit 4) will occur. Enabled when the Soft Limit (Negative Direction) bit (fixed parameter 1, bit 2) is set to 1 (enabled).			

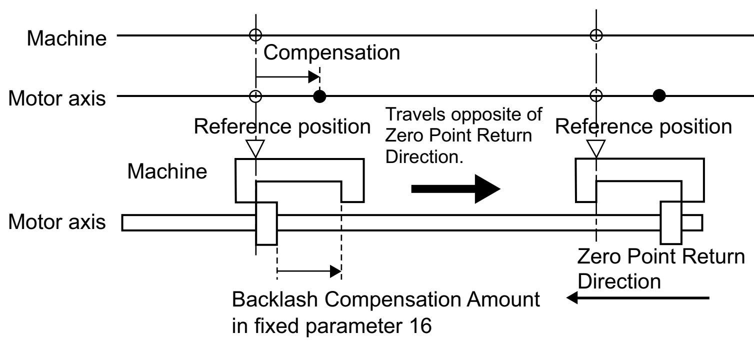
Outline of Software Limit



- The software limit function is enabled only after completing a Zero Point Return or Zero Point Setting operation (IW□□0C, bit 5 is ON).
- For details, refer to *11.3 Software Limit Function* on page 11-13.

(7) Backlash Compensation

No. 16 Backlash Compensation Amount		Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	user units	0
Description	Set the backlash compensation in reference units. Backlash compensation can not be performed by setting this parameter to 0. The backlash compensation is performed in the reverse direction of "Zero Point Return Direction Selection (setting parameter OW□□09, bit 3)". The backlash compensation is always performed in the direction determined by the setting of Zero Point Return Direction no matter if the zero point return method or zero point setting method that does not use the parameter "Zero Point Return Direction Selection" is selected. Note that the backlash compensation method of SVA-01 Module is slightly different from that of SVB Module. <Backlash Compensation Method>			



(8) Hardware Signal

No. 20 Hardware Signal Selection 1			Setting Range	Setting Unit	Default Value
			–	–	0000H
Description	Bit 0	A/B Pulse Input Signal Polarity Selection 0: Positive logic (default) 1: Negative logic			
	Bit 1	C Pulse Input Signal Polarity Selection 0: Positive logic (default) 1: Negative logic			

No. 21 Hardware Signal Selection 2			Setting Range	Setting Unit	Default Value
			–	–	0000H
Description	Bit 0	Deceleration LS Signal Selection Select a signal to be used for DEC1. 0: Use the setting parameter Zero Point Return Deceleration LS Signal (OW☐☐05, bit 8). (default) 1: Use DI_5 signal.			
	Bit 5	General-Purpose DO_2 Signal Selection In normal operation mode, set whether or not to use a general-purpose DO_2 signal as a general-purpose output signal. When setting this bit to 1 (Use as a general-purpose signal) and using the General-Purpose DO_2 bit (setting parameter OW☐☐5D,bit 2), the user can directly control the general-purpose DO_2 signal (pin No.12 of CN1/CN2). 0: Use as a system exclusive signal (default). 1: Use as a general-purpose signal. • The parameter settings of the SERVOPACK to be used are required when setting this bit to 1. Refer to *11.4.4 General-purpose DO_2 Signal Selection* on page 11-17 for details.			

(9) Pulse Count

No. 22 Pulse Counting Mode Selection		Setting Range	Setting Unit	Default Value
		0 to 6	–	6
Description	Select one of the following pulse count mode. 0: Sign mode ∗1 1: Sign mode ∗2 2: Up/Down mode ∗1 3: Up/Down mode ∗2 4: A/B mode ∗1 5: A/B mode ∗2 6: A/B mode ∗4 • Set to 6: A/B mode (∗4) when connecting SVA-01 Module to a SERVOPACK.			

(10) D/A Output

No. 23 D/A Output Voltage at 100% Speed		Setting Range	Setting Unit	Default Value
		1 to 10000	0.001 V	6000
Description	Set the D/A output voltage at 100% speed reference. Normally, set the servo drive input voltage at the rated speed. Set the value according to the specifications of servo drive to be used. D/A output value = Speed Reference Setting (OL☐☐10) × D/A Output Voltage at 100% Speed (fixed parameter no. 23)/10000 <Example> Where D/A Output Voltage at 100% Speed = 6V, and Speed Reference Setting (OL☐☐10) = 100% (10000 × 6 V)/10000 = 6 V. Therefore, 6 V is output.			

No. 24 D/A Output Voltage at 100% Torque Limit	Setting Range	Setting Unit	Default Value
	1 to 10000	0.001 V	3000

Description	Set the D/A output voltage at 100% torque limit reference (and torque limit at speed reference). Common for the positive and negative sides. Set the current limit value when using a SERVOPACK. D/A output value = Positive Side Limiting Torque/Thrust Setting at the Speed Reference (OL□□14) × D/A Output Voltage at 100% Torque Limit (fixed parameter no. 24)/10000 <Example> Where D/A Output Voltage at 100% Torque Limit = 3 V, and Positive Side Limiting Torque/Thrust Setting at the Speed Reference = 200%, (20000 × 3 V)/10000 = 6 V. Therefore, 6 V is output.

(11) A/D Input

No. 26 A/D Input Voltage at 100% Torque Monitor	Setting Range	Setting Unit	Default Value
	1 to 10000	0.001 V	3000

Description	Set the scaling value in units of 1 mV to convert the voltage input through the A/D converter to the torque monitor value (%). The torque monitor value is calculated as follows and stored in the monitoring parameter Feedback Torque/Thrust (IL□□42). Torque monitor value = (A/D input voltage × 10000)/A/D input voltage at 100% torque monitor (fixed parameter No. 26) <Example> Where A/D input voltage at 100% torque monitor = 3 V, and the actual A/D input voltage = 1.5 V, (1.5 V × 10000)/3V = 5000. Therefore, 5000 is stored in IL□□42.

(12) SERVOPACK Settings

No. 28 Servo Driver Type Selection	Setting Range	Setting Unit	Default Value
	0 to 2	–	1

Description	Set the series of servo drive that is being used. 0: Σ-I series 1: Σ-II, Σ-III, Σ-V, or Σ-7 series (default) 2: Reserved for system use

No. 30 Encoder Selection	Setting Range	Setting Unit	Default Value
	0 to 3	–	0

Description	Set the type of encoder that is being used. 0: Incremental encoder 1: Absolute encoder (default) 2: Absolute encoder (Incremental encoder is used.) 3: Reserved for system use • For linear motors, set the encoder type that matches the settings of the linear scale and SERVOPACK being used.

No. 31 Rotation Direction Selection with an Absolute Encoder	Setting Range	Setting Unit	Default Value
	0 or 1	–	0

Description	Set the rotation direction of absolute encoder. 0: Forward (default) 1: Reverse • Set to 1 when “Reverse Rotation Mode” is set in the SERVOPACK parameter* when using an absolute encoder applicable SERVOPACK. * For SGDA and SGDB SERVOPACKs, Cn02, bit 0 = 1 (Reverse rotation mode) For SGDM, SGDH, SGDS, SGDV, or SGD7S SERVOPACKs, Pn-000.0 = 1 (Reverse rotation mode) • Refer to *11.2.3 Rotation Direction Selection* on page 11-12 for details of reverse rotation setting of SERVOPACK parameter.

(13) Encoder Settings

	Setting Range	Setting Unit	Default Value
No. 34 (Rotary Motor) Rated Motor Speed	1 to 32000	min^{-1}	3000

Description	Set the rated motor speed in 1 min^{-1} units. Set this parameter based on the specifications of the motor that is used.

	Setting Range	Setting Unit	Default Value
No.34 (Linear Motor) Rated Speed	1 to 32000	0.1m/s, 0.1mm/s	3000

Description	Set the rated speed. Set the rated speed in accordance with the specifications of the linear servomotor to be used. • Refer to *6.1.8 Linear Scale Pitch and Rated Motor Speed* on page 6-15 for details.

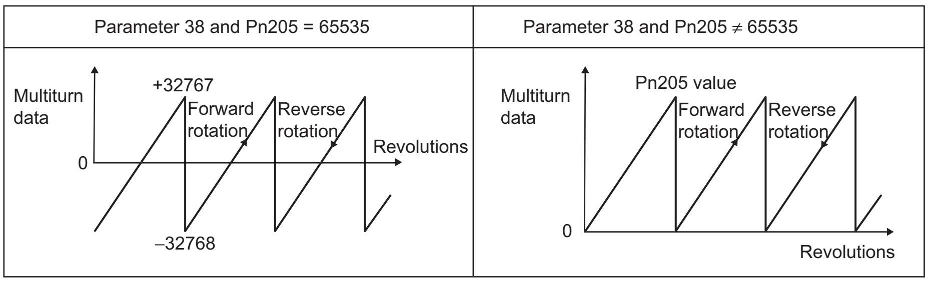
	Setting Range	Setting Unit	Default Value
No. 36 (Rotary Motor) Number of Pulses per Motor Rotation	1 to $2^{31}-1$	pulse	16384

Description	Set the number of feedback pulses per motor rotation. Set the value before multiplication to match the specifications of the motor used. (For example, if a 16-bit encoder is used, set 2^{14} = 16384.) When using the SVA-01 Module in combination with a SGDM, SGDH, SGDS, SGDV, or SGD7S SERVOPACK, set the value in accordance with the SERVOPACK PG dividing ratio: Parameter Pn201 or Pn212 for SGDM, Pn201 for SGDH, and Pn212 for SGDS, SGDV, and SGD7S SERVOPACKs.

	Setting Range	Setting Unit	Default Value
No.36 (Linear Motor) Number of Pulses per Linear Scale Pitch	1 to 2^{31}-1	pulses/scale pitch	65536

Description	Set the number of pulses equivalent to the value set for No.6: Linear Scale Pitch. Set the value in accordance with the specifications of the linear motor to be used. • Refer to *6.1.8 Linear Scale Pitch and Rated Motor Speed* on page 6-15 for details.

	Setting Range	Setting Unit	Default Value
No. 38 Maximum Number of Absolute Encoder Turns Rotation	1 to $2^{31}-1$	revs	65534

Description	Set the maximum number of rotations for the absolute encoder to the highest number that the encoder can manage. Set this parameter to match the settings of the encoder being used. • Σ-I series: Set to 99999 (fixed). • Σ-II, Σ-III, Σ-V, or Σ-7 Series: Set to the same value as the multiturn limit in the SERVOPACK. <Example> For axes set as infinite axes (bit 0 of fixed parameter Function Selection Flag 1 set to 1), set to 65534 max. (same value as Pn205). Finite Axes / Infinite Axes  This parameter is used to manage position information when an absolute encoder is used as an infinite length axis.

	Setting Range	Setting Unit	Default Value
No. 42 Feedback Speed Movement Averaging Time Constant	0 to 32	ms	10

Description	Set the moving average time constant for the feedback speed. The feedback speed is obtained by converting the unit of the difference between feedback pulse inputs in one control cycle and the next control cycle. To avoid the scattering of the values caused by quantization error, a moving average can be applied to the calculation of feedback speed. In the parameter Feedback Speed (monitoring parameter IL□□40), the value obtained by applying the moving average for the time constant set in this parameter to the feedback position of each scan is stored.

5.4.2 Motion Setting Parameter Details

The following tables provide details of motion setting parameters.

- Refer to *5.3.2 Setting Parameter List* on page 5-8 for a list of the motion setting parameters.
- Register number “OW□□00” indicates the leading output register number + 00. Other register numbers listed below indicate output register numbers in the same way. Refer to *5.1.1 Motion Parameter Register Numbers for MP2000 Series Machine Controllers* on page 5-2 for information on how to find the leading output register number.
- Position Phase Speed Torque in the following descriptions indicate that parameter is enabled in position control, phase control, speed control, or torque control. Similarly, Position Phase Speed Torque in the following descriptions indicate that parameter is disabled in position control, phase control, speed control, or torque control.
  The table below shows the relationship between each control mode and motion command.

Control Mode	Motion Command (OW□□08)	
Position Control	0: NOP	No command
	1: POSING	Positioning
	2: EX_POSING	External positioning
	3: ZRET	Zero point return
	4: INTERPOLATE	Interpolation
	5: ENDOF_INTERPOLATE	For system use
	6: LATCH	Interpolation with latch function
	7: FEED	JOG operation
	8: STEP	STEP operation
Phase Control	25: PHASE	Phase reference
Speed Control	23: VELO	Speed reference
Torque Control	24: TRQ	Torque reference

(1) RUN Commands

OW□□00 RUN Command Setting		Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
			–	–	0000H
Description	Bit 0	Servo ON Sends a SERVO ON command to the SERVOPACK. 0: Servo OFF (default) 1: Servo ON			
	Bit 1	Machine Lock 0: OFF (default) 1: ON During the machine lock mode, the Calculated Position in Machine Coordinate System (CPOS) (monitoring parameter IL□□10) will be updated but no movement will occur on the axis. A change in the machine lock mode is valid after all pulses have been distributed. The machine lock mode cannot be changed during speed or torque control.			

OW□□00 RUN Command Setting (cont'd)	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		–	–	0000H

Description	Bit 4	Latch Detection Demand 0: OFF (default) 1: ON When this bit is set to 1 (Latch Request ON), the position at the moment the latch signal turns ON will be reported to the monitoring parameter IL□□18 "Machine Coordinate System Latch Position." When the position is detected and reported, bit 2 "Latch Completed" of the monitoring parameter IW□□0C "Position Management Status" will turn ON. To detect the position again, reset this bit to 0 (OFF) and then set to 1 (ON) again. Use bits 0 to 3 (Latch Detection Signal Selection) of the setting parameter OW□□04 (Function Setting 2) to set the latch signal to be used. • Do not set this bit to 1 (ON) while the motion commands "Zero Point Return," "External Positioning," or "Latch" are being executed. Otherwise, a warning may occur in the SERVOPACK. • Refer to *11.4.1 Modal Latch Function* on page 11-15 for details of the latch function.
	Bit 5	Absolute Position Reading Demand 0: OFF (default) 1: ON Setting this bit to 1 (ON) allows the ladder program to start reading absolute data (at the rising edge). Reading will be executed twice maximum, including one retry. • Refer to *11.4.3 Reading Absolute Data Online* on page 11-16 for details.
	Bit 6	POSMAX Turn Number Presetting Demand 0: OFF (default) 1: ON Preset the Number of POSMAX Turns (monitoring parameter IL□□1E) to the value set for the Number of POSMAX Turns Presetting Data (setting parameter OL□□4C). • Set to 0 for linear type.
	Bit 7	Request ABS Rotary Pos. Load When an infinite length axis is used with an absolute encoder, this bit can be set to 1 to reset the position information with the data (encoder position and pulse position) that was set when the power was last turned OFF. When processing has been completed for this bit, the ABS Rotary Pos. LOAD Complete bit will be turned ON in the Position Management Status (monitoring parameter IW□□0C, bit 8). 0: OFF (default) 1: ON • Refer to *10.4.6 (4) [b] Turning the System Back ON (Turning the Servo Back ON)* on page 10-26 for details. • Set to 0 for linear type.
	Bit B	Integration Reset 0: OFF (default) 1: ON Setting this bit to 1 (ON) will reset the position loop integral items for the SERVOPACK.
	Bit F	Alarm Clear 0: OFF (default) 1: ON At the rising edge of this bit, an alarm is cleared. Additionally, turns ON the /ALMRST signal connected to the SERVOPACK to clear the SERVOPACK alarm. • The following alarm and warning cannot be cleared by Alarm Clear. Remove the cause of the alarm. IW□□02, bit 2: Fixed Parameter Error IW□□04, bit 15: ABS Total Rev. Receive Error • Do not execute Alarm Clear during axis movement using motion commands. Using Alarm Clear may affect axis movement.

(2) Mode 1

OW□□01 Mode Setting 1 (Position, Phase, Speed, Torque)		Setting Range	Setting Unit	Default Value
		–	–	0000H
Description	Bit 0	Excessive Deviation Error Level Setting Set whether excessively following errors are treated as warnings or as alarms. 0: Alarm (default): Axis stops operating when an excessively following error is detected. 1: Warning: Axis continues to operate even if an excessively following error is detected. When the absolute value of deviation amount > 40000000H, Excessive Deviation alarm (IW□□04, bit 9) will occur and the execution of motion command will be ended in error regardless of the setting of this bit. ■ Related Parameters OL□□22: Error Count Alarm Detection IL□□02, bit 0: Warning (Excessive Deviation) IL□□04, bit 9: Alarm (Excessive Deviation)		
	Bit 2	Speed Compen. in Pos. Mode Set whether or not to enable the speed compensation during position control. 0: Disabled (default) 1: Enabled Setting this bit to 1 (Enabled) will validate the following two speed compensation values. ・ OW□□31: Speed compensation ・ OL□□16: Secondly speed compensation		

(3) Function 1

OW□□03 Function Setting 1 (Position, Phase, Speed, Torque)		Setting Range	Setting Unit	Default Value
		–	–	0011H
Description	Bit 0 to Bit 3	Speed Unit Selection Set the unit for speed references. 0: Reference unit/s 1: 10^n reference unit/min (default) (n = number of decimal places/fixed parameter 5) 2: 0.01% 3: 0.0001% • Refer to *6.1.5 Speed Reference* on page 6-9 for setting examples when also setting of the combination with the number of digits below the decimal point.		
	Bit 4 to Bit 7	Acceleration/Deceleration Unit Selection Set whether to specify acceleration/deceleration rates (reference unit/s^2) or acceleration/deceleration time constants (ms) for acceleration/deceleration commands. 0: Reference units/s^2 1: ms (default)		
	Bit 8 to Bit B	Filter Type Selection Set the acceleration/deceleration filter type. 0: Filter none (default) 1: Exponential acceleration/deceleration filter 2: Moving average filter		
	Bit C to Bit F	Torque Unit Selection Set the unit for torque reference as a percentage of rated torque. 0: 0.01% (default) 1: 0.0001% • The unit for torque reference indicates the torque reference resolution, but not guarantees the torque accuracy.		

Motion Parameters

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(4) Function 2

OW□□04 Function Setting 2		Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
			–	–	0000H
Description	Bit 0 to Bit 3	Latch Detection Signal Selection Set the latch signal type. 0: DI_5 (DEC/EXT) (default) 1: DI_2 (ZERO/HOMELS) 2: Phase-C pulse input signal • This setting is enabled when Latch command is executed.			
	Bit 4 to Bit 7	External Positioning Signal Setting Set the external signal for external positioning. 0: DI_5 (DEC/EXT) (default) 1: DI_2 (ZERO/HOMELS) 2: Phase-C pulse input signal			

(5) Function 3

OW□□05 Function Setting 3		Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
			–	–	0000H
Description	Bit 1	Phase Reference Creation Calculation Disable Set whether to disable or enable phase reference generation processing when executing phase reference commands. 0: Enabled (default) 1: Disabled Enable this processing when an electronic shaft is being used. Disable the processing when an electronic cam is being used.			
	Bit 8	Zero Point Return Deceleration LS Signal This bit functions as the LS signal when the bit 0 of fixed parameter No. 21 (Deceleration LS Signal Selection) is set to 0. 0: OFF (default) 1: ON			
	Bit 9	Zero Point Return Reverse Run Side Limit Signal This bit is used to input the reverse limit signal for zero point return. 0: OFF (default) 1: ON			
	Bit A	Zero Point Return Forward Run Side Limit Signal This bit is used to input the forward limit signal for zero point return. 0: OFF (default) 1: ON			
	Bit B	Zero Point Return Input Signal This bit functions as the INPUT signal when the INPUT & C pulse method or INPUT Only method is being used for the Zero Point Return operation. 0: OFF (default) 1: ON			

(6) Motion Commands

OW□□08 Motion Command	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		0 to 25	–	0

Description	Set motion command. 0: NOP — No Command 1: POSING — Position Mode (Positioning) 2: EX_POSING — Latch Target Positioning (External Positioning) 3: ZRET — Zero Point Return 4: INTERPOLATE — Interpolation 5: ENDOF_ INTERPOLATE — Reserved for system use. 6: LATCH — Interpolation Mode with Latch Input 7: FEED — JOG Mode 8: STEP — Relative Position Mode (Step Mode) 9: ZSET — Set Zero Point 23: VELO — Speed Reference 24: TRQ — Torque Reference 25: PHASE — Phase Reference

(7) Motion Command Control Flags

OW□□09 Motion Command Control Flag	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		–	–	0000H

Description	Bit 0	Holds a Command 0: OFF (default) 1: ON The axis will decelerate to a stop if this bit is changed to 1 while an axis is moving during positioning, external positioning, STEP operation, or speed reference. While this bit is 1, the command is held. When this bit is changed to 0, the hold is canceled and positioning restarts. After the axis has been stopped, the Command Hold Completed bit will turn ON in the Motion Command Status (monitoring parameter IW□□09, bit 1).
	Bit 1	Interrupt a Command 0: OFF (default) 1: ON The axis will decelerate to a stop if this bit is changed to 1 while an axis is moving during positioning, external positioning, zero point return, JOG operation, STEP operation, speed reference, or torque reference, and the remaining movement will be canceled.
	Bit 2	Moving Direction (JOG/STEP) Set the movement direction for JOG or STEP. 0: Forward (default) 1: Reverse
	Bit 3	Zero Point Return Direction Selection Set the direction to move for zero point return. This setting is valid for zero point returns using DEC1 + C, ZERO, DEC1 + ZERO, or phase-C. 0: Reverse (default) 1: Forward
	Bit 4	Latch Zone Effective Selection Disable/enable the area where the external signal is valid for external positioning (called the latch zone). 0: Disabled (default) 1: Enabled Always disable this bit when sending latch commands (latch, zero point return) other than those for external positioning. ■ Related Parameters OL□□2A: Latch Zone Lower Limit Setting OL□□2C: Latch Zone Upper Limit Setting
	Bit 5	Position Reference Type Specify whether the value set for the Position Reference Setting (setting parameter OL□□1C) is an Incremental Addition Mode value (calculated by adding the movement amount to the current position) or an Absolute Mode value (an absolute position). 0: Incremental value add method (default) 1: Absolute value set method Always set this bit to Incremental Addition Mode when using motion programs or infinite axes. For details, refer to *6.1.2 (2) Parameter Setting Example Using Rotating Table* on page 6-3.

<table>
<tr><td colspan="2" rowspan="2">OW□□09
Motion Command Control Flag (cont'd)</td><td rowspan="2">Position Phase
Speed Torque</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>–</td><td>–</td><td>0000H</td></tr>
<tr><td>Description</td><td>Bit 6</td><td colspan="4">Phase Compensation Type (Valid with SVA-01 version 1.01 or later)
Select a setting method for Phase Correct Setting (OL□□28).
0: Incremental value add method (default)
1: Absolute value set method
This bit is valid when the electronic cam function is enabled (setting: OW□□05, bit 1 = 1).
If using an electronic shaft (OW□□05, bit 1 = 0), the incremental value of Phase Correct Setting (OL□□28), which is the difference between the values from the previous H scan and the current H scan, is added to the target position regardless of the setting of this bit.
■ Precautions if using as an electronic cam (OW□□05, bit 1 = 1)
• If Absolute value 1 is selected for the Phase Compensation Type when using an electronic cam, always take measures to prevent a sudden and extreme change in the target position before executing the move command. For example, set the Phase Correct Setting (OL□□28) to the same value as CPOS for 32 bit (DPOS) (IL□□14). If preventive measures are not taken, the axis may abruptly move, resulting in a serious situation.
• If using the electronic cam function, do not change the setting of this bit while the move command is being executed. Although the setting of this bit can be changed at any time, changing the setting while the move command is being executed may move the axis abruptly, resulting in serious situation.
■ Precautions if using as an electronic shaft (OW□□05, bit 1 = 0)
• The setting method of Phase Correct Setting (OL□□28) for the SVA-01 Module and that for the SVB/SVB-01 Modules are different. For the SVA-01 Module, the set value of Phase Correct Setting (OL□□28) is simply added to the target position.</td></tr>
</table>

(8) Motion Subcommands

<table>
<tr><td rowspan="2">OW□□0A
Motion Subcommand</td><td rowspan="2">Position Phase
Speed Torque</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>0 to 5</td><td>–</td><td>0</td></tr>
<tr><td>Description</td><td colspan="4">Set the motion subcommands that can be used with the motion command.
0: NOP No Command
5: FIXPRM_RD Read Fixed Parameter</td></tr>
</table>

(9) Torque Reference

Parameter	Control Mode	Setting Range	Setting Unit	Default Value
OL□□0C Torque/Thrust Reference Setting	Position Phase Speed Torque	-2^{31} to $2^{31}-1$	Depends on the torque unit set in Function Setting 1 (setting parameter OW□□03, bits C to F).	0

Description

Set the torque reference for torque reference command (TRQ).

Refer to *7.2.10 Torque Reference (TRQ)* on page 7-77 for details.

- The setting unit for this parameter depends on the Torque Unit Selection (OW□□03, bits C to F), but the result of applying the torque unit setting is not shown here.

Parameter	Control Mode	Setting Range	Setting Unit	Default Value
OW□□0E Speed Limit Setting at the Torque/ Thrust Reference	Position Phase Speed Torque	–32768 to 32767	0.01%	15000

Description

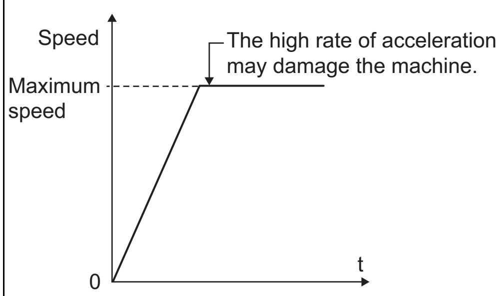
Set the speed limit for torque references as a percentage of the rated speed.

Torque control is used to control the Servomotor to output the specified torque, so it does not control the motor speed. Therefore, when an excessive reference torque is set relative to the load torque of the machine, the machine’s torque is overpowered by the torque reference and the motor speed rapidly increases.

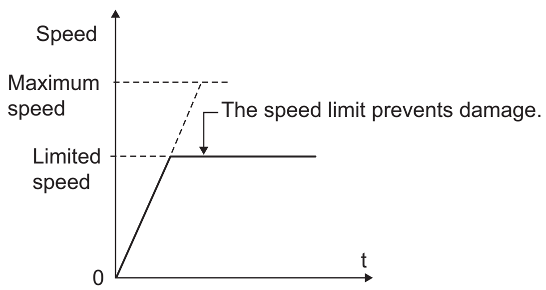
The torque reference speed limit functions to limit the Servomotor speed during torque control to protect the machine.

- The setting is enabled when a torque reference command is executed.

<No speed limit>



<Speed limit used>



■ Related Parameters

For SGDH, SGDM, SGDS, SGDV, and SGD7S SERVOPACKs

- Pn002.1
- Pn407
- Pn408.1
- Pn300

For SGDA and SGDB SERVOPACKs:

- Cn-02, bit 2
- Cn-14
- \-
- Cn-03

Parameter	Control Mode	Setting Range	Setting Unit	Default Value
OW□□0F Torque Reference 1st-order Lag Filter	Position Phase Speed Torque	0 to 32767	ms	0

Description

The primary lag filter can apply to the torque reference and torque limit.

The torque reference primary lag filter set value can be cleared to 0 (zero) at the following timings.

- When the command in execution is switched from a motion command to TRQ command.
- When the command in execution is switched from TRQ command to another command.

(10) Speed Reference

		Setting Range	Setting Unit	Default Value
OL□□10 Speed Reference Setting	Position Phase Speed Torque	-2^{31} to $2^{31}-1$	Depends on the speed unit set in Function Setting 1 (setting parameter OW□□03, bits 0 to 3).	3000
Description	Set the speed reference. This parameter is used by the following motion commands. Refer to *Chapter 7 Motion Commands* on page 7-1 for details. 1: POSING Positioning 2: EX_POSING External Positioning 3: ZRET Zero Point Return 7: FEED JOG operation 8: STEP STEP operation 23: VELO Speed Reference 25: PHASE Phase Reference • The setting unit for this parameter depends on the Speed Unit Selection (OW□□03, bits 0 to 3), but the result of applying the speed unit setting is not shown here.			

		Setting Range	Setting Unit	Default Value
OW□□12 Positive Side Speed Limiter Value	Position Phase Speed Torque	0 to 32767	0.01%	15000
Description	Specify the positive speed upper limit as a percentage of rated speed.			
OW□□13 Negative Side Speed Limiter Value	Position Phase Speed Torque	0 to 32767	0.01%	15000
Description	Specify the negative speed upper limit as a percentage of rated speed			

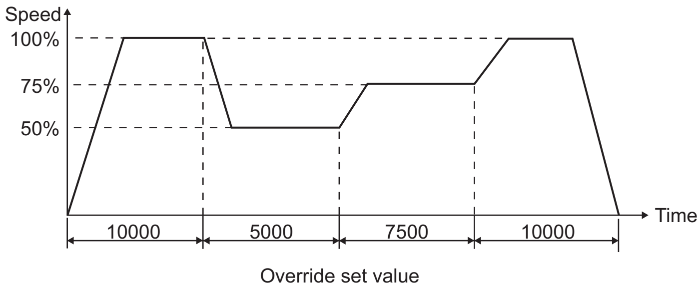
(11) Torque/Thrust Limit Setting at the Speed Reference

		Setting Range	Setting Unit	Default Value
OL□□14 Positive Side Limiting Torque/Thrust Limit Setting at the Speed Reference	Position Phase Speed Torque	-2^{31} to $2^{31}-1$	Depends on the torque unit set in Function Setting 1 (setting parameter OW□□03, bits C to F).	30000
Description	The value set in this parameter is output as the torque limit except when Torque Reference command TRQ is executed. This parameter is used when a torque limit is required at specific timing during operation of the machine, such as applications for pushing a load to stop it or holding a workpiece. • The setting unit for this parameter depends on the Torque Unit Selection (OW□□03, bits C to F), but the result of applying the torque unit setting is not shown here.			

(12) Secondly Speed Compensation

		Setting Range	Setting Unit	Default Value
OL□□16 Secondly Speed Compensation	Position Phase Speed Torque	-2^{31} to $2^{31}-1$	Depends on the speed unit set in Function Setting 1 (setting parameter OW□□03, bits 0 to 3).	0
Description	Set the speed feed forward amount for execution of Positioning (POSING), External Positioning (EX_POSING), Latch (LATCH), Zero Point Return (ZRET), JOG operation (FEED), and STEP operation (STEP) motion commands. The setting unit for Speed Compensation (setting parameter OW□□31) is 0.01% fixed. The unit for this parameter, however, can be selected using Speed Unit Selection. When used at the same time as OW□□31, speed compensation can be performed twice. • The setting unit for this parameter depends on the Speed Unit Selection (OW□□03, bits 0 to 3), but the result of applying the speed unit setting is not shown here.			

(13) Speed Override

OW□□18 Override	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		0 to 32767	0.01%	10000
Description	Set the percentage of the Speed Reference Setting (OL□□10) to output in units of 0.01%. • The override value is always enabled. Set to 10000 (fixed) when not using the override function. Speed Reference Setting (OL□□10) × Override (OW□□18) = Output speed This parameter can be changed at any time to any value during execution of speed reference, and acceleration/deceleration is performed immediately according to the set value.  When the speed override is set to 0, the output speed is 0 and the motor will not operate.			

(14) General-purpose AO

OW□□1A General-purpose AO1	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		−10000 to +10000	0.001 V	0
Description	The analog data set in this parameter is output. This parameter is valid only in general-purpose I/O mode.			

OW□□1B General-purpose AO2	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		−10000 to +10000	0.001 V	0
Description	The analog data set in this parameter is output. This parameter is valid only in general-purpose I/O mode.			

(15) Position Reference Setting

OL□□1C Position Reference Setting	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	Reference unit	0
Description	Set the position reference. This parameter is used for the following motion commands. 1: POSING Positioning 2: EX_POSING External Positioning 4: INTERPOLATE Interpolation 6: LATCH Latch ■ Related Parameters OW□□09, bit 5: Position Reference Type			

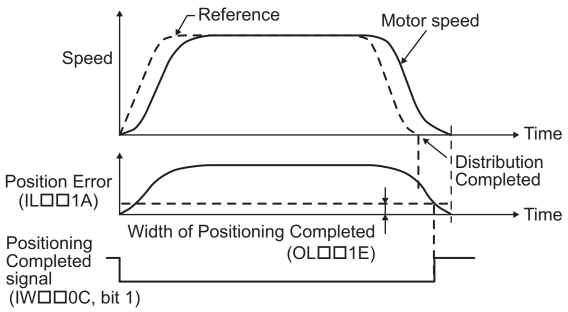
(16) Positioning Completed Width

OL□□1E Width of Positioning Completed	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		0 to 65535	Reference unit	100

Description

The Positioning Completed signal (IW□□0C, bit 1) turns ON when the absolute value of the difference between the reference position and the feedback position is less than the value set here after completion of position reference distribution during position control.

Set values that are appropriate for all machines in the system. If the value is too small, a long time will be required for positioning to complete.



■ Related Parameters

Fixed Parameter 4: Reference Unit Selection
Fixed Parameter 5: Number of Digits Below Decimal Point
Fixed Parameter 6: Travel Distance per Motor Revolution
Fixed Parameter 8: Servo Motor Gear Ratio
Fixed Parameter 9: Machine Gear Ratio
OW□□2E: Position Loop Gain
IW□□0C, bit 0: Discharging Completed (DEN)
IW□□0C, bit 1: Positioning Completed (POSCOMP)

(17) NEAR Signal Output Width

OL□□20 NEAR Signal Output Width	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		0 to 65535	Reference unit	0

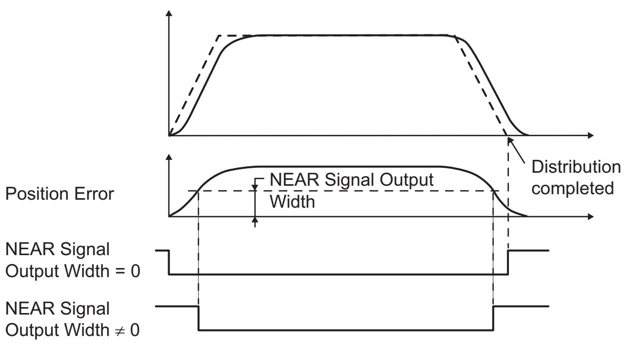
Description

NEAR Position (IW□□0C, bit 3) turns ON when the absolute value of the difference between the command position and the feedback position is less than the value set here.

If the NEAR Signal Output Width is set to 0, the NEAR Position bit (monitoring parameter IW□□0C, bit 3) will be turned ON when reference pulses have been distributed. (monitoring parameter IW□□0C, bit 0).

If the NEAR Signal Output Width is set to a value other than 0, this bit will be turned ON when the result of subtracting the Machine Coordinate System Feedback Position (monitoring parameter IL□□16) from the Machine Coordinate System Reference Position (monitoring parameter IL□□12) is less than the NEAR Signal Output Width, even if the reference pulses have not been distributed.

This parameter has no relation to the SERVOPACK parameter Position Proximity (NEAR) Signal Width.



■ Related Parameter

IW□□0C, bit 3: NEAR Position

(18) Deviation Abnormal Detection Value

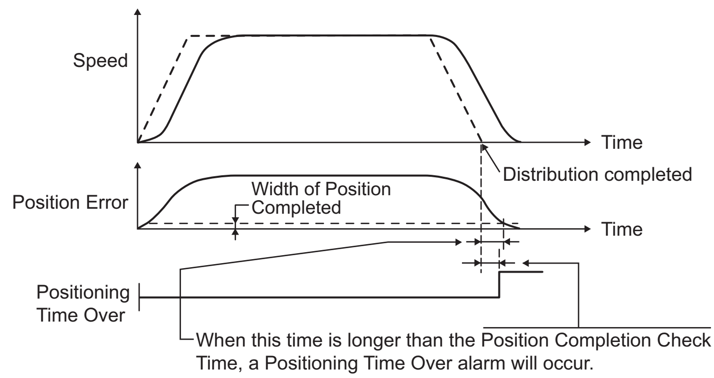
OL□□22 Error Count Alarm Detection	Position / Phase / Speed / Torque	Setting Range	Setting Unit	Default Value
		0 to $2^{31}-1$	Reference unit	$2^{31}-1$
Description	Set the value to detect an excessively following error during position control. The Excessive Deviation bit (IW□□04, bit 9) turns ON if the result from subtracting the Machine Coordinate System Feedback Position (monitoring parameter IL□□16) from the Machine Coordinate System Reference Position (monitoring parameter IL□□12) is greater than the NEAR Signal Output Width. An excessively following error will not be detected if this value is set to 0. ■ Related Parameters An excessively following error can be set to be treated either as a warning or as an alarm in the Excessive Deviation Error Level Setting in Mode Setting 1 (setting parameter OW□□01, bit 0). OW□□01, bit 0 = 0: Alarm (default) (stops axis operation) OW□□01, bit 0 = 1: Warning (continues axis operation)			

(19) Position Compensation

OL□□24 Position Correction Setting	Position / Phase / Speed / Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	Reference unit	0
Description	Set the position compensation amount in reference units.			

(20) Position Complete Timeout

OW□□26 Position Completion Check Time	Position / Phase / Speed / Torque	Setting Range	Setting Unit	Default Value
		0 to 65535	ms	0
Description	Set the time to detect a positioning time over error. If the Positioning Completed bit does not turn ON within the time set here after reference pulses have been distributed during position control, a Positioning Time Over alarm (monitoring parameter IL□□04, bit 6) will occur. The completion of positioning will not be checked if this parameter is set to 0.			



(21) Phase Compensation

OL□□28 Phase Correction Setting	Position / Phase / Speed / Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	Reference unit	0
Description	Set the phase compensation in reference units for phase reference commands. <Using as Electronic Shaft> Use this parameter to compensate for reference pulses in control systems without rigidity, in which higher gain cannot be applied. <Using as Electronic Cam> Use this parameter as the target position for the cam pattern with incremental addition. • Refer to *7.2.11 Phase References (PHASE)* on page 7-81 for details on phase reference commands.			

Motion Parameters

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(22) Latch

OL□□2A Latch Zone Lower Limit Setting	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	Reference unit	-2^{31}
Description	Set the range in which the latch signal is valid (position from the zero position) for external positioning.			

OL□□2C Latch Zone Upper Limit Setting	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	Reference unit	$2^{31}-1$
Description	Same as for OL□□2A.			

(23) Gain and Bias Settings

OW□□2E Position Loop Gain	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		0 to 32767	0.1/s	300
Description	Determine the responsiveness for the SERVOPACK's position loop. If the position loop gain is set high, the responsiveness is high and the positioning time is short. Set the optimum value for the machine rigidity, inertia, and type of Servomotor.			

OW□□30 Speed Feedforward Amends	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		0 to 32767	0.01%	0
Description	Reduces positioning time by applying feed forward compensation. This setting is effective for positioning control commands. Always set this parameter to 0 for phase control.			

OW□□31 Speed Compensation	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		−32768 to 32767	0.01%	0
Description	Set the speed feed forward gain as a percentage of the rated speed for the phase reference (PHASE) commands. The setting unit for this parameter is 0.01% (fixed). • Secondly Speed Compensation (OL□□16) can be used with the phase reference command (PHASE), and the unit can be selected for OL□□16. When used at the same time as OL□□16, speed compensation can be applied twice.			

OW□□32 Position Integration Time Constant	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		0 to 32767	ms	0
Description	Set the position loop integration time constant. Use this parameter to improve the following precision in applications such as electronic cams or shafts. Setting this parameter to 0 clears the integral elements in the position control loop during position control and phase control.			

OW□□33 1st-order Lag Time Constant	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		0 to 32767	ms	0
Description	Set the primary lag time constant (1 = 1ms) for position loop. When this parameter is set to 0, the primary lag calculation will not be performed. This parameter is used in position control mode or zero point return mode. • Setting the primary lag time constant may cause vibration. Set this parameter to 0 unless it is absolutely necessary.			

(24) Acceleration/Deceleration Settings

OL□□36 Straight Line Acceleration/Acceleration Time Constant (Position, Phase, Speed, Torque)	Setting Range	Setting Unit	Default Value
	0 to $2^{31}-1$	Depends on the acceleration/ deceleration unit set in Function Setting 1 (setting parameter OW□□03, bits 4 to 7).	0
Description	Set the linear acceleration rate or linear acceleration time constant. • The setting unit for this parameter depends on the Acceleration/Deceleration Degree Unit Selection (OW□□03, bits 4 to 7), but the result of applying the acceleration/deceleration unit setting is not shown here.		

OL□□38 Straight Line Deceleration/Deceleration Time Constant (Position, Phase, Speed, Torque)	Setting Range	Setting Unit	Default Value
	0 to $2^{31}-1$	Depends on the acceleration/ deceleration unit set in Function Setting 1 (setting parameter OW□□03, bits 4 to 7).	0
Description	Set the linear deceleration rate or linear deceleration time constant. • The setting unit for this parameter depends on the Acceleration/Deceleration Degree Unit Selection (OW□□03, bits 4 to 7), but the result of applying the acceleration/deceleration unit setting is not shown here.		

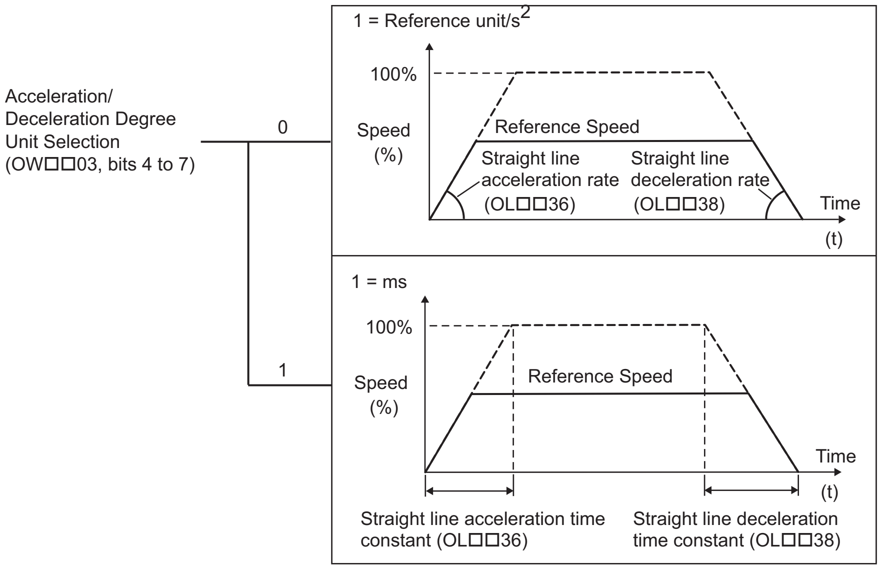
The following two methods can be used to specify the acceleration/deceleration speed.

1. Setting the acceleration/deceleration speed

Set the speed within the range from 0 to 2147483647 reference units/s^2.
When 0 or a negative value is set, the setting parameter warning will be generated and the axis will move at the minimum acceleration or minimum deceleration speed.

2. Setting the time to reach the rated speed from zero speed.

Set the time within the range from 0 to 32767 ms.
When a negative value is set, the setting parameter warning will be generated and the axis will move as it does when 0 is set.



• For details on each acceleration/deceleration parameter, refer to *6.1.6 Acceleration/Deceleration Settings* on page 6-11 and *6.1.7 Acceleration/Deceleration Filter Settings* on page 6-13.

(25) Filter

<table>
<tr><td colspan="2" rowspan="2">OW□□3A
Filter Time Constant</td><td rowspan="2">Position Phase
Speed Torque</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>0 to 65535</td><td>0.1 ms</td><td>0</td></tr>
<tr><td>Description</td><td colspan="5">Set the acceleration/deceleration filter time constant.
Always make sure that pulse distribution has been completed (i.e., that monitoring parameter IW□□0C, bit 0 is ON) before changing the time constant.
First, select the filter type by using the parameter Filter Type Selection (OW□□03, bits 8 to B), and then change the filter time constant.
Once the filter type is set using the motion command, the setting is held until the power is turned OFF or the filter type is changed.</td></tr>
<tr><td colspan="2" rowspan="2">OW□□3B
Bias Speed for Index Acceleration/Deceleration Filter</td><td rowspan="2">Position Phase
Speed Torque</td><td>Setting Range</td><td>Setting Unit</td><td>Default Value</td></tr>
<tr><td>0 to 32767</td><td>Depends on the speed unit set in Function Setting 1 (setting parameter OW□□03, bits 0 to 3)</td><td>0</td></tr>
<tr><td>Description</td><td colspan="5">Set the bias speed for the exponential acceleration/deceleration filter.
• The setting unit for this parameter depends on the Speed Unit Selection (OW□□03, bits 0 to 3), but the result of applying the speed unit setting is not shown here.</td></tr>
</table>

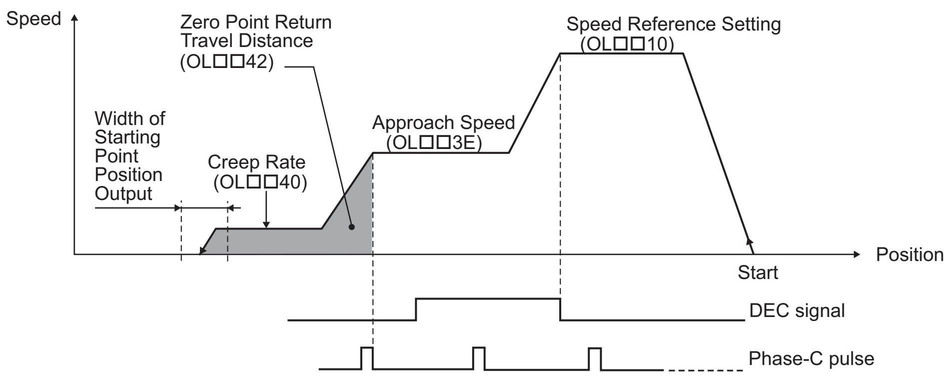
- There are two types of acceleration/deceleration filter: an exponential acceleration/deceleration filter and a moving average filter.
- For details on each acceleration/deceleration parameter, refer to *6.1.6 Acceleration/Deceleration Settings* on page 6-11 and *6.1.7 Acceleration/Deceleration Filter Settings* on page 6-13.

(26) Zero Point Return

		Setting Range	Setting Unit	Default Value
OW□□3C Zero Point Return Method	Position Phase Speed Torque	0 to 19	–	0
Description	Set the operation method when the Zero Point Return (ZRET) motion command is executed. With an incremental encoder, there are 17 different methods that can be performed for the Zero Point Return operation. • Refer to *7.2.3 Zero Point Return (ZRET)* on page 7-15 for information on each method. With an absolute encoder, the axis is returned to the zero point of the machine coordinate system regardless of which method is being used.			
OW□□3D Width of Starting Point Position Output	Position Phase Speed Torque	0 to 65535	Reference unit	100
Description	Set the width in which the Zero Point Position bit (monitoring parameter IW□□0C, bit4) will be ON.			
OL□□3E Approach Speed	Position Phase Speed Torque	-2^{31} to $2^{31}-1$	Depends on the speed unit set in Function Setting 1 (setting parameter OW□□03, bits 0 to 3)	1000
Description	Set the approach speed for a zero point return operation after the deceleration LS is passed. • The setting unit for this parameter depends on the Speed Unit Selection (OW□□03, bits 0 to 3), but the result of applying the speed unit setting is not shown here.			
OL□□40 Creep Rate	Position Phase Speed Torque	-2^{31} to $2^{31}-1$	Depends on the speed unit set in Function Setting 1 (setting parameter OW□□03, bits 0 to 3)	500
Description	Set the creep speed for a zero point return operation after the ZERO signal is detected. • The setting unit for this parameter depends on the Speed Unit Selection (OW□□03, bits 0 to 3), but the result of applying the speed unit setting is not shown here.			
OL□□42 Zero Point Return Travel Distance	Position Phase Speed Torque	-2^{31} to $2^{31}-1$	Reference unit	0
Description	Set the distance from where the signal is detected to the zero point position.			

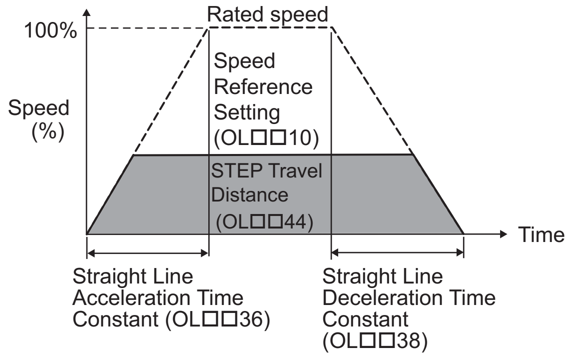
A typical example of a zero point return operation is shown below.

• Refer to *7.2.3 Zero Point Return (ZRET)* on page 7-15 for details.



(27) Step Distance

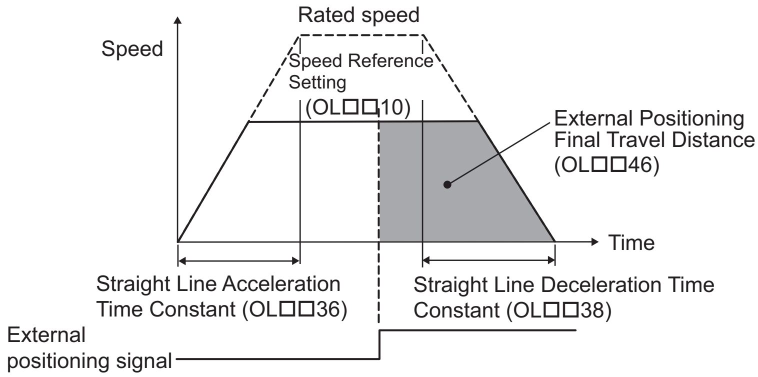
OL□□44 STEP Travel Distance	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		0 to $2^{31}-1$	Reference unit	1000
Description	Set the moving amount for STEP commands.			



- Refer to *7.2.7 STEP Operation (STEP)* on page 7-67 for details on STEP commands.

(28) External Positioning Move Distance

OL□□46 External Positioning Final Travel Distance	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	Reference unit	0
Description	Set the distance from the time the external signal is input for external positioning commands (EX_POSING).			



- Refer to *7.2.2 External Positioning (EX_POSING)* on page 7-9 for details.

(29) Coordinate System Settings

OL□□48 Zero Point Position in Machine Coordinate System Offset	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	Reference unit	0
Description	Set the offset to shift the machine coordinate system. • This parameter is always enabled, so be sure that the setting is correct.			

OL□□4A Work Coordinate System Offset	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	Reference unit	0
Description	Set the offset to shift the work coordinate system. • This parameter is always enabled, so be sure that the setting is correct.			

OL□□4C Number of POSMAX Turns Presetting Data	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	turn	0
Description	When the POSMAX Turn Number Presetting Demand bit (setting parameter OW□□00, bit 6) is set to 1, the value set here will be preset as the Number of POSMAX Turns (monitoring parameter IL□□1E). • This parameter is invalid for linear type.			

- For information on how to use these functions, refer to *Chapter 10 Absolute Position Detection* on page 10-1.

(30) Supplemental Setting

OW□□5C Fixed Parameter Number	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		0 to 65535	–	0
Description	Set the fixed parameter number to be read out by executing the motion subcommand FIXPRM_RD. The result of reading operation will be stored in the monitoring parameter Fixed Parameter Monitor (IW□□56.) • Refer to *7.3 Motion Subcommands* on page 7-85 for details.			

(31) General-purpose DO

OW□□5D General-purpose DO	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		–	–	0000H

Description	Bit 0	General-purpose DO_0 Set the general-purpose DO-0 to OFF or ON. 0: OFF (default) 1: ON This bit can be used only in the general-purpose I/O mode. In the normal operation mode, it is used by the system.
	Bit 1	General-purpose DO_1 Set the general-purpose DO-1 to OFF or ON. 0: OFF (default) 1: ON This bit can be used only in the general-purpose I/O mode. In the normal operation mode, it is used by the system.
	Bit 2	General-purpose DO_2 Set the general-purpose DO-2 to OFF or ON. 0: OFF (default) 1: ON This bit can be used both in the normal operation mode and the general-purpose I/O mode. For use in normal operation mode, this bit must be set to 1 (Use as a general-purpose signal) in General-Purpose DO_2 Signal Selection bit (fixed parameter No.21, bit 5). Refer to *11.4.4 General-purpose DO_2 Signal Selection* on page 11-17 for details.
	Bit 3	General-purpose DO_3 Set the general-purpose DO-3 to OFF or ON. 0: OFF (default) 1: ON This bit can be used in the general-purpose I/O mode and in the normal operation mode.
	Bit 4	General-purpose DO_4 Set the general-purpose DO-4 to OFF or ON. 0: OFF (default) 1: ON This bit can be used in the general-purpose I/O mode and in the normal operation mode.
	Bit 5	General-purpose DO_5 Set the general-purpose DO-5 to OFF or ON. 0: OFF (default) 1: ON This bit can be used only in the general-purpose I/O mode. In the normal operation mode, it is used by the system.

Motion Parameters
5

(32) Absolute Infinite Length Axis Position Control Information

OL□□5E Encoder Position when Power is OFF (Lower 2 words)	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	pulse	0
Description	This is the information for infinite length axis position control when an absolute encoder is used. The encoder position is stored in 4 words. If the Request ABS Rotary Pos. Load bit is set to 1 in the Run Command Setting (setting parameter OW□□00, bit 7), the position information will be recalculated with the values set here and the Pulse Position when Power is OFF (OL□□62 and OL□□64). • Refer to *10.4 Absolute Position Detection for Infinite Length Axes* on page 10-14 for details. • Set to 0 for linear type.			

OL□□60 Encoder Position when Power is OFF (Upper 2 words)	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	pulse	0
Description	Same as for OL□□5E. • Refer to *10.4 Absolute Position Detection for Infinite Length Axes* on page 10-14 for details. • Set to 0 for linear type.			

OL□□62 Pulse Position when Power is OFF (Lower 2 words)	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	pulse	0
Description	This is the information for infinite length axis position control when an absolute encoder is used. The axis position in pulses managed internally by the controller is stored in 4 words. If the Request ABS Rotary Pos. Load bit is set to 1 in the Run Command Setting (setting parameter OW□□00, bit 7), the position information will be recalculated with the values set here and the Encoder Position When Power is OFF (OL□□5E and OL□□60). • Refer to *10.4 Absolute Position Detection for Infinite Length Axes* on page 10-14 for details. • Set to 0 for linear type.			

OL□□64 Pulse Position when Power is OFF (Upper 2 words)	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	pulse	0
Description	Same as for OL□□62. • Refer to *10.4 Absolute Position Detection for Infinite Length Axes* on page 10-14 for details. • Set to 0 for linear type.			

(33) Various Data

OL□□66 Monitor Data Command	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		–	–	0
Description	Reserved for system use. Do not use this parameter.			

OL□□68 Writing Data Type	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		0 to 3	–	0
Description	Reserved for system use. Do not use this parameter.			

OL□□6A Monitor Address	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	–	0
Description	Reserved for system use. Do not use this parameter.			

OL□□6C Writing Data	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	–	0
Description	Reserved for system use. Do not use this parameter.			

(34) Stop Distance

OL □□6E System Reservation (Stop Distance)	Position Phase Speed Torque	Setting Range	Setting Unit	Default Value
		-2^{31} to $2^{31}-1$	–	0
Description	Used in combination with MPOS as the software limit detection condition. This parameter can be used in the normal operation mode and in the simulation mode. • Refer to *11.3.2 Software Limit Detection Function* on page 11-13 for details.			

5.4.3 Motion Monitoring Parameter Details

The following tables provide details of motion monitoring parameters.

- Refer to *5.3.3 Monitoring Parameter List* on page 5-13 for a list of motion monitoring parameters.
- Register number IW□□00 indicates the leading input register number + 00. Other register numbers listed below indicate input register numbers in the same way.
- Refer to *5.1.1 Motion Parameter Register Numbers for MP2000 Series Machine Controllers* on page 5-2 for information on how to find the leading input register number.

(1) Drive Status

IW□□00 RUN Status		Range	Unit
		–	–
Description	Bit 0	Motion Controller Operation Ready 0: Operation not ready 1: Operation ready This bit turns ON when RUN preparations for the Motion Module have been completed. This bit will be OFF under the following conditions: • Major damage has occurred. • Axis that is not used was selected. • Motion fixed parameter setting error • Motion fixed parameters are being changed.	
	Bit 1	Running (Servo ON) 0: Stopped 1: Running (Servo ON) This bit is ON while the axis is in Servo ON status.	
	Bit 3	Servo Ready 0: Servo not ready 1: Servo ready This bit is ON when all of the following conditions are satisfied. • The main power supply for the SERVOPACK is ON. • There are no alarms in the SERVOPACK.	

(2) Over Range Parameter Number

IW□□01 Parameter Number when Range Over is Generated	Range	Unit
	0 to 65535	–
Description	Stores the number of a parameter set outside the setting range. • Setting parameters: 0 or higher • Fixed Parameters: 1000 or higher This parameter stores the number of the setting or fixed parameter that exceeds the setting range either individually or in combination with the settings of other parameters. When motion fixed parameters are used, the parameter stores the parameter number plus 1000.	

(3) Warning

IL□□02 Warning			Range	Unit
			–	–
Description	Bit 0	Excessive Deviation 0: In normal deviation range 1: Abnormal deviation detected This bit turns ON if the following error exceeds the value set for the Error Count Alarm Detection (setting parameter OL□□22) when Excessive Deviation is set to be treated as an warning by setting the Excessive Deviation Error Level Setting to 0 in Mode Setting 1 (setting parameter OW□□01, bit 0).		
	Bit 1	Set Parameter Error 0: In setting range 1: Outside setting range This bit turns ON when one or more motion setting parameters is set outside the setting range. The number of the parameter for which the value is out of range is stored as the Parameter Number when Range Over is Generated (monitoring parameter IW□□01).		
	Bit 2	Fixed Parameter Error 0: In setting range 1: Outside setting range This bit turns ON when one or more motion setting parameters is set outside the motion fixed parameter setting range. The number of the parameter is stored as the Parameter Number when Range Over is Generated (monitoring parameter IW□□01).		
	Bit 4	Motion Command Set Error 0: Command setting normal 1: Command setting error This bit turns ON when a motion command that cannot be used is set.		
	Bit B	Analog Adjust Not Ready Warning 0: Adjustment normally completed 1: Adjustment error This bit turns ON for warning when the SVA-01 Module has not been correctly adjusted before shipment.		

(4) Alarm

IL□□04 Alarm		Range	Unit
		–	–
Description	Bit 0	Servo Driver Error 0: No Servo Driver alarm 1: Servo Driver alarm occurred This bit turns ON when there is a alarm in the SERVOPACK. Connect a digital operator to the SERVOPACK to check the content of the alarm. • Refer to for *12.4.3 Analog Servo Alarm List* on page 12-32 for details.	
	Bit 1	Positive Direction Overtravel 0: No positive overtravel 1: Positive overtravel occurred This bit turns ON when the positive overtravel signal has been input and a move command is executed in the positive direction. • Refer to *11.2 Overtravel Function* on page 11-8 for details.	
	Bit 2	Negative Direction Overtravel 0: No negative overtravel 1: Negative overtravel occurred This bit turns ON when the negative overtravel signal is input and a move command is executed in the negative direction. • Refer to *11.2 Overtravel Function* on page 11-8 for details.	
	Bit 3	Positive Direction Software Limit 0: In positive software limit range 1: Not in positive software limit range This bit turns ON if a move command that exceeds the positive software limit is executed with the following conditions: A finite axis is selected, the positive software limit is enabled, and a Zero Point Return operation has been completed. • Refer to *11.3 Software Limit Function* on page 11-13 for details.	
	Bit 4	Negative Direction Software Limit 0: In negative software limit range 1: Not in negative software limit range This bit turns ON if a move command that exceeds the negative software limit is executed with the following conditions: A finite axis is selected, the negative software limit is enabled, and a Zero Point Return operation has been completed. • Refer to *11.3 Software Limit Function* on page 11-13 for details.	
	Bit 5	Servo OFF 0: Servo ON 1: Servo OFF This bit turns ON when a move command is executed during Servo OFF status.	
	Bit 6	Positioning Time Over 0: No timeout 1: Timeout occurred This bit turns ON when positioning is not completed within the specified time after the end of pulse distribution. The time is set for the Position Completion Check Time (setting parameter OW□□26).	
	Bit 8	Excessive Speed 0: Speed normal 1: Excessive speed This bit turns ON when a speed was set that exceeds the setting range for the speed reference.	
	Bit 9	Excessive Deviation 0: In normal deviation range 1: Abnormal deviation detected This bit turns ON if the following error exceeds the value set for the Error Count Alarm Detection (setting parameter OL□□22) when an Excessive Deviation is set to be treated as an alarm by setting the Excessive Deviation Error Level Setting to 0 in Mode Setting 1 (setting parameter OW□□01, bit 0).	

IL□□04 Alarm (cont'd)		Range	Unit
		–	–
Description	Bit D	Zero Point Unsetting 0: Zero point set 1: Zero point not set error This bit turns ON if a move command (except for JOG or STEP) is performed when an infinite length axis is set and the zero point has not been set.	
	Bit 13	Excessive ABS Encoder Rotations 0: In count range 1: Outside count range This bit turns ON if the number of turns from the absolute encoder exceeds the range that the SVA can handle. This bit is valid when using an absolute encoder and a finite-length axis. This bit also turns ON if the result of the operation converting the current position to reference units when the power is turned ON exceeds 32 bits. • This bit is invalid for linear type.	
	Bit 14	PG Disconnection Error 0: Connected (OFF) 1: Disconnected (ON) This bit turns ON when the PG disconnection is detected.	
	Bit 15	ABS Total Rev. Receive Error 0: Matched (OFF) 1: Unmatched (ON) This bit turns ON when the bit 7 of fixed parameter No. 1 (Absolute Position Data Read-out at Power ON) is set to 1 (Not execute).	

(5) Motion Command Response Codes

IW□□08 Motion Command Response Code	Range	Unit
	0 to 65535	–
Description	Stores the motion command code for the command that is currently being executed. This is the motion command code that is currently being executed and is the same as the Motion Command (setting parameter OW□□08).	

(6) Motion Command Status

IW□□09 Motion Command Status		Range	Unit
		–	–
Description	Bit 0	Command Execution Flag (BUSY) 0: READY (completed) 1: BUSY (processing) This bit indicates the motion command status. This bit turns ON during execution of commands that have been completed or during abort processing. • Refer to *Chapter 7 Motion Commands* for details on command timing charts.	
	Bit 1	Command Hold Completed (HOLDL) 0: Command hold processing not completed 1: Command hold completed This bit turns ON when command hold processing has been completed. • Refer to *Chapter 7 Motion Commands* for details on command timing charts.	
	Bit 3	Command Error Completed Status (FAIL) 0: Normal completion 1: Abnormal completion This bit turns ON if motion command processing does not complete normally. If motion command execution ends in an error, the axis will stop any motion. • Refer to *Chapter 7 Motion Commands* for details on command timing charts.	
	Bit 8	Command Execution Completed (COMPLETE) 0: Normal execution not completed 1: Normal execution completed This bit turns ON when motion command processing was completed normally. • Refer to *Chapter 7 Motion Commands* for details on command timing charts.	

(7) Motion Subcommand Response Code

IW□□0A Motion Subcommand Response Code	Range	Unit
	0 to 65535	–
Description	Stores the motion subcommand code for the command that is being executed. This is the motion subcommand code that is currently being executed and is the same as the Motion Subcommand (setting parameter OW□□0A).	

(8) Motion Subcommand Status

IW□□0B Subcommand Status		Range	Unit
		–	–
Description	Bit 0	Command Execution Flag (BUSY) This bit indicates the motion subcommand status. 0: READY (completed) 1: BUSY (processing) This bit turns ON during execution of commands that have been completed or during abort processing.	
	Bit 3	Command Error Completed Status (FAIL) 0: Normal completion 1: Abnormal completion This bit turns ON if motion subcommand processing does not complete normally.	
	Bit 8	Command Execution Completed (COMPLETE) 0: Normal execution not completed 1: Normal execution completed This bit turns ON when motion subcommand processing was completed normally.	

(9) Position Management Status

IW□□0C Position Management Status		Range	Unit
		–	–
Description	Bit 0	Discharging Completed (DEN) 0: Distributing pulses. 1: Distribution completed. This bit turns ON when pulse distribution has been completed for a move command.	
	Bit 1	Positioning Completed (POSCOMP) 0: Outside positioning completed width. 1: In positioning completed width. This bit turns ON when pulse distribution has been completed and the current position is within the positioning completed width.	
	Bit 2	Latch Completed (LCOMP) 0: Latch not completed. 1: Latch completed. This bit turns OFF when a new latch command is executed and turns ON when the latch has been completed. The latched position is stored as the Machine Coordinate System Latch Position (monitoring parameter IL□□18).	
	Bit 3	NEAR Position (NEAR) 0: Outside position proximity range. 1: In position proximity range. The operation of this bit depends on the setting of NEAR Signal Output Width (setting parameter OL□□20). • OL□□20 = 0: This bit turns ON when pulse distribution has been completed (monitoring parameter IW□□0C, bit 0). • OL□□20 ≠ 0: This bit turns ON when the result of subtracting the Machine Coordinate System Feedback Position (IL□□16) from the Machine Coordinate System Reference Position (IL□□12) is less than the NEAR Signal Output Width, even if pulse distribution has not been completed.	
	Bit 4	Zero Point Position (ZERO) 0: Outside zero point position range 1: In zero point position range. This bit turns ON when the Machine Coordinate System Reference Position (monitoring parameter IL□□12) is within the Width of Starting Point Position Output (setting parameter OW□□3D) after a Zero Point Return (Zero Point Setting) has been completed.	

<table>
<tr><td colspan="2" rowspan="2">IW□□0C
Position Management Status (cont'd)</td><td>Range</td><td>Unit</td></tr>
<tr><td>–</td><td>–</td></tr>
<tr><td rowspan="6">Description</td><td>Bit 5</td><td colspan="2">Zero Point Return (Setting) Completed (ZRNC)
0: Zero point return (setting) not completed.
1: Zero point return (setting) completed.
This bit turns ON when a zero point return (setting) has been completed.
This bit turns OFF when a new zero point return (setting) operation is started.</td></tr>
<tr><td>Bit 6</td><td colspan="2">During Machine Lock (MLKL)
0: Machine lock mode released.
1: Machine lock mode.
This bit turns ON when the Machine Lock bit is set to 1 in the Run Command Setting (setting parameter OW□□00, bit 1) and the axis has actually entered machine lock mode.</td></tr>
<tr><td>Bit 7</td><td colspan="2">Absolute Position Read-out Completed
0: OFF
1: ON (Reading completed)
This bit turns ON when reading the absolute data by setting the setting parameter Absolute Position Reading Demand (OW□□00, bit 5) to 1 (reading ON) has been completed.
This bit stays OFF when the setting parameter Absolute Position Reading Demand (OW□□00, bit 5) is set to 0 (reading OFF).</td></tr>
<tr><td>Bit 8</td><td colspan="2">ABS Rotary Pos. LOAD Complete (ABSLDE)
0: LOAD not completed.
1: LOAD completed.
This bit turns ON when the Request ABS Rotary Pos. Load bit is set to 1 in the Run Command Setting (setting parameter OW□□00, bit 7) and loading of the information has been completed.
• Invalid for linear type.</td></tr>
<tr><td>Bit 9</td><td colspan="2">POSMAX Turn Preset Complete (TPRSE)
0: Preset not completed.
1: Preset completed.
This bit turns ON when the POSMAX Turn Number Presetting Demand bit in the Run Command Setting (setting parameter OW□□00, bit 6) is set to 1 and the POSMAX Number of Turns has been preset with the Number of POSMAX Turns Presetting Data (setting parameter OL□□4C).
• Invalid for linear type.</td></tr>
<tr><td>Bit A</td><td colspan="2">ABS Encoder Rotating Direction
0: Forward rotation
1: Reverse rotation</td></tr>
</table>

(10) Position Information 1

<table>
<tr><td colspan="2" rowspan="2">IL□□0E
Target Position in Machine Coordinate System (TPOS)</td><td>Range</td><td>Unit</td></tr>
<tr><td>-2^{31} to $2^{31}-1$</td><td>Reference unit</td></tr>
<tr><td>Description</td><td colspan="3">Stores the target position in the machine coordinate system managed by the Motion Module.
This is the target position per scan for INTERPOLATE or LATCH commands.
• This parameter will be set to 0 when the power supply is turned ON.
• The data is refreshed even when the machine lock mode is enabled.
• This parameter will not be reset even when an infinite length axis type is selected.</td></tr>
<tr><td colspan="2" rowspan="2">IL□□10
Calculated Position in Machine Coordinate System (CPOS)</td><td>Range</td><td>Unit</td></tr>
<tr><td>-2^{31} to $2^{31}-1$</td><td>Reference unit</td></tr>
<tr><td>Description</td><td colspan="3">Stores the calculated position in the machine coordinate system managed by the Motion Module.
The position data stored in this parameter is the target position for each scan.
• This parameter will be set to 0 when the power supply is turned ON.
• The data is updated even when the machine lock mode is enabled.
• When an infinite length axis type is selected, a range of 0 to (Maximum Value of Rotary Counter (POSMAX) – 1) is stored.</td></tr>
</table>

		Range	Unit
IL□□12 Machine Coordinate System Reference Position (MPOS)		-2^{31} to $2^{31}-1$	Reference unit
Description	Stores the reference position in the machine coordinate system managed by the Motion Module. • This parameter will be set to 0 when the power supply is turned ON. • This data is not updated when the machine lock mode is enabled. (When the machine lock mode is enabled, the position reference data is not output externally.) • When the machine lock mode function is not used, this position is the same as that in IL□□10.		
IL□□14 CPOS for 32 bit (DPOS)		-2^{31} to $2^{31}-1$	Reference unit
Description	Stores the reference position in the machine coordinate system managed by the Motion Module. For a finite length axis, this is the same as the calculated position (CPOS). For both finite and infinite length axes, the value is refreshed between -2^{31} and $2^{31}-1$.		
IL□□16 Machine Coordinate System Feedback Position (APOS)		-2^{31} to $2^{31}-1$	Reference unit
Description	Stores the feedback position in the machine coordinate system managed by the Motion Module. • This parameter will be set to 0 when a Zero Point Return (ZRET) is executed. • When an infinite length axis type is selected, a range of 0 to (Maximum Value of Rotary Counter (POSMAX) – 1) is stored.		
IL□□18 Machine Coordinate System Latch Position (LPOS)		-2^{31} to $2^{31}-1$	Reference unit
Description	Stores the latch position when the latch has been completed.		
IL□□1A Position Error (PERR)		-2^{31} to $2^{31}-1$	Reference unit
Description	Stores the following error (the result of Machine Coordinate System Reference Position (IL□□12) – Machine Coordinate System Feedback Position (IL□□16) converted to reference unit) managed by the Motion Module.		
IL□□1C Target Position Difference Monitor		-2^{31} to $2^{31}-1$	Reference unit
Description	Stores the distribution segment calculated each 500 µs cycle.		
IW□□1E Number of POSMAX Turns		-2^{31} to $2^{31}-1$	rev
Description	This parameter is valid for an infinite length axis. The count stored in this parameter goes up and down every time the current position exceeds the Infinite Length Axis Reset Position (POSMAX). • Invalid for linear type.		

■ Terminology: Machine Coordinate System

The basic coordinate system that is set according to Zero Point Return (ZRET) command execution or Zero Point Setting (ZSET) command execution. The Machine Controller manages the positions using this machine coordinate system.

(11) Speed Information

		Range	Unit
IL□□20 Speed Reference Output Monitor		-2^{31} to $2^{31}-1$	Depends on the speed unit set in Function Setting 1 (setting parameter OW□□03, bits 0 to 3)
Description	Stores the speed reference that is being output.		
IL□□24 Integral Output Monitor		-2^{31} to $2^{31}-1$	Depends on the speed unit set in Function Setting 1 (setting parameter OW□□03, bits 0 to 3)
Description	Stores the output value of PI control operation in the control loop for position control and phase control. This bit is valid in position control mode and phase control mode. • Refer to *9.1 SVA-01 Module Control Block Diagram* on page 9-2 for information on control loop.		
IL□□26 Primary Lag Monitor		-2^{31} to $2^{31}-1$	Depends on the speed unit set in Function Setting 1 (setting parameter OW□□03, bits 0 to 3)
Description	Stores the result of subtraction “Integral output (IL□□24) – Primary lag element output”. This bit is valid in position control mode and phase control mode.		
IL□□28 Position Loop Output Monitor		-2^{31} to $2^{31}-1$	Depends on the speed unit set in Function Setting 1 (setting parameter OW□□03, bits 0 to 3)
Description	Stores the position loop output value (value without adding the position feedforward calculated value). This bit is valid in position control mode and phase control mode.		

(12) Servo Driver Information

		Range	Unit
IL□□40 Feedback Speed		-2^{31} to $2^{31}-1$	Depends on the speed unit set in Function Setting 1 (setting parameter OW□□03, bits 0 to 3)
Description	Stores the feedback speed. The value is determined by the Feedback Speed Movement Averaging Time Constant (fixed parameter 42) and unit set from the difference with the Machine Coordinate System Feedback Position (monitoring parameter IL□□16) in each scan. • The setting unit for this parameter depends on the Speed Unit Selection (OW□□03, bits 0 to 3), but the result of applying the speed unit setting is not shown here.		
IL□□42 Feedback Torque/Thrust		-2^{31} to $2^{31}-1$	Depends on the torque unit set in Function Setting 1 (setting parameter OW□□03, bits C to F)
Description	Stores the value of General-purpose AI Monitor 2 (IW□□5A) converted in the selected torque units. • The setting unit for this parameter depends on the Torque Unit Selection (OW□□03, bits C to F), but the result of applying the torque unit setting is not shown here.		

(13) Position Information 2

		Range	Unit
IL□□4A The Number of Accumulated Rotations of Absolute Value Encoder		-2^{31} to $2^{31}-1$	rev
Description	Stores the accumulated number of rotations read out from the absolute encoder when the power supply is turned ON or when the online absolute data read function is executed.		
IL□□4C The Number of Initial Incremental Pulses		-2^{31} to $2^{31}-1$	pulse
Description	Stores the initial incremental pulses read out from the absolute encoder when the power supply is turned ON or when the online absolute data read function is executed.		

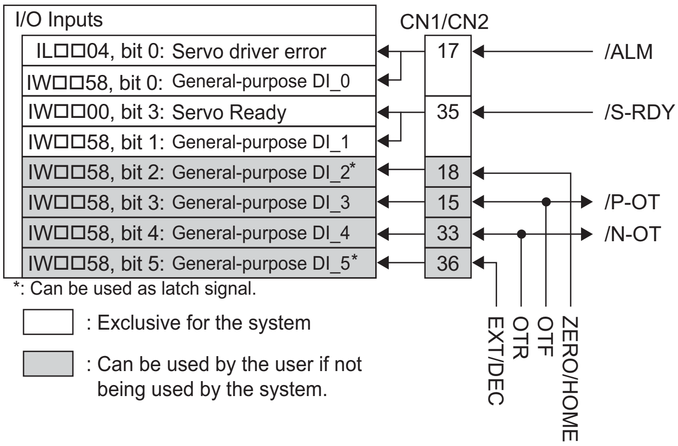
(14) Supplemental Information 1

IL□□56 Fixed Parameter Monitor		Range	Unit
		-2^{31} to $2^{31}-1$	–
Description	Stores the data of the specified fixed parameter number. This parameter stores the data of the fixed parameter when the Read Fixed Parameter (FIXPRM-RD) is selected in the Motion Subcommand (setting parameter OW□□0A).		

(15) Supplemental Information 2

IW□□58 General-purpose DI Monitor			Range	Unit
			–	–
Description	Bit 0	General-purpose DI_0 This bit turns ON when the general-purpose DI_0 signal is being input. The user can use the general-purpose DI_0 signal in general-purpose I/O mode. However, the system uses the signal for Servo Alarm input signal in normal operation mode and the Servo Alarm signal input is stored in this bit.		
	Bit 1	General-purpose DI_1 This bit turns ON when the general-purpose DI_1 signal is being input. The user can use the general-purpose DI_1 signal in general-purpose I/O mode. However, the system uses the signal as Servo Ready input signal in normal operation mode and the Servo Ready signal input is stored in this bit.		
	Bit 2	General-purpose DI_2 This bit turns ON when the general-purpose DI_2 signal is being input. The user can always use the general-purpose DI_2 signal in general-purpose I/O mode, however, the user can use the signal only when the system does not use it in normal operation mode. When the system is using the signal in normal operation mode, the ZERO/HOME LS signal input is stored in this bit.		
	Bit 3	General-purpose DI_3 This bit turns ON when the general-purpose DI_3 signal is being input. The user can always use the general-purpose DI_3 signal in general-purpose I/O mode, however, the user can use the signal only when the system does not use it in normal operation mode. When the system is using the signal in normal operation mode, the Positive Overtravel (OT) signal input is stored in this bit.		
	Bit 4	General-purpose DI_4 This bit turns ON when the general-purpose DI_4 signal is being input. The user can always use the general-purpose DI_4 signal in general-purpose I/O mode, however, the user can use the signal only when the system does not use it in normal operation mode. When the system is using the signal in normal operation mode, the Negative Overtravel (OT) signal input is stored in this bit.		
	Bit 5	General-purpose DI_5 This bit turns ON when the general-purpose DI_5 signal is being input. The user can always use the general-purpose DI_5 signal in general-purpose I/O mode, however, the user can use the signal only when the system does not use it in normal operation mode. When the system is using the signal in normal operation mode, the EXT/DEC signal input is stored in this bit.		
	Bit 7	PG Wire Breaking Down Status Stores the status of PG disconnection signal. 0: Normal 1: Disconnected		

<DI Block Diagram in Normal Operation Mode>



(16) Supplemental Information 3

IW□□59 General-purpose AI Monitor 1	Range	Unit
	–32768 to 32768	0.001 V
Description	Stores the general-purpose analog input. Stores the value of Analog Speed Monitor of SERVOPACK when using a SERVOPACK standard cable.	
IW□□5A General-purpose AI Monitor 2	**Range**	**Unit**
	–32768 to 32768	0.001 V
Description	Stores the general-purpose analog input. Stores the value of Analog Torque Monitor of SERVOPACK when using a SERVOPACK standard cable.	

(17) Absolute Infinite Length Axis Position Control Information

IL□□5E Encoder Position when Power is OFF (Lower 2 words)	Range	Unit
	-2^{31} to $2^{31}-1$	pulse
Description	Stores information used for infinite length axis position control when an absolute encoder is used. The encoder position is normally stored in 4 words.	
IL□□60 Encoder Position when Power is OFF (Upper 2 words)	**Range**	**Unit**
	-2^{31} to $2^{31}-1$	pulse
Description	Same as for IL□□5E.	
IL□□62 Pulse Position when Power is OFF (Lower 2 words)	**Range**	**Unit**
	-2^{31} to $2^{31}-1$	pulse
Description	Stores information used for infinite length axis position control when an absolute encoder is used. These parameters store the axis position managed by the Machine Controller in pulses in 4 words.	
IL□□64 Pulse Position when Power is OFF (Upper 2 words)	**Range**	**Unit**
	-2^{31} to $2^{31}-1$	pulse
Description	Same as for IL□□62.	

(18) Monitor Data

IL□□66 Monitor Data Status	Range	Unit
	-2^{31} to $2^{31}-1$	–
Description	Reserved for system use. Do not use this parameter.	
IL□□68 Monitor Data	**Range**	**Unit**
	-2^{31} to $2^{31}-1$	–
Description	Reserved for system use. Do not use this parameter.	

6

Motion Parameter Setting Examples

This chapter gives setting examples of the motion parameters for each machine.

6.1 Example Setting of Motion Parameters for the Machine

Set the following eight motion parameters to enable motion control that suits the machine's specifications.

- Reference unit
- Electronic gear
- Axis Type selection
- Position Reference
- Speed Reference
- Acceleration/Deceleration Settings
- Acceleration/Deceleration Filter Settings
- Linear Scale Pitch/Rated Speed (when using a linear motor)

The following tables provide details of setting examples for the above items.

6.1.1 Reference Unit

Pulses, millimeters, degrees, or inches can be used as the reference unit for motion control. The reference unit is specified in Reference Unit Selection (motion fixed parameter 4).
The minimum reference unit that can be specified is determined by the setting of Number of Digits below Decimal Point (motion fixed parameter 5).

Motion Fixed Parameter 5: Number of Digits below Decimal Point	Motion Fixed Parameter 4: Reference Unit Selection			
	0: pulse	1: mm	2: deg	3: inch
0: 0 digits	1 pulse	1 mm	1 deg	1 inch
1: 1 digits	1 pulse	0.1 mm	0.1 deg	0.1 inch
2: 2 digits	1 pulse	0.01 mm	0.01 deg	0.01 inch
3: 3 digits	1 pulse	0.001 mm	0.001 deg	0.001 inch
4: 4 digits	1 pulse	0.0001 mm	0.0001 deg	0.0001 inch
5: 5 digits	1 pulse	0.00001 mm	0.00001 deg	0.0001 inch

Minimum reference unit

6.1.2 Electronic Gear

In contrast to the reference unit input to the Machine Controller, the moving unit in the mechanical system is called the "output unit." The electronic gear converts position or speed units from reference units to output units for the mechanical system without going through an actual mechanism, such as a gear.
When the axis at the motor has rotated m times and the mechanical configuration allows the axis at the load to rotate n times, this electronic gear function can be used to make the reference unit equal to the output unit.
The electronic gear function is enabled when the following settings are made:

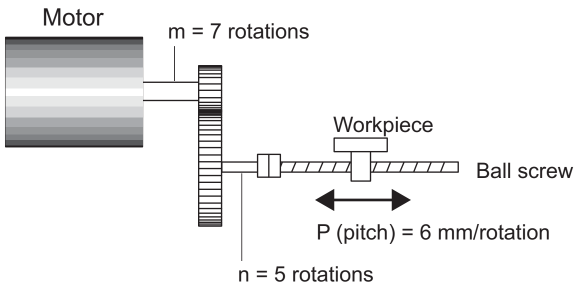
- Fixed Parameter 6: Travel distance per machine rotation
- Fixed Parameter 8: Servo motor gear ratio
- Fixed Parameter 9: Machine gear ratio

♦ The electronic gear is disabled when pulse is specified as the Reference Unit.

The following setting example uses ball screw and rotating table workpieces.

(1) Parameter Setting Example Using Ball Screw

- Machine specifications: Ball screw axis rotates 5 times for each 7 rotations of the motor axis (Refer to the following figure.)
- Reference unit: 0.001 mm

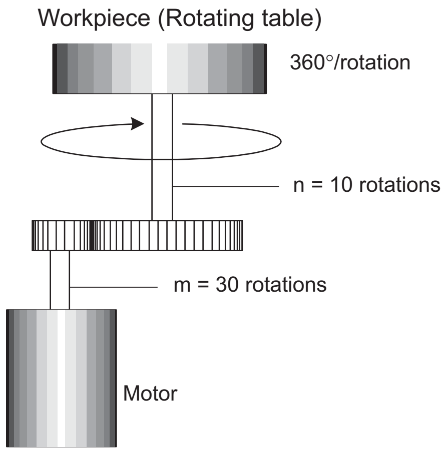


To move the workpiece 0.001 mm for 1 reference unit input under the conditions outlined above, i.e., for 1 reference unit = 1 output unit, make the following settings for fixed parameters 6, 8, and 9.

- Fixed Parameter 6: Travel distance per machine rotation = 6 mm/0.001 mm = 6000 (reference units)
- Fixed Parameter 8: Servo motor gear ratio = m = 7
- Fixed Parameter 9: Machine gear ratio = n = 5

(2) Parameter Setting Example Using Rotating Table

- Machine specifications: Rotating table axis rotates 10 times for each 30 rotations of the motor axis (Refer to the following figure.)
- Reference unit: 0.1°



To rotate the table 0.1° for 1 reference unit input under the conditions outlined above, i.e., for 1 reference unit = 1 output unit, make the following settings for fixed parameters 6, 8, and 9.

- Fixed Parameter 6: Travel distance per machine rotation = 360°/0.1° = 3600 (reference units)
- Fixed Parameter 8: Servo motor gear ratio = m = 30
- Fixed Parameter 9: Machine gear ratio = n = 10
  - The gear ratio for fixed parameters 8 and 9 (m/n) may be constant, e.g., m = 3 and n = 1.

6.1.3 Axis Type Selection

There are two types of position control: finite length position control for return and other operations that are performed only within a specified range, and infinite length position control, which is used for moving in one direction only. Infinite length position control can reset the position to 0 after one rotation, e.g, belt conveyors, or move in one direction only, without resetting position after one rotation. The axis type selection sets which of these types of position control is to be used.
The details of the Axis Type Selection are listed in the following table.

Parameter Type	Parameter No. (Register No.)	Name	Description	Default Value
Motion Fixed Parameters	No. 1, bit 0	Function Selection Flag 1, Axis Selection	Specify the position control method for the controlled axis. 0: Finite Length Axis Set a finite length axis if control is performed within a limited length or for an axis that uses infinite length control in one moving direction only without resetting the position every rotation. 1: Infinite Length Axis Set an infinite length axis for an axis that uses infinite length control while resetting the position every rotation.	0
	No. 10	Infinite Length Axis Reset Position (POSMAX)	Set the reset position of the position data using the reference unit when an infinite length axis has been set for the axis type.	360000

6.1.4 Position Reference

The target position value for position control is set for the Position Reference Setting (motion setting parameter OL□□1C). There are two methods that can be set for using the Position Reference Setting: directly setting the coordinate of the target position value as an absolute value or adding the moving amount from the previous command position as a incremental value.
The following table lists the parameter details relating to position references.

Parameter Type	Parameter No. (Register No.)	Name	Description	Default Value
Motion Setting Parameters	OW□□09, bit 5	Position Reference Type	Specify the type of position data. 0: Incremental Addition Mode Adds the present moving amount value to the previous value of OL□□1C and sets the result in OL□□1C. 1: Absolute Mode Sets the coordinate of the target position in OL□□1C. • Always set to 0 when using a motion program.	0
	OL□□1C	Position Reference Setting	Set the position data. • Incremental Addition Mode (OW□□09, bit 5 = 0) The moving amount (incremental distance) specified this time will be added to the previous value of OL□□1C. OL□□1C ← Previous OL□□1C + Incremental distance Example: If a travel distance of 500 is specified and the previous value of OL□□1C is 1000, the following will occur: OL□□1C ← 1000 + 500 = 1500 • Absolute Mode (OW□□09, bit 5 = 1) The coordinate value of the target position is set. Example: Set 10000 to move to a coordinate value of 10000. OL□□1C ← 10000	0

The following table compares the advantage and disadvantage of incremental addition mode and absolute mode.

Position Reference Type	Advantage	Disadvantage
Incremental Addition Mode	It is not necessary to consider the relationship between OL□□1C and the current position when canceling a move. Incremental addition mode can be used for finite or infinite length axis type.	OL□□1C does not necessarily equal the coordinate value of the target position, so the position reference can be difficult to understand intuitively.
Absolute Mode	The coordinate of the target position is specified directly, making it easy to understand intuitively.	The current position must be set in OL□□1C whenever the power supply is turned ON or a move is canceled. If this is not done, the axis may move suddenly when a move command is started.

Setting of the target position when using an infinite length axis is described below.

(1) Setting the Target Position When Using an Infinite Length Axis: Method 1
Executing a POSING command while no command (NOP) is being executed

- When the incremental addition mode is selected for the Position Reference Setting (OW☐☐09, bit 5 = 0), execute a POSING command in distribution completed status (IW☐☐0C, bit 0 = 1).
  When the absolute mode is selected for the Position Reference Setting (OW☐☐09, bit 5 = 1), a POSING command can be executed if the distribution is not completed (IW☐☐0C, bit 0 = 0).

■ Incremental Addition Mode (OW☐☐09, bit 5 = 0)

Incremental value = Target position (a value between 0 and POSMAX) − IL☐☐10 (CPOS) + POSMAX × n
OL☐☐1C = OL☐☐1C + Incremental value

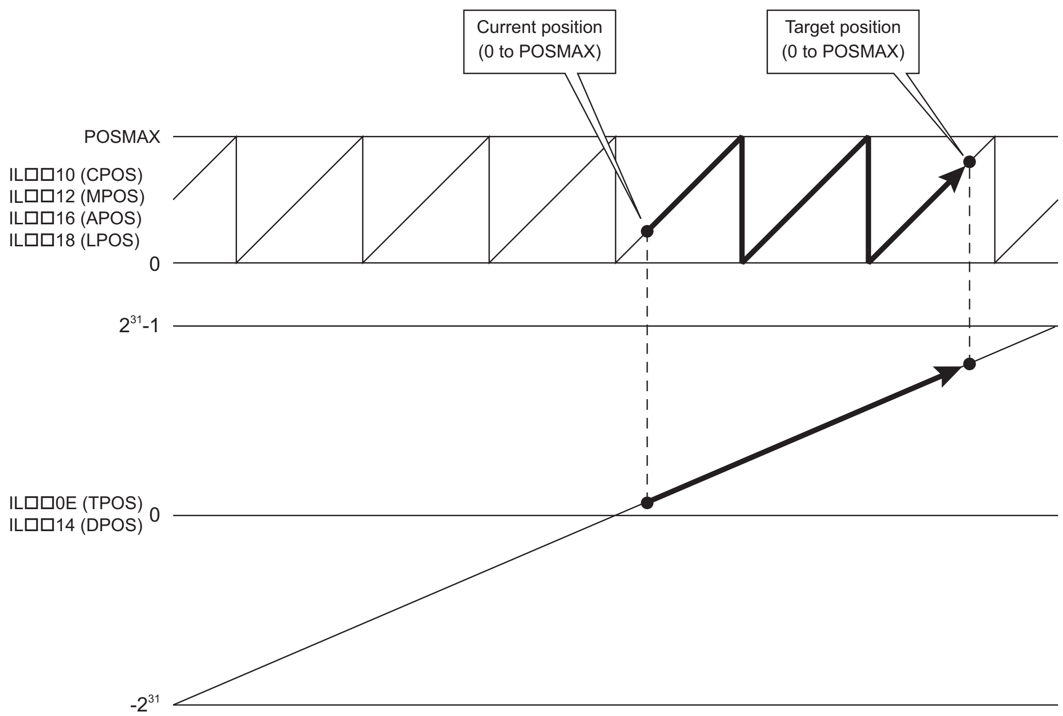
- n refers to the number of POSMAX complete turns needed to move from the current position (CPOS) to the target position. When the distance between the target position and the current position is within the first turn, n is 0.

■ Absolute Mode (OW☐☐09, bit 5 = 1)

Incremental value = Target position (a value between 0 and POSMAX) − IL☐☐10 (CPOS) + POSMAX × n
OL☐☐1C = IL☐☐14 (DPOS) + Incremental value

- n refers to the number of POSMAX complete turns needed to move from the current position (CPOS) to the target position. When the distance between the target position and the current position is within the first turn, n is 0.

<Example when n = 2>



(2) Setting the Target Position When Using an Infinite Length Axis: Method 2
Changing the target position while a POSING command is being executed by specifying another target position on the base of the original target position

- When the absolute mode has been set for the Reference Position Setting (OW□□09, bit 5 = 1), the absolute mode must also be set after having changed the target position.

■ Incremental Addition Mode (OW□□09, bit 5 = 0)

Incremental value = New target position (a value between 0 and POSMAX) – Original target position before change (a value between 0 and POSMAX) + POSMAX × n

OL□□1C = OL□□1C + Incremental value

- Original target position before change: The value that was directly designated or the value that was stored in M register, etc.
- n refers to the number of POSMAX complete turns needed to move from the current position (CPOS) to the target position. When the distance between the target position and the current position is within the first turn, n is 0.

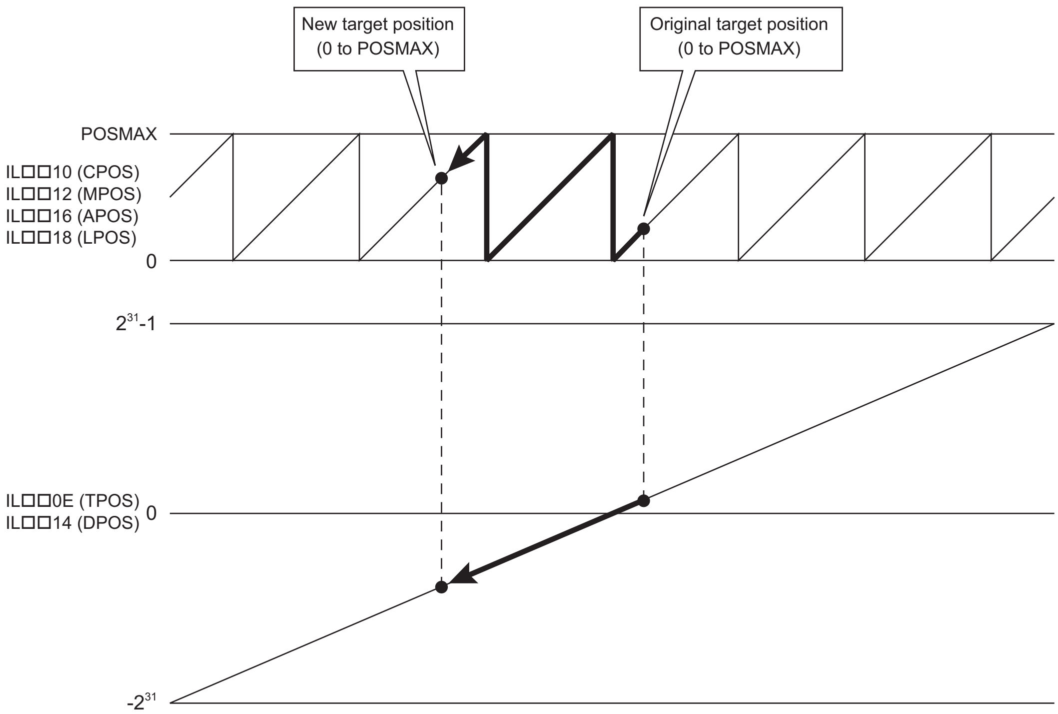
■ Absolute Mode (OW□□09, bit 5 = 1)

Incremental value = New target position (a value between 0 and POSMAX) – Original target position before change (a value between 0 and POSMAX) + POSMAX × n

OL□□1C = OL□□1C + Incremental value

- Original target position before change: The value that was directly designated or the value that was stored in M register, etc.
- n refers to the number of POSMAX complete turns needed to move from the current position (CPOS) to the target position. When the distance between the target position and the current position is within the first turn, n is 0.

<Example when n = –2>



Motion Parameter Setting Examples

6

(3) Setting the Target Position When Using an Infinite Length Axis: Method 3
Changing the target position while a POSING command is being executed by specifying another target position on the base of the current position

- When the incremental addition mode is selected for Position Reference Setting (OW□□09, bit 5 = 0), execute a POSING command in distribution completed status (IW□□0C, bit 0 = 1).
  When the absolute mode is selected for Position Reference Setting (OW□□09, bit 5 = 1), a POSING command can be executed if the distribution is not completed (IW□□0C, bit 0 = 0).

The method is the same as for *(1) Setting the Target Position When Using an Infinite Length Axis: Method 1*.

(4) Setting the Target Position When Using an Infinite Length Axis: Method 4
Switching a command that is being executed to a POSING command

- When the incremental addition mode is selected for Position Reference Setting (OW□□09, bit 5 = 0), execute a POSING command in distribution completed status (IW□□0C, bit 0 = 1).
  When the absolute mode is selected for Position Reference Setting (OW□□09, bit 5 = 1), a POSING command can be executed if the distribution is not completed (IW□□0C, bit 0 = 0).

The method is the same as for *(1) Setting the Target Position When Using an Infinite Length Axis: Method 1*.

6.1.5 Speed Reference

There are two methods of setting the speed reference for the feed speed or other speeds. One method involves using reference units and the other method involves setting the percentage (%) of the rated speed. The settings method depends on the related parameter settings.

(1) Related Parameters

The parameters related to speed references are listed in the following table.

Parameter Type	Parameter No. (Register No.)	Name	Description	Default Value
Motion Fixed Parameters	No. 5	Number of Digits below Decimal Point	Set the number of digits below the decimal point in the reference unit being input. The minimum reference unit is determined by this parameter and the Reference Unit Selection (fixed parameter 4). Example: Reference Unit = mm, Number of Digits below Decimal Point = 3 1 reference unit = 0.001 mm	3
	No. 34	Rated Motor Speed	Set the number of rotations when the motor is rotated at the rated speed (100% speed). Confirm the motor specifications before setting this parameter.	3000
	No. 36	Number of Pulses per Motor Rotation	Set the number of pulses (the value before multiplication) per motor rotation. Example: For a 16-bit encoder, set $2^{(16-2)}$ = 16384.	16384
Motion Setting Parameters	OW□□03 Bits 0 to 3	Speed Unit Selection	Set the unit for reference speeds. 0: Reference unit/s 1:10^n reference units/min (n: Number of Digits below Decimal Point) 2: 0.01% 3: 0.0001%	1
	OL□□10	Speed Reference Setting	Set the feed speed. The unit for this parameter is set in OW□□03, bits 0 to 3. Example: When the Number of Digits below Decimal Point is set to 3, units are as follows for the setting of the Speed Unit: • Speed Unit Set to 0: Reference units/s pulse unit: 1 = 1 pulse/s (regardless of the value n) mm unit: 1 = 0.001 mm/s deg unit: 1 = 0.001 deg/s inch unit: 1 = 0.001 inch/s • Speed Unit Set to 1: 10^n reference units/min pulse unit: 1 = 1000 pulse/min (regardless of the value n) mm unit: 1 = 1 mm/min deg unit: 1 = 1 deg/min inch unit: 1 = 1 inch/min • Speed Unit Set to 2: 0.01% Set as a percentage of the rated speed (1 = 0.01%) unrelated to the reference unit setting.	3000
	OW□□18	Override	Setting an output ratio (%) for the setting allows the positioning speed to be changed without changing the Speed Reference setting. Setting unit: 1 = 0.01%	10000

(2) Speed Reference (OL□□10) Setting Examples

- Fixed parameter No. 5: Number of digits below decimal point = 3
- Fixed parameter No. 34: Rated motor speed = 3000 R/min
- Fixed parameter No. 36: Number of pulses per motor rotation = 16384 pulse/R (the value before multiply by 4)

The following table shows examples of settings for Speed Reference Setting (OL□□10) to obtain the target feed speed (reference speed).

OW□□03, bits 0 to 3: Speed Unit Selection	Fixed Parameter No. 4: Reference Unit Setting	Setting Unit for OL□□10 Speed Reference Setting	Target Feed Speed Example	Set Value for OL□□10 Speed Reference Setting (Unit Conversion Method)
0 (Reference unit/s)	pulse	pulse/s	50 (R/s)	= 50 (R/s) × 65536 (pulses/R) = 3276800 (pulse/s) Set value: 3726800
			1500 (R/min)	= 1500 (R/min) ÷ 60 × 65536 (pulses/R) = 1638400 (pulse/s) Set value: 1638400
	mm (1 reference unit = 0.001 mm)	Reference unit/s (= 0.001 mm/s)	500 (mm/s)	= 500 (mm/s) × 1000 (reference units/mm) = 500000 (reference units/s (=0.001 mm/s)) Set value: 500000
			900 (mm/min)	= 900 (mm/min) ÷ 60 × 1000 (reference units/mm) = 15000 (reference units/s) (=0.001 mm/s)) Set value: 15000
1 (10^n reference units/min) n = Number of digits below decimal point (= 3)	pulse	1000 pulses/min (Fixed to 1000 regardless of value n)	50 (R/s)	= 50 (R/s) × 60 × 65536 (pulses/R) ÷ 1000 (fixed) = 196608 (pulse/min) Set value: 196608
			1500 (R/min)	= 1500 (R/min) × 65536 (pulses/R) ÷ 1000 (fixed) = 98304 (pulses/min) Set value: 98304
	mm (1 reference unit = 0.001 mm)	mm/min (=10^3 reference units/min)	500 (mm/s)	= 500 (mm/s) × 60 = 30000 (mm/min (=10^3 reference units/min) Set value: 30000
			900 (mm/min)	= 900 (mm/min) Set value: 900
2 0.01%	–	0.01%	50 (R/s)	= 50 (R/s) × 60 ÷ 3000 (R/min) × 10000 (0.01%) = 10000 (0.01%) Set value: 10000
			1500 (R/min)	= 1500 (R/min) ÷ 3000 (R/min) × 10000 (0.01%) = 5000 (0.01%) Set value: 5000

(3) Override (OW□□18) Setting Example

The Override parameter (OW□□18) can set the speed as a percentage (output ratio) of the target feed speed, in 0.01% units. Override is set independently of Reference Unit, Number of Digits below Decimal Point, and other parameters. A typical example of a Override setting is shown below.

Setting Example

Output ratio 25%: 25 ÷ 0.01 = 2500
50%: 50 ÷ 0.01 = 5000
75%: 75 ÷ 0.01 = 7500
100%: 100 ÷ 0.01 = 10000

6.1.6 Acceleration/Deceleration Settings

The acceleration/deceleration can be set to either the rate of acceleration/deceleration or the time required to reach the rated speed from 0. The settings method depends on the related parameter settings.

(1) Related Parameters

The parameters related to acceleration/deceleration settings are listed in the following table.

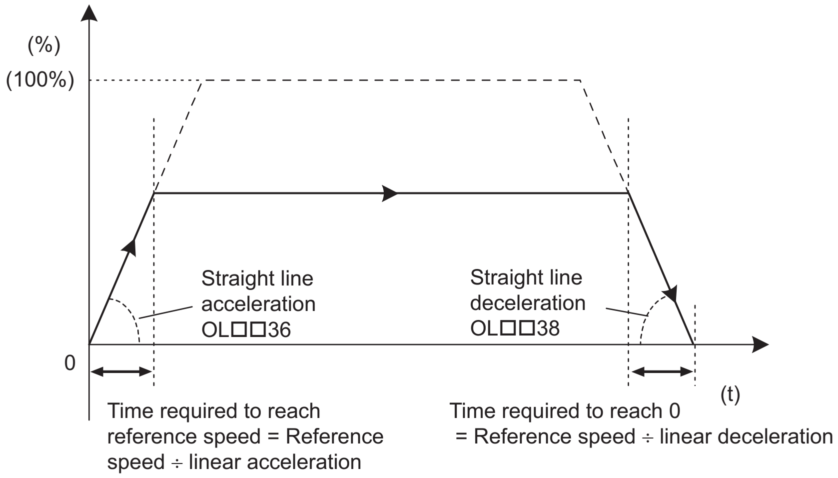
Parameter Type	Parameter No. (Register No.)	Name	Description	Default Value
Motion Fixed Parameters	No. 5	Number of Digits below Decimal Point	Set the number of digits below the decimal point in the input reference unit. The minimum reference unit is determined by this parameter and the Reference Unit (fixed parameter 4). Example: Reference Unit = mm, Number of Digits below Decimal Point = 3 1 reference unit = 0.001 mm	3
	No. 34	Rated Motor Speed	Set the number of rotations when the motor is rotated at the rated speed (100% speed). Confirm the motor specifications before setting this parameter.	3000
	No. 36	Number of Pulses per Motor Rotation	Set the number of pulses (the value before multiplication) per motor rotation. Example: For a 16-bit encoder, set $2^{(16-2)} = 16384$.	16384
Motion Setting Parameters	OW□□03 Bits 4 to 7	Acceleration/Deceleration Degree Unit Selection	Set the unit for acceleration/deceleration. 0: Reference units/s^2 1: ms	1
	OL□□36	Straight Line Acceleration/Acceleration Time Constant	Set the rate of acceleration or acceleration time constant according to the setting of OW□□03, bits 4 to 7. • Acceleration/Deceleration Units is set to 0 (Reference units/s^2): Set the rate of acceleration. pulse unit: 1 = 1 pulse/s^2 mm unit: 1 = 1 reference unit/s^2 deg unit: 1 = 1 reference unit/s^2 inch unit: 1 = 1 reference unit/s^2 Example: Number of Decimal Places = 3 mm unit: 1 = 0.001 mm/s^2 deg unit: 1 = 0.001 deg/s^2 inch unit: 1 = 0.001 inch/s^2 • When Acceleration/Deceleration Units is set to 1 (ms): Set the time constant to go from 0 to the rated speed without relation to the reference unit.	0
	OL□□38	Straight Line Deceleration/Deceleration Time Constant	Set the rate of deceleration or deceleration time constant according to the setting of OW□□03, bits 4 to 7. • Acceleration/Deceleration Units is set to 0 (Reference units/s^2): Set the rate of deceleration. pulse unit: 1 = 1 pulse/s^2 mm unit: 1 = 1 reference unit/s^2 deg unit: 1 = 1 reference unit/s^2 inch unit: 1 = 1 reference unit/s^2 • When Acceleration/Deceleration Units is set to 1 (ms): Set the time constant to go from the rated speed to 0 without relation to the reference unit.	0

(2) Acceleration/Deceleration Units and Speed Changes Over Time

The Straight Line Acceleration /Acceleration Time Constant (OL☐☐36) and Straight Line Deceleration /Deceleration Time Constant (OL☐☐38) settings change depending on the Acceleration/Deceleration Degree Unit Selection (OW☐☐03, bits 4 to 7) setting as shown in the following figure.

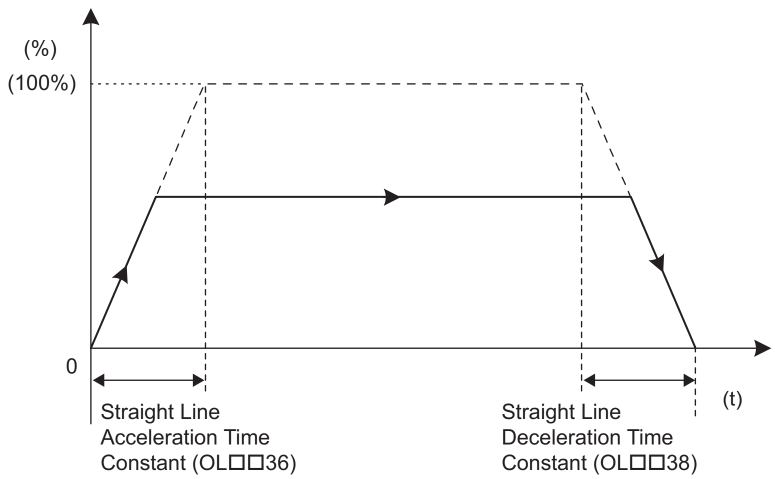
■ When the Acceleration/Deceleration Degree Unit Selection (OW☐☐03, Bits 4 to 7) Set to 0: Reference Unit/s^2

Set value of OL☐☐36 and OL☐☐38 are handled as the linear acceleration rate and linear deceleration rate.



■ When the Acceleration/Deceleration Degree Unit Selection (OW☐☐03, Bits 4 to 7) Set to 1: ms

Set value of OL☐☐36 is handled as the linear acceleration time constant required to reach rated speed from zero using linear acceleration. Set value of OL☐☐38 is handled as the linear deceleration time constant required to reach zero from the rated speed using linear deceleration.



6.1.7 Acceleration/Deceleration Filter Settings

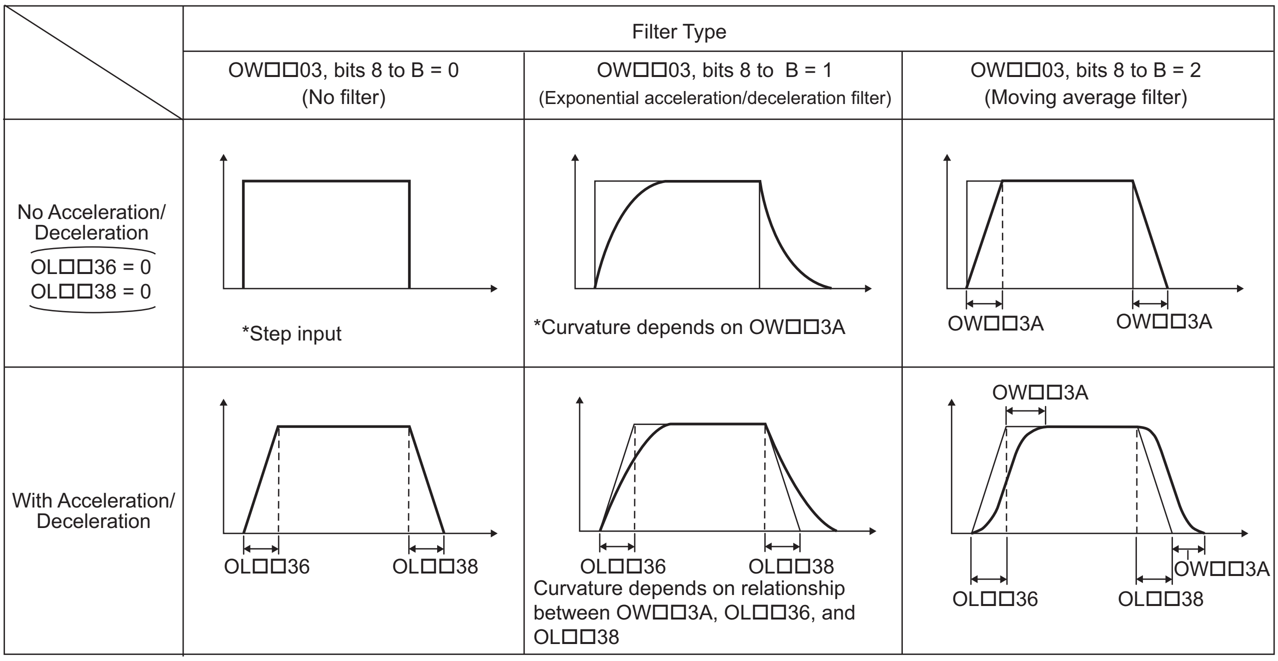
There are two types of acceleration/deceleration filter: The exponential acceleration/deceleration filter and the moving average filter. These filter settings can be used to set non-linear acceleration/deceleration curves.
The table below shows the applicable filter for each motion command.

Motion Command	Exponential Accel/Decel Filter	Moving Average Filter	Description
POSING	Applicable	Applicable	The filter can be continuously used for a motion command other than VELO and TRQ.
EX_POSING	Applicable	Applicable	Same as the above
ZRET	N/A	N/A	–
INTERPOLATE	Applicable	Applicable	The filter can be continuously used for a motion command other than VELO and TRQ.
ENDOF_INTERPOLATE	Applicable	Applicable	Same as the above
LATCH	Applicable	Applicable	Same as the above
FEED	Applicable	Applicable	Same as the above
STEP	Applicable	Applicable	Same as the above
VELO	Applicable	Applicable	The filter can be continuously used for only a motion command VELO.
TRQ	Applicable	N/A	OW☐☐0F (Torque Reference 1st-order Lag Filter) is used instead of OW☐☐3A (Filter Time Constant).
PHASE	N/A	N/A	–

The parameters related to the acceleration/deceleration filter settings are listed in the following table.

Parameter Type	Parameter No. (Register No.)	Name	Description	Default Value
Motion Setting Parameters	OW☐☐03 Bits 8 to B	Filter Type Selection	Set the acceleration/deceleration filter type. 0: Filter none 1: Exponential acceleration/deceleration filter 2: Moving average filter	0
	OW☐☐0F	Torque Reference 1st-order Lag Filter	Set the primary lag filter for the torque/thrust reference and the torque/thrust limit.	0
	OW☐☐3A	Filter Time Constant	Sets the acceleration/deceleration filter time constant for a command other than Torque/Thrust Reference (TRQ) • Always make sure that pulse distribution has been completed (i.e., that monitoring parameter IW☐☐0C, bit 0 is set to 1) before changing the time constant.	0

The following figure shows the relationship between acceleration/deceleration patterns and each parameter.



6.1.8 Linear Scale Pitch and Rated Motor Speed

When using a linear motor, set the number of digits below decimal point (fixed parameter No. 5), the linear scale pitch (fixed parameter No. 6), the rated motor speed (fixed parameter No. 34), and the number of pulses per linear scale pitch (fixed parameter No. 36) according to the linear motor specifications.

(1) Setting Example 1

The following tables give setting examples for these linear motor, linear scale, and SERVOPACK specifications.

■ Linear Motor Specifications

- Rated motor speed : 1.5 (m/s)

■ Linear Scale and SERVOPACK Specifications

- Linear scale pitch : 20 (μm)
- Serial converter resolution: : 256 (division)
  - For SGDM, SGDH, SGDS, SGDV, and SGD7S SERVOPACKs, the set value of SERVOPACK parameter Pn281 (Encoder Output Resolution) is actually used in place of the serial converter resolution.
- Pn281 (Encoder Output Resolution): 128 (pulses/(scale pitch × 4)
  - Set Pn281 to a value of multiples of 4.

[a] Setting Example when Fixed Parameter No. 4 (Reference Unit Selection) is set to 1: mm

Fixed Parameter		Setting Unit	Set Value	Description
No. 4	Reference Unit Selection	–	mm	The actual reference unit is determined by settings of this parameter and the number of digits below decimal point (fixed parameter 5). When Number of Digits below Decimal Point = 3, 1 reference unit = 0.001 (mm) = 1 (μm)
No. 5	Number of Digits below Decimal Point	–	3	When Number of Digits below Decimal Point = 3 or more, the linear scale pitch 20 (μm) can be expressed in an integral number. Therefore, set to 3.
No. 6	Linear Scale Pitch	user units (μm)	20	1 reference unit = 1 (μm) because Number of Digits below Decimal Point = 3. Therefore, set to 20 (μm)
No. 34	Rated Speed	0.1 m/s	15	Set to 15: The value of linear motor rated speed 1.5 (m/s) converted in units of 0.1 m/s.
No. 36	Number of Pulses per Linear Scale Pitch	pulse/ linear scale pitch	32	Set to the result of division: Pn281 (Encoder Output Resolution) ÷ 4 (In this example, 128 ÷ 4 = 32)

[b] Setting Example when Fixed Parameter No. 4 (Reference Unit Selection) is set to 0: pulse

Fixed Parameter		Setting Unit	Set Value	Description
No. 4	Reference Unit Selection	–	pulse	–
No. 5	Number of Digits below Decimal Point	–	–	This parameter is invalid when "pulse" is selected for Reference Unit.
No. 6	Linear Scale Pitch	μm	256	When "pulse" is selected for Reference Unit, the setting unit of this parameter is fixed to "μm". Therefore, set to 20.
No. 34	Rated Speed	0.1 m/s	15	Set to 15: The value of linear motor rated speed 1.5 (m/s) converted in units of 0.1 m/s.
No. 36	Number of Pulses per Linear Scale Pitch	pulse/ linear scale pitch	2	Set to the result of division: Pn281 (Encoder Output Resolution) ÷ 4 (In this example, 128 ÷ 4 = 32)

(2) Setting Example 2

The following tables give setting examples for these linear motor, linear scale, and SERVOPACK specifications.

■ Linear Motor Specifications

- Rated motor speed : 1.5 (m/s)

■ Linear Scale and SERVOPACK Specifications

- Linear scale pitch : 25.6 (μm)
- Serial converter resolution : 256 (division)
  - For SGDM, SGDH, SGDS, SGDV, and SGD7S SERVOPACKs, the set value of SERVOPACK parameter Pn281 (Encoder Output Resolution) is actually used in place of the serial converter resolution.
- Pn281 (Encoder Output Resolution): 8 (pulses/(scale pitch × 4)
  - Set Pn281 to a value of multiples of 4.

[a] Setting Example when Fixed Parameter No. 4 (Reference Unit Selection) is Set to 1: mm

Fixed Parameter		Setting Unit	Set Value	Description
No. 4	Reference Unit Selection	–	mm	The actual reference unit is determined by settings of this parameter and the number of digits below decimal point (fixed parameter 5). When Number of Digits below Decimal Point = 4, 1 reference unit = 0.0001 (mm) = 0.1 (μm)
No. 5	Number of Digits below Decimal Point	–	4	When Number of Digits below Decimal Point = 4 or more, the linear scale pitch 25.6 (μm) can be expressed in an integral number. Therefore, set to 4.
No. 6	Linear Scale Pitch	user units (0.1 μm)	256	1 reference unit = 0.1 (μm) because Number of Digits below Decimal Point = 4. Therefore, set to 256 (0.1 μm)
No. 34	Rated Speed	0.1 m/s	15	Set to 15: The value of linear motor rated speed 1.5 (m/s) converted in units of 0.1 m/s.
No. 36	Number of Pulses per Linear Scale Pitch	pulse/ linear scale pitch	2	Set to the result of division: Pn281 (Encoder Output Resolution) ÷ 4 (In this example, 8 ÷ 4 = 2)

[b] Setting Example when Fixed Parameter No. 4 (Reference Unit Selection) is Set to 0: pulse

Fixed Parameter		Setting Unit	Set Value	Description
No. 4	Reference Unit Selection	–	pulse	–
No. 5	Number of Digits below Decimal Point	–	–	This parameter is invalid when "pulse" is selected for Reference Unit.
No. 6	Linear Scale Pitch	μm	256	When "pulse" is selected for Reference Unit, the setting unit of this parameter is fixed to "μm". However, the linear scale pitch 25.6 (μm) cannot be expressed in an integral number in this setting unit. Therefore, adjust the linear scale pitch by multiplying by 10 and set to the result of multiplication: 256.
No. 34	Rated Speed	0.1m/s	150	The value of the linear motor rated speed 1.5 (m/s) converted in 0.1 m/s is 15. However, the actual linear scale pitch multiplied by 10 is set for Linear Scale Pitch. To keep equivalence, set to the value of the actual rated speed multiplied by 10: 150.
No. 36	Number of Pulses per Linear Scale Pitch	pulse/ linear scale pitch	2	Set to the result of division: Pn281 (Encoder Output Resolution) ÷ 4 (In this example, 8 ÷ 4 = 2)

7

Motion Commands

This chapter describes each motion command parameters and the parameter setting examples.

7.1 Motion Commands

7.1.1 Motion Command Table

The SVA-01 Module supports the following motion commands provided for the MP2000 series Machine Controllers. Refer to Reference Page in the Table for details on each motion command.

Command Code	Command	Name	Description	Reference Page
0	NOP	No command	–	–
1	POSING	Positioning	Positions to the specified position using the specified acceleration/deceleration time constants and the specified speed.	7-3
2	EX_POSING	External Positioning	Positions by moving the external positioning travel distance from the point an external positioning signal was input when already performing a positioning operation.	7-9
3	ZRET	Zero Point Return	Returns to the zero point in the machine coordinate system. When using an incremental encoder, there are 17 different zero point return methods that can be used.	7-15
4	INTERPOLATE	Interpolation	Performs interpolation feeding using positioning data distributed consecutively from the CPU Module.	7-57
6	LATCH	Latch	Memorizes the current position when the latch signal is input during an interpolation feed operation.	7-60
7	FEED	JOG Operation	Moves the axis at the specified speed in the specified direction until the command is canceled.	7-63
8	STEP	STEP Operation	Positions the specified travel distance in the specified direction at the specified speed.	7-67
9	ZSET	Zero Point Setting	Sets the zero point in the machine coordinate system and enables the software limit function.	7-71
23	VELO	Speed Reference	Operates with speed control mode.	7-73
24	TRQ	Torque Reference	Operates with torque control mode.	7-77
25	PHASE	Phase Reference	Operates with phase control mode.	7-81

7.2 Motion Command Details

The following describes the procedure for executing motion commands.

7.2.1 Positioning (POSING)

The POSING command positions the axis to the target position using the specified target position and speed. Parameters related to acceleration and deceleration are set in advance.

(1) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	There are no alarms.	IL□□04 is 0.
2	The Servo ON condition.	IW□□00, bit 1 is ON.
3	Motion command execution has been completed.*	IW□□08 is 0 and IW□□09, bit 0 is OFF.

* This condition is a basic execution condition. Refer to *Chapter 8 Switching Commands during Execution* on page 8-1 when changing the command that is being executed to a POSING command.

2. Set the following motion setting parameters.

Speed Reference Setting: OL□□10
Filter Type Selection: OW□□03, bits 8 to B

- The speed reference can be changed during operation.
- An override of between 0% to 327.67% can be set for the speed reference.

3. Set OW□□08 to 1 to execute the POSING motion command.

- When the bit 5 of OW□□09 (Position Reference Type) is set to 1 (Absolute Mode), set the parameter OL□□1C (Position Reference Setting) before or at the same scan timing as sending the POSING command.

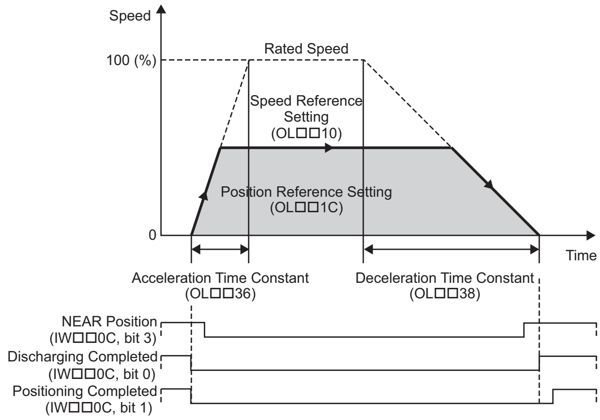
4. Set the target position (OL□□1C).

Positioning will start. IW□□08 will be 1 during the positioning.
IW□□0C, bit 3 will turn ON when the axis approaches the target position.
IW□□0C, bit 1 will turn ON when the axis reaches the target position and the positioning has been completed.

- If the Position Reference Type (OW□□09, bit 5) is set for an absolute mode, the target position can be set before executing the command.
- The target position can be changed during operation.
- When the target position is changed so that there is not sufficient deceleration distance or after the new target position has already been passed, the system will first decelerate to a stop and then reposition according to the new target position.

5. Set OW□□08 to 0 to execute the NOP motion command to complete the positioning operation.

POSING Operation Pattern



■ Terminology: Command execution

When a command code is stored in the motion command register (OW□□08), execution of the motion command corresponding to that code is started. Used in describing motion command operations.

(2) Holding

Axis travel can be stopped during command execution and then the remaining travel can be restarted. A command is held by setting the Holds A Command bit (OW□□09, bit 0) to 1.

- Set the Holds A Command bit (OW□□09, bit 0) to 1. The axis will decelerate to a stop.
- When the axis has stopped, the Command Hold Completed bit (IW□□09, bit 1) will turn ON.
- Reset the Holds A Command bit (OW□□09, bit 0) to 0. The command hold status will be cleared and the remaining portion of the positioning will be restarted.

(3) Aborting

Axis travel can be stopped during command execution and the remaining travel canceled by aborting execution of a command. A command is aborted by setting the Interrupt A Command bit (OW□□09, bit 1) to 1.

- Set the Interrupt A Command bit (OW□□09, bit 1) to 1. The axis will decelerate to a stop.
- When the axis has stopped, the remain travel will be canceled and the Positioning Completed bit (IW□□0C, bit 1) will turn ON.
- The positioning will restart if the Interrupt A Command bit (OW□□09, bit 1) is reset to 0 during abort processing.
- This type of operation will also be performed if the motion command is changed to NOP during axis movement.

(4) Related Parameters

[a] Setting Parameters

Parameter	Name	Setting
OW☐☐00 Bit 0	Servo ON	Turn the power to the Servomotor ON and OFF. 1: Power ON to Servomotor, 0: Power OFF to Servomotor Set this bit to 1 before setting the Motion Command (OW☐☐08) to 1.
OW☐☐03	Function Setting 1	Set the speed unit, acceleration/deceleration unit, and filter type.
OW☐☐08	Motion Command	The positioning starts when this parameter is set to 1. The operation will be canceled if this parameter is set to 0 during POSING command execution.
OW☐☐09 Bit 0	Holds A Command	The axis will decelerate to a stop if this bit is set to 1 during POSING command execution. The positioning will restart if this bit is reset to 0 when a command is being held.
OW☐☐09 Bit 1	Interrupt A Command	The axis will decelerate to a stop if this bit is set to 1 during POSING command execution. When this bit is reset to 0 after decelerating to a stop, the operation depends on the setting of the Position Reference Type (OW☐☐09, bit 5).
OW☐☐09 Bit 5	Position Reference Type	Select the type of position reference. 0: Incremental addition mode, 1: Absolute mode Set this bit before setting the Motion Command (OW☐☐08) to 1.
OL☐☐10	Speed Reference Setting	Specify the speed for the positioning. This setting can be changed during operation. The unit depends on the Function Setting 1 setting (OW☐☐03, bits 0 to 3).
OW☐☐18	Override	This parameter allows the positioning speed to be changed without changing the Speed Reference Setting (OL☐☐10). Set the speed as a percentage of the Speed Reference Setting. This setting can be changed during operation. Setting range: 0 to 32767 (0% to 327.67%) Setting unit: 1 = 0.01% Example: Setting for 50%: 5000
OL☐☐1C	Position Reference Setting	Set the target position for positioning. This setting can be changed during operation. The meaning of the setting depends on the status of the Position Reference Type bit (OW☐☐09, bit 5).
OL☐☐1E	Width of Positioning Completion	Set the width in which to turn ON the Positioning Completed bit (IW☐☐0C, bit 1).
OL☐☐20	NEAR Signal Output Width	Set the range in which the NEAR Position bit (IW☐☐0C, bit 3) will turn ON. The NEAR Position bit will turn ON when the absolute value of the difference between the reference position and the feedback position is less than the value set here.
OL☐☐36	Straight Line Acceleration/ Acceleration Time Constant	Set the rate of acceleration or acceleration time constant for positioning.
OL☐☐38	Straight Line Deceleration/ Deceleration Time Constant	Set the rate of deceleration or deceleration time constant for positioning.
OW☐☐3A	Filter Time Constant	Set the acceleration/deceleration filter time constant. Exponential acceleration/deceleration or a moving average filter can be selected in the Function Setting 1 bit (OW☐☐03, bits 8 to B). Change the setting only after pulse distribution has been completed for the command (IW☐☐0C, bit 0 is ON).

■ Terminology: Pulse distribution

Pulse distribution transfers reference values from the Machine Controller registers to the SERVOPACK registers every scan. Used in describing motion command operation.

Motion Commands

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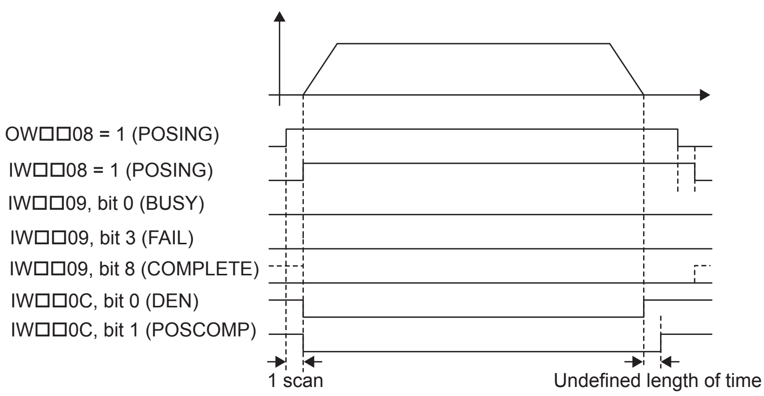
[b] Monitoring Parameters

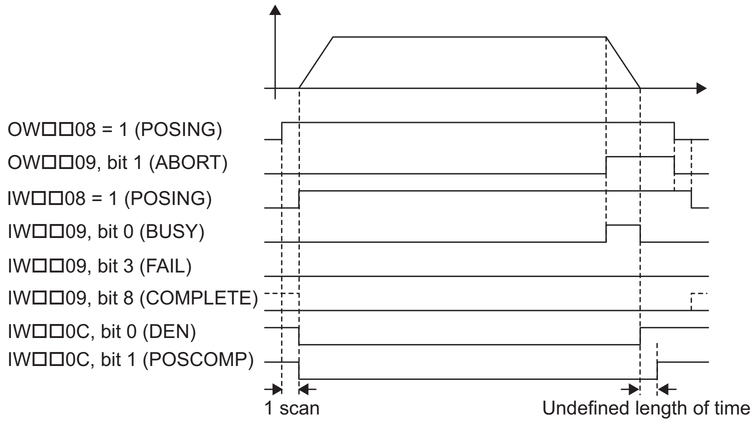
Parameter	Name	Monitor Contents
IW□□00 Bit 1	Running (At Servo ON)	Indicates the Servo ON status. ON: Power supplied to Servomotor, OFF: Power not supplied to Servomotor
IL□□02	Warning	Stores the most current warning.
IL□□04	Alarm	Stores the most current alarm.
IW□□08	Motion Command Response Code	Indicates the motion command that is being executed. The response code is 1 during POSING command execution.
IW□□09 Bit 0	Command Execution Flag	Turns ON when abort processing is being performed for POSING command. Turns OFF when abort processing has been completed.
IW□□09 Bit1	Command Hold Completed	Turns ON when a deceleration to a stop has been completed as the result of setting the Holds A Command bit (OW□□09, bit 0) to 1 during POSING command execution.
IW□□09 Bit 3	Command Error Completed Status	Turns ON if an error occurs during POSING command execution. The axis will decelerate to a stop if it is moving. Turns OFF when another command is executed.
IW□□09 Bit 8	Command Execution Completed	Always OFF for POSING command. Use the Positioning Completed bit (IW□□0C, bit 1) to confirm completion of this command.
IW□□0C Bit 0	Discharging Completed	Turns ON when pulse distribution has been completed for the move command. Turns OFF during execution of the move command.
IW□□0C Bit 1	Positioning Completed	Turns ON when pulse distribution has been completed and the current position is within the Width of Positioning Completion. OFF in all other cases.
IW□□0C Bit 3	NEAR Position	The operation depends on the setting of the NEAR Signal Output Width (setting parameter OL□□20). OL□□20 = 0:Turns ON when pulse distribution has been completed (DEN = ON). Otherwise, it turns OFF. OL□□20 ≠ 0:Turns ON when the absolute value of the difference between MPOS (IL□□12) and APOS (IL□□16) is less than the NEAR Position Setting even if pulse distribution has not been completed. OFF in all other cases.

(5) Timing Charts

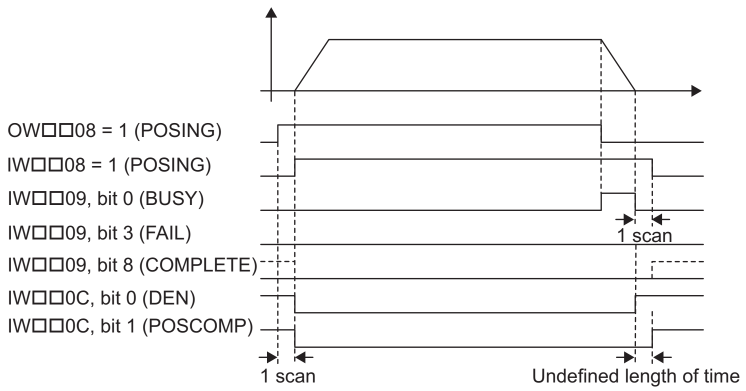
[a] Normal Execution



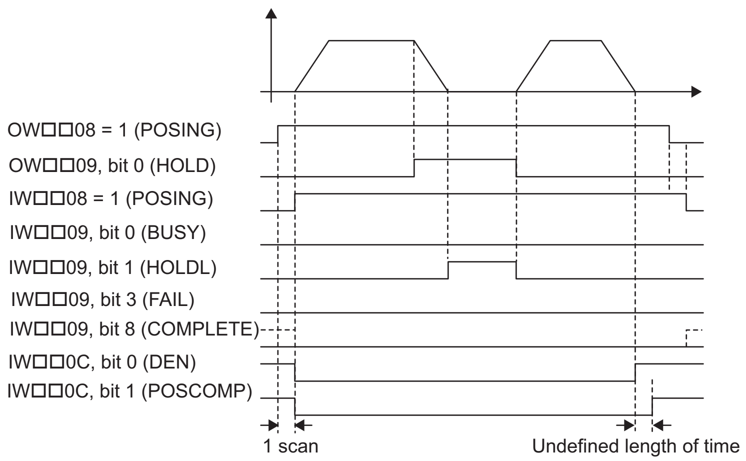
[b] Execution when Aborted



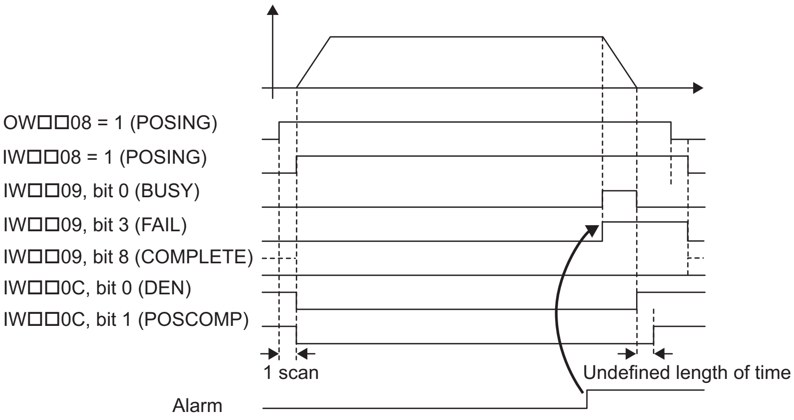
[c] Execution when Aborting by Changing the Command



[d] Command Hold



[e] Execution when an Alarm Occurs



7.2.2 External Positioning (EX_POSING)

The EX_POSING command positions the axis to the target position using the specified target position and speed. Parameters related to acceleration and deceleration are set in advance.
If the external positioning signal turns ON during axis movement, the axis will move the distance specified for the External Positioning Move Distance from the point at which the external positioning signal turned ON, and then stop.
If the external positioning signal does not turn ON, positioning will be completed to the original target position.

(1) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	There are no alarms.	IL□□04 is 0.
2	The Servo ON condition.	IW□□00, bit 1 is ON.
3	Motion command execution has been completed.*	IW□□08 is 0 and IW□□09, bit 0 is OFF.

* This condition is a basic execution condition. Refer to *Chapter 8 Switching Commands during Execution* on page 8-1 when changing the command that is being executed to an EX_POSING command.

2. Set the following motion setting parameters.

External Positioning Final Travel Distance: OL□□46
External Positioning Signal Setting: OW□□04
Speed Reference Setting: OL□□10
Filter Type Selection: OW□□03, bits 8 to B
Position Reference Setting: OL□□1C

- The Speed Reference can be changed during operation.
- An override of between 0% to 327.67% can be set for the speed reference.
- A latch zone can be set.

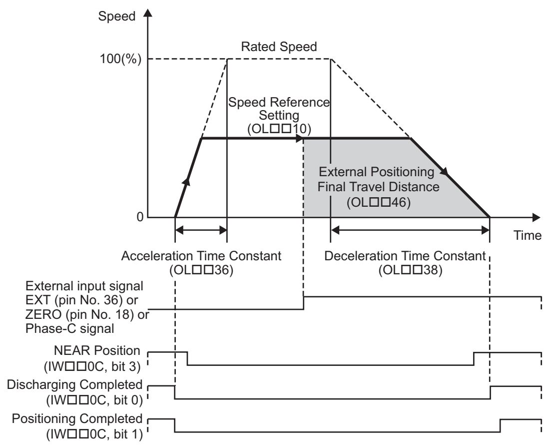
3. Set OW□□08 to 2 to execute the EX_POSING motion command to use the preceding settings in the same scan.

4. Turn ON the external positioning signal.

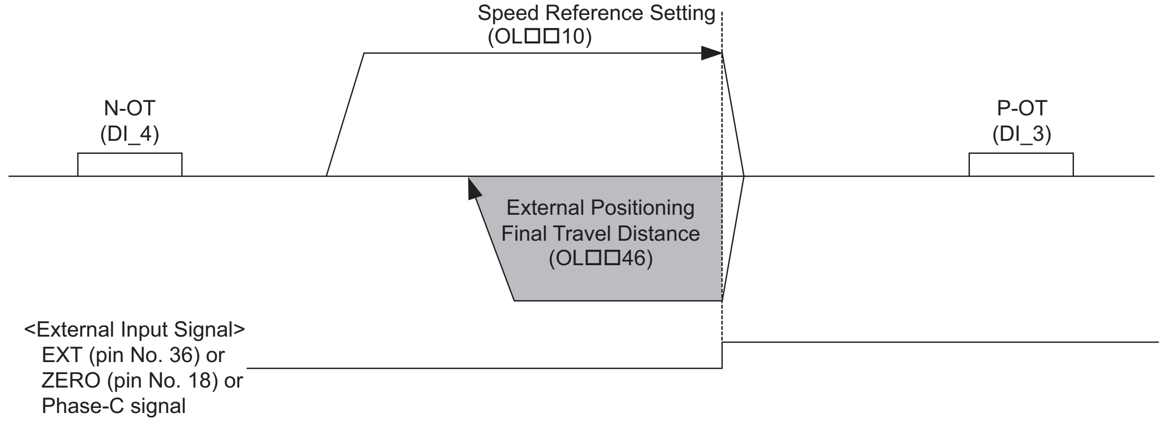
The axis will move for the External Positioning Final Travel Distance and decelerate to a stop.
IW□□09, bit 8 will turn ON when the axis stops and external positioning has been completed.

5. Set OW□□08 to 0 to execute the NOP motion command to complete the external positioning operation.

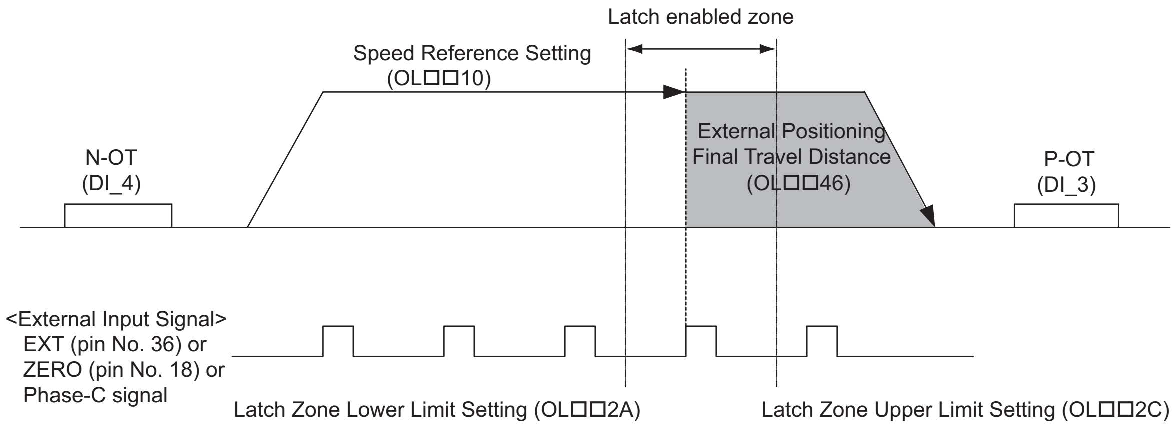
EX_POSING Operation Pattern



When the sign of the External Positioning Final Travel Distance is opposite to the direction of positioning to the target position, the axis will be decelerated to a stop and then starts moving in the reverse direction as illustrated below.



While the latch zone setting is enabled, any external input signal out of the latch enabled zone is ignored.
In this case, the position is latched when the first external signal is input in the latch enabled zone, and the axis moves from this latched position for the external positioning move distance for positioning.



(2) Holding

Axis travel can be stopped during command execution and then the remaining travel can be restarted. A command is held by setting the Holds A Command bit (OW□□09, bit 0) to 1.

- Set the Holds A Command bit (OW□□09, bit 0) to 1. The axis will decelerate to a stop.
- When the axis has stopped, the Command Hold Completed bit (IW□□09, bit 1) will turn ON.
- Reset the Holds A Command bit (OW□□09, bit 0) to 0.
  The command hold status will be cleared and the remaining portion of the operation will be restarted.

(3) Aborting

Axis travel can be stopped during command execution and the remaining travel canceled by aborting execution of a command. A command is aborted by setting the Interrupt A Command bit (OW□□09, bit 1) to 1.

- Set the Interrupt A Command bit (OW□□09, bit 1) to 1. The axis will decelerate to a stop.
- When the axis has stopped, the remain travel will be canceled and the Positioning Completed bit (IW□□0C, bit 1) will turn ON.
- The positioning will restart if the Interrupt A Command bit (OW□□09, bit 1) is reset to 0 during abort processing.
- This type of operation will also be performed if the motion command is changed to NOP during axis movement.

(4) Related Parameters

[a] Setting Parameters

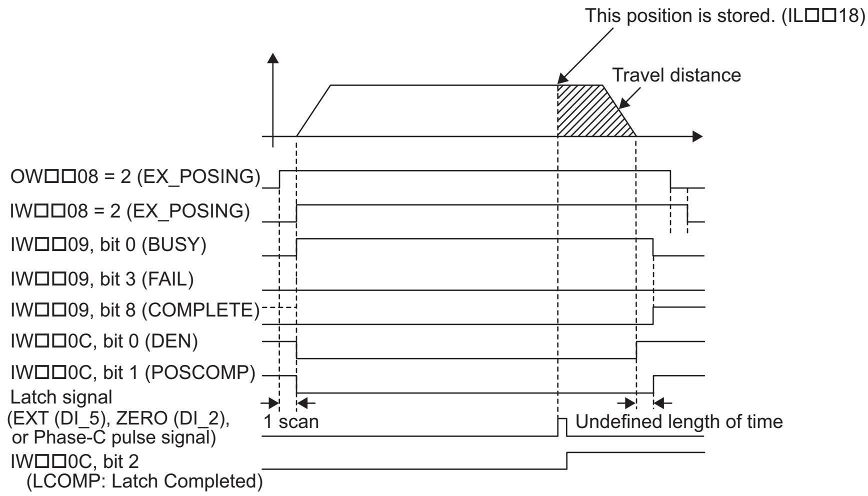
Parameter	Name	Setting
OW☐☐00 Bit 0	Servo ON	Turn the power to the Servomotor ON and OFF. 1: Power ON to Servomotor, 0: Power OFF to Servomotor Set this bit to 1 before setting the Motion Command (OW☐☐08) to 2.
OW☐☐03	Function Setting 1	Set the speed unit, acceleration/deceleration unit, and filter type.
OW☐☐04	Function Setting 2	Set the external positioning signal. 0: EXT (DI_5), 1: ZERO (DI_2), 2: Phase-C pulse signal
OW☐☐08	Motion Command	The positioning starts when this parameter is set to 2. The operation will be canceled if this parameter is set to 0 during EX_POSING command execution.
OW☐☐09 Bit 0	Holds A Command	The axis will decelerate to a stop if this bit is set to 1 during execution of EX_POSING command execution. The positioning will restart if this bit is reset to 0 when a command is being held.
OW☐☐09 Bit 1	Interrupt A Command	The axis will decelerate to a stop if this bit is set to 1 during EX_POSING command execution.
OW☐☐09 Bit 4	Latch Zone Effective Selection	Enable or disable the area where the external positioning signal is valid. If the latch zone is enabled, the external positioning signal will be ignored if it is input outside of the latch zone. 0: Disable, 1: Enable
OW☐☐09 Bit 5	Position Reference Type	Select the type of position reference. 0: Incremental addition mode, 1: Absolute mode Set this bit before setting the Motion Command (OW☐☐08) to 2.
OL☐☐10	Speed Reference Setting	Specify the speed for the positioning. This setting can be changed during operation. The unit depends on the Function Setting 1 setting (OW☐☐03, bits 0 to 3).
OW☐☐18	Override	This parameter allows the positioning speed to be changed without changing the Speed Reference Setting (OL☐☐10). Set the speed as a percentage of the Speed Reference Setting. This setting can be changed during operation. Setting range: 0 to 32767 (0% to 327.67%) Setting unit: 1 = 0.01%
OL☐☐1C	Position Reference Setting	Set the target position for positioning. The meaning of the setting depends on the status of the Position Reference Type bit (OW☐☐09, bit 5).
OL☐☐1E	Width of Positioning Completion	Set the width in which to turn ON the Positioning Completed bit (IW☐☐0C, bit 1).
OL☐☐20	NEAR Signal Output Width	Set the range in which the NEAR Position bit (IW☐☐0C, bit 3) will turn ON. The NEAR Position bit will turn ON when the absolute value of the difference between the reference position and the feedback position is less than the value set here.
OL☐☐2A	Latch Zone Lower Limit	Set the boundary in the negative direction of the area in which the external positioning signal is to be valid.
OL☐☐2C	Latch Zone Upper Limit	Set the boundary in the positive direction of the area in which the external positioning signal is to be valid.
OL☐☐36	Straight Line Acceleration/ Acceleration Time Constant	Set the rate of acceleration or acceleration time constant for positioning.
OL☐☐38	Straight Line Deceleration/ Deceleration Time Constant	Set the rate of deceleration or deceleration time constant for positioning.
OW☐☐3A	Filter Time Constant	Set the acceleration/deceleration filter time constant. Exponential acceleration/deceleration or a moving average filter can be selected in OW☐☐03, bits 8 to B. Change the setting only after pulse distribution has been completed for the command (IW☐☐0C, bit 0 is ON).
OL☐☐46	External Positioning Final Travel Distance	Set the moving amount after the external positioning signal is input.

[b] Monitoring Parameters

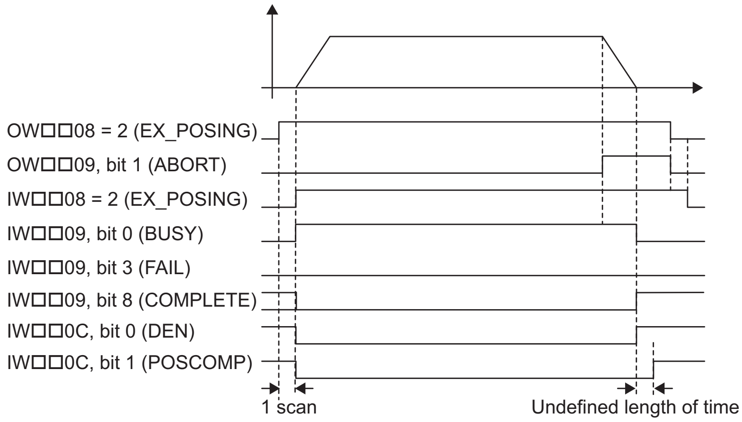
Parameter	Name	Monitor Contents
IW□□00 Bit 1	Running (At Servo ON)	Indicates the Servo ON status. ON: Power supplied to Servomotor, OFF: Power not supplied to Servomotor
IL□□02	Warning	Stores the most current warning.
IL□□04	Alarm	Stores the most current alarm.
IW□□08	Motion Command Response Code	Indicates the motion command that is being executed. The response code is 2 during EX_POSING command execution.
IW□□09 Bit 0	Command Execution Flag	Turns ON during EX_POSING command execution. Turns OFF when command execution has been completed.
IW□□09 Bit 1	Command Hold Completed	Turns ON when a deceleration to a stop has been completed as the result of setting the Holds A Command bit (OW□□09, bit 1) to 1 during EX_POSING command execution (IW□□08 = 2).
IW□□09 Bit 3	Command Error Completed Status	Turns ON if an error occurs during EX_POSING command execution. The axis will decelerate to a stop if it is moving. Turns OFF when another command is executed.
IW□□09 Bit 8	Command Execution Completed	Turns ON when EX_POSING command execution has been completed.
IW□□0C Bit 0	Discharging Completed	Turns ON when pulse distribution has been completed for the move command. Turns OFF during execution of a move command.
IW□□0C Bit 1	Positioning Completed	Turns ON when pulse distribution has been completed and the current position is within the Positioning Completed Width. OFF in all other cases.
IW□□0C Bit 2	Latch Completed	Turns OFF when a new latch command is executed and turns ON when the latch has been completed. The latched position is stored as the Machine Coordinate System Latch Position (monitoring parameter IL□□18).
IW□□0C Bit 3	NEAR Position	The operation depends on the setting of the NEAR Signal Output Width (setting parameter OL□□20). OL□□20 = 0: Turns ON when pulse distribution has been completed (DEN = ON). Otherwise, it turns OFF. OL□□20 ≠ 0: Turns ON when the absolute value of the difference between MPOS (IL□□12) and APOS (IL□□16) is less than the NEAR Position Setting even if pulse distribution has not been completed. OFF in all other cases.
IL□□18	Machine Coordinate System Latch Position	Stores the current position in the machine coordinate system when the latch signal turned ON.

(5) Timing Charts

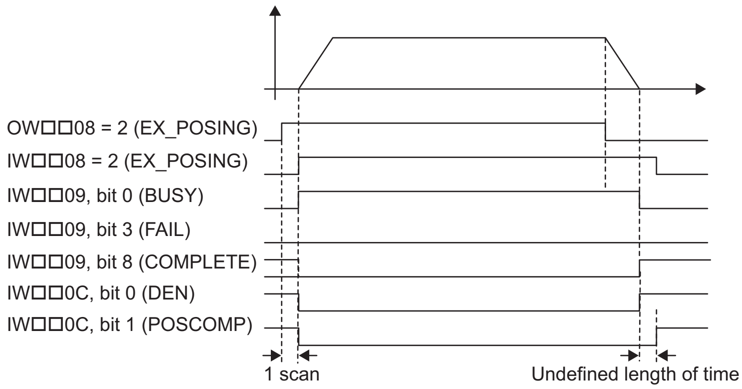
[a] Normal Execution



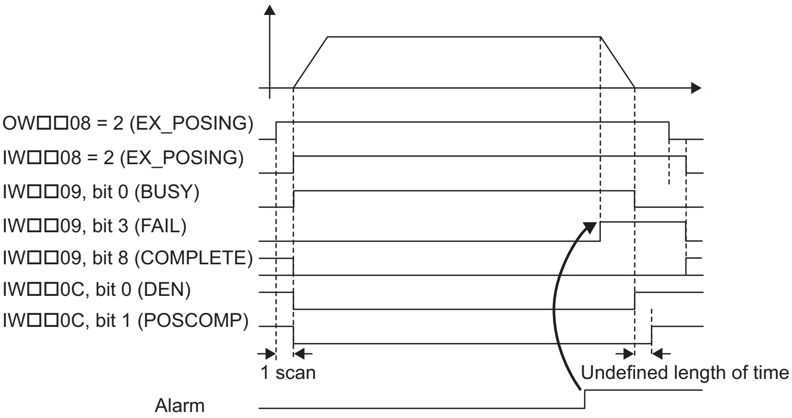
[b] Execution when Aborted



[c] Execution when Aborting by Changing the Command



[d] Execution when an Alarm Occurs



7.2.3 Zero Point Return (ZRET)

When the Zero Point Return command (ZRET) is executed, the axis will return to the zero point of the machine coordinate system.
The operation to detect the position of the zero point is different between an absolute encoder and an incremental encoder.
With an absolute encoder, positioning is performed to the zero point of the machine coordinate system, the machine coordinate system is constructed using the zero point as the value set for OL□□48 (Zero Point Position in Machine Coordinate System Offset), and then the command execution is completed.

- When using an absolute encoder, use POSING (positioning) command instead of ZRET (zero point return) command unless ZRET command is absolutely necessary.

With an incremental encoder, there are 17 different methods (see below) that can be performed for the zero point return operation.

(1) Selecting the Zero Point Return Method (with an Incremental Encoder)

When an incremental encoder is selected for the Encoder Selection by fixed parameter No. 30 to 0, the coordinate system data will be lost when the power supply is turned OFF. This command must be executed when the power supply is turned ON again to establish a new coordinate system.
The following table lists the 17 zero point return methods that are supported by the MP2000 Series Machine Controller. Select the best method for the machine according to the setting parameters. Refer to the page in the Table for additional command information.

Setting Parameter OW□□3C	Name	Method	Signal Meaning	Reference Page
0	DEC1 + Phase-C	Applies a 3-step deceleration method using the deceleration limit switch and phase-C pulse.	DEC1 signal: DI_5 or OW□□05, bit 8	7-21
1	ZERO signal	Uses the ZERO signal.	ZERO signal: DI_2	7-22
2	DEC1 + ZERO signals	Applies a 3-step deceleration method using the deceleration limit switch and ZERO signal.	DEC1 signal: DI_5 or OW□□05, bit 8 ZERO signal: DI_2	7-23
3	Phase-C	Uses the phase-C pulse.	–	7-24
4	DEC2 + ZERO signals	Uses the deceleration limit switch (LS) signal as the zone signal, and ZERO signal as the zero point signal.	DEC2 signal: DI_5 or OW□□05, bit 8 ZERO signal: DI_2	7-25
5	DEC1 + LMT + ZERO signals	Uses the deceleration limit switch (LS) signal and two limit signals (LMT) for zero point return as the zone signals, and ZERO signal as the zero point signal.	DEC1 signal: DI_5 or OW□□05, bit 8 Reverse LMT signal: OW□□05, bit 9 Forward LMT signal: OW□□05, bit 10 ZERO signal: DI_2	7-28
6	DEC2 + Phase-C signals	Uses the deceleration limit switch (LS) signal as the zone signal, and the phase-C signal as the zero point signal.	DEC2 signal: DI_5 or OW□□05, bit 8	7-34
7	DEC1 + LMT + Phase-C signals	Uses the deceleration limit switch (LS) signal and two limit signals (LMT) for zero point return as the zone signals, and the phase-C signal as the zero point signal.	DEC1 signal: DI_5 or OW□□05, bit 8 Reverse LMT signal: OW□□05, bit 9 Forward LMT signal: OW□□05, bit 10	7-37
11	C pulse Only	Uses only the phase-C pulse.	P-OT: DI_3 N-OT: DI_4	7-43
12	P-OT & C pulse	Uses the positive overtravel signal and phase-C pulse.	P-OT: DI_3	7-44
13	P-OT Only	Uses only the positive overtravel signal.	P-OT: DI_3 This method must not be used if repeat accuracy is required.	7-45
14	Home LS & C pulse	Uses the home signal and phase-C pulse.	P-OT: DI_3, N-OT: DI_4 HOME: DI_2	7-47
15	Home LS Only	Uses only the home signal.	P-OT: DI_3, N-OT: DI_4 HOME: DI_2	7-49

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Setting Parameter OW□□3C	Name	Method	Signal Meaning	Reference Page
16	N-OT & C pulse	Uses the negative overtravel signal and phase-C pulse.	N-OT: DI_4	7-51
17	N-OT Only	Uses only the negative overtravel signal.	N-OT: DI_4 This method must not be used if repeat accuracy is required.	7-52
18	INPUT & C pulse	Uses the INPUT signal and phase-C pulse.	INPUT: OW□□05, bit B	7-53
19	INPUT Only	Uses only the INPUT signal.	INPUT: OW□□05, bit B. This method must not be used if repeat accuracy is required.	7-55

(2) Signals Used for Zero Point Return

The following table shows the details on the signals used for zero point return operation.

Signal Name	Signal Allocation	Polarity Inversion Function	Latch Function	Description	Zero Point Return Methods (OW□□3C) That Use the Signal
Phase-C	5 - 6 pin (Differential input)	Valid *1	Valid	Used as the zero point signal for zero point return	0, 3, 6, 7, 11, 12, 14, 16, and 18
ZERO	General-purpose DI_2 (pin No. 18)	Valid *2	Valid	Used as the zero point signal for zero point return	1, 2, 4, and 5
HOME LS			Valid	Used as the deceleration limit switch (LS) signal for zero point return	14
				Used as the zero point signal for zero point return	15
P-OT	General-purpose DI_3 (pin No. 14)	Invalid	Invalid	Used as the deceleration limit switch (LS) signal for zero point return.	12
				Used as the deceleration limit switch (LS) signal and the zero point signal for zero point return.	13
N-OT	General-purpose DI_4 (pin No. 13)	Invalid	Invalid	Used as the deceleration limit switch (LS) signal for zero point return.	16
				Used as the deceleration limit switch (LS) signal and the zero point signal for zero point return.	17
DEC1	General-purpose DI_5 (pin No. 36) or OW□□05, bit 8	Valid*2	Invalid	Used as the deceleration limit switch (LS) signal for zero point return.	0, 2, 5, and 7
DEC2			Invalid	Used as the zone signal and the deceleration limit switch (LS) signal for zero point return.	4 and 6
EXT	General-purpose DI_5 (pin No. 36)		Valid	Used as the external input signal for the external positioning command. Also used as the input signal for the modal latch function.	–
Reverse LMT	OW□□05, bit 9	Invalid	Invalid	Used as the zone signal for zero point return.	5 and 7
Forward LMT	OW□□05, bit 10	Invalid	Invalid	Used as the zone signal for zero point return.	5 and 7
INPUT	OW□□05, bit 11	Invalid	Invalid	Used as the deceleration limit switch (LS) signal for zero point return.	18
				Used as the zero point signal for zero point return.	19

* 1. The polarity can be inversed by setting the fixed parameter No. 20, bit 1 (C Pulse Input Signal Polarity Selection).
* 2. The polarity can be inversed by setting the fixed parameter No. 1, bit 5 (Deceleration LS Inversion Selection).

(3) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	There are no alarms.	IL□□04 is 0.
2	The Servo ON condition.	IW□□00, bit 1 is ON.
3	Motion command execution has been completed.*	IW□□08 is 0 and IW□□09, bit 0 is OFF.

* This condition is a basic execution condition. Refer to *Chapter 8 Switching Commands during Execution* on page 8-1 when changing the command that is being executed to a ZRET command.

2. When an incremental encoder is selected for the Encoder Selection by setting fixed parameter No. 30 to 0, set the zero point return method that will be used in the Zero Point Return Method (motion setting parameter OW□□3C) as described on the previous page.

- The software limit function will be enabled after the zero point return operation has been completed.

3. Refer to *7.2.3 (8) Zero Point Return Operation and Parameters* on page 7-21 and set the required parameters.

4. Set OW□□08 to 3 to execute the ZRET motion command.

The zero point return operation will start. IW□□08 will be 3 during the operation.
IB□□0C, bit5 will turn ON when the axis reaches the zero point and zero point return has been completed.

5. Set OW□□08 to 0 to execute the NOP motion command and then complete the zero point return operation.

(4) Holding

Holding execution is not possible during zero point return operation. The Holds A Command bit (OW□□09, bit 0) is ignored.

(5) Aborting

The zero point return can be canceled by aborting execution of a command. A command is aborted by setting the Interrupt A Command bit (OW□□09, bit 1) to 1.

- Set the Interrupt A Command bit (OW□□09, bit 1) to 1. The axis will decelerate to a stop.
- When the axis has stopped, the remain travel will be canceled and the Positioning Completed bit (IW□□0C, bit 1) will turn ON.
- This type of operation will also be performed if the motion command is changed to NOP during axis movement.

(6) Related Parameters

[a] Setting Parameters

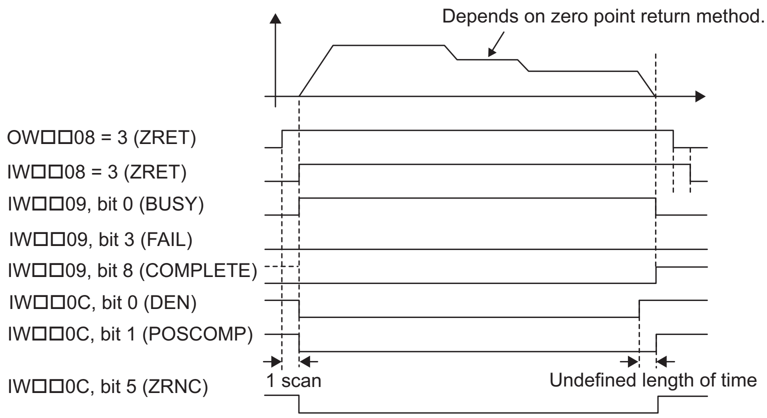
Parameter	Name	Setting
OW□□00 Bit 0	Servo ON	Turns the power to the Servomotor ON and OFF. 1: Power ON to Servomotor, 0: Power OFF to Servomotor Set this bit to 1 before setting the Motion Command (OW□□08) to 3.
OW□□03	Function Setting 1	Set the speed unit.
OW□□08	Motion Command	Zero point return operation starts when this parameter is set to 3. The operation will be canceled if this parameter is set to 0 during ZRET command execution.
OW□□09 Bit 1	Interrupt A Command	The axis will decelerate to a stop if this bit is set to 1 during ZRET command execution.
OW□□09 Bit 5	Position Reference Type	Select the type of position reference. 0: Incremental addition mode, 1: Absolute mode Set this bit before setting the Motion Command (OW□□08) to 3.
OL□□36	Straight Line Acceleration/Acceleration Time Constant	Set the rate of acceleration or acceleration time constant for positioning.
OL□□38	Straight Line Deceleration/Deceleration Time Constant	Set the rate of deceleration or deceleration time constant for positioning.
OW□□3D	Width of Starting Point Position Output	Set the width in which the Zero Point Position bit (IW□□0C, bit 4) will turn ON.

[b] Monitoring Parameters

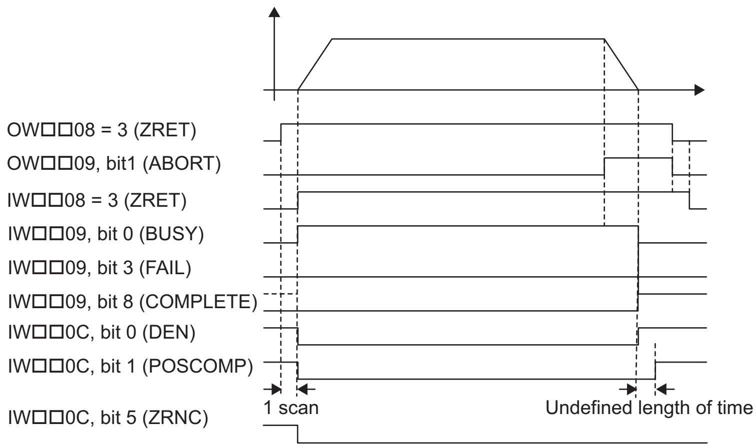
Parameter	Name	Monitor Contents
IW□□00 Bit 1	Running (At Servo ON)	Indicates the Servo ON status. ON: Power supplied to Servomotor, OFF: Power not supplied to Servomotor
IL□□02	Warning	Stores the most current warning.
IL□□04	Alarm	Stores the most current alarm.
IW□□08	Motion Command Response Code	Indicates the motion command that is being executed. The response code is 3 during ZRET command execution.
IW□□09 Bit 0	Command Execution Flag	Turns ON during ZRET command execution. Turns OFF when command execution has been completed.
IW□□09 Bit 1	Command Hold Completed	Always OFF for ZRET command.
IW□□09 Bit 3	Command Error Completed Status	Turns ON if an error occurs during ZRET command execution. The axis will decelerate to a stop if it is moving. Turns OFF when another command is executed.
IW□□09 Bit 8	Command Execution Completed	Turns ON when ZRET command execution has been completed.
IW□□0C Bit 0	Discharging Completed	Turns ON when pulse distribution has been completed for the move command. Turns OFF during execution of a move command.
IW□□0C Bit 3	NEAR Position	The operation depends on the setting of the NEAR Signal Output Width (setting parameter OL□□20). OL□□20 = 0: Turns ON when pulse distribution has been completed (DEN = ON). Otherwise, it turns OFF. OL□□20 ≠ 0: Turns ON when the absolute value of the difference between MPOS (IL□□12) and APOS (IL□□16) is less than the NEAR Position Setting even if pulse distribution has not been completed. OFF in all other cases.
IW□□0C Bit 4	Zero Point Position	Turns ON if the current position after the zero point return operation has been completed is within the Width of Starting Point Position Output from the zero point position. Otherwise, it turns OFF.
IW□□0C Bit 5	Zero Point Return (Setting) Completed	Turns ON when the zero point return has been completed.

(7) Timing Charts

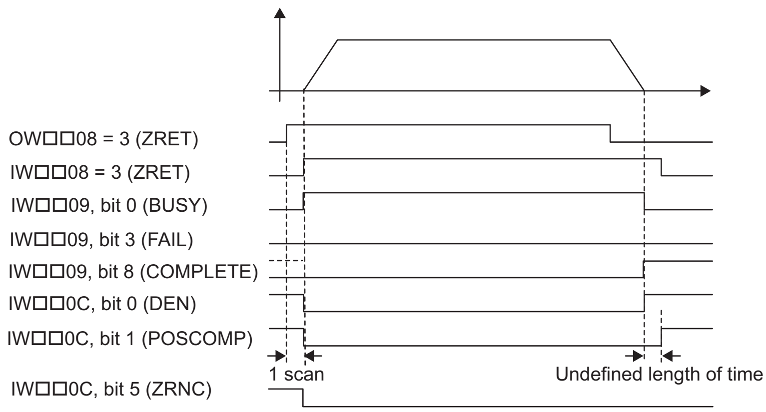
[a] Normal Execution



[b] Execution when Aborted



[c] Execution when Aborting by Changing the Command



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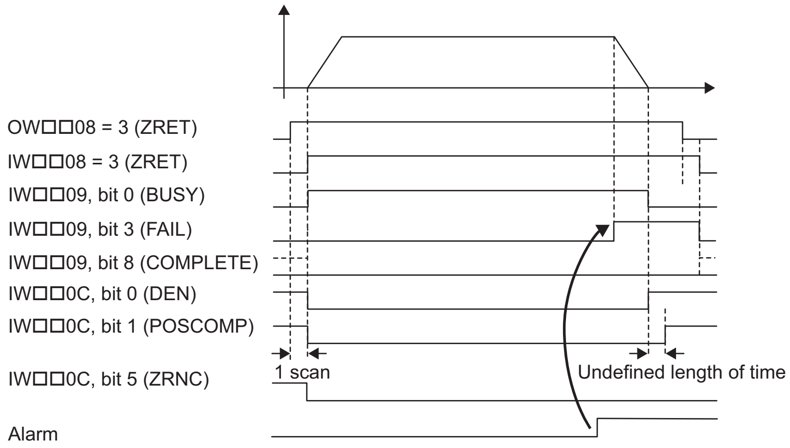
[d] Execution when an Alarm Occurs



(8) Zero Point Return Operation and Parameters

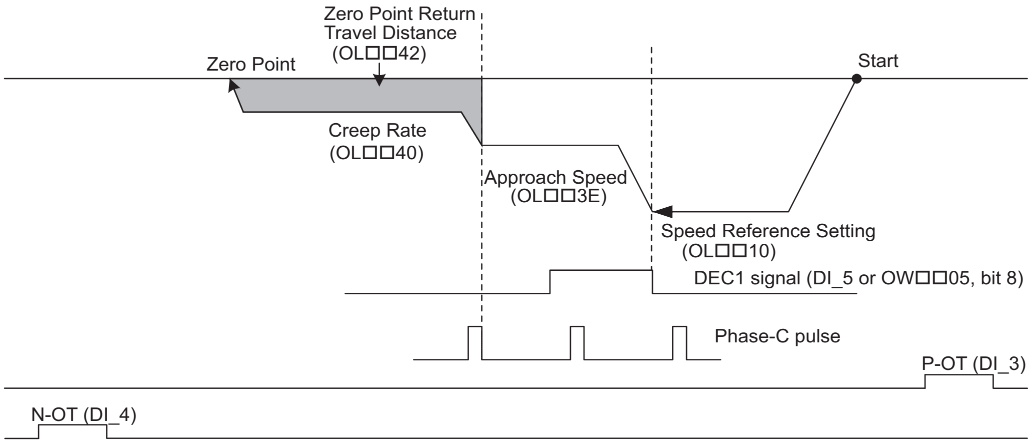
With an incremental encoder, there are 17 different methods that can be performed for the zero point return operation. This section explains the operation that occurs after starting a zero point return and the parameters that need to be set before executing the command.

[a] DEC1 + Phase-C Method (OW□□3C = 0)

■ Operation after Zero Point Return Starts

Travel is started at the zero point return speed in the direction specified in the parameters.
When the rising edge of the DEC1 signal is detected, the speed is reduced to the approach speed.
When the first phase-C pulse is detected after passing the DEC1 signal at the approach speed, the speed is reduced to the creep speed and positioning is performed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the phase-C pulse is detected is set in the Zero Point Return Travel Distance, (OL□□42).
- If an OT signal is detected during the zero point return operation, an OT alarm will occur.



■ Parameters to be Set

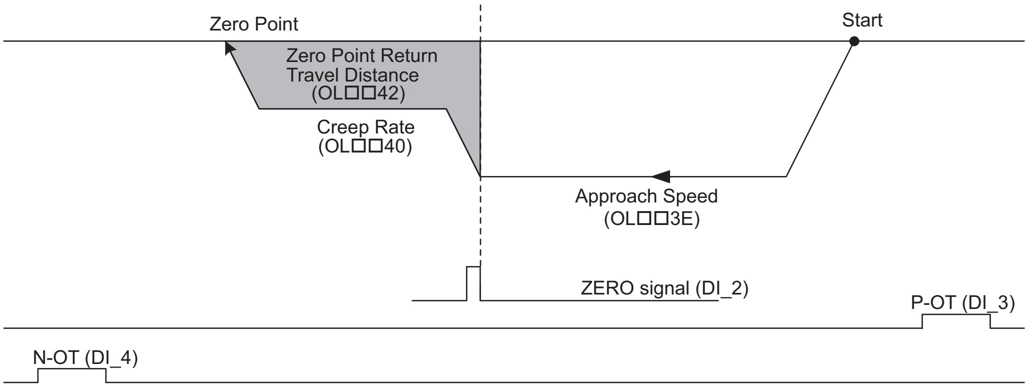
Parameter	Name	Setting
Fixed Parameter No. 1, Bit 5	Deceleration LS Inversion Selection	Set whether or not to invert the polarity of DI_5 signal used as DEC1 signal. However, the Zero Point Return Deceleration LS Signal (OW□□05, bit 8) will not be inverted even if this bit is set to 1 (invert).
Fixed Parameter No. 21, Bit 0	Deceleration LS Signal Selection	Select the signal to be used as DEC1. 0: OW□□05, bit 8, 1: DI_5
OW□□05, Bit 8	Zero Point Return Deceleration LS Signal (DEC1)	Used to input DEC1 signal from the ladder program when the bit 0 of fixed parameter No.21 is 0.
OW□□09, Bit 3	Zero Point Return Direction Selection	Set the zero point return direction. 0: Reverse rotation (default), 1: Forward rotation
OL□□10	Speed Reference Setting	Set the speed to use when starting a zero point return. Only a positive value can be set; a negative value will result in an error.
OW□□18	Override	This parameter allows the Zero Point Return speed to be changed without changing the Speed Reference Setting (OL□□10). Set the speed as a percentage of the Speed Reference Setting. This setting can be changed during operation. Setting range: 0 to 32767 (0% to 327.67%) Setting unit: 1 = 0.01% Example: Setting for 50%: 5000
OW□□3C	Zero Point Return Method	0: DEC1 + Phase-C
OL□□3E	Approach Speed	Set the speed to use after detecting the DEC1 signal. Only a positive value can be set; a negative value will result in an error.
OL□□40	Creep Rate	Set the speed to use after detecting the first phase-C pulse after passing the DEC1 signal. Only a positive value can be set; a negative value will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where the first phase-C pulse is detected after passing the DEC1 signal. If the sign is positive, travel will be toward the zero point return direction; if the sign is negative, travel will be away from the zero point return direction.

[b] ZERO Signal Method (OW□□3C = 1)

■ Operation after Zero Point Return Starts

Travel is started at the approach speed in the direction specified in the parameters.
When the rising edge of the ZERO signal is detected, the speed is reduced to the creep speed and positioning is performed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the ZERO signal is detected is set in the Zero Point Return Travel Distance (OL□□42).
- If an OT signal is detected during the zero point return operation, an OT alarm will occur.



■ Parameters to be Set

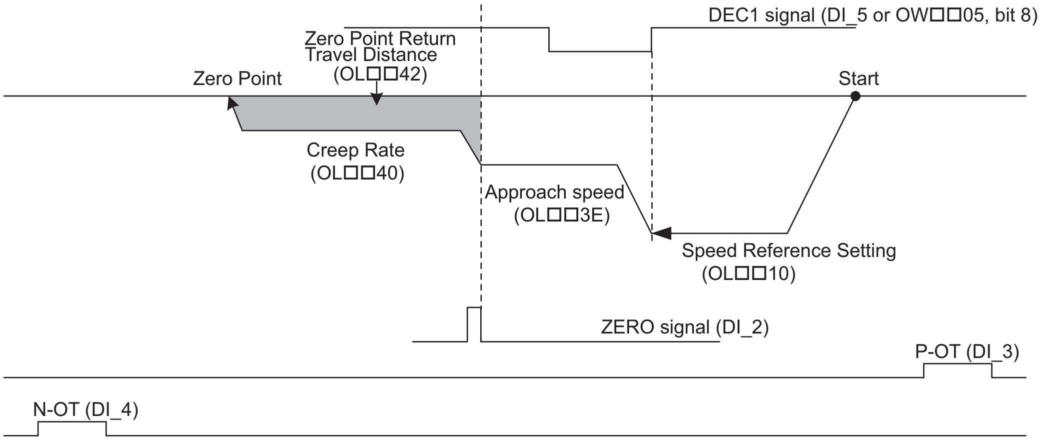
Parameter	Name	Setting
OW□□3C	Zero Point Return Method	1: ZERO Signal Method
OW□□09, Bit 3	Zero Point Return Direction Selection	Set the zero point return direction. 0: Reverse rotation (default), 1: Forward rotation
OL□□3E	Approach Speed	Set the speed to use when starting a zero point return. Only a positive value can be set; a negative value will result in an error.
OL□□40	Creep Rate	Set the speed to use after detecting the ZERO signal. Only a positive value can be set; a negative value will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where the ZERO signal is detected. If the sign is positive, travel will be toward the zero point return direction; if the sign is negative, travel will be away from the zero point return direction.

[c] DEC1 + ZERO Signal Method (OW□□3C = 2)

■ Operation after Zero Point Return Starts

Travel is started at the zero point return speed in the direction specified in the parameters.
When the rising edge of the DEC1 signal is detected, the speed is reduced to the approach speed.
When the rising edge of the ZERO signal is detected after passing the DEC1 signal at the approach speed, the speed is reduced to the creep speed and positioning is performed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the ZERO signal is detected is set in the Zero Point Return Travel Distance (OL□□42).
- If an OT signal is detected during the zero point return operation, an OT alarm will occur.



■ Parameters to be Set

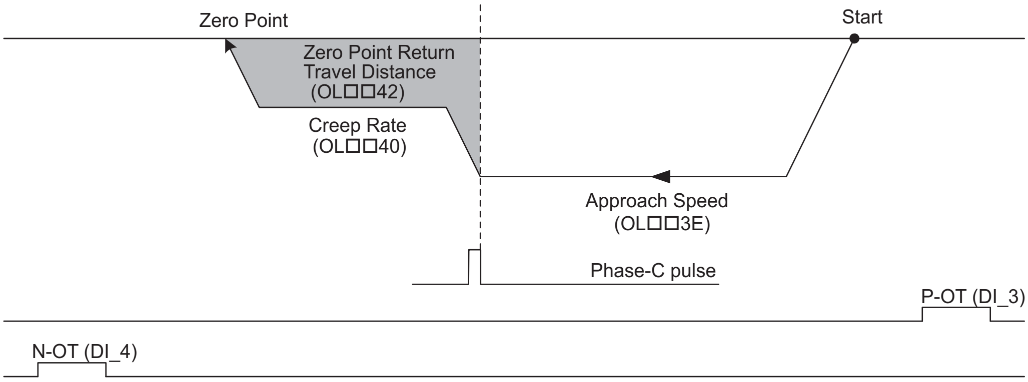
Parameter	Name	Setting
Fixed Parameter No. 1, Bit 5	Deceleration LS Inversion Selection	Set whether or not to invert the polarity of DI_5 signal used as DEC1 signal. However, the Zero Point Return Deceleration LS Signal (OW□□05, bit 8) will not be inverted even if this bit is set to 1 (invert).
Fixed Parameter No. 21, Bit 0	Deceleration LS Signal Selection	Select the signal to be used as DEC1. 0: OW□□05, bit 8, 1: DI_5
OW□□05, Bit 8	Zero Point Return Deceleration LS Signal (DEC1)	Used to input DEC1 signal from the ladder program when the bit 0 of fixed parameter No.21 is 0.
OW□□09, Bit 3	Zero Point Return Direction Selection	Set the zero point return direction. 0: Reverse rotation (default), 1: Forward rotation
OL□□10	Speed Reference Setting	Set the speed to use when starting a zero point return. Only a positive value can be set; a negative value will result in an error.
OW□□18	Override	This parameter allows the Zero Point Return speed to be changed without changing the Speed Reference Setting (OL□□10). Set the speed as a percentage of the Speed Reference Setting. This setting can be changed during operation. Setting range: 0 to 32767 (0% to 327.67%) Setting unit: 1 = 0.01% Example: Setting for 50%: 5000
OW□□3C	Zero Point Return Method	2: DEC1 + ZERO Signal Method
OL□□3E	Approach Speed	Set the speed to use after detecting the DEC1 signal. Only a positive value can be set; a negative value will result in an error.
OL□□40	Creep Rate	Set the speed to use after detecting the ZERO signal after passing the DEC1 signal. Only a positive value can be set; a negative value will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where the ZERO signal is detected after passing the DEC1 signal. If the sign is positive, travel will be toward the zero point return direction; if the sign is negative, travel will be away from the zero point return direction.

[d] Phase-C Method (OW☐☐3C = 3)

■ Operation after Zero Point Return Starts

Travel is started at the approach speed in the direction specified in the parameters.
When the rising edge of the phase-C pulse is detected, the speed is reduced to the creep speed and positioning is performed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the phase-C pulse is detected is set in the Zero Point Return Travel Distance (OL☐☐42).
- If an OT signal is detected during the zero point return operation, an OT alarm will occur.



■ Parameters to be Set

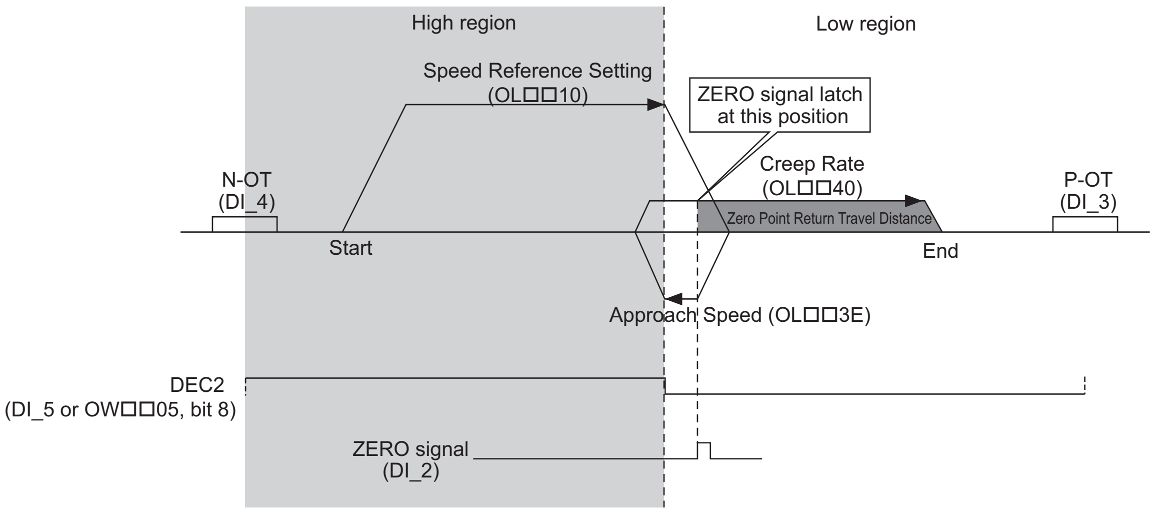
Parameter	Name	Setting
OW☐☐09, Bit 3	Zero Point Return Direction Selection	Set the zero point return direction. 0: Reverse rotation (default), 1: Forward rotation
OW☐☐3C	Zero Point Return Method	3: Phase-C Method
OL☐☐3E	Approach Speed	Set the speed to use when starting a zero point return. Only a positive value can be set; a negative value will result in an error.
OL☐☐40	Creep Rate	Set the speed to use after detecting the phase-C pulse. Only a positive value can be set; a negative value will result in an error.
OL☐☐42	Zero Point Return Travel Distance	Set the travel distance from the point where a phase-C pulse is detected. If the sign is positive, travel will be toward the zero point return direction; if the sign is negative, travel will be away from the zero point return direction.

[e] DEC2 + ZERO Signal Method (OW3□□C = 4)

With this method, the machine's position is confirmed by the ON/OFF status of the DEC2 signal and the retracting operation is performed automatically, so the zero point return is always performed with the same conditions.

■ Starting the Zero Point Return in the High Region

1. Travel is started in the forward direction at the speed specified by the Speed Reference Setting (setting parameter OL□□10).
2. When the falling edge of the DEC2 signal is detected, the axis decelerates to a stop.
3. After decelerating to a stop, the axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).
4. When the rising edge of the DEC2 signal is detected, the axis decelerates to a stop.
5. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).
6. After the falling edge of the DEC2 signal is detected, the position is latched when the rising edge of the ZERO signal is detected.
7. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during zero point return operation, an OT alarm will occur.

■ Starting the Zero Point Return in the Low Region

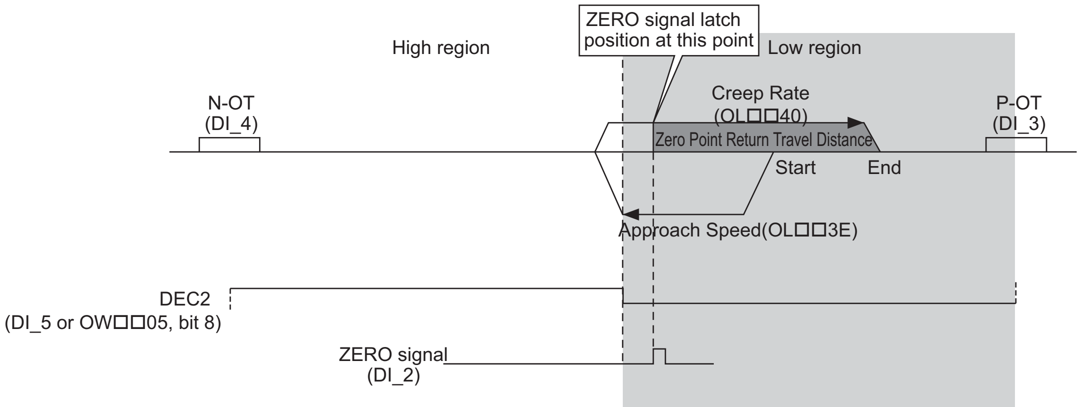
1. The axis travels in the reverse direction at the Approach Speed (setting parameter OL☐☐3E).

2. When the rising edge of the DEC2 signal is detected, the axis decelerates to a stop.

3. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL☐☐40).

4. After the falling edge of the DEC2 signal is detected, the position is latched when the rising edge of the ZERO signal is detected.

5. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL☐☐42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during zero point return operation, an OT alarm will occur.

■ Related Parameters

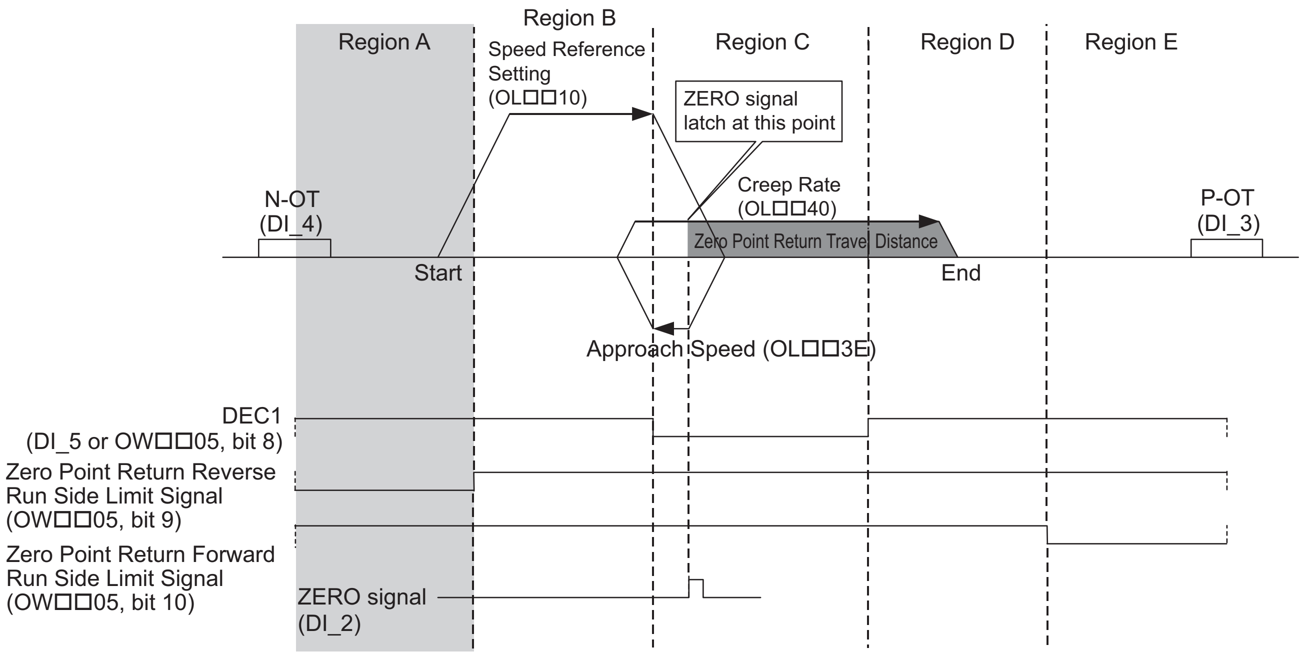
Parameter	Name	Setting
Fixed Parameter No. 1, Bit 5	Deceleration LS Inversion Selection	Set whether or not to inverse the polarity of DI_5 signal used as DEC2 signal. 0: Do not invert 1: Invert However, the deceleration limit signal for zero point return (OW☐☐05, bit 8) will not be invert even if this bit is set to 1 (invert).
Fixed Parameter No. 21, Bit 0	Deceleration LS Signal Selection	Select the signal to be used as DEC2. 0: Setting parameter OW☐☐05, bit 8 1: DI_5
OW☐☐03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL☐☐10 (Speed Reference Setting), OL☐☐3E (Approach Speed), and OL☐☐40 (Creep Rate.) 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OW☐☐05, Bit 8	Zero Point Return Deceleration LS Signal (DEC2)	Used to input DEC2 signal from the ladder program when the bit 0 of fixed parameter No.21 is 0. 0: OFF 1: ON
OL☐☐10	Speed Reference Setting	Set the speed to use when starting a zero point return. Only a positive value can be set; a negative value will result in an error.
OW☐☐18	Override	This parameter allows the Zero Point Return speed to be changed without changing the Speed Reference Setting (OL☐☐10). Set the speed as a percentage of the Speed Reference Setting. This setting can be changed during operation. Setting range: 0 to 32767 (0% to 327.67%) Setting unit: 1 = 0.01% (Example) Setting for 50%: 5000
OW☐☐3C	Zero Point Return Method	4: DEC2 + ZERO Signal Method
OL☐☐3E	Approach Speed	Set the approach speed. Only a positive value can be set; 0 or a negative value will result in an error.
OL☐☐40	Creep Rate	Set the creep speed. Only a positive value can be set; 0 or a negative value will result in an error.
OL☐☐42	Zero Point Return Travel Distance	Set the travel distance from the point where the ZERO signal is detected after passing the DEC2 signal. If the sign is positive, travel will be toward the zero point return direction; if the sign is negative, travel will be away from the zero point return direction.

[f] DEC1 + LMT + ZERO Signal Method (OW□□3C = 5)

With this method, the machine's position is confirmed by the ON/OFF status of the DEC1, Reverse Limit, and Forward Limit signals and the retracting operation is performed automatically, so the zero point return is always performed with the same conditions.

■ Starting the Zero Point Return in Region A

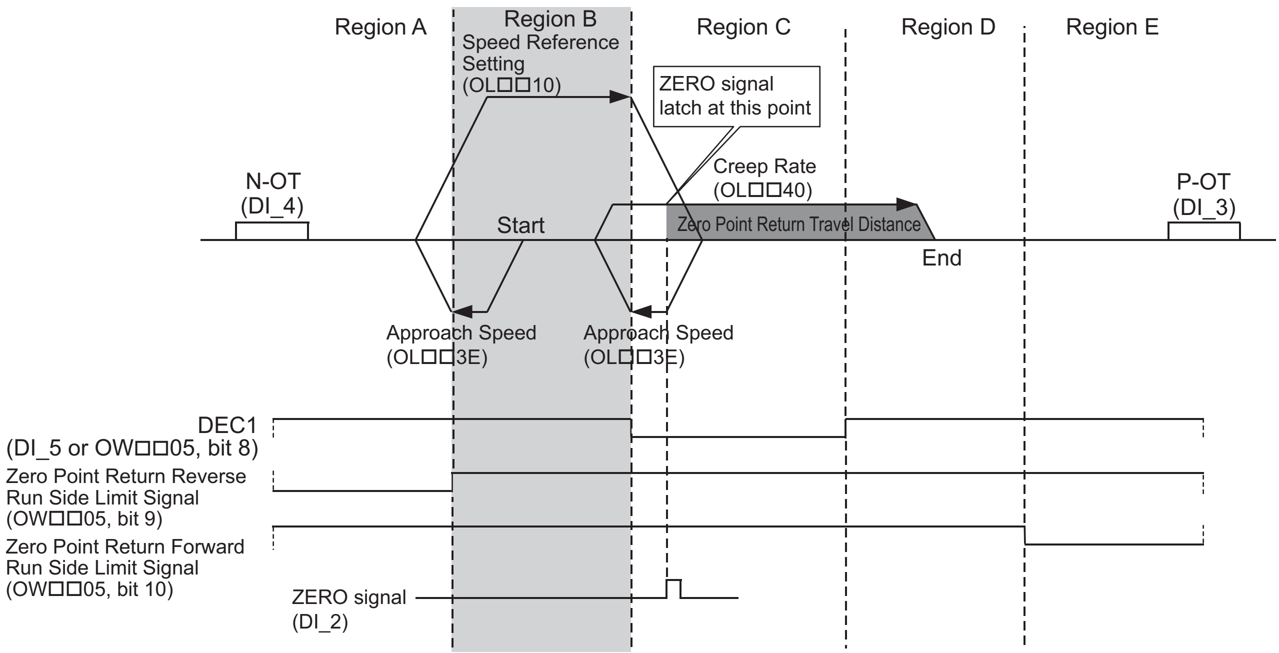
1. Travel is started in the positive direction at the speed specified by the Speed Reference Setting (setting parameter OL□□10).
2. When the falling edge of the DEC1 signal is detected, the axis decelerates to a stop.
3. After decelerating to a stop, the axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).
4. When the rising edge of the DEC1 signal is detected, the axis decelerates to a stop.
5. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).
6. After the falling edge of the DEC1 signal is detected, the position is latched when the rising edge of the ZERO signal is detected.
7. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during the zero point return operation, an OT alarm will occur.
- The command will end in an error at the start of the Zero Point Return operation if the status of the DEC1, Forward Limit, and Reverse Limit signals is not the same as the status shown in the diagram above.

■ Starting the Zero Point Return in Region B

1. The axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).
2. When the falling edge of the Reverse Limit signal is detected, the axis decelerates to a stop.
3. After decelerating to a stop, travel starts in the forward direction at the speed specified by the Speed Reference Setting (setting parameter OL□□10).
4. When the falling edge of the DEC1 signal is detected, the axis decelerates to a stop.
5. After decelerating to a stop, the axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).
6. When the rising edge of the DEC1 signal is detected, the axis decelerates to a stop.
7. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).
8. After the falling edge of the DEC1 signal is detected, the position is latched when the rising edge of the ZERO signal is detected.
9. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.

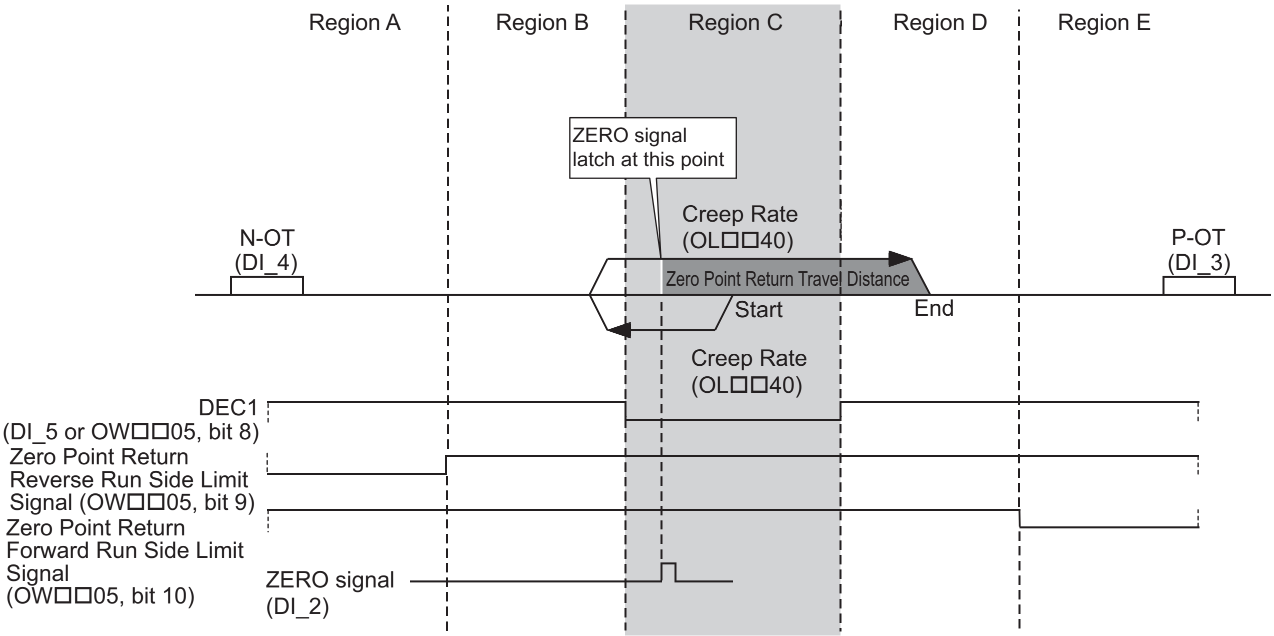


- If an OT signal is detected during zero point return operation, an OT alarm will occur.

Motion Commands
7

■ Starting the Zero Point Return in Region C

1. The axis travels in the reverse direction at the Creep Rate (setting parameter OL□□40).
2. When the rising edge of the DEC1 signal is detected, the axis decelerates to a stop.
3. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).
4. After the falling edge of the DEC1 signal is detected, the position is latched when the rising edge of the ZERO signal is detected.
5. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during the zero point return operation, an OT alarm will occur.

■ Starting the Zero Point Return in Region D

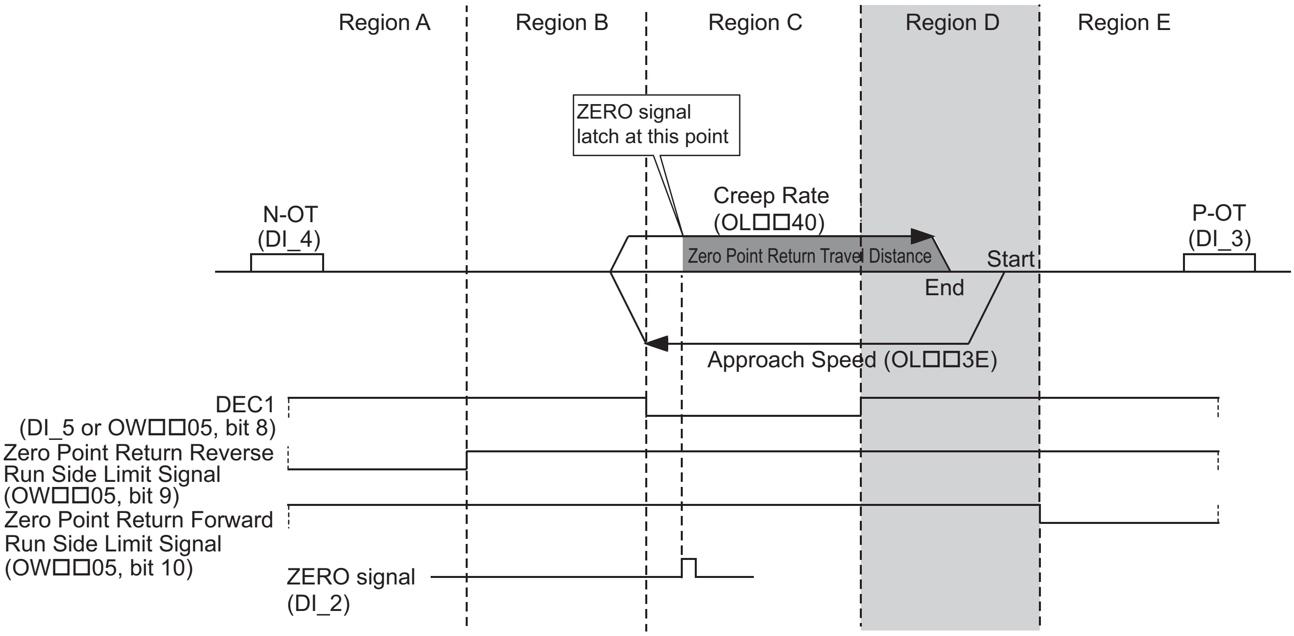
1. The axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).

2. When the rising edge of the DEC1 signal is detected, the axis decelerates to a stop.

3. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).

4. After the falling edge of the DEC1 signal is detected, the position is latched when the rising edge of the ZERO signal is detected.

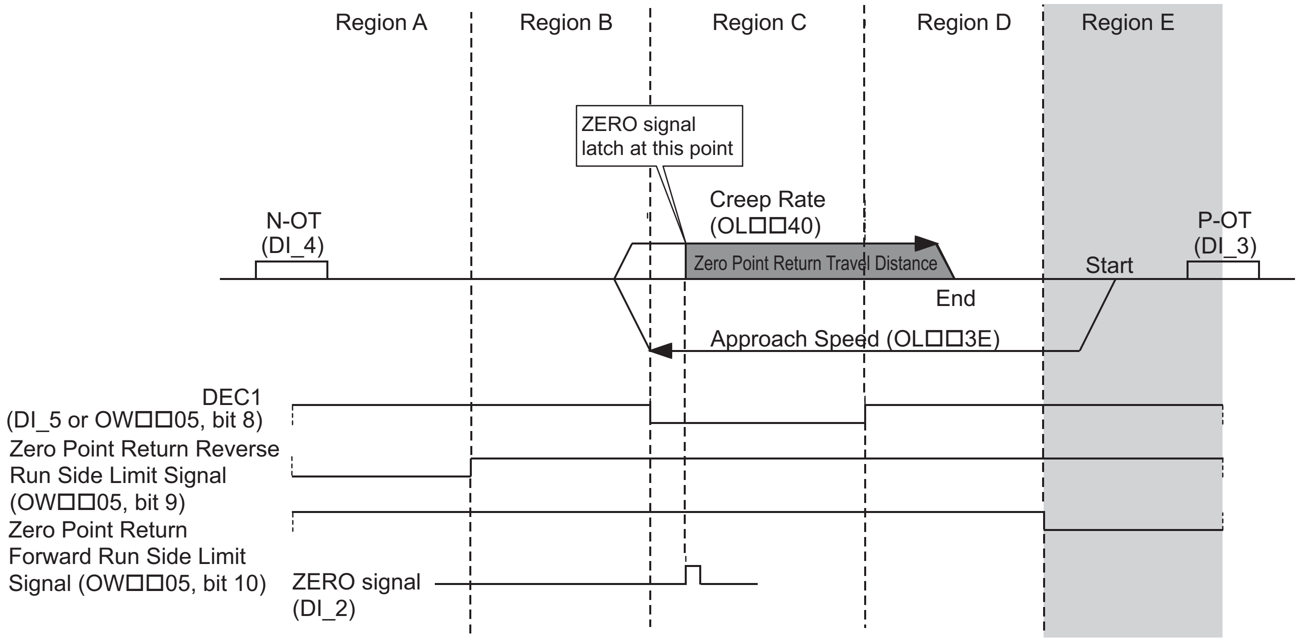
5. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during the zero point return operation, an OT alarm will occur.

■ Starting the Zero Point Return in Region E

1. The axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).
2. When the rising edge of the DEC1 signal is detected, the axis decelerates to a stop.
3. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).
4. After the falling edge of the DEC1 signal is detected, the position is latched when the rising edge of the ZERO signal is detected.
5. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during the zero point return operation, an OT alarm will occur.

■ Related Parameters

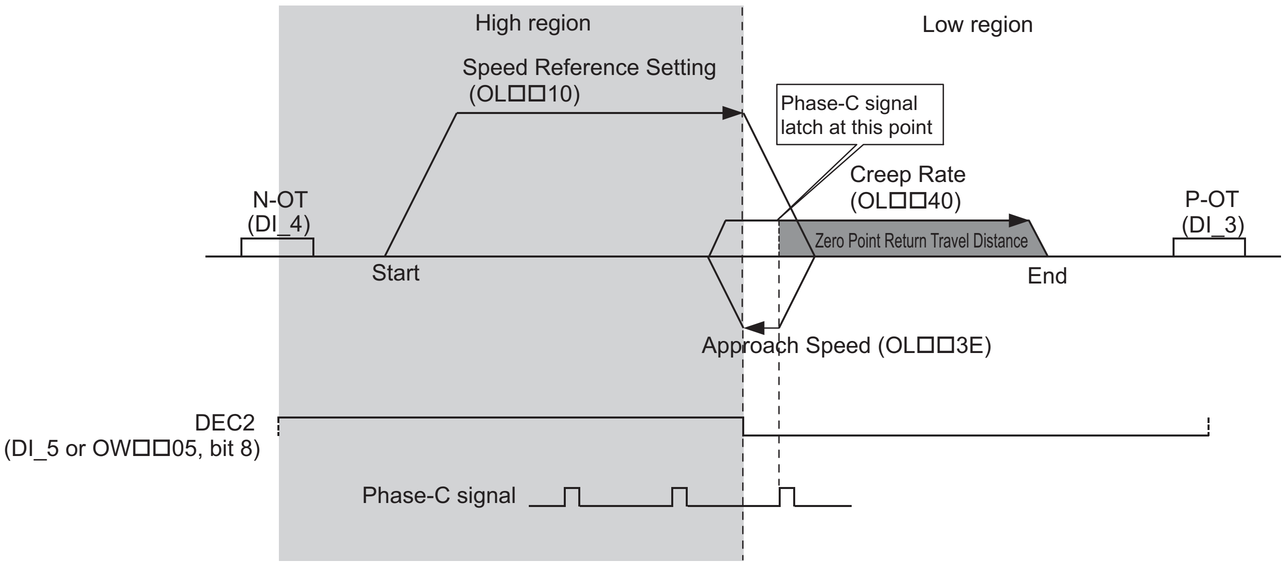
Parameter	Name	Setting
Fixed Parameter No. 1, Bit 5	Deceleration LS Inversion Selection	Set whether or not to inverse the polarity of DI_5 signal used as DEC1 signal. 0: Do not invert 1: Invert However, the deceleration limit signal for zero point return (OW□□05, bit 8) will not be inverted even if this bit is set to 1 (invert).
Fixed Parameter No. 21, Bit 0	Deceleration LS Signal Selection	Select the signal to be used as DEC2. 0: Setting parameter OW□□05, bit 8 1: DI_5
OW□□03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL□□10 (Speed Reference Setting), OL□□3E (Approach Speed), and OL□□40 (Creep Rate.) 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OW□□05, Bit 8	Zero Point Return Deceleration LS Signal (DEC1)	Used to input DEC1 signal from the ladder program when the bit 0 of fixed parameter No.21 is 0. 0: OFF 1: ON
OL□□10	Speed Reference Setting	Set the speed to use when starting a zero point return. Only a positive value can be set; a negative value will result in an error.
OW□□18	Override	This parameter allows the Zero Point Return speed to be changed without changing the Speed Reference Setting (OL□□10). Set the speed as a percentage of the Speed Reference Setting. This setting can be changed during operation. Setting range: 0 to 32767 (0% to 327.67%) Setting unit: 1 = 0.01% (Example) Setting for 50%: 5000
OW□□3C	Zero Point Return Method	5: DEC1 + LMT + ZERO Signal Method
OL□□3E	Approach Speed	Set the approach speed. Only a positive value can be set; 0 or a negative value will result in an error.
OL□□40	Creep Rate	Set the creep speed. Only a positive value can be set; 0 or a negative value will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where the ZERO signal is detected after passing the DEC1 signal. If the sign is positive, travel will be toward the zero point return direction; if the sign is negative, travel will be away from the zero point return direction.

[g] DEC2 + Phase-C Signal Method (OW□□3C = 6)

With this method, the machine's position is confirmed by the ON/OFF status of the DEC2 signal and the retracting operation is performed automatically, so the zero point return is always performed with the same conditions.

■ Starting the Zero Point Return in the High Region

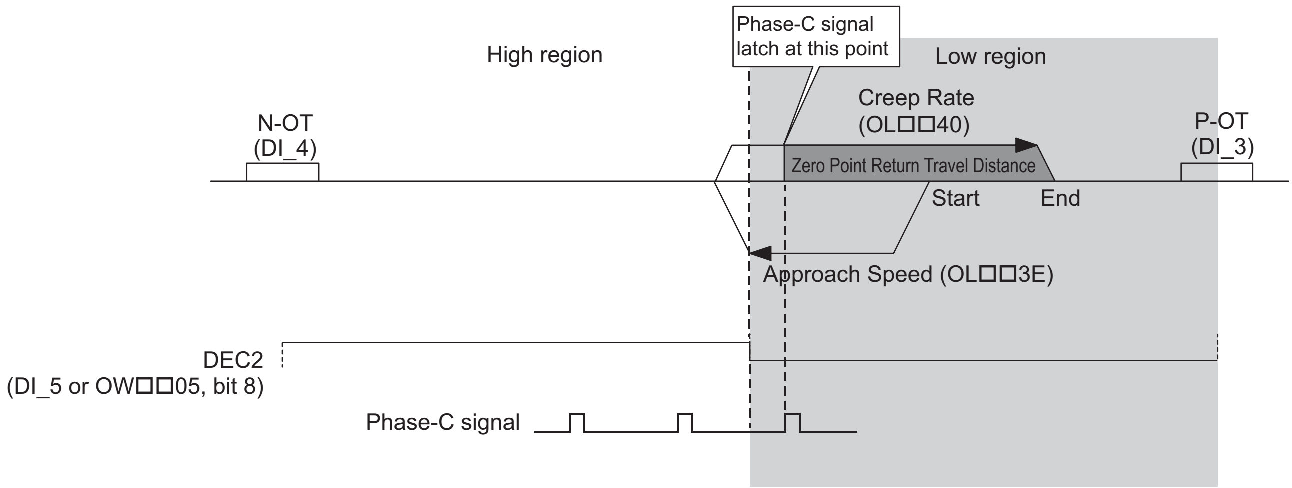
1. Travel is started in the positive direction at the speed specified by the Speed Reference Setting (setting parameter OL□□10).
2. When the falling edge of the DEC2 signal is detected, the axis decelerates to a stop.
3. After decelerating to a stop, the axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).
4. When the rising edge of the DEC2 signal is detected, the axis decelerates to a stop.
5. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).
6. After the falling edge of the DEC2 signal is detected, the position is latched when the rising edge of the first phase-C pulse is detected.
7. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during the zero point return operation, an OT alarm will occur.

■ Starting the Zero Point Return in the Low Region

1. The axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).
2. When the rising edge of the DEC2 signal is detected, the axis decelerates to a stop.
3. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).
4. After the falling edge of the DEC2 signal is detected, the position is latched when the rising edge of the first phase-C pulse is detected.
5. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during the zero point return operation, an OT alarm will occur.

■ Related Parameters

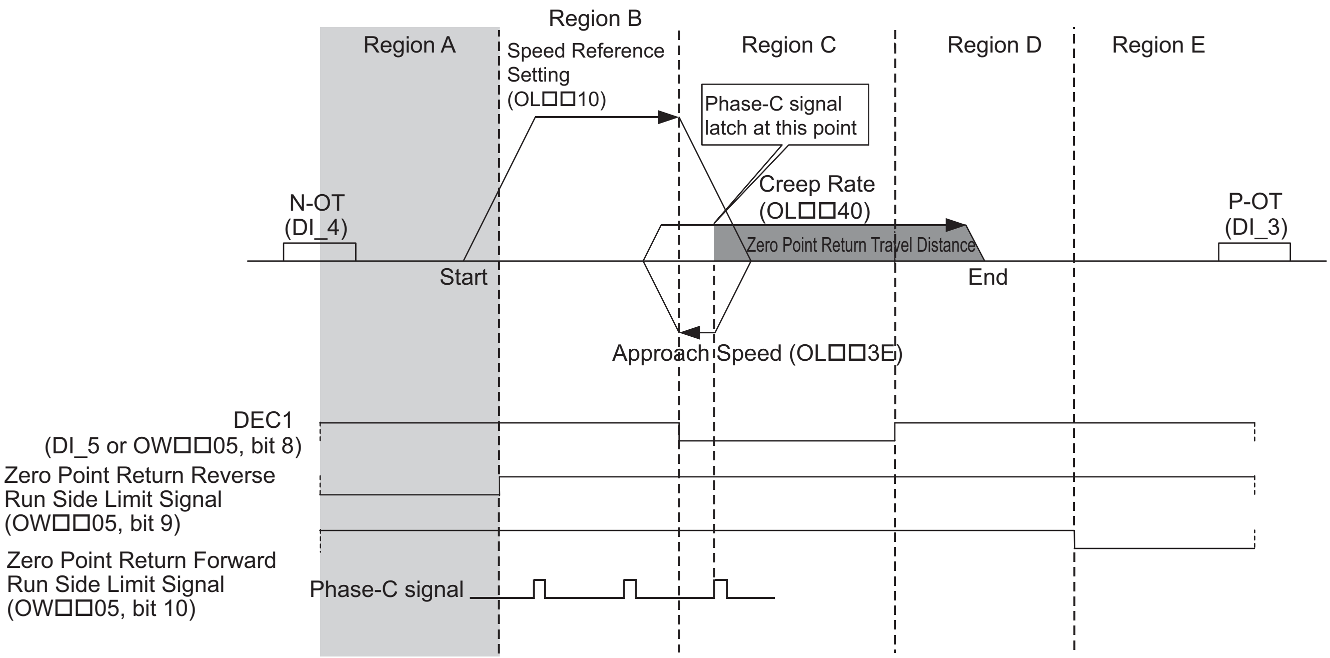
Parameter	Name	Setting
Fixed Parameter No. 1, Bit 5	Deceleration LS Inversion Selection	Set whether or not to invert the polarity of DI_5 signal used as DEC2 signal. 0: Do not invert 1: Invert However, the deceleration limit signal for zero point return (OW□□05, bit 8) will not be inverted even if this bit is set to 1 (invert).
Fixed Parameter No. 21, Bit 0	Deceleration LS Signal Selection	Select the signal to be used as DEC2. 0: Setting parameter OW□□05, bit 8 1: DI_5
OW□□03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL□□10 (Speed Reference Setting), OL□□3E (Approach Speed), and OL□□40 (Creep Rate.) 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OW□□05, Bit 8	Zero Point Return Deceleration LS Signal (DEC2)	Used to input DEC2 signal from the ladder program when the bit 0 of fixed parameter No.21 is 0. 0: OFF 1: ON
OL□□10	Speed Reference Setting	Set the speed to use when starting a zero point return. Only a positive value can be set; a negative value will result in an error.
OW□□18	Override	This parameter allows the Zero Point Return speed to be changed without changing the Speed Reference (OL□□10). Set the speed as a percentage of the Speed Reference Setting. This setting can be changed during operation. Setting range: 0 to 32767 (0% to 327.67%) Setting unit: 1 = 0.01% (Example) Setting for 50%: 5000
OW□□3C	Zero Point Return Method	6: DEC2 + Phase-C Signal Method
OL□□3E	Approach Speed	Set the approach speed. Only a positive value can be set; 0 or a negative value will result in an error.
OL□□40	Creep Rate	Set the creep speed. Only a positive value can be set; 0 or a negative value will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where the ZERO signal is detected after passing the DEC2 signal. If the sign is positive, travel will be toward the zero point return direction; if the sign is negative, travel will be away from the zero point return direction.

[h] DEC1 + LMT + Phase-C Signal Method (OW□□3C = 7)

With this method, the machine's position is confirmed by the ON/OFF status of the DEC1, Reverse Limit, and Forward Limit signals and the retracting operation is performed automatically, so the zero point return is always performed with the same conditions.

■ Starting the Zero Point Return in Region A

1. Travel is started in the positive direction at the speed specified by the Speed Reference Setting (setting parameter OL□□10).
2. When the falling edge of the DEC1 signal is detected, the axis decelerates to a stop.
3. After decelerating to a stop, the axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).
4. When the rising edge of the DEC1 signal is detected, the axis decelerates to a stop.
5. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).
6. After the falling edge of the DEC1 signal is detected, the position is latched when the rising edge of the first phase-C pulse is detected.
7. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during the zero point return operation, an OT alarm will occur.

■ Starting the Zero Point Return in Region B

1. The axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).

2. When the falling edge of the Reverse Limit signal is detected, the axis decelerates to a stop.

3. After decelerating to a stop, travel starts in the forward direction at the speed specified by the Speed Reference Setting (setting parameter OL□□10).

4. When the falling edge of the DEC1 signal is detected, the axis decelerates to a stop.

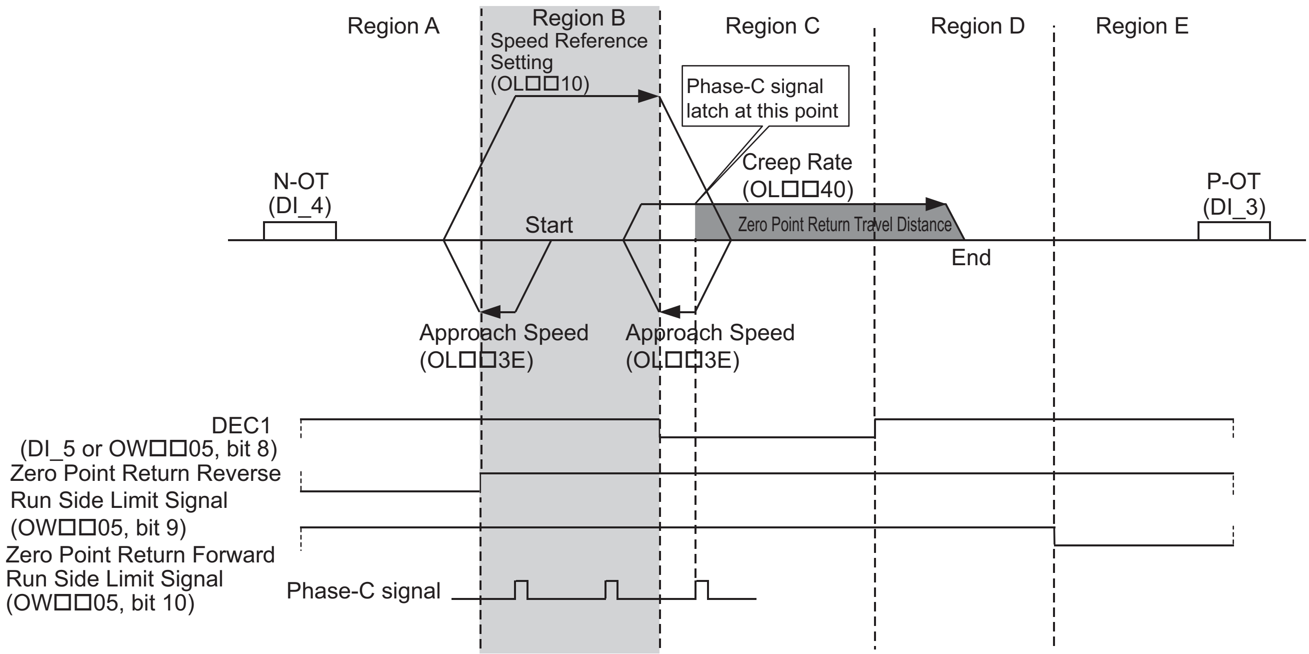
5. After decelerating to a stop, the axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).

6. When the rising edge of the DEC1 signal is detected, the axis decelerates to a stop.

7. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).

8. After the falling edge of the DEC1 signal is detected, the position is latched when the rising edge of the first phase-C pulse is detected.

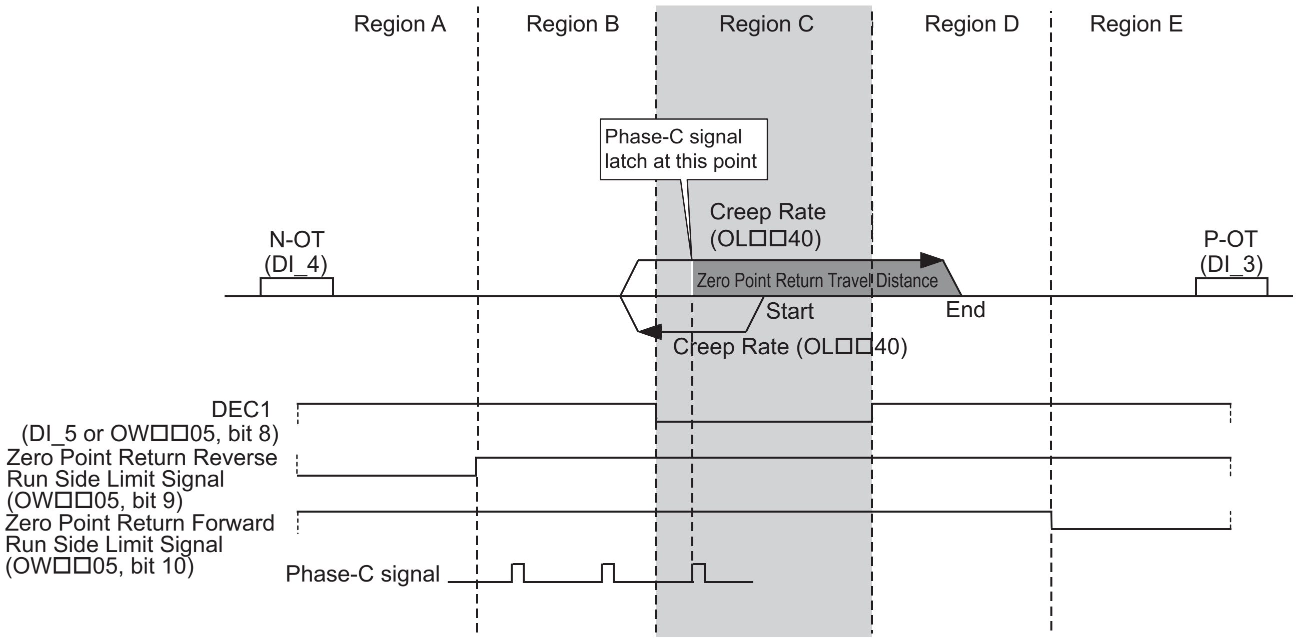
9. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during the zero point return operation, an OT alarm will occur.

■ Starting the Zero Point Return in Region C

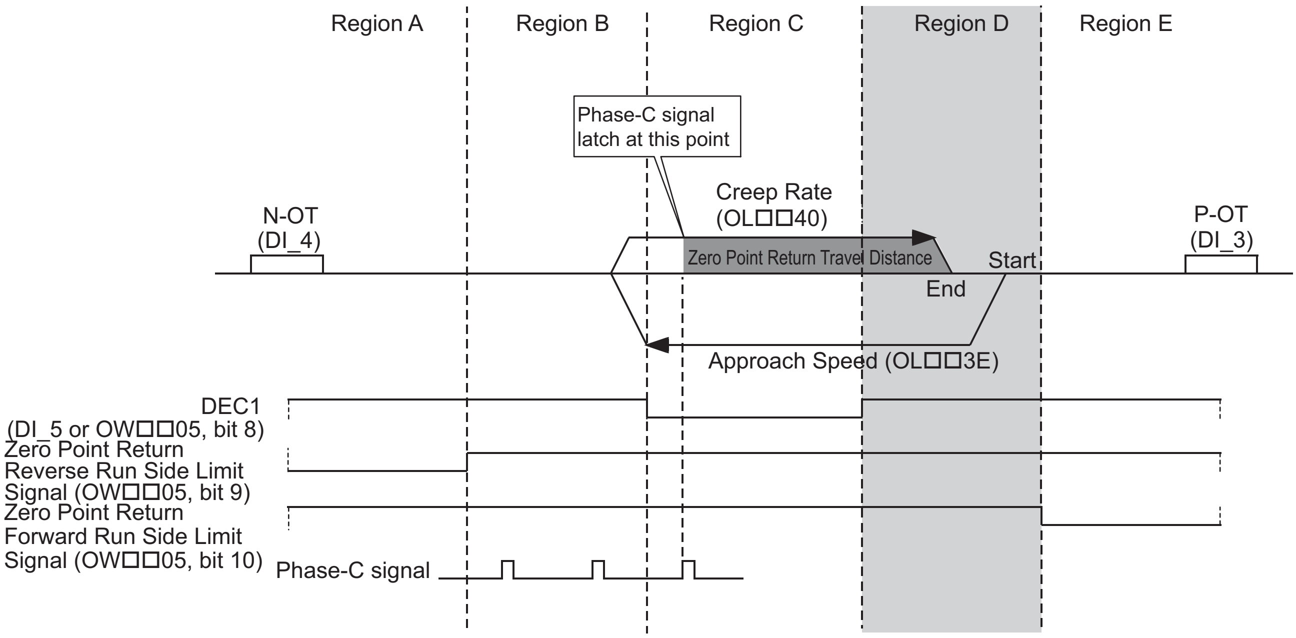
1. The axis travels in the reverse direction at the Creep Rate (setting parameter OL□□40).
2. When the rising edge of the DEC1 signal is detected, the axis decelerates to a stop.
3. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).
4. After the falling edge of the DEC1 signal is detected, the position is latched when the rising edge of the first phase-C pulse is detected.
5. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during the zero point return operation, an OT alarm will occur.

■ Starting the Zero Point Return in Region D

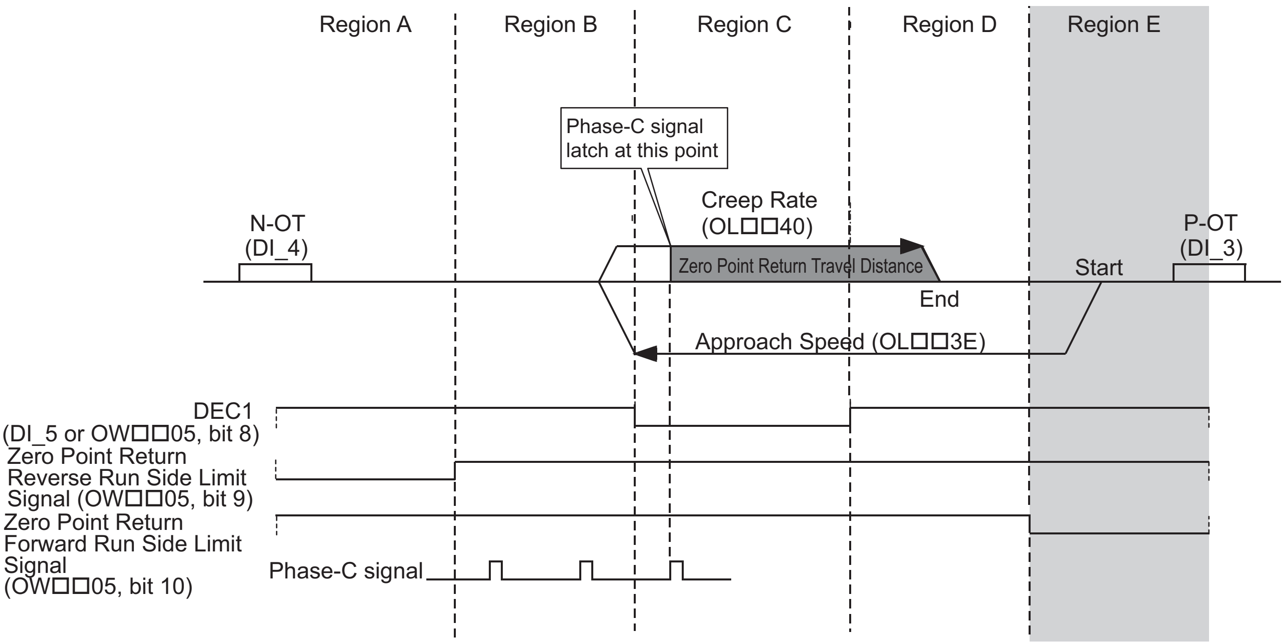
1. The axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).
2. When the rising edge of the DEC1 signal is detected, the axis decelerates to a stop.
3. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).
4. After the falling edge of the DEC1 signal is detected, the position is latched when the rising edge of the first phase-C pulse is detected.
5. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during the zero point return operation, an OT alarm will occur.

■ Starting the Zero Point Return in Region E

1. The axis travels in the reverse direction at the Approach Speed (setting parameter OL□□3E).
2. When the rising edge of the DEC1 signal is detected, the axis decelerates to a stop.
3. After decelerating to a stop, the axis travels in the forward direction at the Creep Rate (setting parameter OL□□40).
4. After the falling edge of the DEC1 signal is detected, the position is latched when the rising edge of the first phase-C pulse is detected.
5. The axis moves from the latched position by the distance set in the Zero Point Return Travel Distance (setting parameter OL□□42) and stops. The machine coordinate system is established with this final position as the zero point.



- If an OT signal is detected during the zero point return operation, an OT alarm will occur.

■ Related Parameters

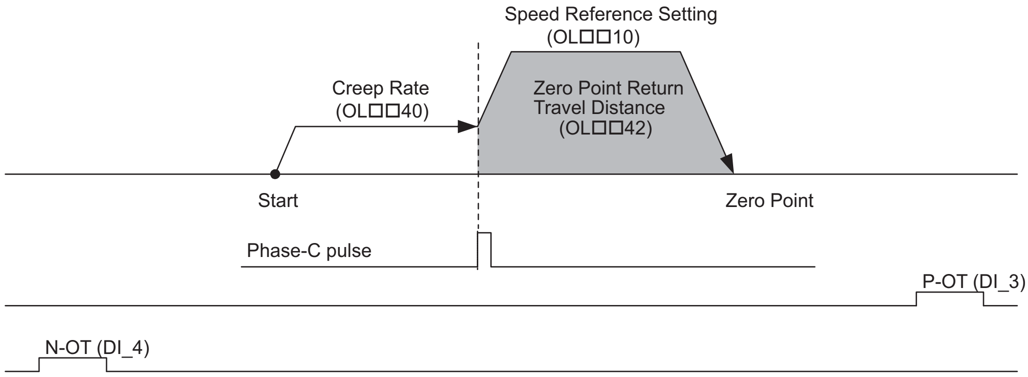
Parameter	Name	Setting
Fixed Parameter No. 1, Bit 5	Deceleration LS Inversion Selection	Set whether or not to invert the polarity of DI_5 signal used as DEC1 signal. 0: Do not invert 1: Invert However, the deceleration limit signal for zero point return (OW□□05, bit 8) will not be inverted even if this bit is set to 1 (invert).
Fixed Parameter No. 21, Bit 0	Deceleration LS Signal Selection	Select the signal to be used as DEC1. 0: Setting parameter OW□□05, bit 8 1: DI_5
OW□□03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL□□10 (Speed Reference Setting), OL□□3E (Approach Speed), and OL□□40 (Creep Rate.) 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OW□□05, Bit 8	Zero Point Return Deceleration LS Signal (DEC1)	Used to input DEC1 signal from the ladder program when the bit 0 of fixed parameter No.21 is 0. 0: OFF 1: ON
OL□□10	Speed Reference Setting	Set the speed to use when starting a zero point return. Only a positive value can be set; a negative value will result in an error.
OW□□18	Override	This parameter allows the Zero Point Return speed to be changed without changing the Speed Reference Setting (OL□□10). Set the speed as a percentage of the Speed Reference Setting. This setting can be changed during operation. Setting range: 0 to 32767 (0% to 327.67%) Setting unit: 1 = 0.01% (Example) Setting for 50%: 5000
OW□□3C	Zero Point Return Method	7: DEC1 + LMT + Phase-C Signal Method
OL□□3E	Approach Speed	Set the approach speed. Only a positive value can be set; 0 or a negative value will result in an error.
OL□□40	Creep Rate	Set the creep speed. Only a positive value can be set; 0 or a negative value will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where the ZERO signal is detected after passing the DEC1 signal. If the sign is positive, travel will be toward the zero point return direction; if the sign is negative, travel will be away from the zero point return direction.

[i] C Pulse Only Method (OW□□3C = 11)

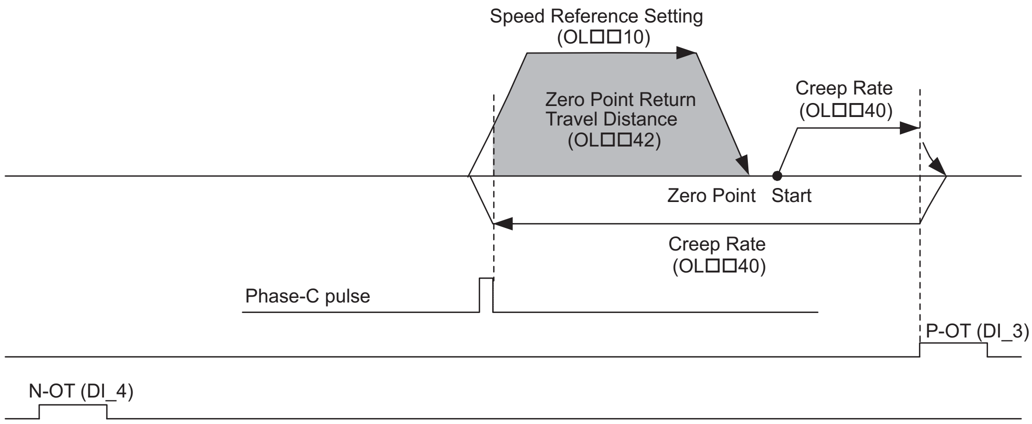
■ Operation after Zero Point Return Starts

Travel is started at the creep speed in the direction specified by the sign of the creep speed. When the rising edge of the phase-C pulse is detected, positioning is performed at the positioning speed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the phase-C pulse is detected is set in the Zero Point Return Travel Distance. The positioning speed is set in the Speed Reference Setting.
- If an OT signal is detected during creep speed operation, an OT alarm will not occur, the direction will be reversed, and a search will be made for the phase-C pulse.
- If an OT signal is detected during positioning speed operation, an OT alarm will occur.



<OT Signal Detected during Creep Speed Operation>



- The stopping method when the OT signal is detected depends on the setting of SERVOPACK parameters.

■ Parameters to be Set

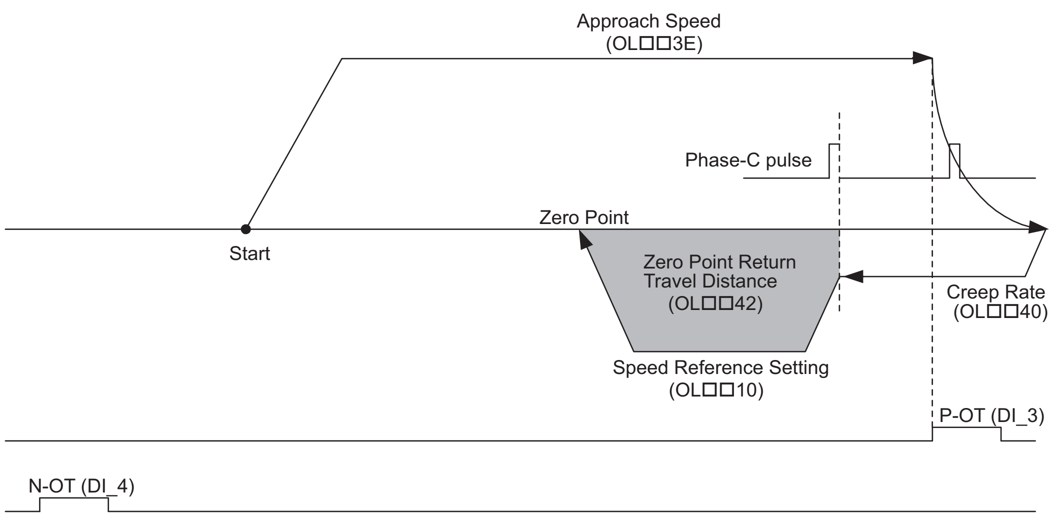
Parameter	Name	Setting
OW☐☐03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL☐☐10 (Speed Reference Setting) and OL☐☐40 (Creep Rate). 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OL☐☐10	Speed Reference Setting	Set the positioning speed to use after detecting the phase-C pulse. The sign is ignored. The travel direction will depend on the sign of the Zero Point Return Travel Distance. Setting to 0 or a negative value will result in an error.
OW☐☐18	Override	This parameter allows the travel speed to be changed without changing the Speed Reference Setting (OL☐☐10). The setting can be changed during operation. Setting range: 0 to 32767 (0 to 327.67%) Setting unit: 1 = 0.01% (Example) Setting for 50%: 5000
OW☐☐3C	Zero Point Return Method	11: C Pulse Only Method
OL☐☐40	Creep Rate	Set the speed and travel direction (sign) to use when starting a zero point return. The setting cannot be changed during operation. The speed and travel direction (sign) at the operation start is applied. Setting to 0 will result in an error.
OL☐☐42	Zero Point Return Travel Distance	Set the travel distance from the point where a phase-C pulse is detected. The travel direction will depend on the sign.

[j] P-OT & Phase-C Pulse Method (OW☐☐3C = 12)

■ Operation after Zero Point Return Starts

Travel is started at the approach speed in the positive direction until the stroke limit is reached.
When the P-OT signal is detected, the direction is reversed to return at creep speed.
When the phase-C pulse is detected during the return after passing the P-OT signal, the positioning is performed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the phase-C pulse is detected is set in the Zero Point Return Travel Distance. The positioning speed is set in the Speed Reference Setting.
- If a negative value is set for the approach speed, the command will end in an error.
- If an OT signal is detected during the positioning speed operation, an OT alarm will occur.



- The stopping method when the OT signal is detected depends on the setting of SERVOPACK parameters.

■ Parameters to be Set

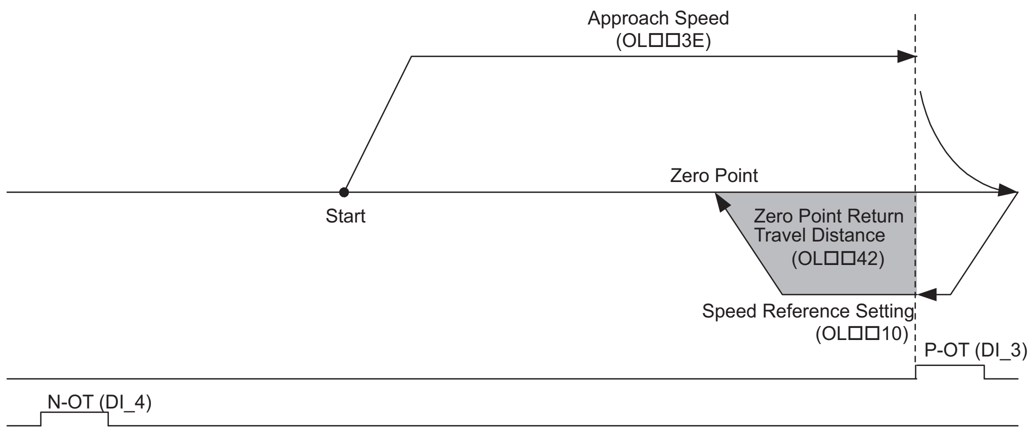
Parameter	Name	Setting
OW□□03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL□□10 (Speed Reference Setting), OL□□3E (Approach Speed), and OL□□40 (Creep Rate). 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OL□□10	Speed Reference Setting	Set the positioning speed to use after detecting the phase-C pulse. The sign is ignored. The travel direction will depend on the sign of the Zero Point Return Travel Distance. Setting to 0 or a negative value will result in an error.
OW□□18	Override	This parameter allows the travel speed to be changed without changing the Speed Reference Setting (OL□□10). The setting can be changed during operation. Setting range: 0 to 32767 (0 to 327.67%) Setting unit: 1 = 0.01% (Example): Setting value for 50%: 5000
OW□□3C	Zero Point Return Method	12: P-OT & Phase-C Pulse Method
OL□□3E	Approach Speed	Set the speed to be used at zero point return start. Only a positive value can be set. 0 or a negative value will result in an error.
OL□□40	Creep Rate	Set the speed to return in the reverse direction after detecting the P-OT signal. The sign is ignored, and the axis moves in the negative direction. Setting to 0 will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where a phase-C pulse is detected. The travel direction will depend on the sign.

[k] P-OT Signal Method (OW□□3C = 13)

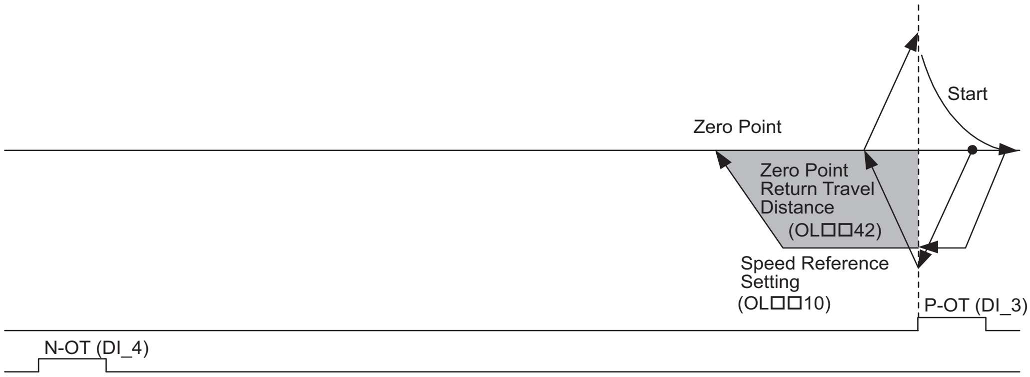
■ Operation after Zero Point Return Starts

Travel is started at the approach speed in the positive direction until the stroke limit is reached.
When the P-OT signal is detected, the direction is reversed to return at positioning speed.
When a change in the P-OT signal status from ON to OFF is detected during the return, the positioning is performed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after a change in the P-OT signal status is detected is set in the Zero Point Return Travel Distance. The positioning speed is set in the Speed Reference Setting.
- If a negative value is set for the approach speed, the command will end in an error.
- If an OT signal is detected during the positioning speed operation, an OT alarm will occur.
- Detecting the change in the OT signal status is performed using software processing. The position where positioning is completed will depend on the high-speed scan setting, positioning speed, etc. Do not use this method if repeat accuracy is required in the position where the zero point return operation is completed.



<Starting on the Positive Stroke Limit (P-OT)>



- The stopping method when the OT signal is detected depends on the setting of SERVOPACK parameters.

■ Parameters to be Set

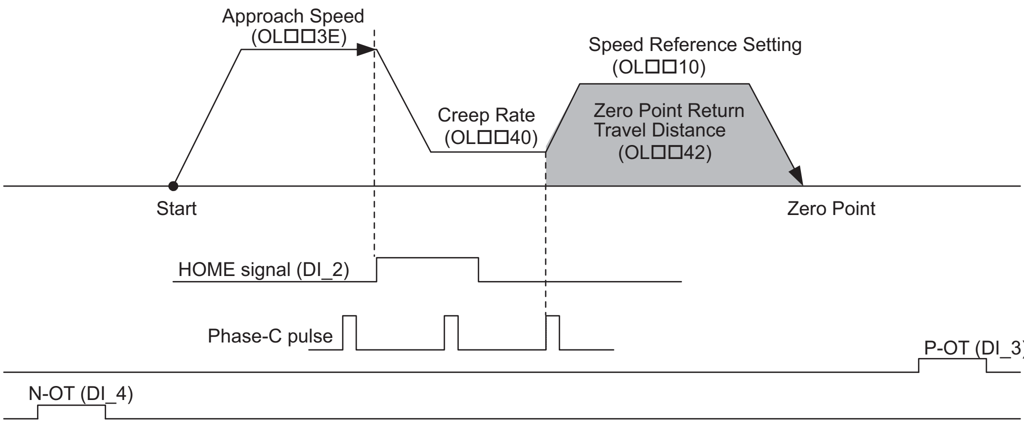
Parameter	Name	Setting
OW□□03 Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL□□10 (Speed Reference Setting) and OL□□3E (Approach Speed). 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OL□□10	Speed Reference Setting	Set the positioning speed to use after detecting the P-OT signal. The sign is ignored. The travel direction will depend on the sign of the Zero Point Return Travel Distance. Setting to 0 or a negative value will result in an error.
OW□□18	Override	This parameter allows the travel speed to be changed without changing the Speed Reference (OL□□10). The setting can be changed during operation moving. Setting range: 0 to 32767 (0 to 327.67%) Setting unit: 1 = 0.01%
OW□□3C	Zero Point Return Method	13: P-OT Only Method
OL□□3E	Approach Speed	Set the speed to be used at zero point return start. Only a positive value can be set. 0 or a negative value will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where P-OT signal is detected. The travel direction will depend on the sign. Always set to a negative value when using P-OT Only Method.

[I] HOME LS & Phase-C Pulse Method (OW□□3C = 14)

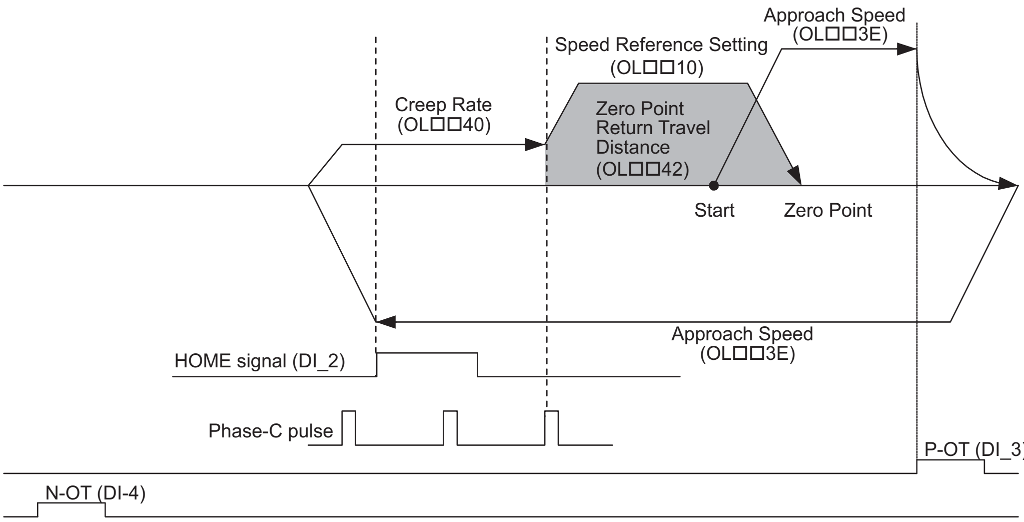
■ Operation after Zero Point Return Starts

Travel is started at the approach speed in the direction specified by the sign of the approach speed.
When the rising edge of HOME signal is detected, the speed is reduced to the creep speed. And, the travel direction depends on the sign of the creep speed.
When the first phase-C pulse is detected after the falling edge of HOME signal, the positioning is performed at positioning speed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the phase-C pulse is detected is set in the Zero Point Return Travel Distance. The positioning speed is set in the Speed Reference Setting.
- If an OT signal is detected during approach speed operation, an alarm will not occur, the direction will be reversed, and a search will be made for the HOME signal.
- If an OT signal is detected during creep-speed and positioning speed operation, an OT alarm will occur.



<Detecting the OT Signal during Approach Speed Movement>



- The stopping method when the OT signal is detected depends on the setting of SERVOPACK parameters.

Motion Commands

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■ Parameters to be Set

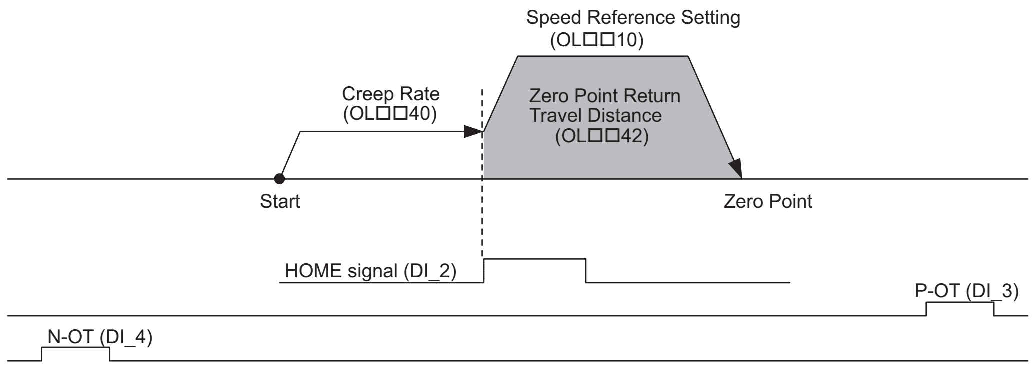
Parameter	Name	Setting
Fixed Parameter No.1, Bit 5	Deceleration LS Inversion Selection	Set whether or not to invert the polarity of DI_2 signal that is used for HOME signal. 0: Do not invert 1: Invert However, the deceleration limit switch signal for zero point return (OW□□05, bit 8) will not be inverted even if this bit is set to 1 (Invert).
OW□□03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL□□10 (Speed Reference Setting), OL□□3E (Approach Speed), and OL□□40 (Creep Rate). 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OL□□10	Speed Reference Setting	Set the positioning speed to use after detecting the phase-C pulse. The sign is ignored. The travel direction will depend on the sign of the Zero Point Return Travel Distance. Setting to 0 or a negative value will result in an error.
OW□□18	Override	This parameter allows the travel speed to be changed without changing the Speed Reference Setting (OL□□10). The setting can be changed during operation. Setting range: 0 to 32767 (0 to 327.67%) Setting unit: 1 = 0.01%
OW□□3C	Zero Point Return Method	14: HOME LS & Phase-C Pulse Method
OL□□3E	Approach Speed	Set the speed to be used at zero point return start. The travel direction depends on the sign of the approach speed. Setting to 0 will result in an error.
OL□□40	Creep Rate	Set the speed and travel direction after the HOME signal is detected. Setting to 0 will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where a phase-C pulse is detected. The travel direction will depend on the sign.

[m] HOME LS Signal Method (OW□□3C = 15)

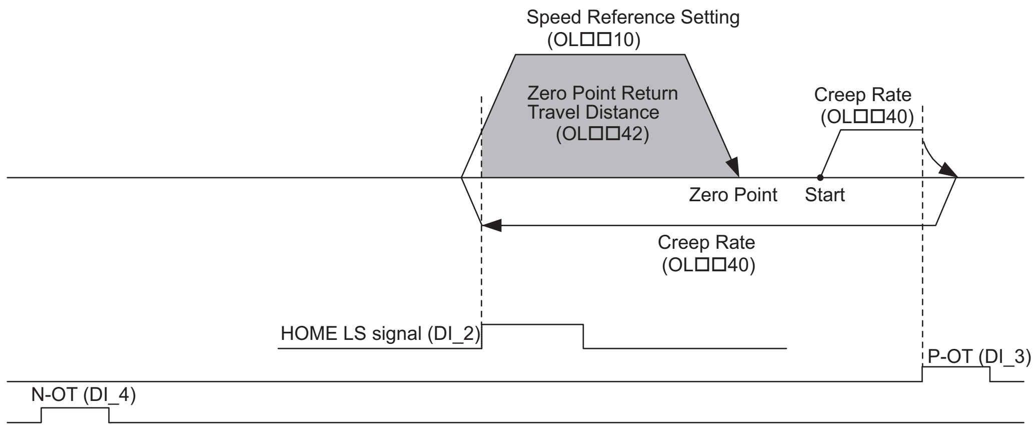
■ Operation after Zero Point Return Starts

Travel is started at the creep speed in the direction specified by the sign of the creep speed.
When the rising edge of the HOME signal is detected, positioning is performed at the positioning speed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the rising edge of the HOME signal is detected is set in the Zero Point Return Travel Distance. The positioning speed is set in the Speed Reference Setting.
- If an OT signal is detected during creep speed operation, an alarm will not occur, the direction will be reversed, and a search will be made for the HOME signal.
- If an OT signal is detected during positioning speed operation, an OT alarm will occur.



<Detecting the OT Signal during Creep Speed Movement>



- The stopping method when the OT signal is detected depends on the setting of SERVOPACK parameters.

■ Parameters to be Set

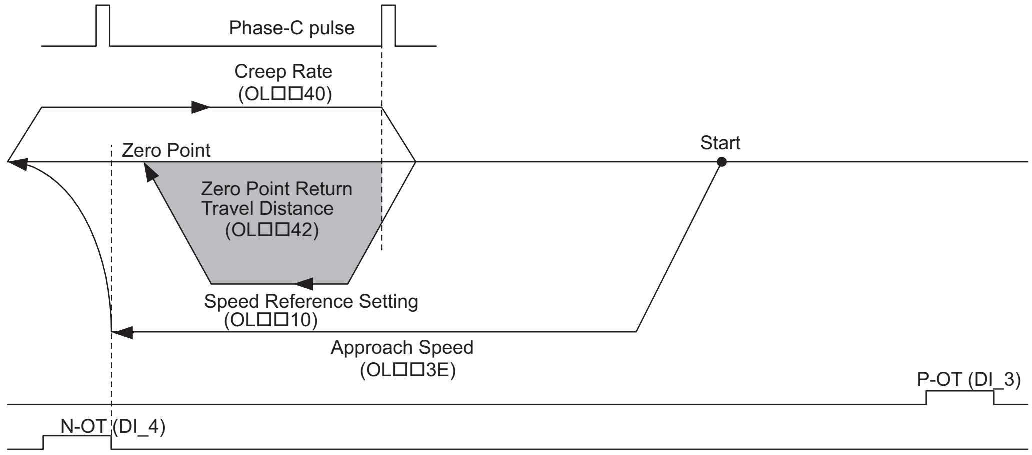
Parameter	Name	Setting
Fixed Parameter No.1, Bit 5	Deceleration LS Inversion Selection	Set whether or not to invert the polarity of DI_2 signal that is used for HOME signal. 0: Do not invert 1: Invert However, the deceleration limit switch signal for zero point return (OW□□05, bit 8) will not be inverted even if this bit is set to 1 (Invert).
OW□□03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL□□10 (Speed Reference Setting) and OL□□40 (Creep Rate). 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OL□□10	Speed Reference Setting	Set the positioning speed to use after detecting the HOME signal. The sign is ignored. The travel direction will depend on the sign of the Zero Point Return Travel Distance. Setting to 0 or a negative value will result in an error.
OW□□18	Override	This parameter allows the travel speed to be changed without changing the Speed Reference Setting (OL□□10). The setting can be changed during operation. Setting range: 0 to 32767 (0 to 327.67%) Setting unit: 1 = 0.01%
OW□□3C	Zero Point Return Method	15: HOME LS Only Method
OL□□40	Creep Rate	Set the speed and travel direction (sign) to be used at zero point return start. Setting to 0 will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where the HOME signal is detected. The travel direction will depend on the sign.

[n] N-OT & Phase-C Pulse Method (OW□□3C = 16)

■ Operation after Zero Point Return Starts

Travel is started at the approach speed in the negative direction until the stroke limit is reached.
When the N-OT signal is detected, the direction is reversed to return at the creep speed.
When the phase-C pulse is detected during the return after passing the N-OT signal, the positioning is performed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the phase-C pulse is detected is set in the Zero Point Return Travel Distance. The positioning speed is set in the Speed Reference Setting.
- If a positive value is set for the approach speed, the command will end in an error.
- If an OT signal is detected during the positioning speed operation, an OT alarm will occur.



- The stopping method when the OT signal is detected depends on the setting of SERVOPACK parameters.

■ Parameters to be Set

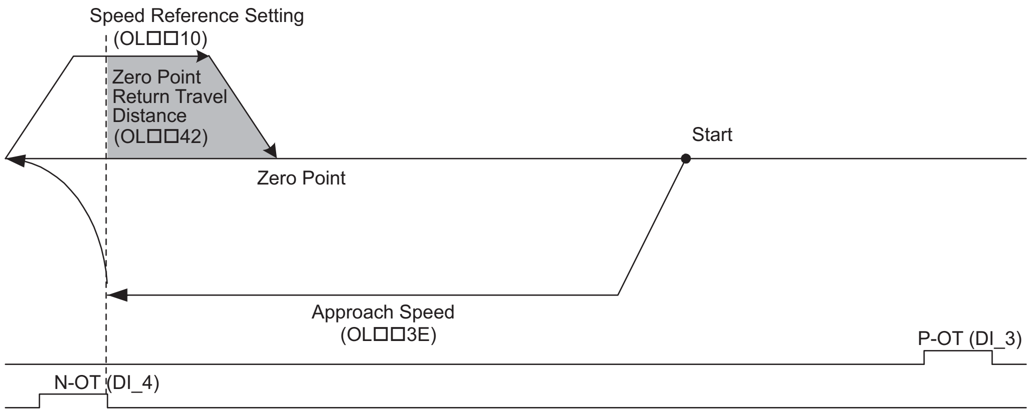
Parameter	Name	Setting
OW□□03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL□□10 (Speed Reference Setting), OL□□3E (Approach Speed), and OL□□40 (Creep Rate). 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OL□□10	Speed Reference Setting	Set the positioning speed to use after detecting a phase-C pulse. The sign is ignored. The travel direction will depend on the sign of the Zero Point Return Travel Distance. Setting to 0 or a negative value will result in an error.
OW□□18	Override	This parameter allows the travel speed to be changed without changing the Speed Reference Setting (OL□□10). The setting can be changed during operation. Setting range: 0 to 32767 (0 to 327.67%) Setting unit: 1 = 0.01%
OW□□3C	Zero Point Return Method	16: N-OT & Phase-C Pulse Method
OL□□3E	Approach Speed	Set the speed to be used at zero point return start. Only a negative value can be used. Setting to 0 or a positive value will result in an error.
OL□□40	Creep Rate	Set the speed after the N-OT signal is detected. The sign is ignored. The axis travels in the forward direction. Setting to 0 will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where a phase-C pulse is detected. The travel direction will depend on the sign.

[o] N-OT Signal Method (OW□□3C = 17)

■ Operation after Zero Point Return Starts

Travel is started at the approach speed in the negative direction until the stroke limit is reached.
When the N-OT signal is detected, the direction is reversed to return at the positioning speed.
When a change in the N-OT signal status from ON to OFF is detected during the return, the positioning is performed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the change of the N-OT signal status is detected is set in the Zero Point Return Travel Distance. The positioning speed is set in the Speed Reference Setting.
- If a positive value is set for the approach speed, the command will end in an error.
- If an OT signal is detected during the positioning speed operation, an OT alarm will occur.
- Detecting the change in the OT signal status is performed using software processing. The position where positioning is completed will depend on the high-speed scan setting, positioning speed, etc. Do not use this method if repeat accuracy is required in the position where the zero point return operation is completed.



- The stopping method when the OT signal is detected depends on the setting of SERVOPACK parameters.

■ Parameters to be Set

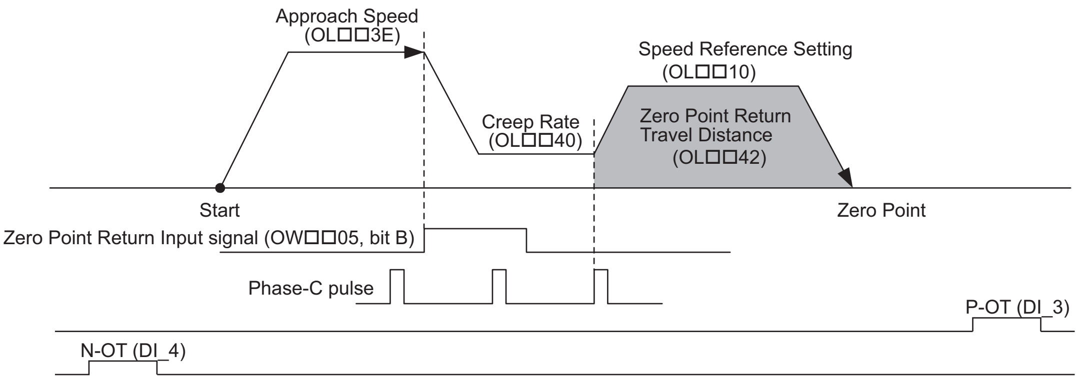
Parameter	Name	Setting
OW□□03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL□□10 (Speed Reference Setting) and OL□□3E (Approach Speed). 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OL□□10	Speed Reference Setting	Set the positioning speed to use after detecting the N-OT signal. The sign is ignored. The travel direction will depend on the sign of the Zero Point Return Travel Distance. Setting to 0 or a negative value will result in an error.
OW□□18	Override	This parameter allows the travel speed to be changed without changing the Speed Reference Setting (OL□□10). The setting can be changed during operation. Setting range: 0 to 32767 (0 to 327.67%) Setting unit: 1 = 0.01%
OW□□3C	Zero Point Return Method	17: N-OT Only Method
OL□□3E	Approach Speed	Set the speed to be used at zero point return start. Only a negative value can be used. Setting to 0 or a positive value will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where the N-OT signal is detected. The travel direction will depend on the sign. Always set to a positive value when using N-OT Only Method.

[p] INPUT & Phase-C Pulse Method (OW☐☐3C = 18)

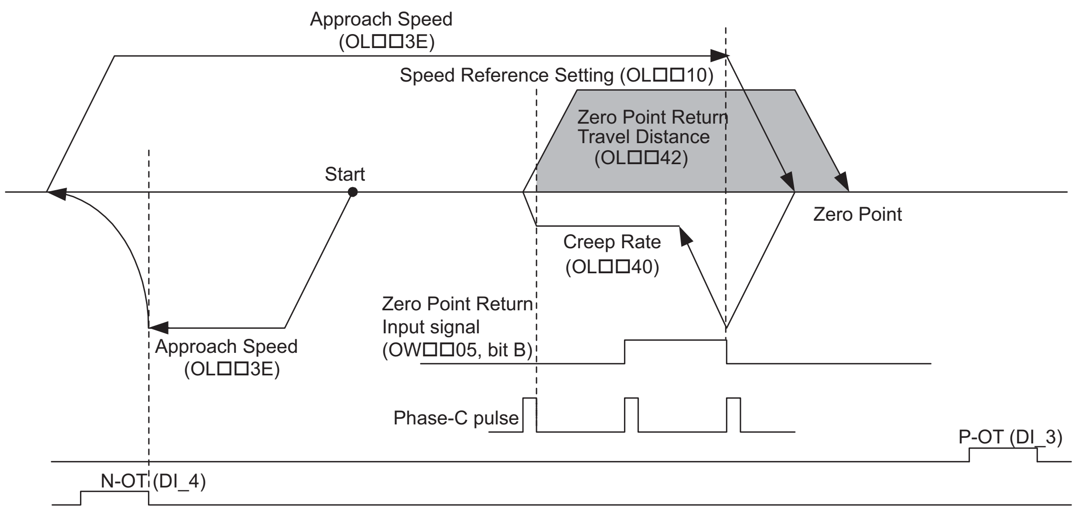
■ Operation after Zero Point Return Starts

Travel is started at the approach speed in the direction specified by the sign of the approach speed.
When the rising edge of the INPUT signal is detected, the speed is reduced to the creep speed. And, the travel direction depends on the sign of the creep speed.
When the first phase-C pulse is detected after the falling edge of the INPUT signal, the positioning is performed at positioning speed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the phase-C pulse is detected is set in the Zero Point Return Travel Distance. The positioning speed is set in the Speed Reference Setting.
- If an OT signal is detected during approach speed operation, an OT alarm will not occur, the direction will be reversed, and a search will be made for the INPUT signal.
- If an OT signal is detected during creep speed or positioning speed operation, an OT alarm will occur.



<Detecting the OT Signal during Approach Speed Movement>



- The stopping method when the OT signal is detected depends on the setting of SERVOPACK parameters.

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■ Parameters to be Set

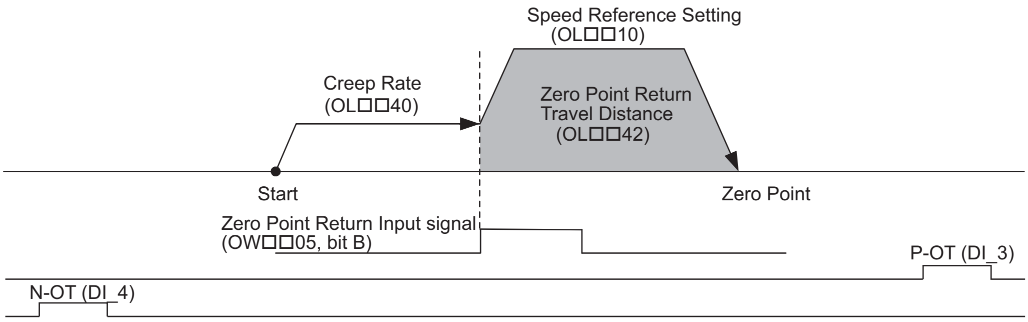
Parameter	Name	Setting
OW□□03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL□□10 (Speed Reference Setting), OL□□3E (Approach Speed), and OL□□40 (Creep Rate). 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OW□□05, Bit B	Zero Point Return Input Signal	This signal must be turned ON by using the ladder program.
OL□□10	Speed Reference Setting	Set the positioning speed to use after detecting a phase-C pulse. The sign is ignored. The travel direction will depend on the sign of the Zero Point Return Travel Distance. Setting to 0 or a negative value will result in an error.
OW□□18	Override	This parameter allows the travel speed to be changed without changing the Speed Reference Setting (OL□□10). The setting can be changed during operation. Setting range: 0 to 32767 (0 to 327.67%) Setting unit: 1 = 0.01%
OW□□3C	Zero Point Return Method	18: INPUT & Phase-C Pulse Method
OL□□3E	Approach Speed	Set the speed to be used at zero point return start. The travel direction depends on the sign of the approach speed. Setting to 0 will result in an error.
OL□□40	Creep Rate	Set the speed and travel direction (sign) after the INPUT signal is detected. Setting to 0 will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where a phase-C pulse is detected. The travel direction will depend on the sign.

[q] INPUT Signal Method (OW□□3C = 19)

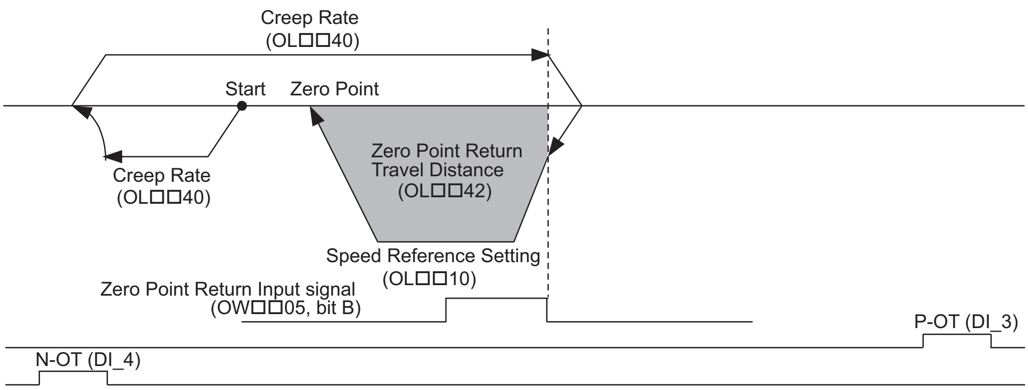
■ Operation after Zero Point Return Starts

Travel is started at the creep speed in the direction specified by the sign of the creep speed.
When the rising edge of the INPUT signal is detected, the positioning is performed at the positioning speed.
When the positioning has been completed, a machine coordinate system is established with the final position as the zero point.

- The moving amount after the rising edge of the INPUT signal is detected is set in the Zero Point Return Travel Distance. The positioning speed is set in the Speed Reference Setting.
- If an OT signal is detected during creep speed operation, an OT alarm will not occur, the direction will be reversed, and a search will be made for the INPUT signal.
- If an OT signal is detected during positioning speed operation, an OT alarm will occur.
- The INPUT signal is allocated to the motion setting parameter OW□□05 bit B, allowing the zero point return operation to be performed without actually wiring a signal. This method can thus be used to temporarily set the zero point during trial operation.
- Detecting the rising edge of the INPUT signal is performed using software processing. The position where positioning is completed will depend on the high-speed scan setting, positioning speed, etc. Do not use this method if repeat accuracy is required in the position where the zero point return operation is completed.



<Detecting the OT Signal during Creep Speed Movement>



- The stopping method when the OT signal is detected depends on the setting of SERVOPACK parameters.

■ Parameters to be Set

Parameter	Name	Setting
OW□□03, Bits 0 to 3	Speed Unit Selection	Select the setting unit for OL□□10 (Speed Reference Setting) and OL□□40 (Creep Rate). 0: Reference unit/s 1: 10^n reference units/min 2: Percentage of rated speed (1 = 0.01%) 3: Percentage of rated speed (1 = 0.0001%)
OW□□05, Bit B	Zero Point Return Input Signal	This signal must be turned ON by using the ladder program.
OL□□10	Speed Reference Setting	Set the positioning speed to use after detecting the INPUT signal. The sign is ignored. The travel direction will depend on the sign of the Zero Point Return Travel Distance. Setting to 0 or a negative value will result in an error.
OW□□18	Override	This parameter allows the travel speed to be changed without changing the Speed Reference Setting (OL□□10). The setting can be changed during operation. Setting range: 0 to 32767 (0 to 327.67%) Setting unit: 1 = 0.01%
OW□□3C	Zero Point Return Method	19: INPUT Only Method
OL□□40	Creep Rate	Set the speed and travel direction (sign) to be used at zero point return start. Setting to 0 will result in an error.
OL□□42	Zero Point Return Travel Distance	Set the travel distance from the point where the INPUT signal is detected. The travel direction will depend on the sign.

7.2.4 Interpolation (INTERPOLATE)

The INTERPOLATE command positions the axis according to the target position that changes in sync with the high-speed scan. The positioning data is generated by a ladder program.

- Speed feed forward compensation can be applied.

(1) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	There are no alarms.	IL☐☐04 is 0.
2	The Servo ON condition.	IW☐☐00, bit 1 is ON.
3	Motion command execution has been completed.	IW☐☐08 is 0 and IW☐☐09, bit 0 is OFF.

2. Set the following motion setting parameters.

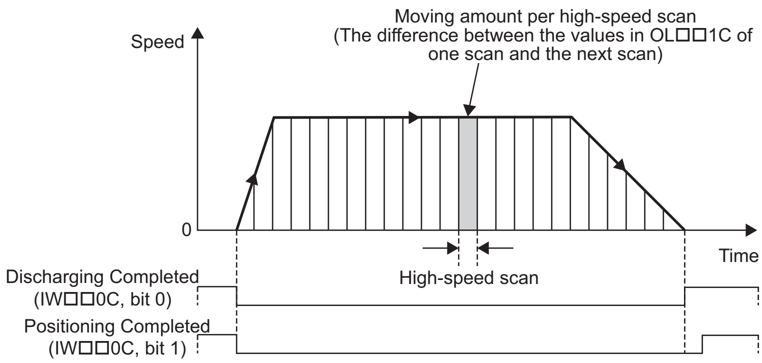
Position Reference Setting: OL☐☐1C
Filter Type Selection: OW☐☐03, bits 8 to B
Speed Feedforward Amends: OW☐☐30

3. Set the parameter OW☐☐08 to 4 to execute an INTERPOLATE command.

The positioning starts. The travel speed is automatically calculated.
4 is stored in IW☐☐08 during positioning.
The target position will be refreshed every high-speed scan. Set the target position to be refreshed in OL☐☐1C (Position Reference Setting).
When the axis reaches the target position, the bit 1 of IW☐☐0C turns ON and the positioning is completed.

4. Set OW☐☐08 to 0 to execute the NOP motion command to complete the positioning operation.

INTERPOLATE Operation Pattern



(2) Holding and Aborting

The axis will decelerate to a stop if there is no change in the target position each high-speed scan.
The Holds A Command bit (OW☐☐09, bit 0) and the Interrupt A Command bit (OW☐☐09, bit 1) cannot be used.
Change a motion command to NOP to stop the interpolation execution.

(3) Related Parameters

[a] Setting Parameters

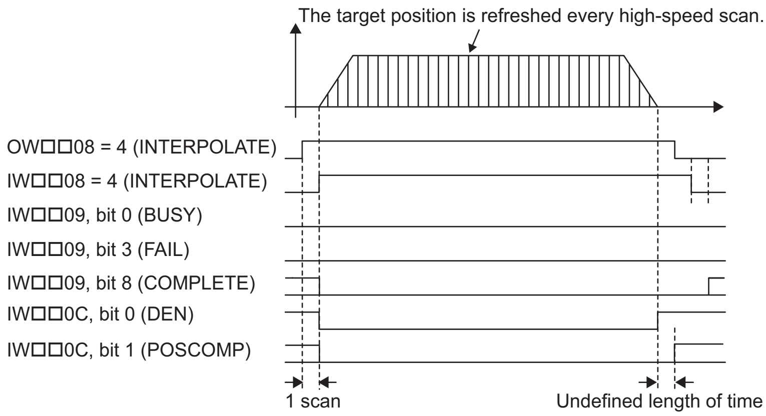
Parameter	Name	Setting
OW□□00 Bit 0	Servo ON	Turns the power to the Servomotor ON and OFF. 1: Power ON to Servomotor, 0: Power OFF to Servomotor Set this bit to 1 before setting the Motion Command (OW□□08) to 4.
OW□□03	Function Setting 1	Select the filter type.
OW□□08	Motion Command	The positioning starts when this parameter is set to 4.
OW□□09 Bit 5	Position Reference Type	Select the type of position reference. 0: Incremental addition mode, 1: Absolute mode Set this bit before setting the Motion Command (OW□□08) to 4.
OL□□1C	Position Reference Type	Set the target position for positioning. The setting can be updated every high-speed scan.
OL□□1E	Width of Positioning Completion	Set the width in which to turn ON the Positioning Completed bit (IW□□0C, bit 1).
OL□□20	NEAR Signal Output Width	Set the range in which the NEAR Position bit (IW□□0C, bit 3) will turn ON. The NEAR Position bit will turn ON when the absolute value of the difference between the reference position and the feedback position is less than the value set here.
OW□□3A	Filter Time Constant	Set the acceleration/deceleration filter time constant. Exponential acceleration/deceleration or a moving average filter can be selected in the Function Setting 1 (OW□□03, bits 8 to B). Change the setting only after pulse distribution has been completed for the command (IW□□0C, bit 0 is ON).

[b] Monitoring Parameters

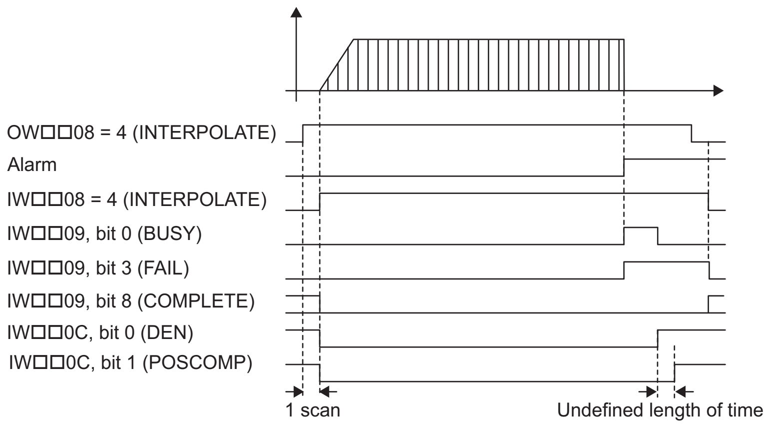
Parameter	Name	Monitor Contents
IW□□00 Bit 1	Running (At Servo ON)	Indicates the Servo ON status. ON: Power supplied to Servomotor, OFF: Power not supplied to Servomotor
IL□□02	Warning	Stores the most current warning.
IL□□04	Alarm	Stores the most current alarm.
IW□□08	Motion Command Response Code	Indicates the motion command that is being executed. The response code is 4 during INTERPOLATE command execution.
IW□□09 Bit 0	Command Execution Flag	Always OFF for INTERPOLATE command.
IW□□09 Bit 1	Command Hold Completed	Always OFF for INTERPOLATE command.
IW□□09 Bit 3	Command Error Completed Status	Turns ON if an error occurs during INTERPOLATE command execution. The axis will decelerate to a stop if it is moving. Turns OFF when another command is executed.
IW□□09 Bit 8	Command Execution Completed	Always OFF for INTERPOLATE command.
IW□□0C Bit 0	Discharging Completed	Turns ON when pulse distribution has been completed for the move command. Turns OFF during execution of a move command.
IW□□0C Bit 1	Positioning Completed	Turns ON when pulse distribution has been completed and the current position is within the Width of Positioning Completion. OFF in all other cases.
IW□□0C Bit 3	NEAR Position	The operation depends on the setting of the NEAR Signal Output Width (setting parameter OL□□20). OL□□20 = 0: Turns ON when pulse distribution has been completed (DEN = ON). Otherwise, it turns OFF. OL□□20 ≠ 0: Turns ON when the absolute value of the difference between MPOS (IL□□12) and APOS (IL□□16) is less than the NEAR Position Setting even if pulse distribution has not been completed. OFF in all other cases.

(4) Timing Charts

[a] Normal Execution



[b] Execution when an Alarm Occurs



7.2.5 Latch (LATCH)

The LATCH command saves in a register the current position when the latch signal is detected during interpolation positioning.
The latch signal type is set in setting register OW□□04 and can be set to the EXT, ZERO, or phase-C signal.

- Speed feed forward compensation can be applied.
- When executing the LATCH command more than once after latching the current position by the LATCH command, change the Motion Command to NOP for at least one scan before executing LATCH again.

(1) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	There are no alarms.	IL□□04 is 0.
2	The Servo ON condition.	IW□□00, bit 1 is ON.
3	Motion command execution has been completed.	IW□□08 is 0 and IW□□09, bit 0 is OFF.

2. Set the following motion setting parameters.

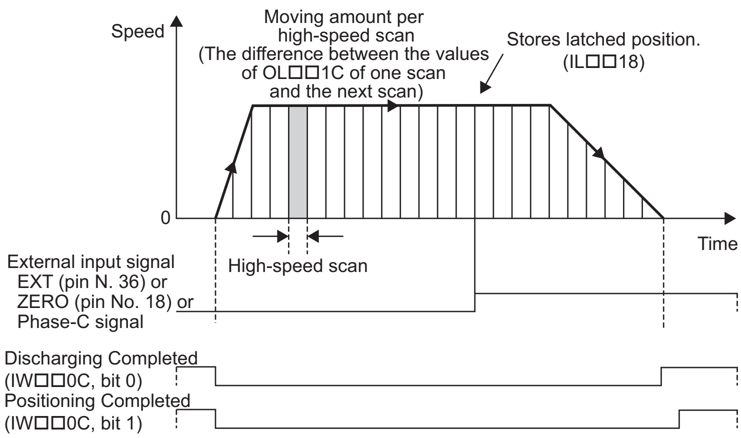
Position Reference Setting: OL□□1C
Filter Type Selection: OW□□03, bits 8 to B
Speed Feedforward Amends: OW□□30
Latch Detection Signal Selection: OW□□04

3. Set OW□□08 to 6 (Latch) to execute a LATCH motion command.

The positioning starts. The travel speed is automatically calculated.
6 is stored in IW□□08 during positioning.
The target position is refreshed every high-speed scan. Set the target position to be refreshed in OL□□1C (Position Reference Setting).
When the latch signal turns ON, the current position is latched and stored in IL□□18.
When the axis reaches the target position, the bit 1 of IW□□0C turns ON and the positioning is completed.

4. Set OW□□08 to 0 to execute the NOP motion command and then complete the positioning operation.

LATCH Operation Pattern



(2) Holding and Aborting

The axis will decelerate to a stop if there is no change in the target position each high-speed scan.
The Holds A Command bit (OW□□09, bit 0) and the Interrupt A Command bit (OW□□09, bit 1) cannot be used.
Change a motion command to NOP to stop the interpolation execution.

(3) Related Parameters

[a] Setting Parameters

Parameter	Name	Setting
OW☐☐00 Bit 0	Servo ON	Turns the power to the Servomotor ON and OFF. 1: Power ON to Servomotor, 0: Power OFF to Servomotor Set this bit to 1 before setting the Motion Command (OW☐☐08) to 6.
OW☐☐03	Function Setting 1	Select the filter type.
OW☐☐04	Function Setting 2	Select the latch signal type. 0: EXT (DI_5), 1: ZERO (DI_2), 2: Phase-C pulse signal
OW☐☐08	Motion Command	The positioning starts when this parameter is set to 6.
OW☐☐09 Bit 5	Position Reference Type	Select the type of position reference. 0: Incremental addition mode, 1: Absolute mode Set this bit before setting the Motion Command (OW☐☐08) to 6.
OL☐☐1C	Position Reference Setting	Set the target position for positioning. The setting can be updated every high-speed scan.
OL☐☐1E	Width of Positioning Completion	Set the width in which to turn ON the Positioning Completed bit (IW☐☐0C, bit 1).
OL☐☐20	NEAR Signal Output Width	Set the range in which the NEAR Position bit (IW☐☐0C, bit 3) will turn ON. The NEAR Position bit will turn ON when the absolute value of the difference between the reference position and the feedback position is less than the value set here.
OW☐☐3A	Filter Time Constant	Set the acceleration/deceleration filter time constant. Exponential acceleration/deceleration or a moving average filter can be selected in the Function Setting 1 (OW☐☐03, bits 8 to B). Change the setting only after pulse distribution has been completed for the command (IW☐☐0C, bit 0 is ON).

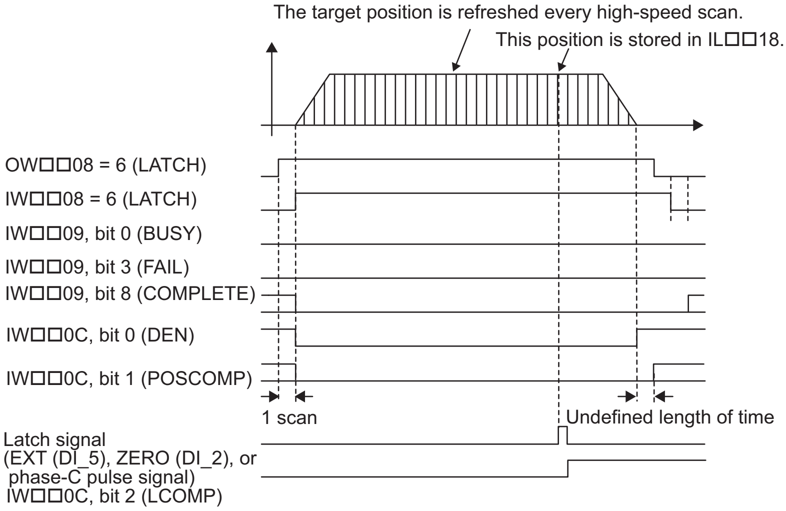
[b] Monitoring Parameters

Parameter	Name	Monitor Contents
IW☐☐00 Bit 1	Running (At Servo ON)	Indicates the Servo ON status. ON: Power supplied to Servomotor, OFF: Power not supplied to Servomotor
IL☐☐02	Warning	Stores the most current warning.
IL☐☐04	Alarm	Stores the most current alarm.
IW☐☐08	Motion Command Response Code	Indicates any alarms that have occurred during execution. The response code is 6 during LATCH command operation.
IW☐☐09 Bit 0	Command Execution Flag	Always OFF for LATCH command.
IW☐☐09 Bit 1	Command Hold Completed	Always OFF for LATCH command.
IW☐☐09 Bit 3	Command Error Completed Status	Turns ON if an error occurs during LATCH command operation. The axis will decelerate to a stop if it is moving. Turns OFF when another command is executed.
IW☐☐09 Bit 8	Command Execution Completed	Always OFF for LATCH command.
IW☐☐0C Bit 0	Discharging Completed	Turns ON when pulse distribution has been completed for the move command. Turns OFF during execution of a move command.
IW☐☐0C Bit 1	Positioning Completed	Turns ON when pulse distribution has been completed and the current position is within the Width of Positioning Completion. OFF in all other cases.
IW☐☐0C Bit 2	Latch Completed	Turns OFF when a new latch command is executed and turns ON when the latch has been completed. The latched position is stored as the Machine Coordinate System Latch Position (monitoring parameter IL☐☐18).
IW☐☐0C Bit3	NEAR Position	The operation depends on the setting of the NEAR Signal Output Width (setting parameter OL☐☐20). OL☐☐20 = 0:Turns ON when pulse distribution has been completed (DEN = ON). Otherwise, it turns OFF. OL☐☐20 ≠ 0:Turns ON when the absolute value of the difference between MPOS (IL☐☐12) and APOS (IL☐☐16) is less than the NEAR Position Setting even if pulse distribution has not been completed. OFF in all other cases.

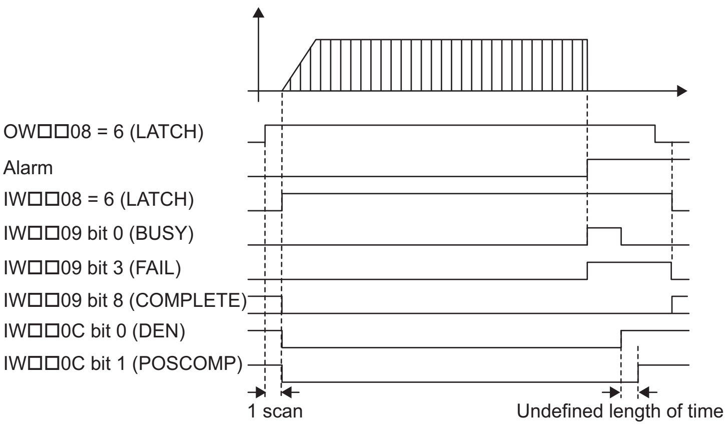
Parameter	Name	Monitor Contents
IL□□18	Machine Coordinate System Latch Position	Stores the current position in the machine coordinate system when the latch signal turned ON.

(4) Timing Charts

[a] Normal Execution



[b] Execution when an Alarm Occurs



7.2.6 JOG Operation (FEED)

The FEED command starts movement in the specified travel direction at the specified travel speed. Execute the NOP motion command to stop the operation.
Parameters related to acceleration and deceleration are set in advance.

(1) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	There are no alarms.	IL□□04 is 0.
2	The Servo ON condition.	IW□□00, bit 1 is ON.
3	Motion command execution has been completed. *	IW□□08 is 0 and IW□□09, bit 0 is OFF.

* This condition is a basic execution condition. Refer to *Chapter 8 Switching Commands during Execution* on page 8-1 when changing the command being executed to a FEED command.

2. Set the following motion setting parameters.

Moving Direction: OW□□09, bit 2
Speed Reference Setting: OL□□10
Filter Type Selection: OW□□03, bits 8 to B

- The speed reference can be changed during operation.

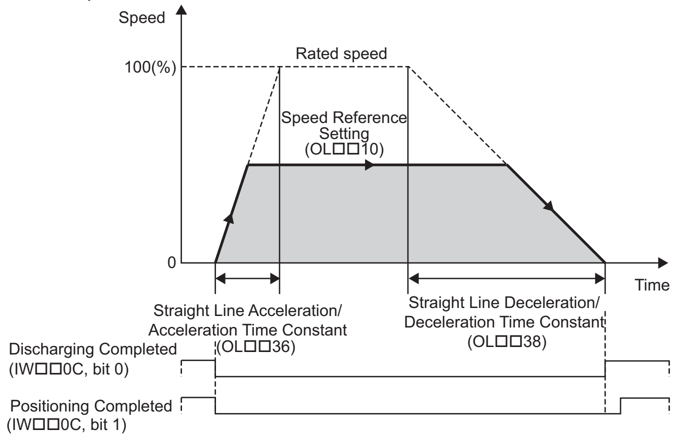
3. Set OW□□08 to 7 to execute the FEED motion command.

JOG operation will start. IW□□08 will be 7 during the execution.

4. Set OW□□08 to 0 to execute the NOP motion command.

IW□□0C, bit 1 turns ON and the JOG operation has been completed.

FEED Operation Pattern



(2) Holding

Holding execution is not possible during FEED command execution. The Holds A Command bit (OW□□09, bit 0) is ignored.

Motion Commands

7

(3) Aborting

Axis travel can be stopped during FEED command execution by aborting execution of a command. A command is aborted by setting the Interrupt A Command bit (OW☐☐09, bit 1) to 1.

- Set the Interrupt A Command bit (OW☐☐09, bit 1) to 1. The axis will decelerate to a stop.
- When the axis has stopped, the Positioning Completed bit (IW☐☐0C, bit 1) will turn ON.
- The JOG operation will restart if the Interrupt A Command bit (OW☐☐09, bit 1) is reset to 0 during abort processing.
- This type of operation will also be performed if the motion command is changed to NOP during axis movement.

(4) Related Parameters

[a] Setting Parameters

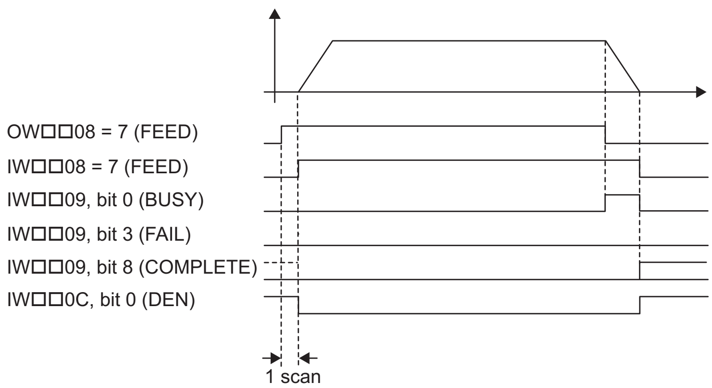
Parameter	Name	Setting
OW☐☐00 Bit 0	Servo ON	Turns the power to the Servomotor ON and OFF. 1: Power ON to Servomotor, 0: Power OFF to Servomotor Set this bit to 1 before setting the Motion Command (OW☐☐08) to 7.
OW☐☐03	Function Setting 1	Set the speed unit, acceleration/deceleration unit, and filter type.
OW☐☐08	Motion Command	The JOG operation starts when this parameter is set to 7. The axis is decelerated to a stop and the JOG operation is completed if this parameter is set to 0 during the execution of a FEED command.
OW☐☐09 Bit 1	Interrupt A Command	The axis is decelerated to a stop if this bit is set to 1 during JOG operation.
OW☐☐09 Bit 2	Moving Direction	Set the travel direction for JOG operation. 0: Positive direction, 1: Negative direction
OL☐☐10	Speed Reference Setting	Specify the speed for the positioning. This setting can be changed during operation. The unit depends on the Function Setting 1 (OW☐☐03, bits 0 to 3).
OW☐☐18	Override	This parameter allows the feed speed to be changed without changing the Speed Reference (OL☐☐10). Set the speed as a percentage of the Speed Reference Setting. This setting can be changed during operation. Setting range: 0 to 32767 (0% to 327.67%) Setting unit: 1 = 0.01% Example: Setting for 50%: 5000
OL☐☐1E	Width of Positioning Completion	Set the width in which to turn ON the Positioning Completed bit (IW☐☐0C, bit 1).
OL☐☐20	NEAR Signal Output Width	Set the range in which the NEAR Position bit (IW☐☐0C, bit 3) will turn ON. The NEAR Position bit will turn ON when the absolute value of the difference between the reference position and the feedback position is less than the value set here.
OL☐☐36	Straight Line Acceleration/ Acceleration Time Constant	Set the feed acceleration in acceleration rate or acceleration time.
OL☐☐38	Straight Line Deceleration/ Deceleration Time Constant	Set the feed deceleration in deceleration rate or deceleration time.
OW☐☐3A	Filter Time Constant	Set the acceleration/deceleration filter time constant. Exponential acceleration/deceleration or a moving average filter can be selected in the Function Setting 1 (OW☐☐03, bits 8 to B). Change the setting only after pulse distribution has been completed for the command (IW☐☐0C, bit 0 is ON).

[b] Monitoring Parameters

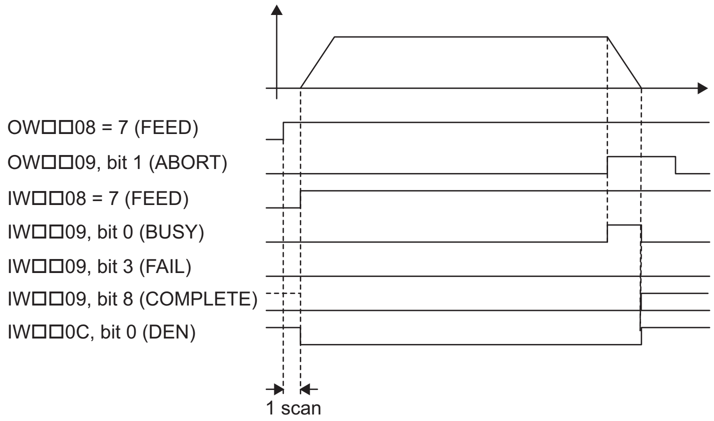
Parameter	Name	Monitor Contents
IW□□00 Bit 1	Running (At Servo ON)	Indicates the Servo ON status. ON: Power supplied to Servomotor, OFF: Power not supplied to Servomotor
IL□□02	Warning	Stores the most current warning.
IL□□04	Alarm	Stores the most current alarm.
IW□□08	Motion Command Response Code	Indicates the motion command that is being executed. The response code is 7 during FEED command execution.
IW□□09 Bit 0	Command Execution Flag	Turns ON when abort processing is being performed for FEED command. Turns OFF when abort processing has been completed.
IW□□09 Bit 1	Command Hold Completed	Always OFF for FEED command.
IW□□09 Bit 3	Command Error Completed Status	Turns ON if an error occurs during FEED command execution. The axis will decelerate to a stop if it is moving. Turns OFF when another command is executed.
IW□□09 Bit 8	Command Execution Completed	Always OFF for FEED command.
IW□□0C Bit 0	Discharging Completed	Turns ON when pulse distribution has been completed for the move command. Turns OFF during execution of a move command.
IW□□0C Bit 1	Positioning Completed	Turns ON when pulse distribution has been completed and the current position is within the Width of Positioning Completion. OFF in all other cases.
IW□□0C Bit 3	NEAR Position	The operation depends on the setting of the NEAR Signal Output Width (setting parameter OL□□20). OL□□20 = 0: Turns ON when pulse distribution has been completed (DEN = ON). Otherwise, it turns OFF. OL□□20 ≠ 0: Turns ON when the absolute value of the difference between MPOS (IL□□12) and APOS (IL□□16) is less than the NEAR Position Setting even if pulse distribution has not been completed. OFF in all other cases.

(5) Timing Charts

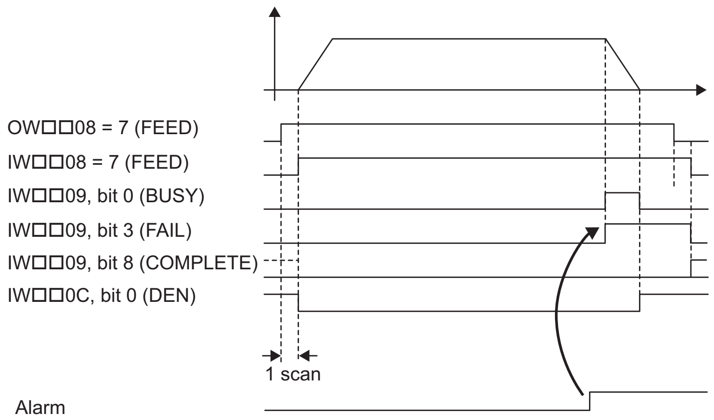
[a] Normal Execution



[b] Execution when Aborted



[c] Execution when an Alarm Occurs



7.2.7 STEP Operation (STEP)

The STEP command executes a positioning for the specified travel direction, moving amount, and travel speed. Parameters related to acceleration and deceleration are set in advance.

(1) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	There are no alarms.	IL□□04 is 0.
2	The Servo ON condition.	IW□□00, bit 1 is ON.
3	Motion command execution has been completed.	IW□□08 is 0 and IW□□09, bit 0 is OFF.

2. Set the following motion setting parameters.

STEP Travel Distance: OL□□44
Moving Direction: OW□□09, bit 2
Speed Reference Setting: OL□□10
Filter Type Selection: OW□□03, bits 8 to B

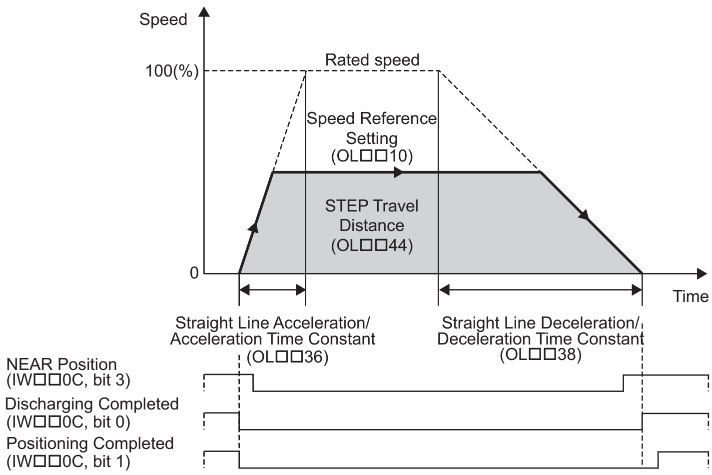
- The speed reference bit OL□□10 can be changed during operation.
- An override of between 0% to 327.67% can be set for the travel speed.

3. Set OW□□08 to 8 to execute the STEP motion command.

STEP operation will start. IW□□08 will be 8 during execution.
IW□□0C, bit 3 will turn ON when the axis reaches the target position.
IW□□0C, bit 1 will turn ON when the axis reaches the target position and the positioning has been completed.

4. Set OW□□08 to 0 to execute the NOP motion command and then complete the STEP operation.

STEP Operation Pattern



(2) Holding

Axis travel can be stopped during command execution and then the remaining travel can be restarted. A command is held by setting the Holds A Command (OW□□09, bit 0) to 1.

- Set the Holds A Command bit (OW□□09, bit 0) to 1. The axis will decelerate to a stop.
- When the axis has stopped, the Command Hold Completed bit (IW□□09, bit 1) will turn ON.
- Reset the Holds A Command bit (OW□□09, bit 0) to 0.
  The command hold status will be cleared and the remaining portion of the positioning will be restarted.

(3) Aborting

Axis travel can be stopped during command execution and the remaining travel canceled by aborting execution of a command. A command is aborted by setting the Interrupt A Command bit (OW□□09, bit 1) to 1.

- Set the Interrupt A Command bit (OW□□09, bit 1) to 1. The axis will decelerate to a stop.
- When the axis has stopped, the remain travel will be canceled and the Positioning Completed bit (IW□□0C, bit 1) will turn ON.
- This type of operation will also be performed if the motion command is changed to NOP during axis movement.

(4) Related Parameters

[a] Setting Parameters

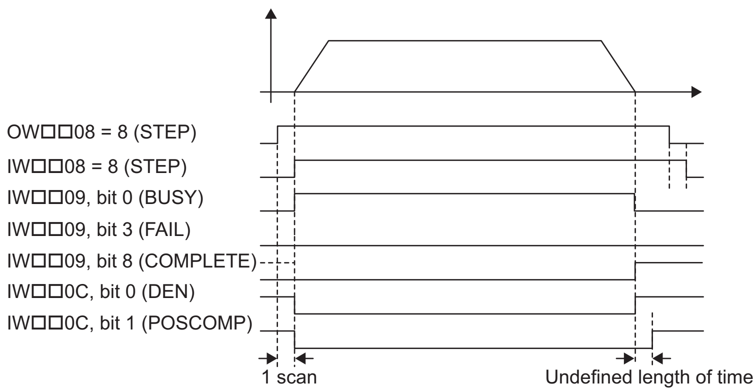
Parameter	Name	Setting
OW□□00 Bit 0	Servo ON	Turns the power to the Servomotor ON and OFF. 1: Power ON to Servomotor, 0: Power OFF to Servomotor Set this bit to 1 before setting the Motion Command (OW□□08) to 8.
OW□□03	Function Setting 1	Set the speed unit, acceleration/deceleration unit, and filter type.
OW□□08	Motion Command	The STEP operation starts when this parameter is set to 8. The axis will decelerate to a stop and the STEP operation is completed if this parameter is set to 0 during STEP command execution.
OW□□09 Bit 0	Holds A Command	The axis will decelerate to a stop if this bit is set to 1 during STEP operation. The operation will restart if this bit is reset to 0 when a command is being held.
OW□□09 Bit 1	Interrupt A Command	The axis will decelerate to a stop if this bit is set to 1 during the positioning. When this bit is reset to 0 after decelerating to a step, the operation depends on the setting of the Position Reference Type (OW□□09, bit 5).
OW□□09 Bit 2	Moving Direction	Set the travel direction for STEP operation. 0: Positive direction, 1: Negative direction
OW□□09 Bit 5	Position Reference Type	Select the type of position reference. 0: Incremental addition mode, 1: Absolute mode Set this bit before setting the Motion Command (OW□□08) to 8.
OL□□10	Speed Reference Setting	Specify the speed for the positioning. This setting can be changed during operation. The unit depends on the setting of the Function Setting 1 (OW□□03, bits 0 to 3).
OW□□18	Override	This parameter allows the positioning speed to be changed without changing the Speed Reference Setting (OL□□10). Set the speed as a percentage of the Speed Reference Setting. This setting can be changed during operation. Setting range: 0 to 32767 (0% to 327.67%) Setting unit: 1 = 0.01% Example: Setting for 50%: 5000
OL□□1E	Width of Positioning Completion	Set the width in which to turn ON the Positioning Completed bit (IW□□0C, bit 1).
OL□□20	NEAR Signal Output Width	Set the range in which the NEAR Position bit (IW□□0C, bit 3) will turn ON. The NEAR Position bit will turn ON when the absolute value of the difference between the reference position and the feedback position is less than the value set here.
OL□□36	Straight Line Acceleration/ Acceleration Time Constant	Set the positioning acceleration in acceleration rate or acceleration time.
OL□□38	Straight Line Deceleration/ Deceleration Time Constant	Set the positioning deceleration in deceleration rate or deceleration time.
OW□□3A	Filter Time Constant	Set the acceleration/deceleration filter time constant. Exponential acceleration/deceleration or a moving average filter can be selected in the Function Setting 1 (OW□□03, bits 8 to B). Change the setting only after pulse distribution has been completed for the command (IW□□0C, bit 0 is ON).
OL□□44	STEP Travel Distance	Set the moving amount for STEP operation.

[b] Monitoring Parameters

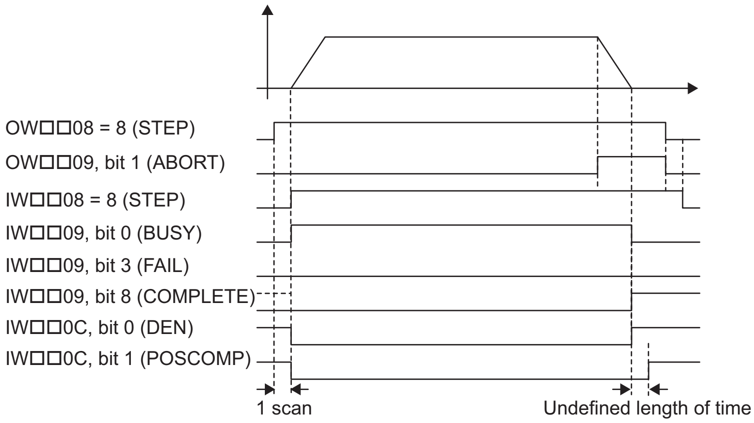
Parameter	Name	Monitor Contents
IW□□00 Bit 1	Running (At Servo ON)	Indicates the Servo ON status. ON: Power supplied to Servomotor, OFF: Power not supplied to Servomotor
IL□□02	Warning	Stores the most current warning.
IL□□04	Alarm	Stores the most current alarm.
IW□□08	Motion Command Response Code	Indicates the motion command that is being executed. The response code is 8 during STEP command execution.
IW□□09 Bit 0	Command Execution Flag	Turns ON during STEP command execution and then turns OFF when STEP command execution has been completed.
IW□□09 Bit 1	Command Hold Completed	Turns ON when a deceleration to a stop has been completed as the result of setting the Holds A Command bit (OW□□09, bit 1) to 1 during STEP command execution (IW□□08 = 8).
IW□□09 Bit 3	Command Error Completed Status	Turns ON if an error occurs during STEP command execution. The axis will decelerate to a stop if it is moving. Turns OFF when another command is executed.
IW□□09 Bit 8	Command Execution Completed	Turns ON when STEP command execution has been completed.
IW□□0C Bit 0	Discharging Completed	Turns ON when pulse distribution has been completed for the move command. Turns OFF during execution of a move command.
IW□□0C Bit 1	Positioning Completed	Turns ON when pulse distribution has been completed and the current position is within the Width of Positioning Completion. OFF in all other cases.
IW□□0C Bit 3	NEAR Position	The operation depends on the setting of the NEAR Signal Output Width (setting parameter OL□□20). OL□□20 = 0: Turns ON when pulse distribution has been completed (DEN = ON). Otherwise, it turns OFF. OL□□20 ≠ 0: Turns ON when the absolute value of the difference between MPOS (IL□□12) and APOS (IL□□16) is less than the NEAR Position Setting even if pulse distribution has not been completed. OFF in all other cases.

(5) Timing Charts

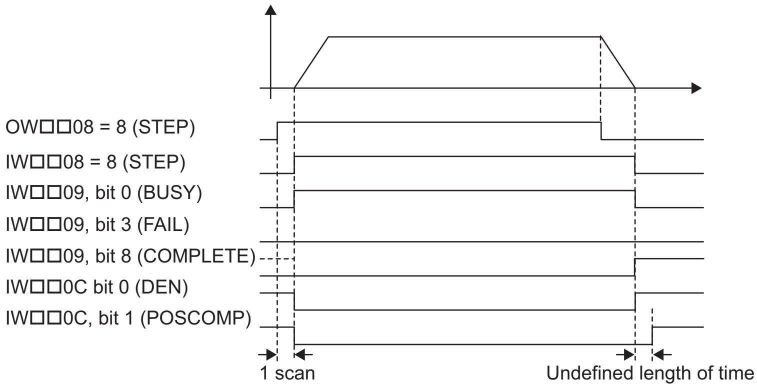
[a] Normal Execution



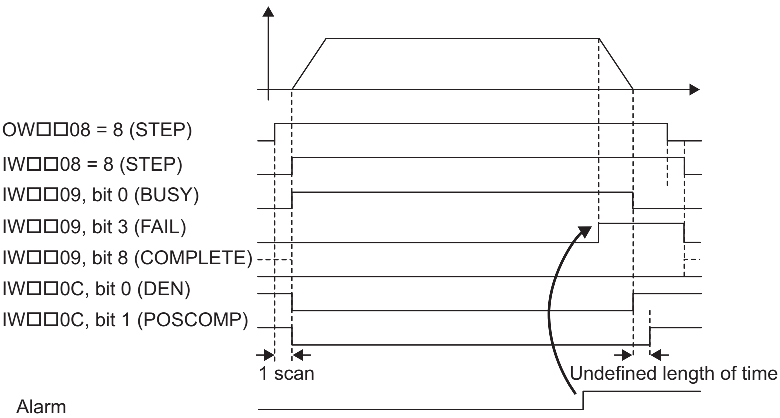
[b] Execution when Aborted



[c] Execution when Aborting by Changing the Command



[d] Execution when an Alarm Occurs



7.2.8 Zero Point Setting (ZSET)

The ZSET command sets the current position as the zero point of the machine coordinate system. This enables setting the zero point without performing a zero point return operation.

- When using software limits, always execute the zero point setting or zero point return operation. The software limit function will be enabled after the zero point setting operation has been completed.

(1) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	There are no alarms.	IL□□04 is 0.
2	Motion command execution has been completed.	IW□□08 is 0 and IW□□09, bit 0 is OFF.

2. Set OW□□08 to 9 to execute the ZSET motion command.

A new machine coordinate system will be established with the current position as the zero point. IW□□08 will be 9 during the zero point setting operation. IW□□0C, bit 5 will turn ON when zero point setting has been completed.

3. Set OW□□08 to 0 to execute the NOP motion command and then complete the zero point setting.

(2) Holding and Aborting

The Holds A Command bit (OW□□09, bit 0) and the Interrupt A Command bit (OW□□09, bit 1) cannot be used.

(3) Related Parameters

[a] Setting Parameters

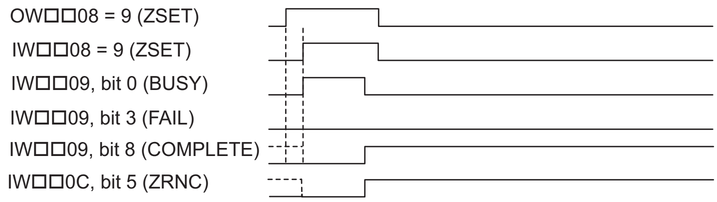
Parameter	Name	Setting
OW□□08	Motion Command	Set to 9 for ZSET command.
OW□□09 Bit 0	Holds A Command	This parameter is ignored for ZSET command.
OW□□09 Bit 1	Interrupt A Command	This parameter is ignored for ZSET command.
OL□□48	Zero Point Position in Machine Coordinate System Offset	Sets the position offset from the zero point in the machine coordinate system after the setting of the zero point has been completed.

[b] Monitoring Parameters

Parameter	Name	Monitor Contents
IL□□02	Warning	Stores the most current warning.
IL□□04	Alarm	Stores the most current alarm.
IW□□08	Motion Command Response Code	Indicates the motion command that is being executed. The response code is 9 during ZSET command execution.
IW□□09 Bit 0	Command Execution Flag	Turns ON during ZSET command execution and turns OFF when ZSET command execution has been completed.
IW□□09 Bit 1	Command Hold Completed	Always OFF for ZSET command.
IW□□09 Bit 3	Command Error Completed Status	Turns ON if an error occurs during ZSET command execution. Turns OFF when another command is executed.
IW□□09 Bit 8	Command Execution Completed	Turns ON when ZSET command execution has been completed.
IW□□0C Bit 5	Zero Point Return (Setting) Completed	Turns ON when the setting of the zero point has been completed.

(4) Timing Charts

[a] Normal Execution



7.2.9 Speed Reference (VELO)

The VELO command is used to operate the SERVOPACK in the speed control mode.

(1) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	There are no alarms.	IL□□04 is 0.
2	Motion command execution has been completed.*	IW□□08 is 0 and IW□□09, bit0 is OFF.

* This condition is a basic execution condition. Refer to *Chapter 8 Switching Commands during Execution* on page 8-1 when changing the command being executed to a VELO command.

2. Set the following motion setting parameters.

Speed Reference Setting: OL□□10
Positive Side Limiting Torque/Thrust Setting at the Speed Reference: OL□□14
Filter Type Selection: OW□□03, bits 8 to B

- The Speed Reference can be changed during operation.
- An override of between 0% to 327.67% can be set for the reference speed.

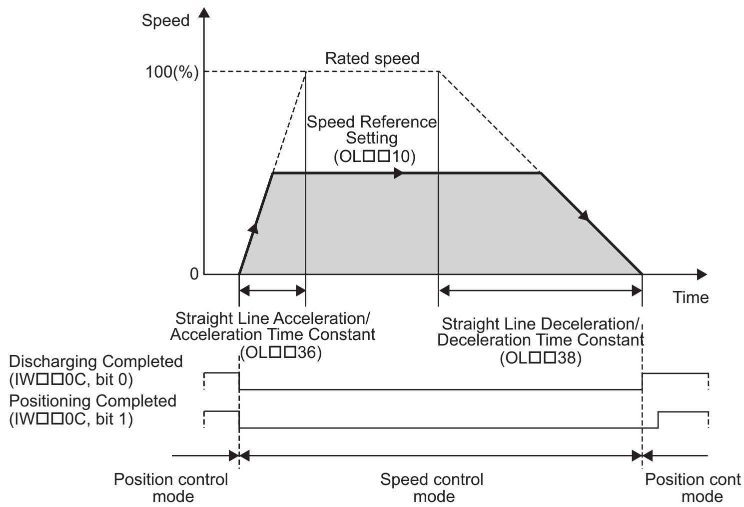
3. Set OW□□08 to 23 to execute the VELO motion command.

The control mode in the SERVOPACK will be switched to speed control.
IW□□08 will be 23 during command execution.

- This command can be executed even when the Servo is OFF.
- Position management using the position feedback is possible during operation with speed control mode.

4. Execute another motion command to cancel the speed control mode.

VELO Operation Pattern



(2) Holding

Axis travel can be stopped during command execution and then the remaining travel can be restarted. A command is held by setting the Holds A Command bit (OW□□09, bit 0) to 1.

- Set the Holds A Command bit (OW□□09, bit 0) to 1. The axis will decelerate to a stop.
- When the axis has stopped, the Command Hold Completed bit (IW□□09, bit 1) will turn ON.
- Reset the Holds A Command bit (OW□□09, bit 0) to 0.
  The command hold status will be cleared and the remaining portion of the operation will be restarted.

(3) Aborting

The VELO command can be canceled by aborting execution of a command. A command is aborted by setting the Interrupt A Command bit (OW☐☐09, bit 1) to 1.

- Set the Interrupt A Command bit (OW☐☐09, bit 1) to 1. The axis will decelerate to a stop in the speed control mode. Once the axis stops, the control mode will change to the position control mode and the abort processing will be completed.
- The VELO command will restart if the Interrupt A Command bit (OW☐☐09, bit 1) is reset to 0 during abort processing.
- Setting the Interrupt A Command bit (OW☐☐09, bit 1) to 0 after the abort processing has been completed will not restart the execution of VELO command.
- This type of operation will also be performed if the motion command is changed to NOP during operation with speed control mode.

(4) Related Parameters

[a] Setting Parameters

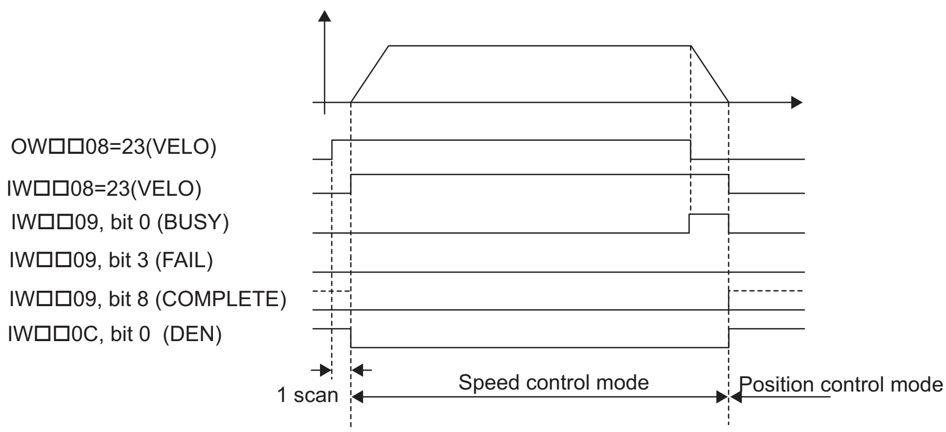
Parameter	Name	Setting
OW☐☐00 Bit 0	Servo ON	Turn the power to the Servomotor ON and OFF. 1: Power ON to Servomotor, 0: Power OFF to Servomotor The motor will start to rotate when this bit is set to 1 under the speed control data mode.
OW☐☐03	Function Setting 1	Set the speed unit, acceleration/deceleration unit, and filter type.
OW☐☐08	Motion Command	The mode is changed to speed control mode when this parameter is set to 23.
OW☐☐09 Bit 0	Holds A Command	The axis will decelerate to a stop if this bit is set to 1 during speed command operation. The operation will restart if this bit is set to 0 while the command is being held.
OW☐☐09 Bit 1	Interrupt A Command	The axis will decelerate to a stop if this bit is set to 1 during operation.
OL☐☐10	Speed Reference Setting	Specify the speed. This setting can be changed during operation. The unit depends on the Function Setting 1 (OW☐☐03, bits 0 to 3).
OL☐☐14	Positive Side Limiting Torque/Thrust Setting at the Speed Reference	Set the torque limit for the speed reference. The same value is used for both the positive and negative directions.
OW☐☐18	Override	This parameter allows the motor speed to be changed without changing the Speed Reference Setting (OL☐☐10). Set the speed as a percentage of the Speed Reference Setting. This setting can be changed during operation. Setting range: 0 to 32767 (0% to 327.67%) Setting unit: 1 = 0.01% Example: Setting for 50%: 5000
OL☐☐36	Straight Line Acceleration/ Acceleration Time Constant	Set the linear acceleration rate or acceleration time.
OL☐☐38	Straight Line Deceleration/ Deceleration Time Constant	Set the linear deceleration rate or deceleration time.
OW☐☐3A	Filter Time Constant	Set the acceleration/deceleration filter time constant. Exponential acceleration/deceleration or a moving average filter can be selected in the Function Setting 1 (OW☐☐03, bits 8 to B). Change the setting only after pulse distribution has been completed for the command (IW☐☐0C, bit 0 is ON).

[b] Monitoring Parameters

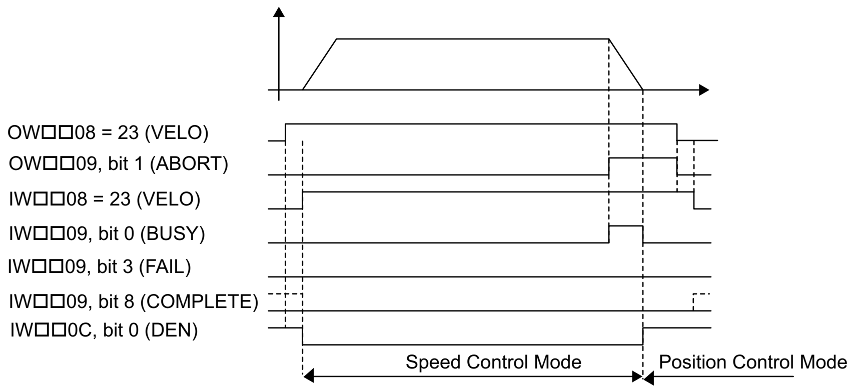
Parameter	Name	Monitor Contents
IW□□00 Bit 1	Running (At Servo ON)	Indicates the Servo ON status. ON: Power supplied to Servomotor, OFF: Power not supplied to Servomotor
IL□□02	Warning	Stores the most current warning.
IL□□04	Alarm	Stores the most current alarm.
IW□□08	Motion Command Response Code	Indicates the motion command that is being executed. The response code is 23 during VELO command execution.
IW□□09 Bit 0	Command Execution Flag	Turns ON when abort processing is being performed for VELO command. Turns OFF when abort processing has been completed.
IW□□09 Bit 1	Command Hold Completed	Always OFF for VELO command.
IW□□09 Bit 3	Command Error Completed Status	Turns ON if an error occurs during VELO command execution. The axis will decelerate to a stop if it is operating. Turns OFF when another command is executed.
IW□□09 Bit 8	Command Execution Completed	Always OFF for VELO command.
IW□□0C Bit 0	Discharging Completed	Turns ON when pulse distribution has been completed for the move command. Turns OFF during execution of a move command.
IW□□0C Bit 1	Positioning Completed	Turns ON when pulse distribution has been completed and the current position is within the Width of Positioning Completion. OFF in all other cases.
IW□□0C Bit 3	NEAR Position	The operation depends on the setting of NEAR Signal Output Width (setting parameter OL□□20). OL□□20 = 0: Turns ON when pulse distribution has been completed (DEN = ON). Otherwise, it turns OFF. OL□□20 ≠ 0: Turns ON when the absolute value of the difference between MPOS (IL□□12) and APOS (IL□□16) is less than the NEAR Position Setting, even if pulse distribution has not been completed. OFF in all other cases.

(5) Timing Charts

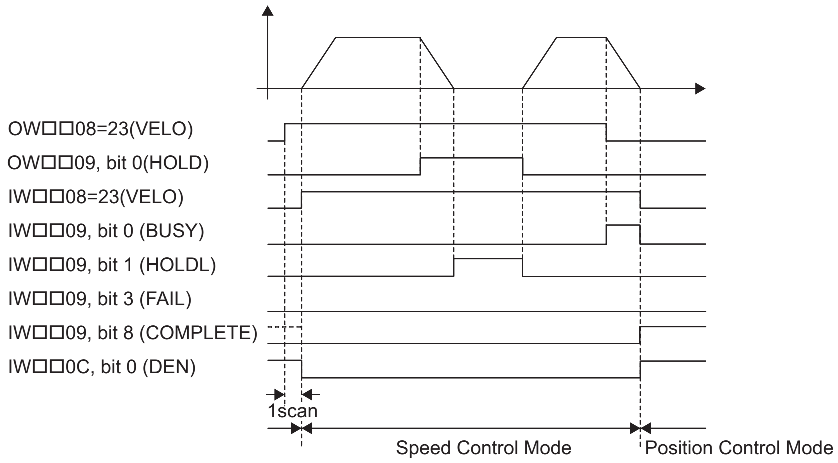
[a] Normal Execution



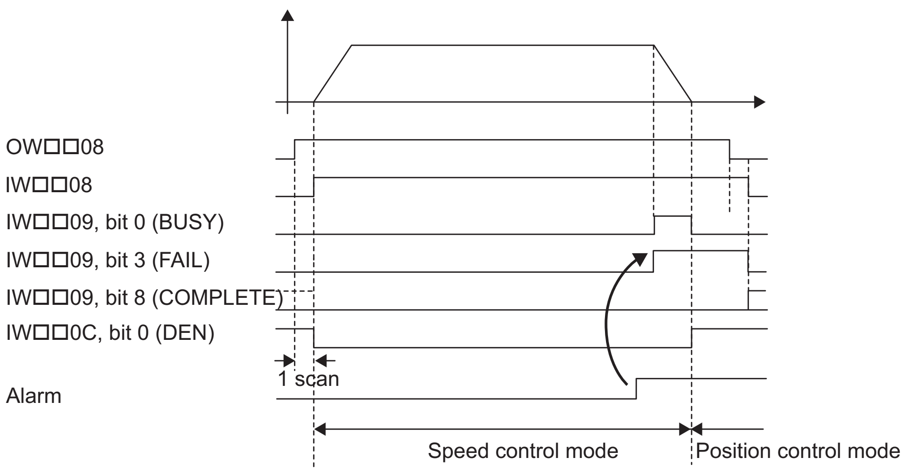
[b] Execution when Aborted



[c] Command Hold



[d] Execution when an Alarm Occurs



7.2.10 Torque Reference (TRQ)

The TRQ command is used to operate the SERVOPACK in the torque control mode.

(1) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	There are no alarms.	IL□□04 is 0.
2	Motion command execution has been completed.*	IW□□08 is 0 and IW□□09, bit 0 is OFF.

* This condition is a basic execution condition. Refer to *Chapter 8 Switching Commands during Execution* on page 8-1 when changing the command being executed to a TRQ command.

2. Set the following motion setting parameters.

Torque/Thrust Reference Setting: OL□□0C
Speed Limit Setting at the Torque/Thrust Reference: OL□□0E
Torque Unit Selection: OW□□03, bits C to F

- The Torque/Thrust Reference Setting (OL□□0C) can be changed during operation.

3. Set OW□□08 to 24 to execute the TRQ motion command.

The control mode in the SERVOPACK will be changed to torque control.
IW□□08 will be 24 during command execution.

- This command can be executed even when the Servo is OFF.
- Position management using the position feedback is possible during operation with torque control mode.

4. Execute another motion command to cancel the torque control mode.

TRQ Operation Pattern

(2) Holding

Axis travel can be stopped during command execution and then the remaining travel can be restarted. A command is held by setting the Holds A Command bit (OW□□09, bit 0) to 1.

- Set the Holds A Command bit (OW□□09, bit 0) to 1. The axis will decelerate to a stop.
- When the axis has stopped, the Command Hold Completed bit (IW□□09, bit 1) will turn ON.
- Reset the Holds A Command bit (OW□□09, bit 0) to 0.
  The command hold status will be cleared and the remaining portion of the operation will be restarted.

(3) Aborting

The TRQ command can be canceled by aborting execution of a command. A command is aborted by setting the Interrupt A Command bit (OW□□09 bit1) to 1.

- Set the Interrupt A Command bit (OW□□09, bit 1) to 1, the axis will decelerate to a stop in the speed mode. Once the axis stops, the control mode will change to the position control mode and the abort processing will be completed.
- The TRQ command will restart if the Interrupt A Command bit (OW□□09, bit 1) is reset to 0 during abort processing.
- Setting the Interrupt A Command bit (OW□□09, bit 1) to 0 after the abort processing has been completed will not restart the execution of TRQ command.
- This type of operation will also be performed if the motion command is changed to NOP during operation with torque control mode.

(4) Related Parameters

[a] Setting Parameters

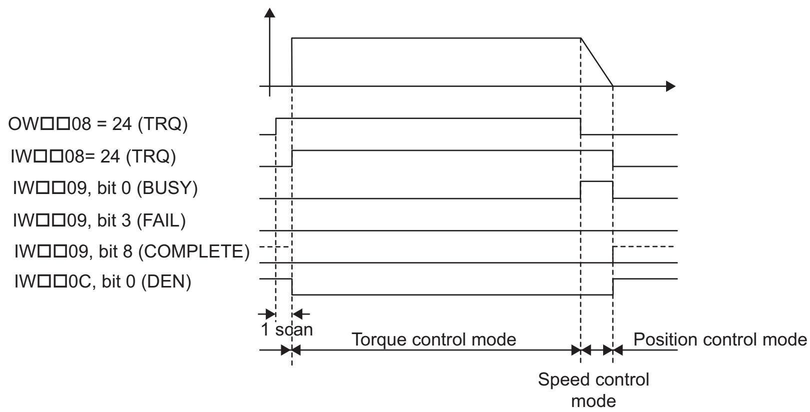
Parameter	Name	Setting
OW□□00 Bit 0	Servo ON	Turn the power to the Servomotor ON and OFF. 1: Power ON to Servomotor, 0: Power OFF to Servomotor Motor will start to rotate when the Servo is turned ON after switching to Torque Control Mode.
OW□□03	Function Setting 1	Set the unit for torque reference.
OW□□08	Motion Command	The mode is changed to torque control mode when this parameter is set to 24.
OW□□09 Bit 0	Holds A Command	The axis will stop if this bit is set to 1 during torque reference operation. The operation will restart if this bit is set to 0 while the command is being held.
OW□□09 Bit 1	Interrupt A Command	An axis will decelerate to a stop if this bit is set to 1 during operation.
OL□□0C	Torque/Thrust Reference Setting	Set the torque reference. This setting can be changed during operation. The unit depends on the Function Setting 1 (OW□□03, bits C to F).
OL□□0E	Speed Limit Setting at the Torque/Thrust Reference	Set the speed limit for torque references. The speed limit is set as a percentage of the rated speed.
OL□□38	Straight Line Deceleration/ Deceleration Time Constant	Set the rate of deceleration or deceleration time for aborting the command.

[b] Monitoring Parameters

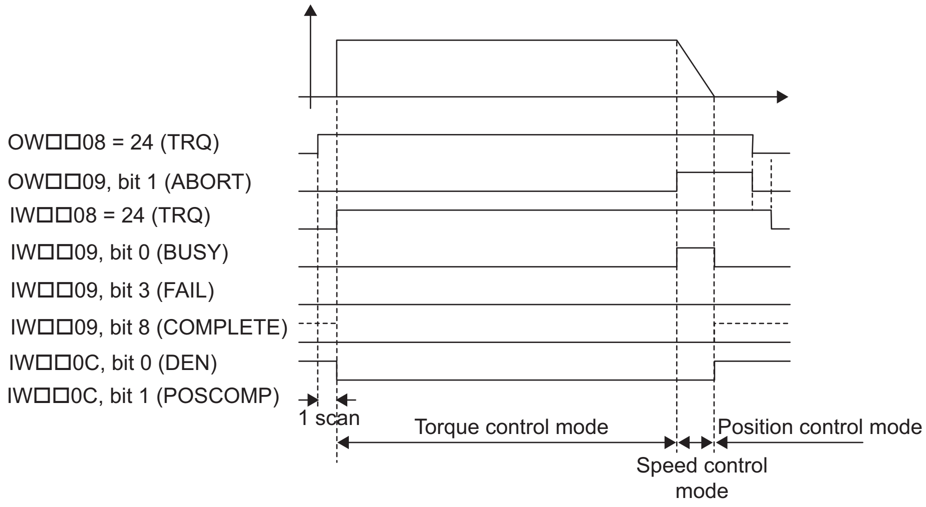
Parameter	Name	Monitor Contents
IW□□00 Bit 1	Running (At Servo ON)	Indicates the Servo ON status. ON: Power supplied to Servomotor, OFF: Power not supplied to Servomotor
IL□□02	Warning	Stores the most current warning.
IL□□04	Alarm	Stores the most current alarm.
IW□□08	Motion Command Response Code	Indicates the motion command that is being executed. The response code is 24 during TRQ command execution.
IW□□09 Bit 0	Command Execution Flag	Turns ON when abort processing is being performed for TRQ command. Turns OFF when abort processing has been completed.
IW□□09 Bit 1	Command Hold Completed	Always OFF for TRQ command.
IW□□09 Bit 3	Command Error Completed Status	Turns ON if an error occurs during TRQ command execution. The axis will decelerate to a stop if it is operating. Turns OFF when another command is executed.
IW□□09 Bit 8	Command Execution Completed	Always OFF for TRQ command.
IW□□0C Bit 0	Discharging Completed	Turns ON when pulse distribution has been completed for the move command. Turns OFF during execution of a move command.
IW□□0C Bit 1	Positioning Completed	Turns ON when pulse distribution has been completed and the current position is within the Width of Positioning Completion. OFF in all other cases.
IW□□0C Bit 3	NEAR Position	The operation bit depends on the setting of NEAR Signal Output Width (setting parameter OL□□20). OL□□20 = 0: Turns ON when pulse distribution has been completed (DEN = ON). Otherwise, it turns OFF. OL□□20 ≠ 0: Turns ON when the absolute value of the difference between MPOS (IL□□12) and APOS (IL□□16) is less than the NEAR Position Setting, even if pulse distribution has not been completed. OFF in all other cases.

(5) Timing Charts

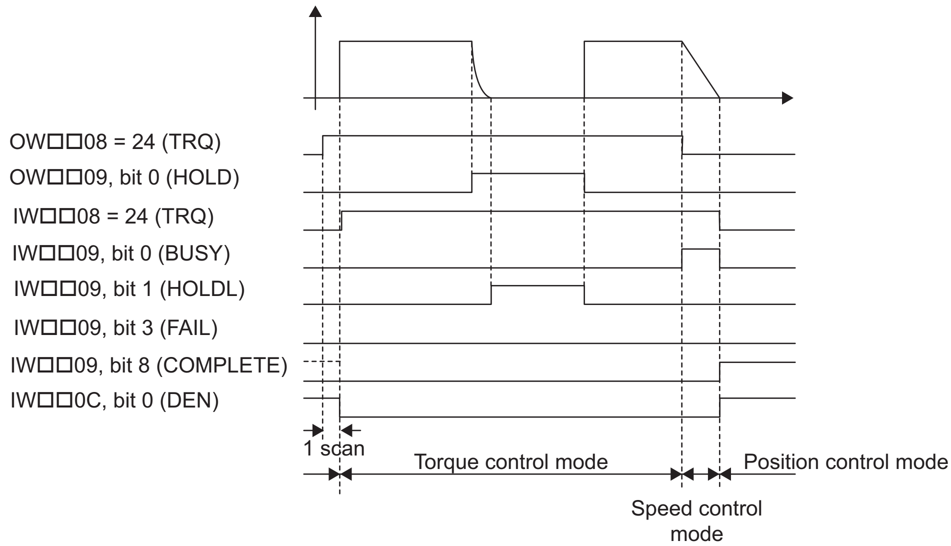
[a] Normal Execution



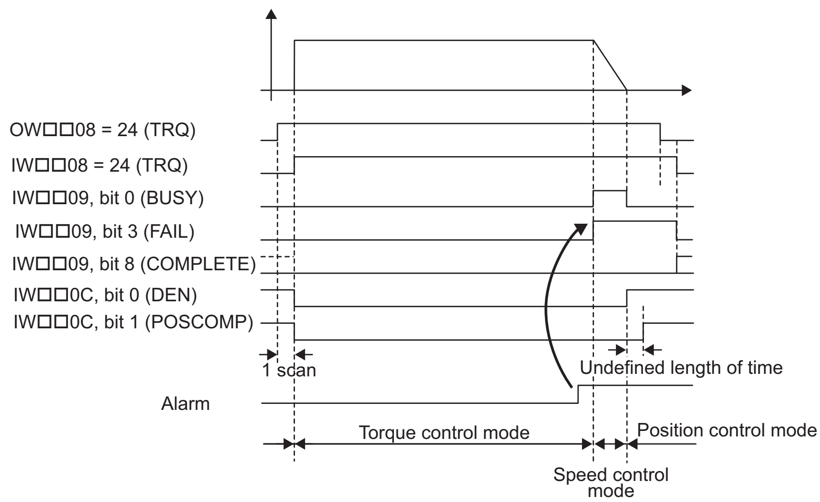
[b] Execution when Aborted



[c] Command Hold



[d] Execution when an Alarm Occurs



7.2.11 Phase References (PHASE)

The PHASE command is used for the synchronized operation of multiple axes under phase control mode, using the specified speed, phase bias, and speed compensation value.

(1) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	There are no alarms.	IL□□04 is 0.
2	The Servo ON condition.	IW□□00, bit 1 is ON.
3	Motion command execution has been completed.	IW□□08 is 0 and IW□□09, bit 0 is OFF.

2. Set the following motion setting parameters.

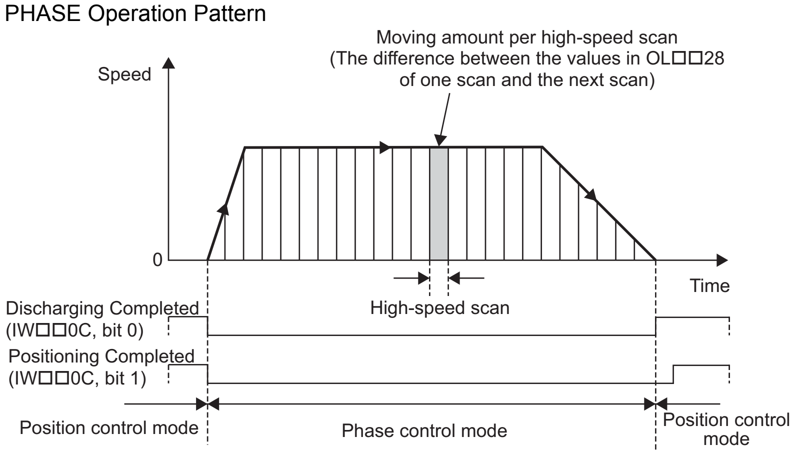
Speed Reference Setting: OL□□10
Phase Correction Setting: OL□□28
Speed Compensation: OW□□31

3. Set OW□□08 to 25 to execute the PHASE motion command.

Synchronized operation using phase control will start.
IW□□08 will be 25 during the execution.

4. Execute another motion command to cancel the phase control mode.

PHASE Operation Pattern



(2) Holding and Aborting

The Holds A Command bit (OW□□09, bit 0) and the Interrupt A Command bit (OW□□09, bit 1) cannot be used. When the motion command is changed from PHASE to NOP during execution of PHASE command, the axis will decelerate to a stop in the speed control mode. Once the axis stops, the control mode will change from the speed control mode to the position control mode.

(3) Related Parameters

[a] Setting Parameters

Parameter	Name	Setting
OW☐☐00 Bit 0	Servo ON	Turns the power to the Servomotor ON and OFF. 1: Power ON to Servomotor, 0: Power OFF to Servomotor Set this bit to 1 before setting the Motion Command (OW☐☐08) to 25.
OW☐☐03	Function Setting 1	Sets the speed unit, acceleration/deceleration unit, and filter type.
OW☐☐05 Bit 1	Phase Reference Creation Calculation Disable	Disables/enables phase reference generation processing when executing phase reference commands. This bit enables setting processing appropriate to an electronic shaft or electronic cam. • Enable this processing when an electronic shaft is being used, and disable it when an electronic cam is being used.
OW☐☐08	Motion Command	Phase control operation starts when this parameter is set to 25.
OL☐☐10	Speed Reference Setting	Set the speed reference. The setting can be changed during operation. The unit depends on the Function Setting 1 setting (OW☐☐03, bits 0 to 3).
OL☐☐16	Secondly Speed Compensation	Set the speed feed forward amount for PHASE command. The setting unit for Speed Compensation (setting parameter OW☐☐31) is 0.01% (fixed). The unit for this parameter, however, can be selected by the user. When used at the same time as OW☐☐31, speed compensation can be performed twice.
OL☐☐28	Phase Correction Setting	Set the phase compensation in reference units. • Set the number of pulses for phase compensation in pulses when an electronic shaft is being used. • Use the incremental addition mode to calculate the cam pattern target position when an electronic cam is being used.
OW☐☐31	Speed Compensation	Set the speed feed forward gain as a percentage of the rated speed. The setting units for this parameter is 0.01% (fixed).
OL☐☐38	Straight Line Deceleration/ Deceleration Time Constant	Specify the deceleration rate when the motion command is changed from PHASE to NOP.

[b] Monitoring Parameters

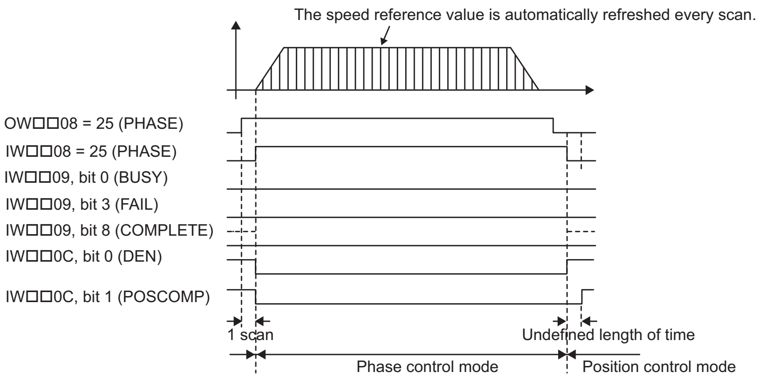
Parameter	Name	Monitor Contents
IW☐☐00 Bit 1	Running (At Servo ON)	Indicates the Servo ON status. ON: Power supplied to Servomotor, OFF: Power not supplied to Servomotor
IL☐☐02	Warning	Stores the most current warning.
IL☐☐04	Alarm	Stores the most current alarm.
IW☐☐08	Motion Command Response Code	Indicates the motion command that is being executed. The response code is 25 during PHASE command execution.
IW☐☐09 Bit 0	Command Execution Flag	Always OFF for PHASE command.
IW☐☐09 Bit 1	Command Hold Completed	Always OFF for PHASE command.
IW☐☐09 Bit 3	Command Error Completed Status	Turns ON if an error occurs during PHASE command execution. The axis will decelerate to a stop if it is moving. Turns OFF when another command is executed.
IW☐☐09 Bit 8	Command Execution Completed	Always OFF for PHASE command.
IW☐☐0C Bit 0	Discharging Completed	Turns ON when pulse distribution has been completed for the move command. Turns OFF during execution of a move command.
IW☐☐0C Bit 1	Positioning Completed	Turns ON when pulse distribution has been completed and the current position is within the Width of Positioning Completion. OFF in all other cases.

(cont'd)

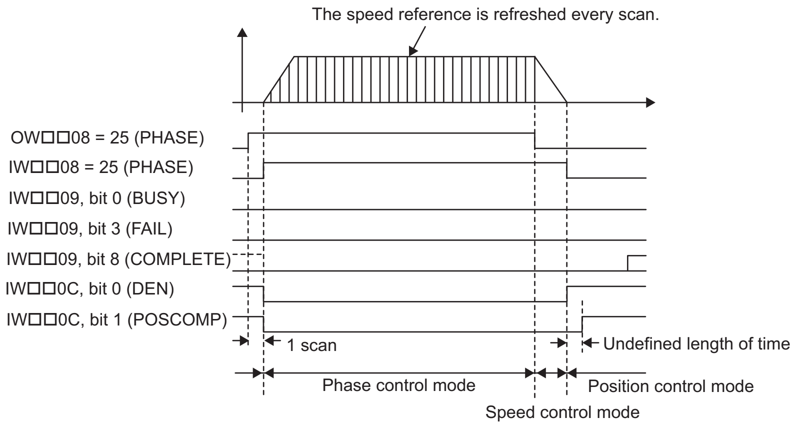
Parameter	Name	Monitor Contents
IW□□0C Bit 3	NEAR Position	The operation depends on the setting of NEAR Signal Output Width (setting parameter OL□□20). OL□□20 = 0: Turns ON when pulse distribution has been completed (DEN = ON). Otherwise, it turns OFF. OL□□20 ≠ 0: Turns ON when the absolute value of the difference between MPOS (IL□□12) and APOS (IL□□16) is less than the NEAR Position Setting, even if pulse distribution has not been completed. OFF in all other cases.

(4) Timing Charts

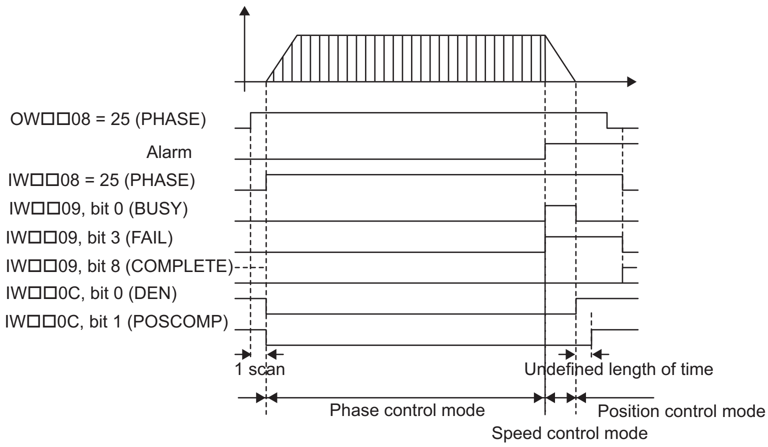
[a] Normal Execution



[b] Execution when Aborted



[c] Execution when an Alarm Occurs



7.3 Motion Subcommands

With the SVA-01 Module, two motion subcommands can be used: NOP and FIXPRM_RD.
The following provides a detailed description of these two subcommands.

7.3.1 No Command (NOP)

Set this command when a subcommand is not being specified.

(1) Related Parameters

[a] Setting Parameters

Parameter	Name	Setting Contents
OW☐☐0A	Motion Subcommand	Set to 0 to specify no command (NOP).

[b] Monitoring Parameters

Parameter	Name	Monitoring Contents
IW☐☐0A	Motion Subcommand Response Code	Indicates the motion subcommand that is being executed. The response code is 0 during NOP command execution.
IW☐☐0B Bit 0	Command Execution Flag	Turns ON during NOP command execution. Turns OFF when execution has been completed.
IW☐☐0B Bit 3	Command Error Completed Status	Turns ON if an error occurs during NOP command execution. Turns OFF when another command is executed.
IW☐☐0B Bit 8	Command Execution Completed *	Turns ON when NOP command execution has been completed.

* The NOP command’s subcommand status stored in Command Execution Completed (COMPLETE) is not defined.

7.3.2 Read Fixed Parameters (FIXPRM_RD)

The FIXPRM_RD command reads the current value of the specified fixed parameter and stores the value in the monitoring parameter IL□□56 (Fixed Parameter Monitor).

(1) Executing/Operating Procedure

1. Check to see if all the following conditions are satisfied.

No.	Execution Conditions	Confirmation Method
1	Motion subcommand execution has been completed.	IW□□0A is 0 and IW□□0B, bit 0 is OFF.

2. Set OW□□0A to 5 to execute the FIXPRM_RD motion subcommand.

The FIXPRM_RD will read the specified fixed parameter's current value and store the code in the monitoring parameter.
IW□□0A will be 5 during command execution.
IW□□0B, bit 0 will turn ON during the command processing and will turn OFF when the command processing has been completed.

3. Set OW□□0A to 0 to execute the NOP motion command and then complete the monitoring operation.

(2) Related Parameters

[a] Setting Parameters

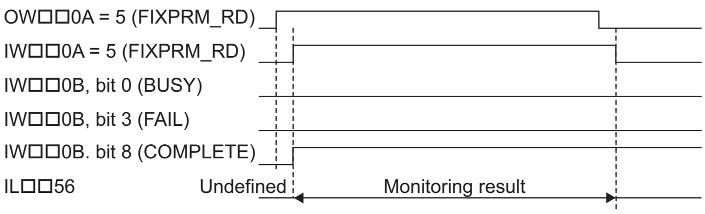
Parameter	Name	Setting
OW□□0A	Motion Subcommand	The Read Fixed Parameter subcommand is executed when this parameter is set to 5.
OW□□5C	Fixed Parameter Number	Set the parameter number of the fixed parameter to be read.

[b] Monitoring Parameters

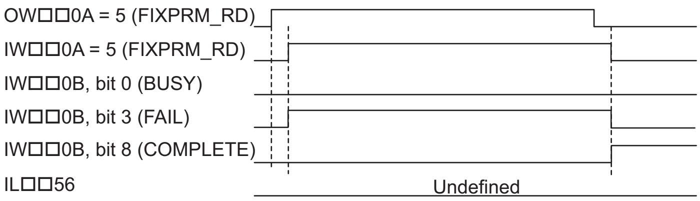
Parameter	Name	Monitor Contents
IW□□0A	Motion Subcommand Response Code	Indicates the motion subcommand that is being executed. The response code is 5 during FIXPRM_RD command execution.
IW□□0B Bit 0	Command Execution Flag	Turns ON during FIXPRM_RD command execution. Turns OFF when execution has been completed.
IW□□0B Bit 3	Command Error Completed Status	Turns ON if an error occurs during FIXPRM_RD command execution. Turns OFF when another command is executed.
IW□□0B Bit 8	Command Execution Completed	Turns ON when FIXPRM_RD command execution has been completed.
IL□□56	Fixed Parameter Monitor	Stores the data of the specified fixed parameter number.

(3) Timing Charts

[a] Normal End



[b] Error End



8

Switching Commands during Execution

This chapter describes motion commands that can be switched during execution and how the axis will move when they are switched.

8.1 Switchable Motion Commands

8.1.1 Switching Between Motion Commands

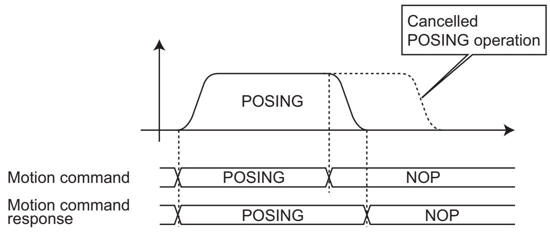
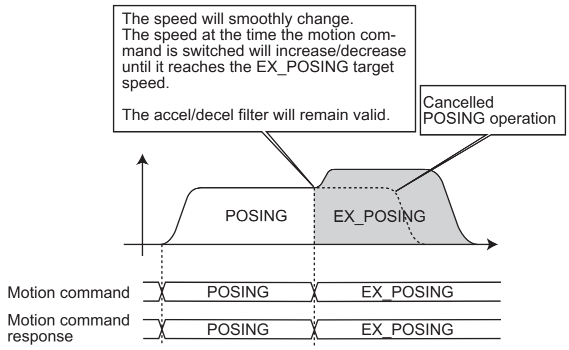
The following table shows motion commands that can be switched during execution.

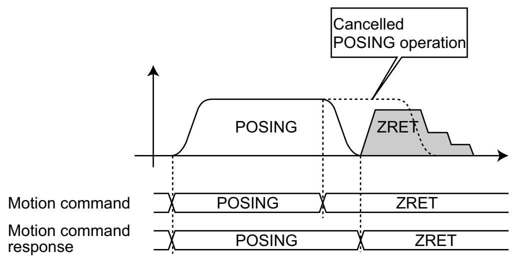
			Switched To (Newly Set Command)												
			0	1	2	3	4	5	6	7	8	9	23	24	25
			NOP	POS	EX_P	ZRET	INTE	ENDO	LATC	FEED	STEP	ZSET	VELO	TRQ	PHAS
Switched From (Command in Execution)	0	NOP	–	○	○	○	○	○	○	○	○	○	○	○	○
	1	POSING	×	–	○	×	○	○	○	○	○	×	○	○	○
	2	EX_POSING	×	○	–	×	○	○	○	○	○	×	○	○	○
	3	ZRET	×	×	×	–	×	×	×	×	×	×	×	×	×
	4	INTERPOLATE	○	○	○	×	–	○	○	○	○	×	○	○	○
	5	ENDOF_ INTERPOLATE	○	○	○	×	○	–	○	○	○	×	○	○	○
	6	LATCH	○	○	○	×	○	○	–	○	○	×	○	○	○
	7	FEED	×	○	○	×	○	○	○	–	○	×	○	○	○
	8	STEP	×	○	○	×	○	○	○	○	–	×	○	○	○
	9	ZSET	○	○	○	○	○	○	○	○	○	–	○	○	○
	23	VELO	×	○	○	×	×	×	×	○	○	×	–	○	○
	24	TRQ	×	○	○	×	×	×	×	○	○	×	○	–	○
	25	PHASE	×	○	○	×	×	×	×	○	○	×	○	○	–

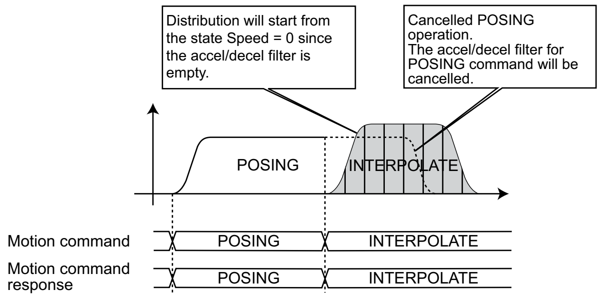
- ○: Available
  ×: The command in execution is aborted (the axis will be decelerated to a stop), and the newly set command will be executed.

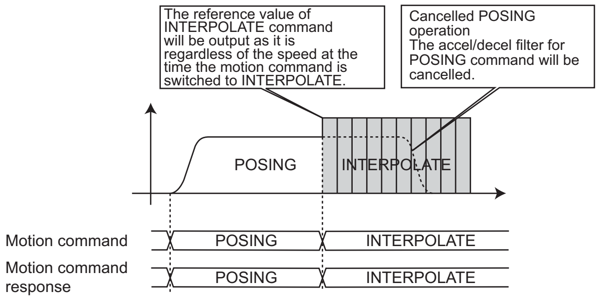
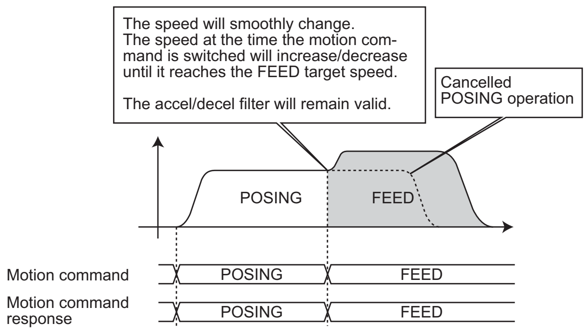
The details of motion changes enacted when the command in execution is switched to another command are described in the following sections.

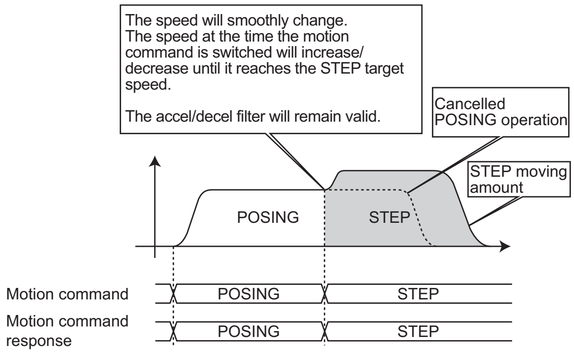
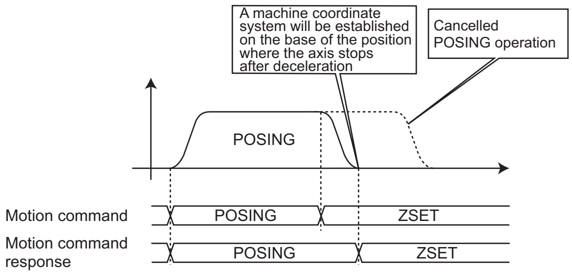
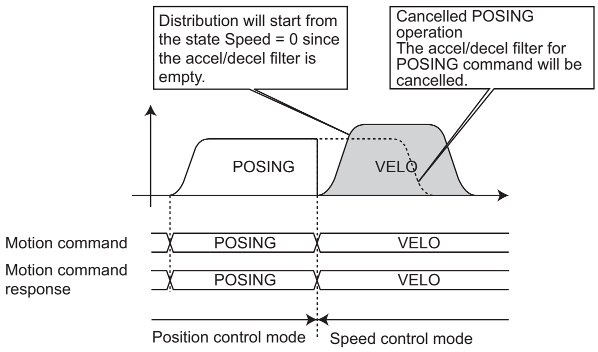
8.1.2 Switching from POSING

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="4">POSING</td><td>NOP</td><td>POSING will switch to NOP when the axis stops after deceleration.

</td></tr>
<tr><td>POSING</td><td>POSING operation will continue.</td></tr>
<tr><td>EX_POSING</td><td>POSING will immediately switch to EX_POSING, and the moving amount stored in the accel/decel filter will be maintained.


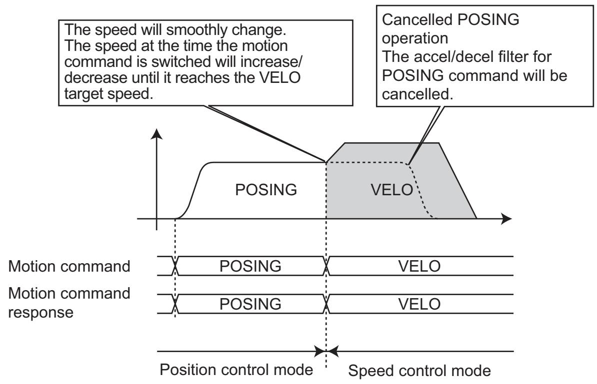
The value of the Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Target position – IL□□14 (DPOS)
OL□□1C = OL□□1C+ Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = Target position</td></tr>
<tr><td>ZRET</td><td>POSING will switch to ZRET when the axis stops after deceleration.

</td></tr>
</table>

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="4">POSING</td><td>INTERPOLATE</td><td>POSING will immediately switch to INTERPOLATE. The moving amount stored in the accel/decel filter will be reset to 0.
The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Position incremental value per high-speed scan
OL□□1C = OL□□1C + Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = IL□□14 (DPOS) + Position incremental value per high-speed scan
• INTERPOLATE switched from POSING starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for INTERPOLATE command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for INTERPOLATE command (see (2).)
(1) When Using the Accel/Decel Filter for INTERPOLATE Command


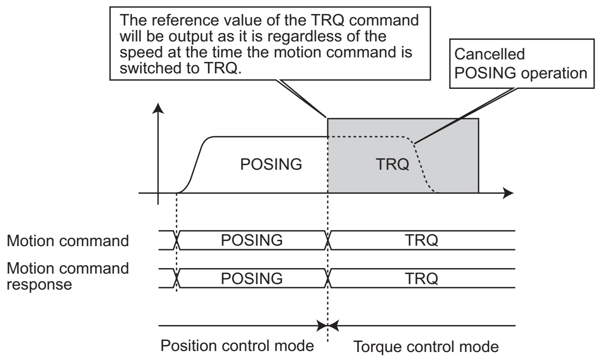
(2) When Not Using the Accel/Decel Filter for INTERPOLATE Command

</td></tr>
<tr><td>ENDOF_INTERPOLATE</td><td>Same as INTERPOLATE</td></tr>
<tr><td>LATCH</td><td>Same as INTERPOLATE</td></tr>
<tr><td>FEED</td><td>POSING will immediately switch to FEED, and the moving amount stored in the accel/decel filter will be maintained.

</td></tr>
</table>

Switched From	Switched To	Operation
POSING	STEP	POSING will immediately switch to STEP, and the moving amount stored in the accel/decel filter will be maintained. 
	ZSET	POSING will switch to ZSET when the axis stops after deceleration. 
	VELO	POSING will immediately switch to VELO and the control mode will be changed from position control mode to speed control mode. The moving amount stored in the accel/decel filter will be reset to 0. • VELO switched from POSING starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for VELO command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for VELO command (see (2).) (1) When Using the Accel/Decel Filter for VELO Command 

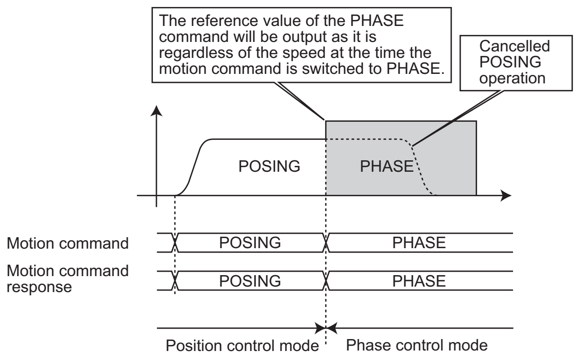
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="3">POSING</td><td>VELO
(cont'd)</td><td>
(2) When Not Using the Accel/Decel Filter for VELO Command



</td></tr>
<tr><td>TRQ</td><td>
POSING will immediately switch to TRQ and the control mode will be changed from position control mode to torque control mode. The moving amount stored in the accel/ decel filter will be reset to 0.

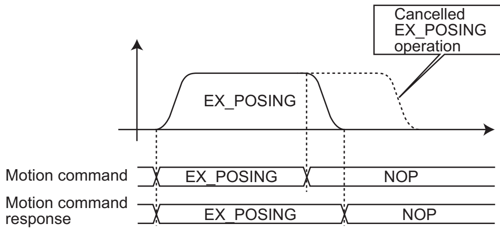
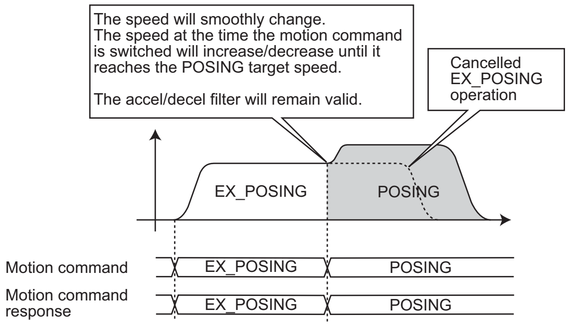
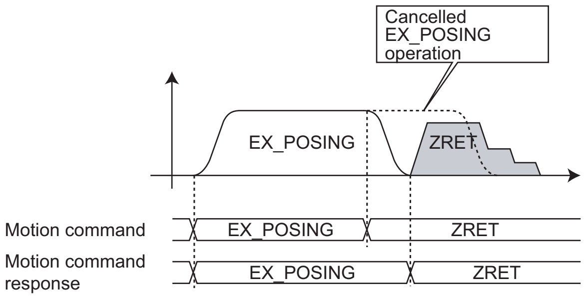


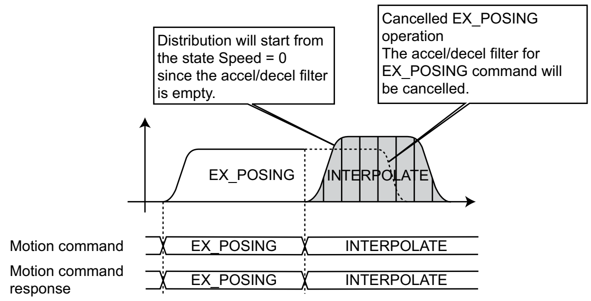
- After POSING has switched to TRQ, the TRQ command will be executed without the accel/decel filter. This is because TRQ is a motion command for which the accel/decel filter is disabled.
</td></tr>
<tr><td>PHASE</td><td>
POSING will immediately switch to PHASE, and the control mode will be changed from position control mode to phase control mode.
The moving amount stored in the accel/decel filter will be reset to 0.

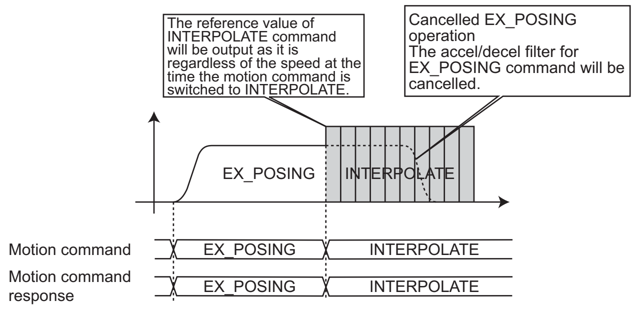
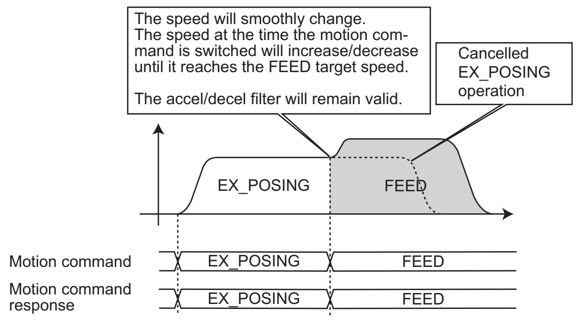


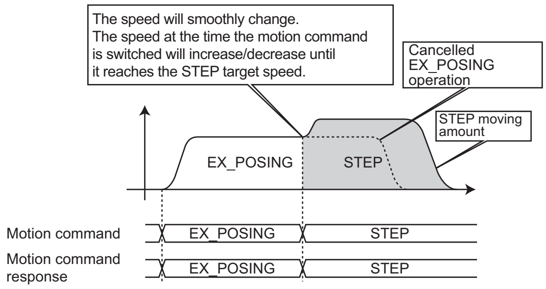
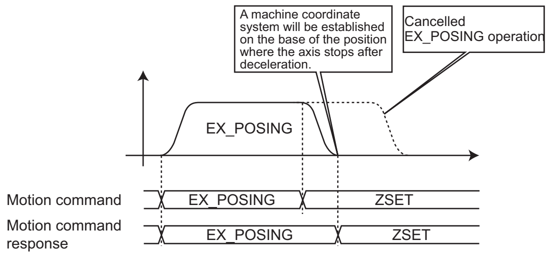
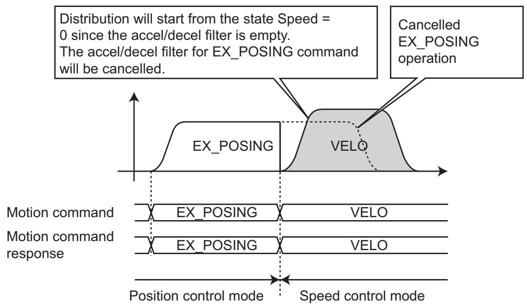
- After POSING has switched to PHASE, the PHASE command will be executed without the accel/decel filter. This is because PHASE is a motion command for which the accel/decel filter is disabled.
</td></tr>
</table>

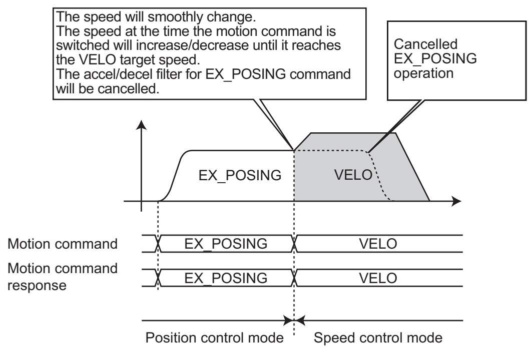
8.1.3 Switching from EX_POSING

Switched From	Switched To	Operation
EX_POSING	NOP	EX_POSING will switch to NOP when the axis stops after deceleration. 
	POSING	EX_POSING will immediately switch to POSING. The moving amount stored in the accel/decel filter will be reset to 0.  The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows. <In Incremental Addition Mode (OW□□09, bit 5 = 0)> Incremental value = Target position – IL□□14 (DPOS) OL□□1C = OL□□1C + Incremental value <In Absolute Mode (OW□□09, bit 5 = 1)> OL□□1C = Target position
	EX_POSING	EX_POSING operation will continue.
	ZRET	EX_POSING will switch to ZRET when the axis stops after deceleration. 

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="4">EX_POSING</td><td>INTERPOLATE</td><td>EX_POSING will immediately switch to INTERPOLATE. The moving amount stored in the accel/decel filter will be reset to 0.
The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Position incremental value per high-speed scan
OL□□1C = OL□□1C + Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = IL□□14 (DPOS) + Position incremental value per high-speed scan
• INTERPOLATE switched from EX_POSING starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for INTERPOLATE command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for INTERPOLATE command (see (2).)
(1) When Using the Accel/Decel Filter for INTERPOLATE Command


(2) When Not Using the Accel/Decel Filter for INTERPOLATE Command

</td></tr>
<tr><td>ENDOF_INTERPOLATE</td><td>Same as INTERPOLATE</td></tr>
<tr><td>LATCH</td><td>Same as INTERPOLATE</td></tr>
<tr><td>FEED</td><td>EX_POSING will be immediately switch to FEED, and the moving amount stored in the accel/decel filter will be maintained.

</td></tr>
</table>

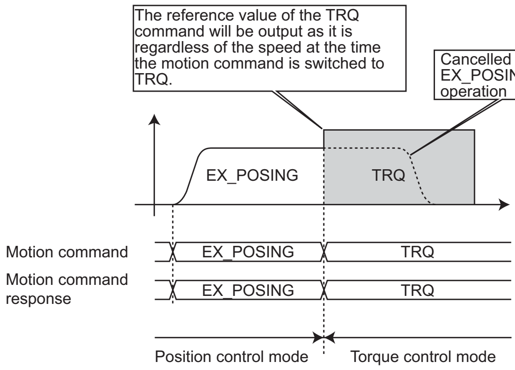
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="3">EX_POSING</td><td>STEP</td><td>EX_POSING will immediately switch to STEP, and the moving amount stored in the accel/decel filter will be maintained.

</td></tr>
<tr><td>ZSET</td><td>EX_POSING will switch to ZSET when the axis stops after deceleration.

</td></tr>
<tr><td>VELO</td><td>EX_POSING will immediately switch to VELO, and the control mode will be changed from position control mode to speed control mode. The moving amount stored in the accel/decel will be reset to 0.
• VELO switched from EX_POSING starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for VELO command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for VELO command (see (2).)
(1) When Using the Accel/Decel Filter for VELO Command


(2) When Not Using the Accel/Decel Filter for VELO Command

</td></tr>
</table>

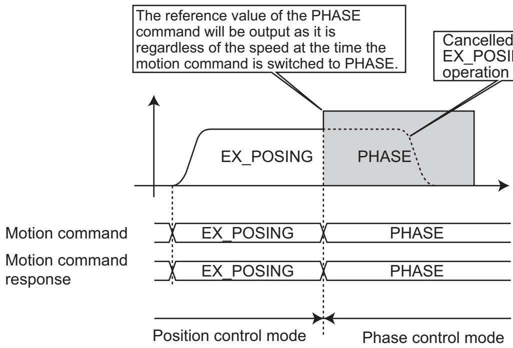
Switching Commands during Execution

8

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">EX_POSING</td><td>TRQ</td><td>EX_POSING will immediately switch to TRQ, and the control mode will be changed from position control mode to torque control mode.
The moving amount stored in the accel/decel filter will be reset to 0.

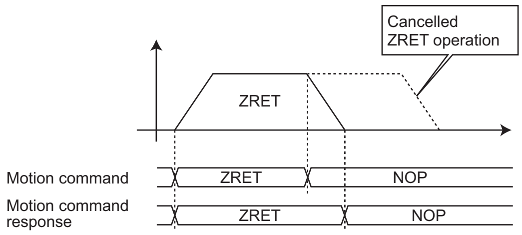
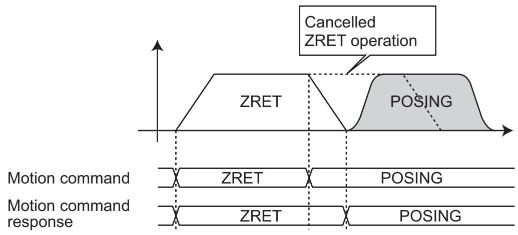


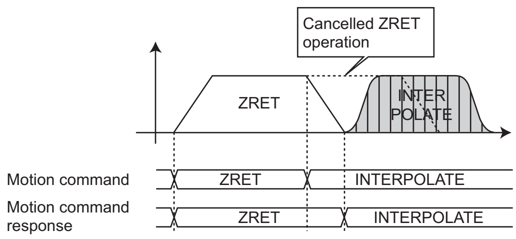
After EX_POSING has switched to TRQ, the TRQ command will be executed without the accel/decel filter. This is because TRQ is a motion command for which the accel/decel filter is disabled.</td></tr>
<tr><td>PHASE</td><td>EX_POSING will immediately switch to PHASE, and the control mode will change from the position control mode to phase control mode.
The moving amount stored in the accel/decel filter will be reset to 0.

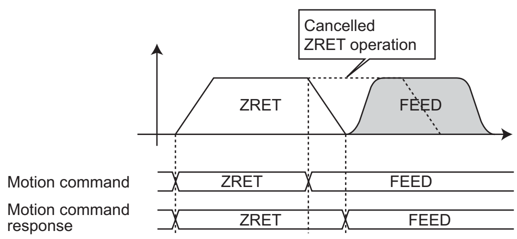


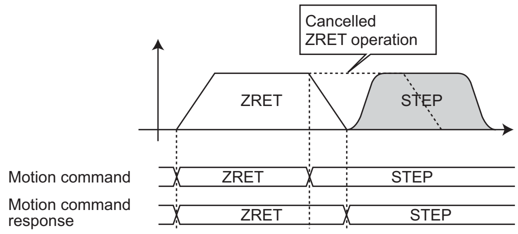
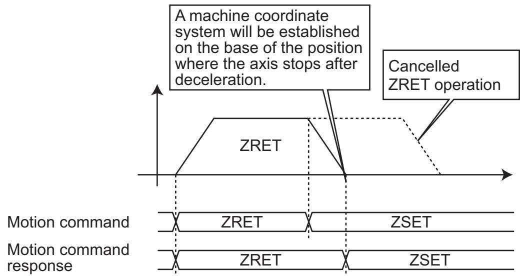
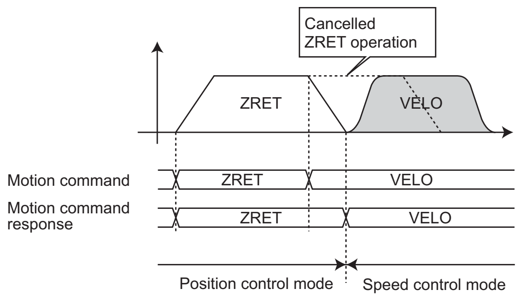
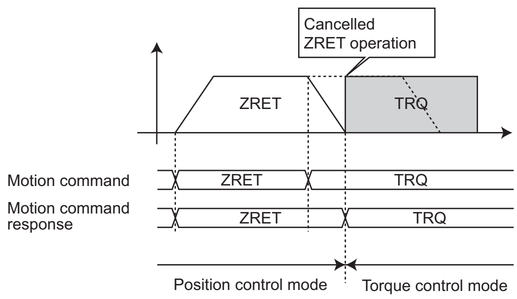
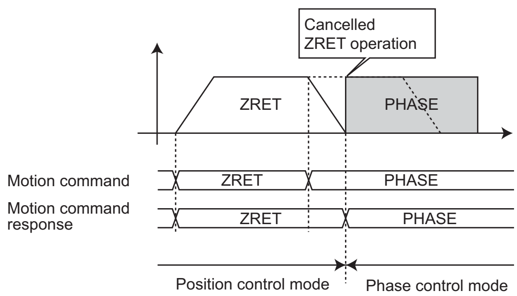
After EX_POSING has switched to PHASE, the PHASE command will be executed without accel/decel filter. This is because PHASE is a motion command for which the accel/decel filter is disabled.</td></tr>
</table>

8.1.4 Switching from ZRET

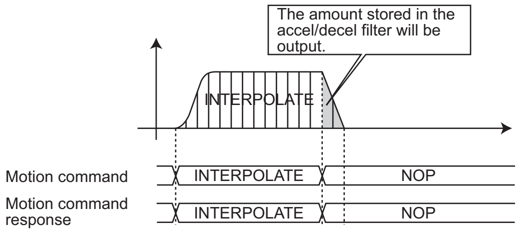
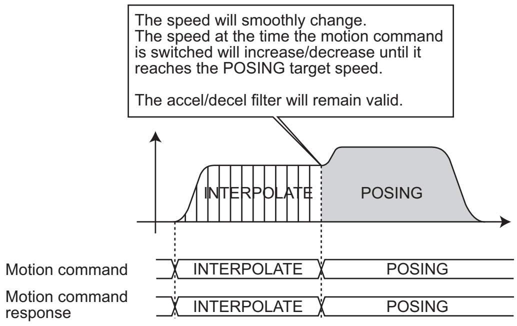
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="8">ZRET</td><td>NOP</td><td>ZRET will switch to NOP when the axis stops after deceleration.

</td></tr>
<tr><td>POSING</td><td>ZRET will switch to POSING when the axis stops after deceleration.


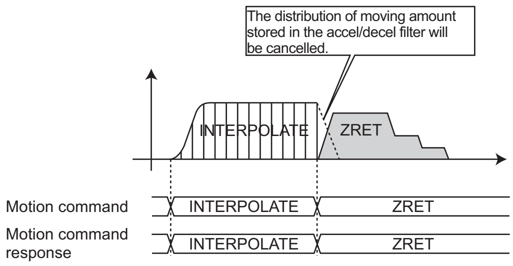
<Change in Position Reference Setting (OL□□1C) during Deceleration>
• In Incremental Addition Mode (OW□□09, bit 5 = 0)
Any change in the Position Reference Setting (OL□□1C) will be ignored.
• In Absolute Mode (OW□□09, bit 5 = 1)
The value of the Position Reference Setting (OL□□1C) when POSING execution starts will be the target position.
♦ Do not change the Position Reference Setting during deceleration unless it is absolutely necessary.</td></tr>
<tr><td>EX_POSING</td><td>Same as POSING</td></tr>
<tr><td>ZRET</td><td>ZRET operation will continue.</td></tr>
<tr><td>INTERPOLATE</td><td>ZRET will switch to INTERPOLATE when the axis stops after deceleration.


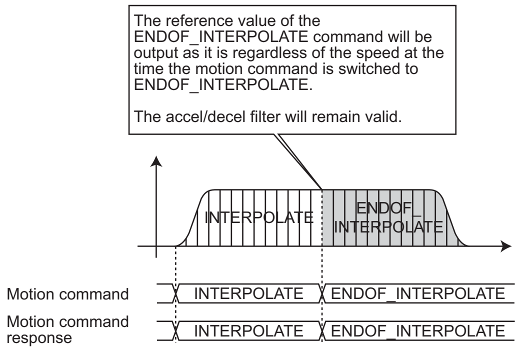
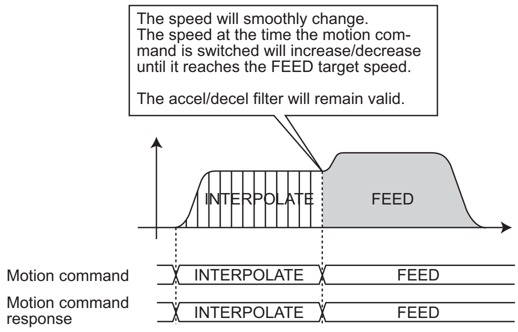
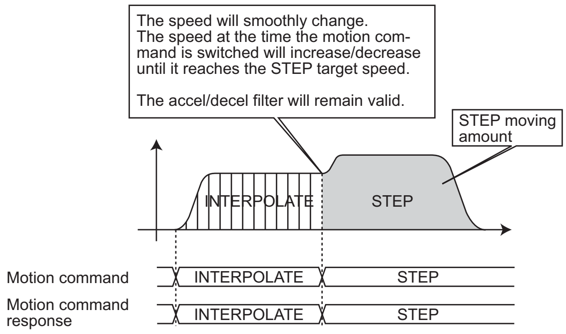
<Change in Position Reference Setting (OL□□1C) during Deceleration>
• In Incremental Addition Mode (OW□□09, bit 5 = 0)
Any change in the Position Reference Setting (OL□□1C) will be ignored.
• In Absolute Mode (OW□□09, bit 5 = 1)
The change in the Position Reference Setting (OL□□1C) will be output as soon as the first high-speed scan after INTERPOLATE execution starts.
♦ Do not change the Position Reference Setting during deceleration unless it is absolutely necessary.</td></tr>
<tr><td>ENDOF_INTER POLATE</td><td>Same as INTERPOLATE</td></tr>
<tr><td>LATCH</td><td>Same as INTERPOLATE</td></tr>
<tr><td>FEED</td><td>ZRET will switch to FEED when the axis stops after deceleration.

</td></tr>
</table>

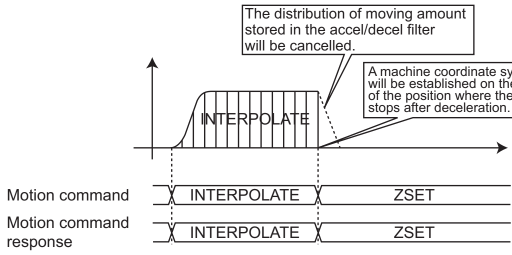
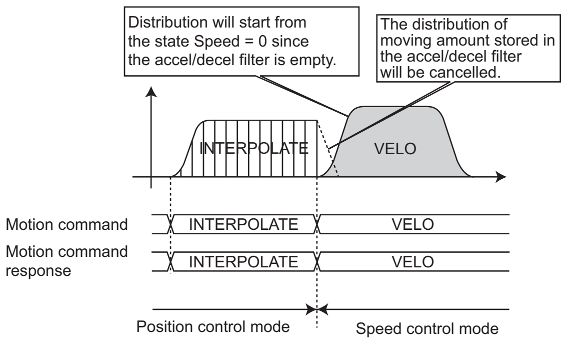
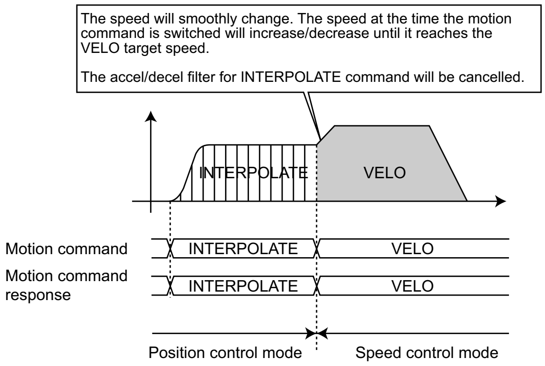
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="5">ZRET</td><td>STEP</td><td>ZRET will switch to STEP when the axis stops after deceleration.

</td></tr>
<tr><td>ZSET</td><td>ZRET will switch to ZSET when the axis stops after deceleration.

</td></tr>
<tr><td>VELO</td><td>ZRET will switch to VELO when the axis stops after deceleration.

</td></tr>
<tr><td>TRQ</td><td>ZRET will switch to TRQ when the axis stops after deceleration.

</td></tr>
<tr><td>PHASE</td><td>ZRET will switch to PHASE when the axis stops after deceleration.

</td></tr>
</table>

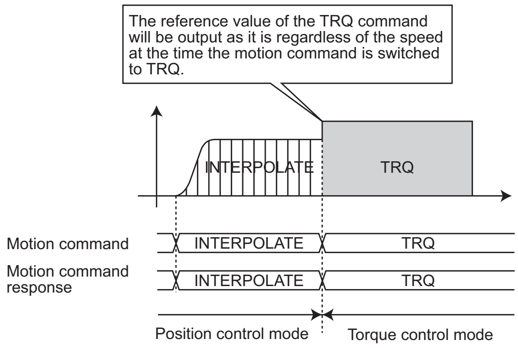
8.1.5 Switching from INTERPOLATE

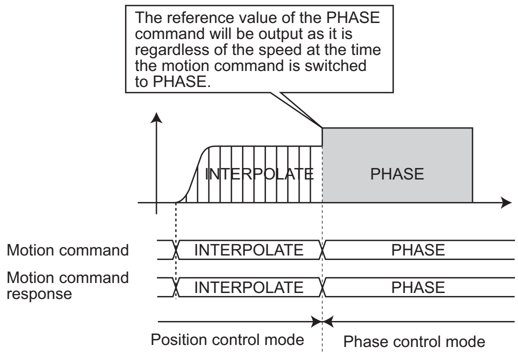
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="5">INTERPOLATE</td><td>NOP</td><td>INTERPOLATE will immediately switch to NOP, and the moving amount stored in the accel/decel filter will be maintained.

</td></tr>
<tr><td>POSING</td><td>INTERPOLATE will immediately switch to POSING, and the moving amount stored in the accel/decel filter will be maintained.


The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Target position – IL□□14 (DPOS)
OL□□1C = OL□□1C+ Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = Target position</td></tr>
<tr><td>EX_POSING</td><td>Same as POSING</td></tr>
<tr><td>ZRET</td><td>INTERPOLATE will immediately switch to ZRET and the moving amount stored in the accel/decel filter will be reset to 0.

</td></tr>
<tr><td>INTERPOLATE</td><td>INTERPOLATE operation will continue.</td></tr>
</table>

Switched From	Switched To	Operation
INTERPOLATE	ENDOF_INTERPOLATE	INTERPOLATE will immediately switch to ENDOF_INTERPOLATE, and the moving amount stored in the accel/decel filter will be maintained. 
	LATCH	Same as ENDOF_INTERPOLATE
	FEED	INTERPOLATE will immediately switch to FEED, and the moving amount stored in the accel/decel filter will be maintained. 
	STEP	INTERPOLATE will immediately switch to STEP, and the moving amount stored in the accel/decel filter will be maintained. 

Switched From	Switched To	Operation
INTERPOLATE	ZSET	INTERPOLATE will immediately switch to ZSET, and the moving amount stored in the accel/decel filter will be reset to 0. 
	VELO	INTERPOLATE will immediately switch to VELO, and the control mode will be changed from position control mode to speed control mode. The moving amount stored in the accel/decel filter will be reset to 0. • VELO switched from INTERPOLATE starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for VELO command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for VELO command (see (2).) (1) When Using the Accel/Decel Filter for VELO Command  (2) When Not Using the Accel/Decel Filter for VELO Command 

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">INTERPOLATE</td><td>TRQ</td><td>INTERPOLATE will immediately switch to TRQ, and the control mode will be changed from position control mode to torque control mode.
The moving amount stored in the accel/decel filter will be reset to 0.


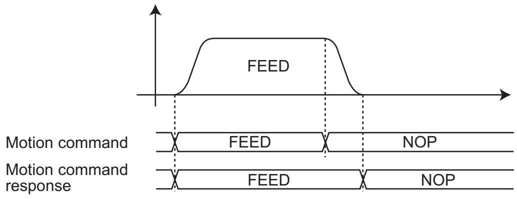
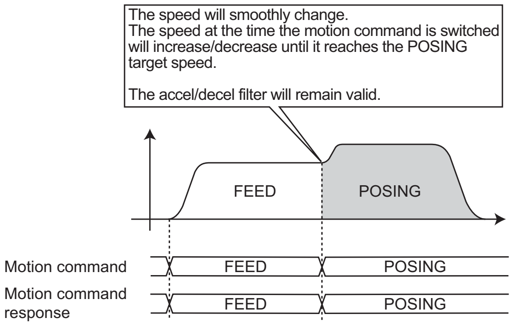
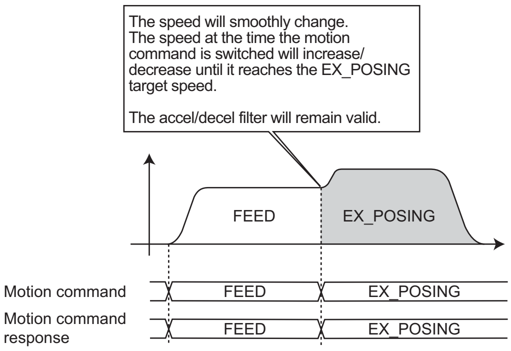
After INTERPOLATE has switched to TRQ, the TRQ command will be executed without the accel/decel filter. This is because TRQ is a motion command for which the accel/decel filter is disabled.</td></tr>
<tr><td>PHASE</td><td>INTERPOLATE will immediately switch to PHASE, and the control mode will be changed from position control mode to phase control mode.
The moving amount stored in the accel/decel filter will be reset to 0.


After INTERPOLATE has switched to PHASE, the PHASE command will be executed without the accel/decel filter. This is because PHASE is a motion command for which the accel/decel filter is disabled.</td></tr>
</table>

8.1.6 Switching from ENDOF_INTERPOLATE or LATCH

The operations are the same as are described in *8.1.5 Switching from INTERPOLATE* on page 8-13.

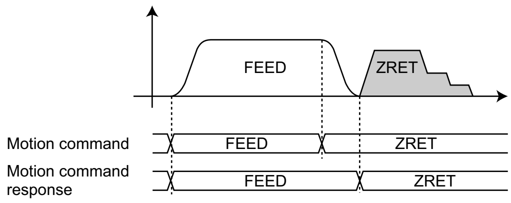
8.1.7 Switching from FEED

Switched From	Switched To	Operation
FEED	NOP	FEED will switch to NOP when the axis stops after deceleration. 
	POSING	FEED will immediately switch to POSING, and the moving amount stored in the accel/ decel filter will be maintained.  The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows. <In Incremental Addition Mode (OW□□09, bit 5 = 0)> Incremental value = Target position – IL□□14 (DPOS) OL□□1C = OL□□1C + Incremental value <In Absolute Mode (OW□□09, bit 5 = 1)> OL□□1C = Target position
	EX_POSING	FEED will immediately switch to EX_POSING, and the moving amount stored in the accel/decel will be maintained.  The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows. <In Incremental Addition Mode (OW□□09, bit 5 = 0)> Incremental value = Target position – IL□□14 (DPOS) OL□□1C = OL□□1C + Incremental value <In Absolute Mode (OW□□09, bit 5 = 1)> OL□□1C = Target position

Switching Commands during Execution

8

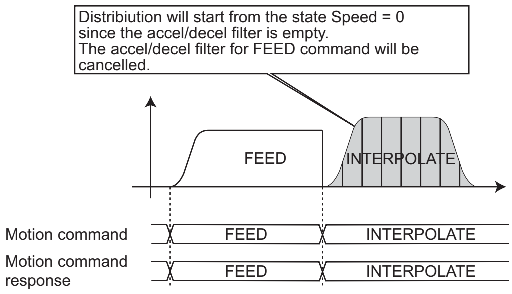
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="5">FEED</td><td>ZRET</td><td>FEED will switch to ZRET when the axis stops after deceleration.



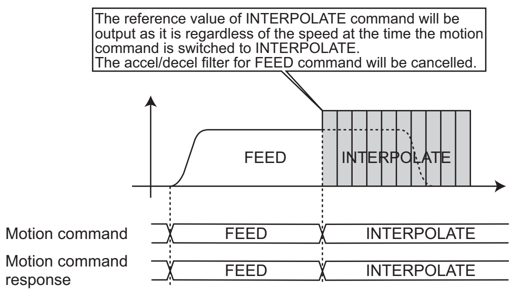
</td></tr>
<tr><td>INTERPOLATE</td><td>FEED will immediately switch to INTERPOLATE, and the moving amount stored in the accel/decel will be reset to 0.
The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Position incremental value per high-speed scan
OL□□1C = OL□□1C + Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = IL□□14 (DPOS) + Position incremental value per high-speed scan

- INTERPOLATE switched from FEED starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for INTERPOLATE command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for INTERPOLATE command (see (2).)

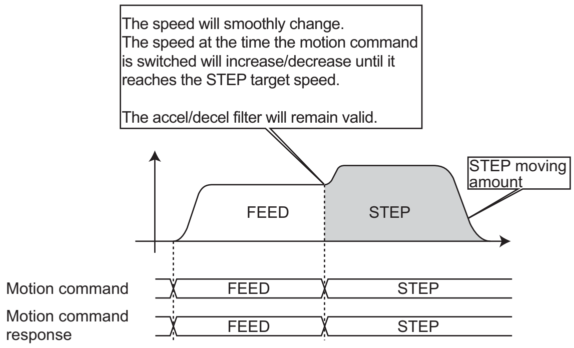
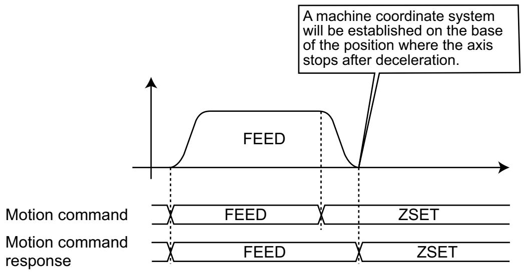
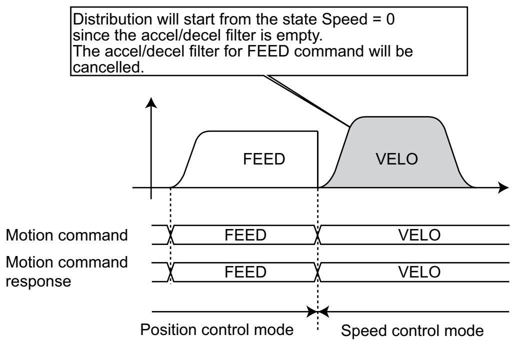
(1) When Using the Accel/Decel Filter for INTERPOLATE Command

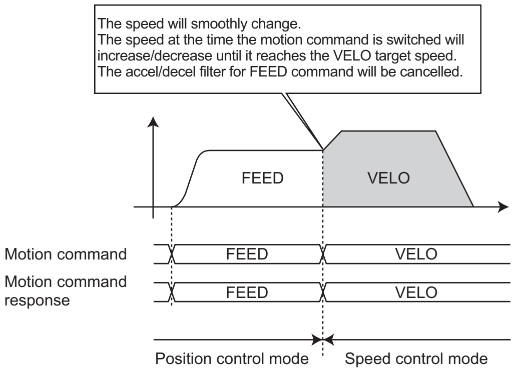
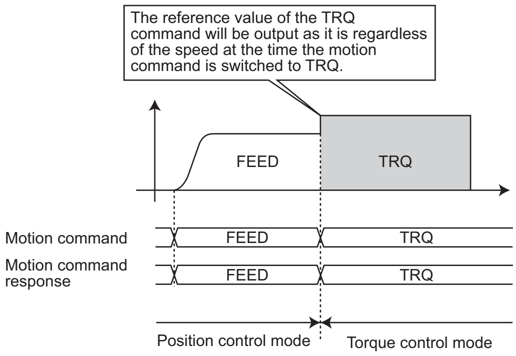


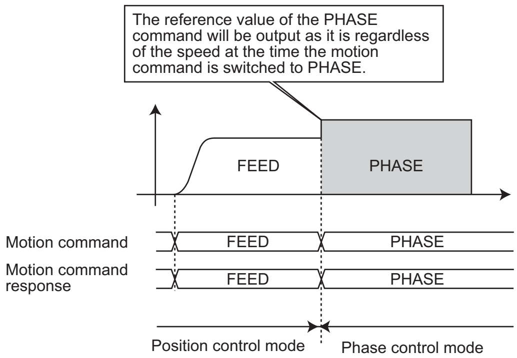
(2) When Not Using the Accel/Decel Filter for INTERPOLATE Command



</td></tr>
<tr><td>ENDOF_INTERPOLATE</td><td>Same as INTERPOLATE</td></tr>
<tr><td>LATCH</td><td>Same as INTERPOLATE</td></tr>
<tr><td>FEED</td><td>FEED operation will continue.</td></tr>
</table>

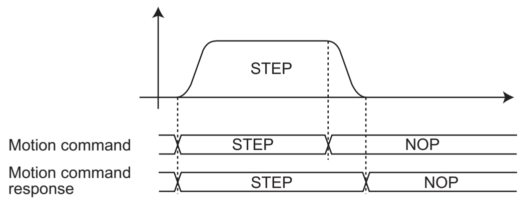
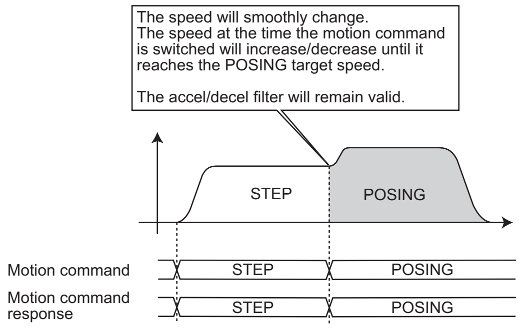
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="3">FEED</td><td>STEP</td><td>FEED will immediately switch to STEP, and the moving amount stored in the accel/decel filter will be maintained.

</td></tr>
<tr><td>ZSET</td><td>FEED will switch to ZSET when the axis stops after deceleration.

</td></tr>
<tr><td>VELO</td><td>FEED will immediately switch to VELO, and the control mode will be changed from position control mode to speed control mode.
The moving amount stored in the accel/decel filter will be reset to 0.
• VELO switched from FEED starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for VELO command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for VELO command (see (2).)
(1) When Using the Accel/Decel Filter for VELO Command

</td></tr>
</table>

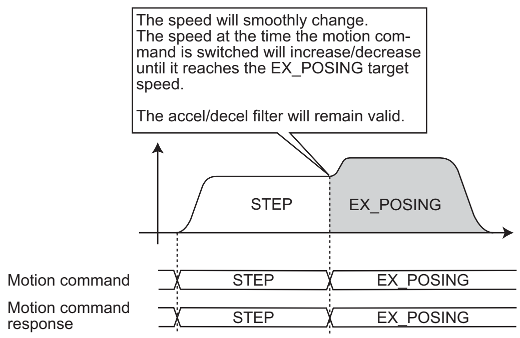
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="3">FEED</td><td>VELO
(cont'd)</td><td>(2) When Not Using the Accel/Decel Filter for VELO Command

</td></tr>
<tr><td>TRQ</td><td>FEED will immediately switch to TRQ, and the control mode will be changed from position control mode to torque/thrust control mode.
The moving amount stored in the accel/decel filter will be reset to 0.


• After FEED has switched to TRQ, the TRQ command will be executed without the accel/decel filter. This is because TRQ is a motion command for which the accel/decel filter is disabled.</td></tr>
<tr><td>PHASE</td><td>FEED will immediately switch to PHASE, and the control mode will be changed from position control mode to phase control mode.
The moving amount stored in the accel/decel filter will be reset to 0.


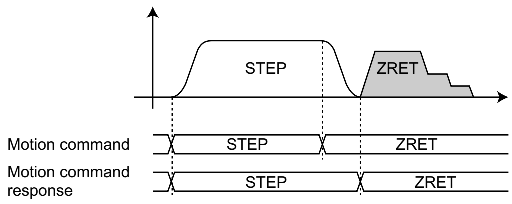
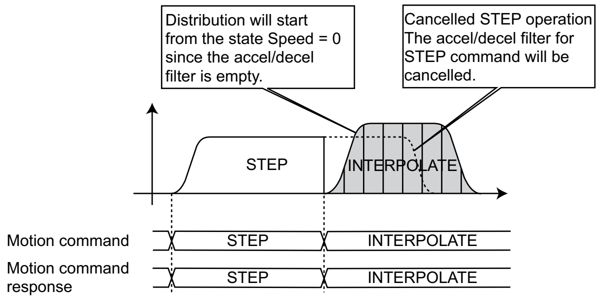
• After FEED has switched to PHASE, the PHASE command will be executed without the accel/decel filter. This is because PHASE is a motion command for which the accel/decel filter is disabled.</td></tr>
</table>

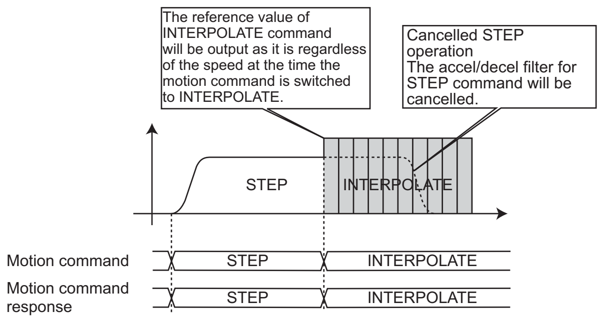
8.1.8 Switching from STEP

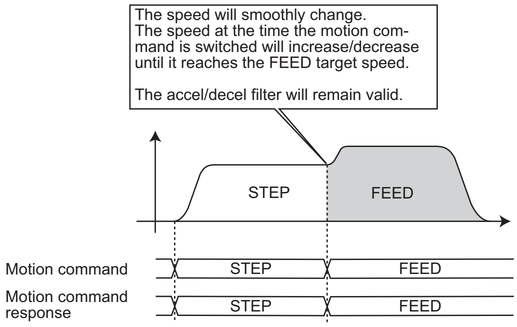
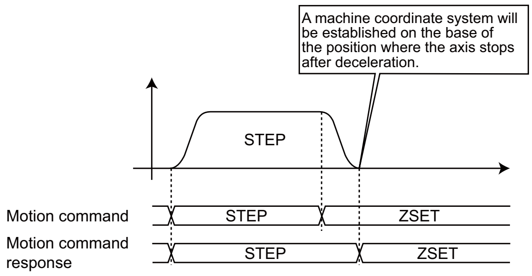
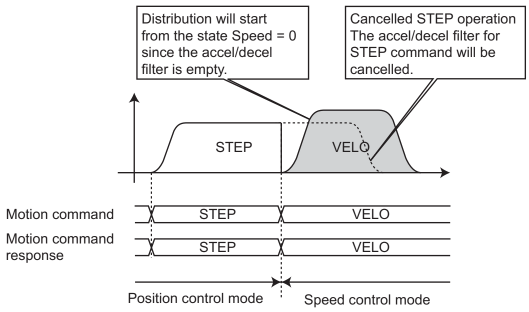
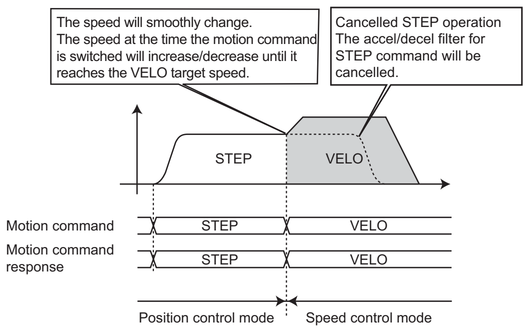
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="3">STEP</td><td>NOP</td><td>STEP will switch to NOP when the axis stops after deceleration.

</td></tr>
<tr><td>POSING</td><td>STEP will immediately switch to POSING, and the moving amount stored in the accel/decel filter will be maintained.


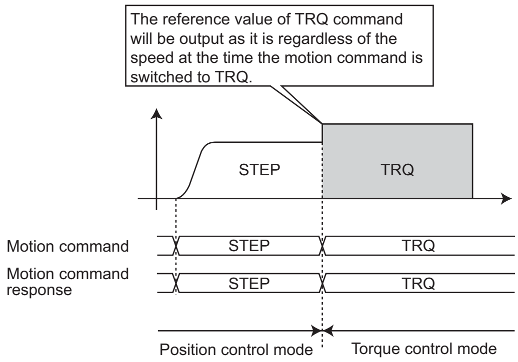
The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Target position – IL□□14 (DPOS)
OL□□1C = OL□□1C+ Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = Target position</td></tr>
<tr><td>EX_POSING</td><td>STEP will immediately switch to EX_POSING, and the moving amount stored in the accel/decel filter will be maintained.


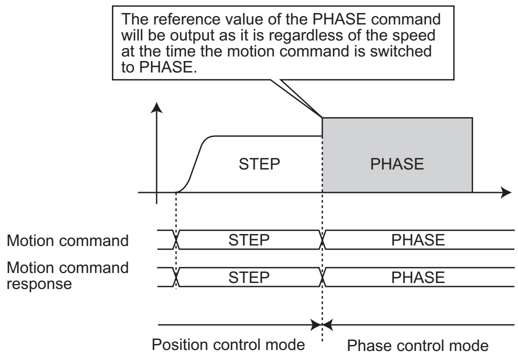
The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Target position – IL□□14 (DPOS)
OL□□1C = OL□□1C+ Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = Target position</td></tr>
</table>

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="4">STEP</td><td>ZRET</td><td>STEP will switch to ZRET when the axis stops after deceleration.

</td></tr>
<tr><td>INTERPOLATE</td><td>STEP will immediately switch to INTERPOLATE, and the moving amount stored in the accel/decel filter will be reset to 0.
The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Position incremental value per high-speed scan
OL□□1C = OL□□1C + Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = IL□□14 (DPOS) + Position incremental value per high-speed scan
• INTERPOLATE switched from FEED starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for INTERPOLATE command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for INTERPOLATE command (see (2).)
(1) When Using the Accel/Decel Filter for INTERPOLATE Command


(2) When Not Using the Accel/Decel Filter for INTERPOLATE Command

</td></tr>
<tr><td>ENDOF_INTERPOLATE</td><td>Same as INTERPOLATE</td></tr>
<tr><td>LATCH</td><td>Same as for INTERPOLATE</td></tr>
</table>

Switched From	Switched To	Operation
STEP	FEED	STEP will immediately switch to FEED, and the moving amount stored in the accel/decel filter will be maintained. 
	STEP	STEP operation will continue.
	ZSET	STEP will switch to ZSET when the axis stops after deceleration. 
	VELO	STEP will immediately switch to VELO, and the control mode will be changed from position control mode to speed control mode. The moving amount stored in the accel/decel filter will be reset to 0. • VELO switched from STEP starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for VELO command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for VELO command (see (2).) (1) When Using the Accel/Decel Filter for VELO Command  (2) When Not Using the Accel/Decel Filter for VELO Command 

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">STEP</td><td>TRQ</td><td>STEP will immediately switch to TRQ, and the control mode will be changed from position control mode to torque/thrust control mode.
The moving amount stored in the accel/decel filter will be reset to 0.


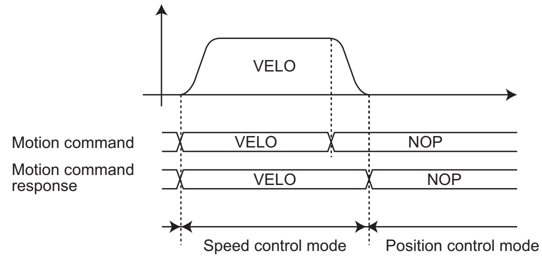
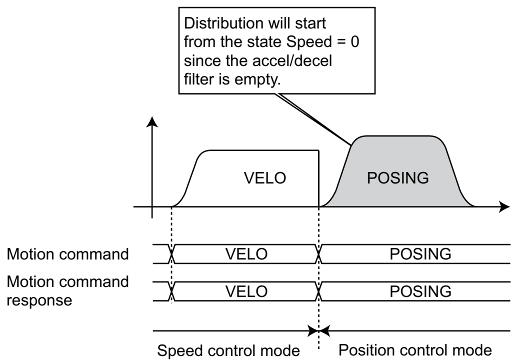
◆ After STEP has switched to TRQ, the TRQ command will be executed without the accel/decel filter. This is because TRQ is a motion command for which the accel/decel filter is disabled.</td></tr>
<tr><td>PHASE</td><td>STEP will immediately switch to PHASE, and the control mode will be changed from position control mode to phase control mode.
The moving amount stored in the accel/decel filter will be reset to 0.


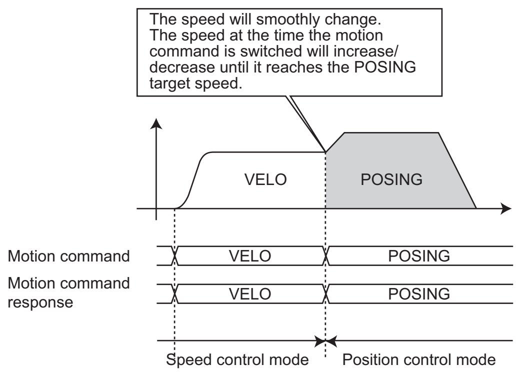
◆ After STEP has switched to PHASE, the PHASE command will be executed without the accel/decel filter. This is because PHASE is a motion command for which the accel/decel filter is disabled.</td></tr>
</table>

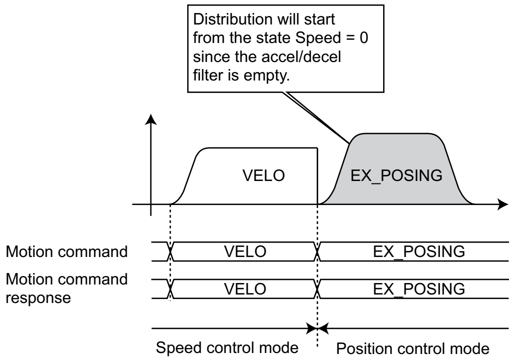
8.1.9 Switching from ZSET

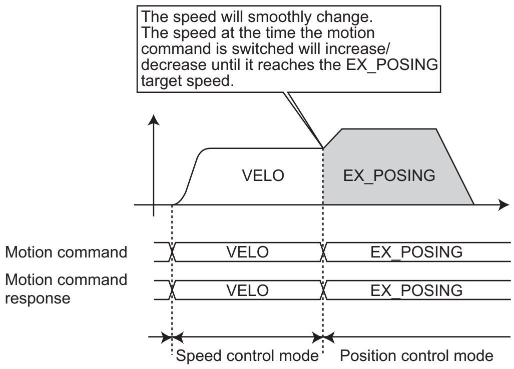
The execution of the ZSET command is completed in one scan if neither Absolute Mode nor infinite length axis are selected. So, a motion command that is set to be executed while the ZSET command is being carried out will be executed as soon as it is issued.

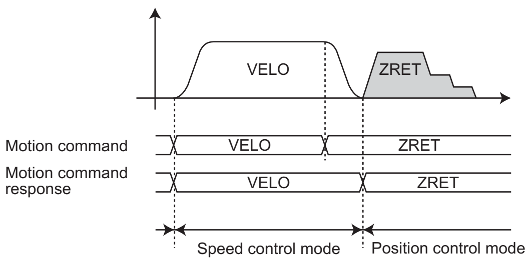
8.1.10 Switching from VELO

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">VELO</td><td>NOP</td><td>VELO will switch to NOP when the axis stops after deceleration, and the control mode will be changed from speed control mode to position control mode.

</td></tr>
<tr><td>POSING</td><td>VELO will immediately switch to POSING, and the control mode will be changed from speed control mode to position control mode. The moving amount stored in the accel/decel filter will be reset to 0.
The value of the Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Target position – IL□□14 (DPOS)
OL□□1C = OL□□1C+ Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = Target position
• POSING switched from VELO starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for POSING command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for POSING command (see (2).)
(1) When Using the Accel/Decel Filter for POSING Command


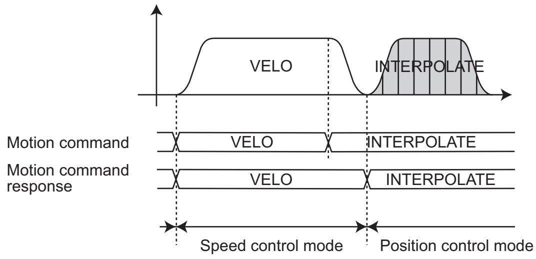
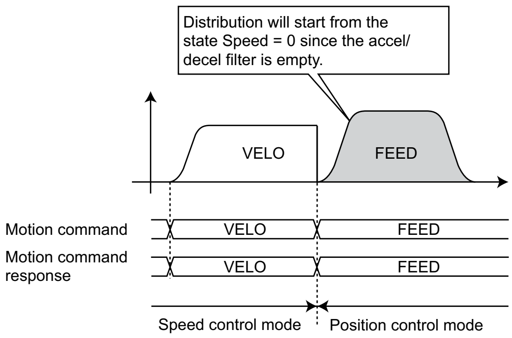
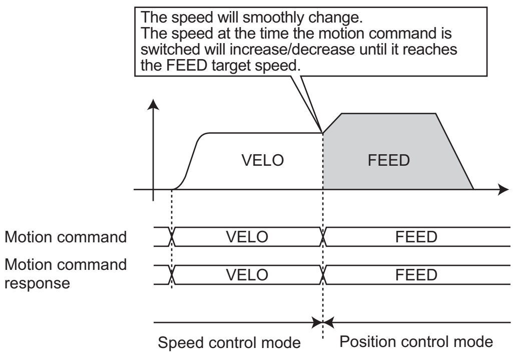
(2) When Not Using the Accel/Decel Filter for POSING Command

</td></tr>
</table>

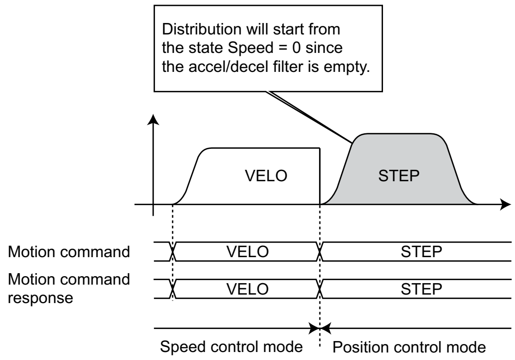
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">VELO</td><td>EX_POSING</td><td>
VELO will immediately switch to EX_POSING, and the control mode will be changed from speed control mode to position control mode. The moving amount stored in the accel/decel filter will be reset to 0.
The value of the Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Target position – IL□□14 (DPOS)
OL□□1C = OL□□1C+ Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = Target position
♦ EX_POSING switched from VELO starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for EX_POSING command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for EX_POSING command (see (2).)
(1) When Using the Accel/Decel Filter for EX_POSING Command


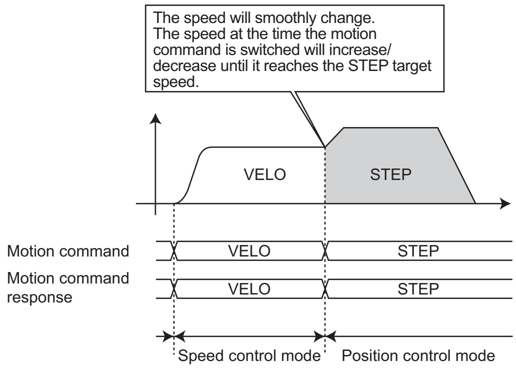
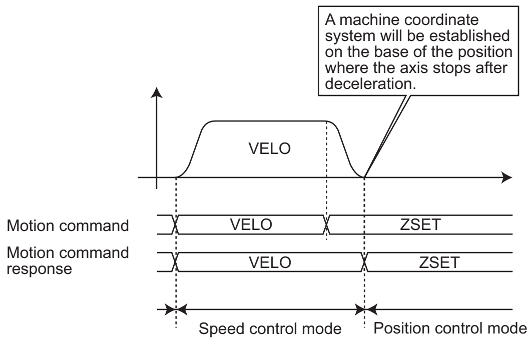
(2) When Not Using the Accel/Decel Filter for EX_POSING Command


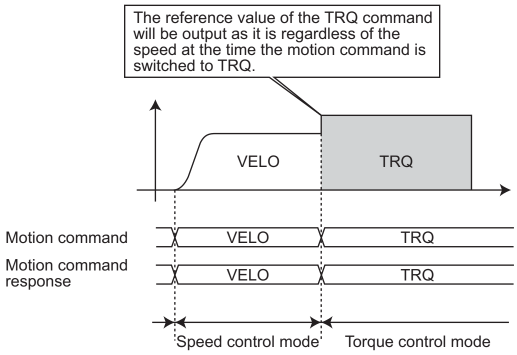
</td></tr>
<tr><td>ZRET</td><td>
VELO will switch to ZRET when the axis stops after deceleration, and the control mode will be changed from speed control mode to position control mode.


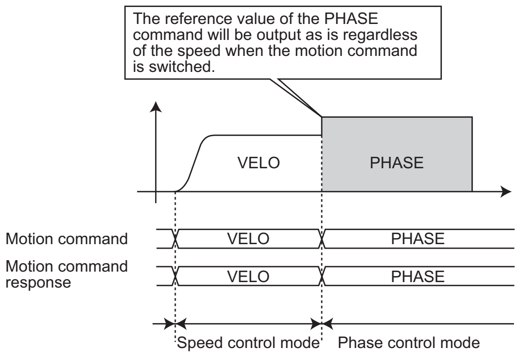
</td></tr>
</table>

Switched From	Switched To	Operation
VELO	INTERPOLATE	VELO will switch to INTERPOLATE when the axis stops after deceleration, and the control mode will be changed from speed control mode to position control mode after the axis deceleration is completed.  <Change in Position Reference Setting (OL□□1C) during Deceleration> • In Incremental Addition Mode (OW□□09, bit 5 = 0) Any change in the Position Reference Setting (OL□□1C) will be ignored. • In Absolute Mode (OW□□09, bit 5 = 1) The change in Position Reference Setting (OL□□1C) will be output as soon as the first high-speed scan after INTERPOLATE execution starts. ♦ Do not change the Position Reference Setting during deceleration unless it is absolutely necessary.
	ENDOF_INTERPOLATE	Same as INTERPOLATE
	LATCH	Same as INTERPOLATE
	FEED	VELO will immediately switch to FEED, and the control mode will be changed from speed control mode to position control mode. The moving amount stored in the accel/decel filter will be reset to 0. ♦ FEED switched from VELO starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for FEED command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for FEED command (see (2).) (1) When Using the Accel/Decel Filter for FEED Command  (2) When Not Using the Accel/Decel Filter for FEED Command 

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="3">VELO</td><td>STEP</td><td>VELO will immediately switch to STEP, and the control mode will be changed from speed control mode to position control mode. The moving amount stored in the accel/decel filter will be reset to 0.
♦ STEP switched from VELO starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for STEP command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for STEP command (see (2).)
(1) When Using the Accel/Decel Filter for STEP Command


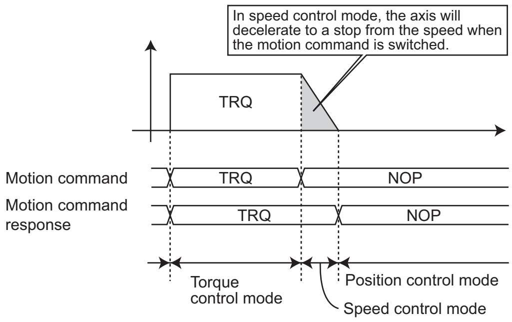
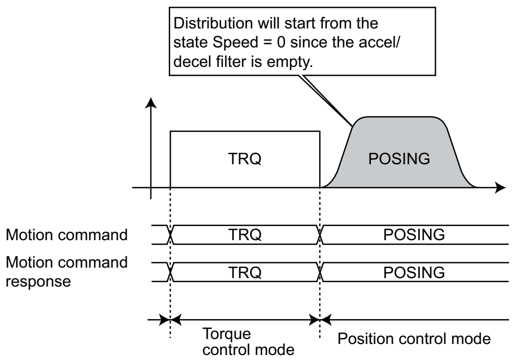
(2) When Not Using the Accel/Decel Filter for STEP Command

</td></tr>
<tr><td>ZSET</td><td>VELO will switch to ZSET when the axis stops after deceleration.

</td></tr>
<tr><td>VELO</td><td>VELO operation will continue.</td></tr>
</table>

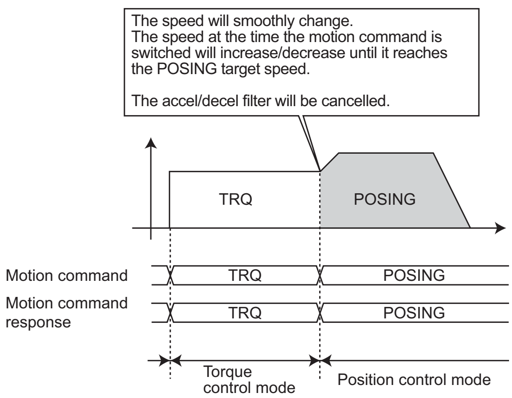
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">VELO</td><td>TRQ</td><td>VELO will immediately switch to TRQ, and the control mode will be changed from speed control mode to torque/thrust control mode. The moving amount stored in the accel/decel filter will be reset to 0.


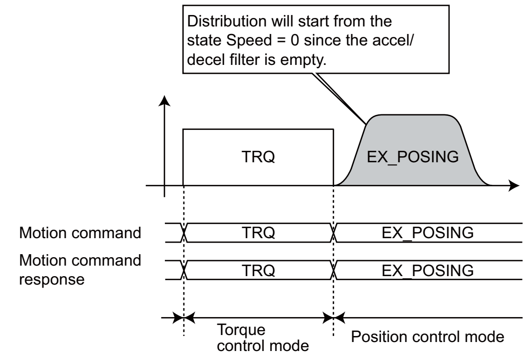
• After VELO has switched to TRQ, the TRQ command will be executed without the accel/decel filter. This is because TRQ is a motion command for which the accel/decel filter is disabled.</td></tr>
<tr><td>PHASE</td><td>VELO will immediately switch to PHASE, and the control mode will be changed from speed control mode to phase control mode. The moving amount stored in the accel/decel filter will be reset to 0.


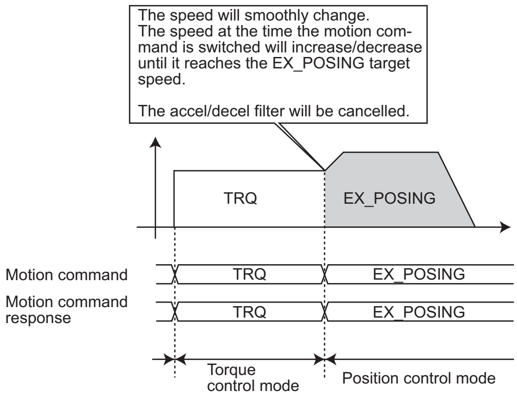
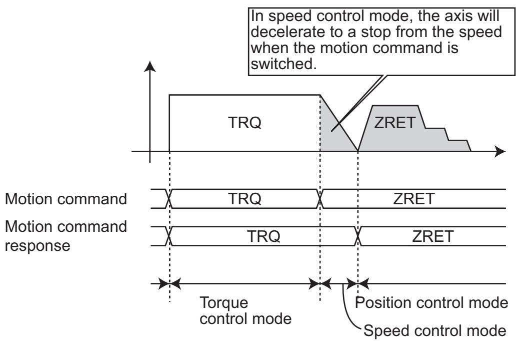
• After VELO has switched to PHASE, the PHASE command will be executed without the accel/decel filter. This is because PHASE is a motion command for which the accel/decel filter is disabled.</td></tr>
</table>

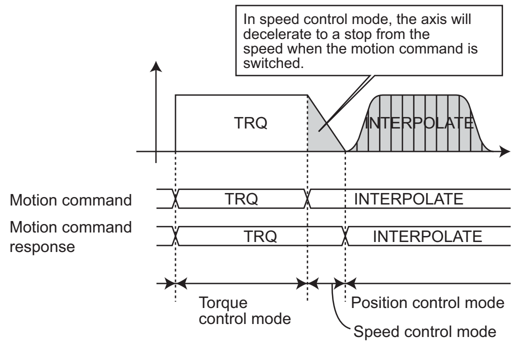
8.1.11 Switching from TRQ

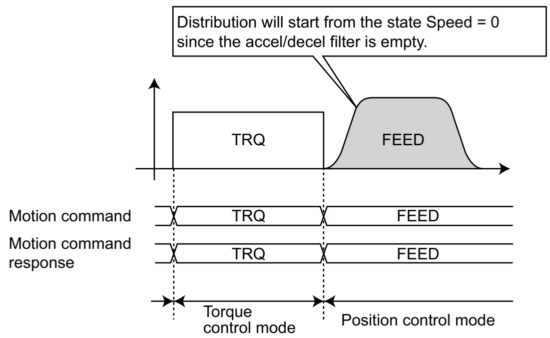
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">TRQ</td><td>NOP</td><td>The axis will decelerate to a stop from the speed when the motion command is switched in position control mode.
TRQ will switch to NOP when the axis stops after deceleration.

</td></tr>
<tr><td>POSING</td><td>TRQ will immediately switch to POSING, and the control mode will be changed from torque/thrust control mode to position control mode.
The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Target position – IL□□14 (DPOS)
OL□□1C = OL□□1C+ Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = Target position
♦ POSING switched from TRQ starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for POSING command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for POSING command (see (2).)
(1) When Using the Accel/Decel Filter for POSING Command


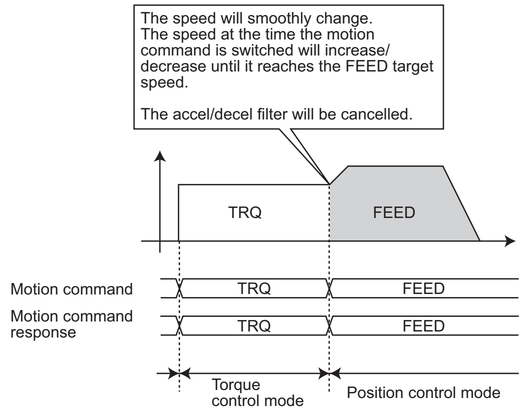
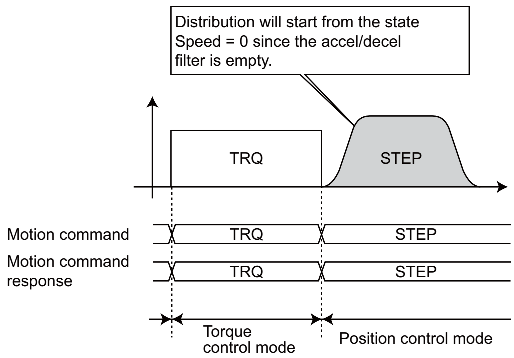
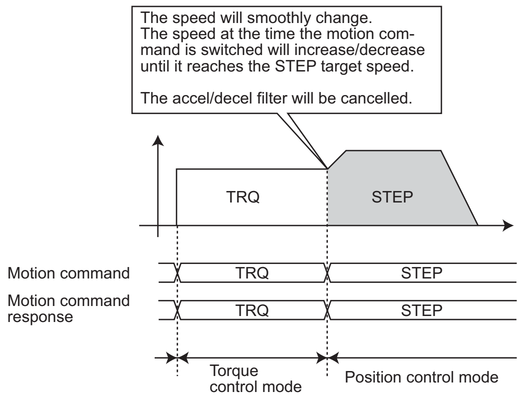
(2) When Not Using the Accel/Decel Filter for POSING Command

</td></tr>
</table>

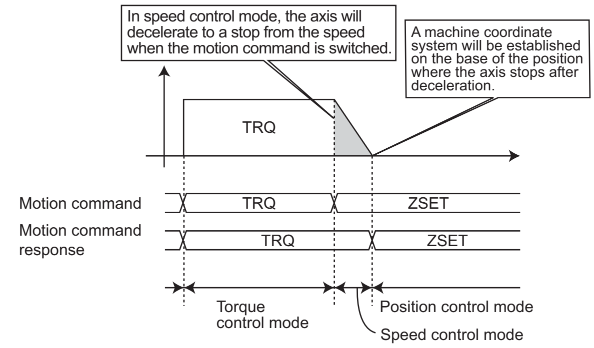
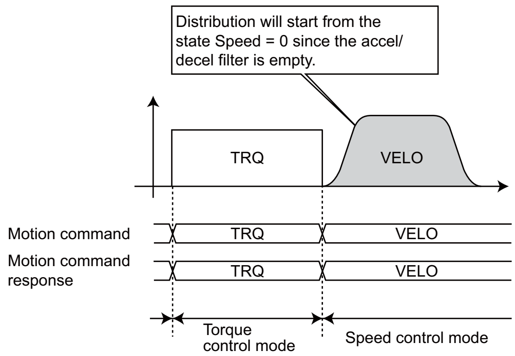
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">TRQ</td><td>EX_POSING</td><td>TRQ will immediately switch to EX_POSING, and the control mode will be changed from torque/thrust control mode to position control mode. The moving amount stored in the accel/decel filter will be reset to 0.
The value of Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Target position − IL□□14 (DPOS)
OL□□1C = OL□□1C+ Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = Target position
• EX_POSING switched from TRQ starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for EX_POSING command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for EX_POSING command (see (2).)
(1) When Using the Accel/Decel Filter for EX_POSING Command


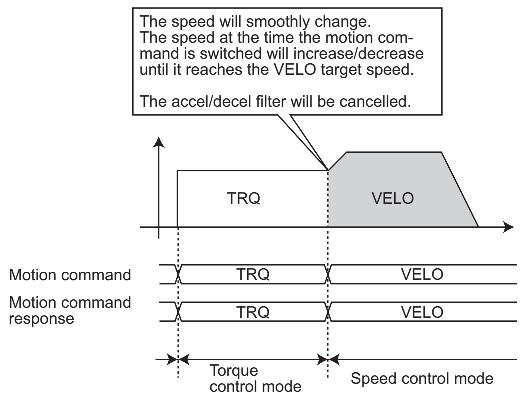
(2) When Not Using the Accel/Decel Filter for EX_POSING Command

</td></tr>
<tr><td>ZRET</td><td>The axis will decelerate to a stop in speed control mode, and the control mode will be changed from speed control mode to position control mode when the axis stops.
TRQ will switch to ZRET when the axis stops after deceleration.

</td></tr>
</table>

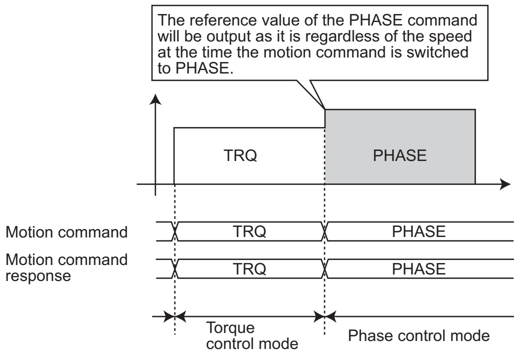
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="4">TRQ</td><td>INTERPOLATE</td><td>The axis will decelerate to a stop in speed control mode, and the control mode will be changed from speed control mode to position control mode when the axis stops.
TRQ will switch to INTERPOLATE when the axis stops after deceleration.


<Change in Position Reference Setting (OL□□1C) during Deceleration>
• In Incremental Addition Mode (OW□□09, bit 5 = 0)
Any change in the Position Reference Setting (OL□□1C) will be ignored.
• In Absolute Mode (OW□□09, bit 5 = 1)
The change in the Position Reference Setting (OL□□1C) will be output as soon as the first high-speed scan after INTERPOLATE execution starts.
♦ Do not change the Position Reference Setting during deceleration unless it is absolutely necessary.</td></tr>
<tr><td>ENDOF_INTERPOLATE</td><td>Same as INTERPOLATE</td></tr>
<tr><td>LATCH</td><td>Same as INTERPOLATE</td></tr>
<tr><td>FEED</td><td>TRQ will immediately switch to FEED, and the control mode will be changed from torque/thrust control mode to position control mode.
♦ FEED switched from TRQ starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for FEED command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for FEED command (see (2).)
(1) When Using the Accel/Decel Filter for FEED Command

</td></tr>
</table>

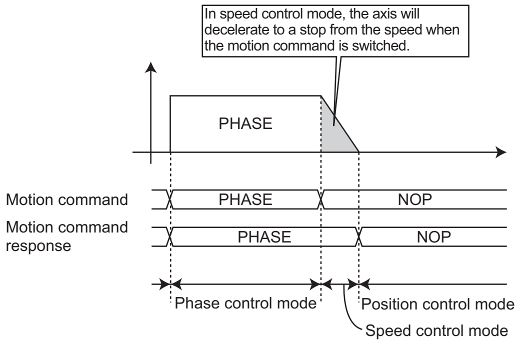
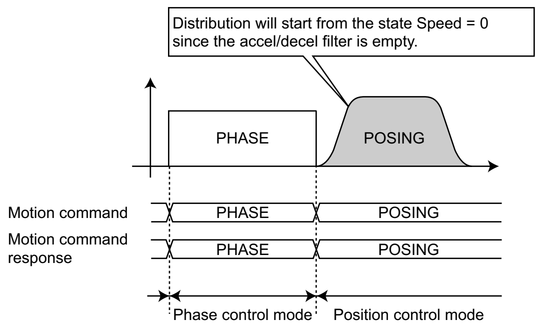
Switched From	Switched To	Operation
TRQ	FEED (cont'd)	(2) When Not Using the Accel/Decel Filter for FEED Command 
	STEP	TRQ will immediately switch to STEP, and the control mode will be changed from torque/ thrust control mode to position control mode. • STEP switched from TRQ starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for STEP command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for STEP command (see (2).) (1) When Using the Accel/Decel Filter for STEP Command  (2) When Not Using the Accel/Decel Filter for STEP Command 

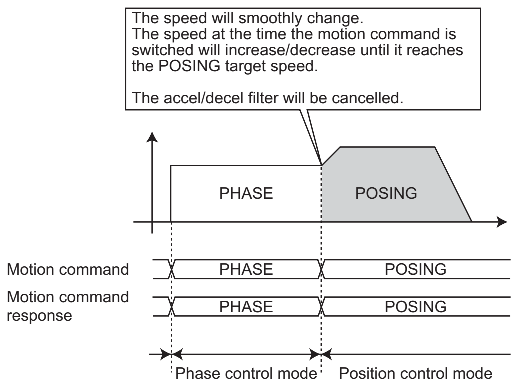
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="3">TRQ</td><td>ZSET</td><td>The axis will decelerate to a stop in speed control mode, and the control mode will be changed from speed control mode to position control mode when the axis stops.
TRQ will switch to ZSET when the axis stops after deceleration.

</td></tr>
<tr><td>VELO</td><td>TRQ will immediately switch to VELO, and the control mode will be changed from torque/thrust control mode to speed control mode.
♦ VELO switched from TRQ starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for VELO command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for VELO command (see (2).)
(1) When Using the Accel/Decel Filter for VELO Command


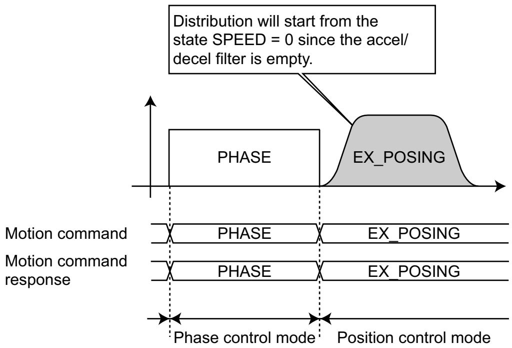
(2) When Not Using the Accel/Decel Filter for VELO Command

</td></tr>
<tr><td>TRQ</td><td>TRQ operation will continue.</td></tr>
</table>

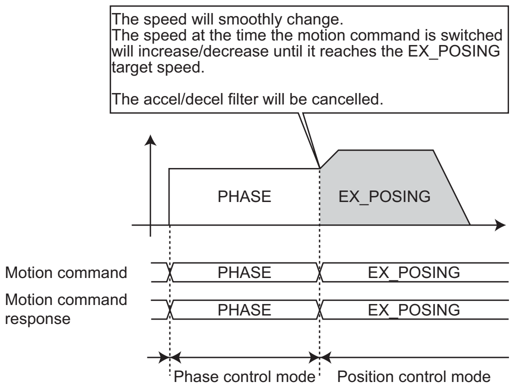
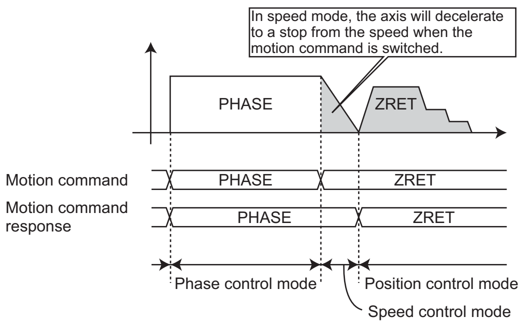
Switched From	Switched To	Operation
TRQ	PHASE	TRQ will immediately switch to PHASE, and the control mode will be changed from torque/thrust control mode to phase control mode. The moving amount stored in the accel/decel filter will be reset to 0.  • After TRQ has switched to PHASE, the PHASE command will be executed without the accel/decel filter. This is because PHASE is a motion command for which the accel/decel filter is disabled.

8.1.12 Switching from PHASE

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">PHASE</td><td>NOP</td><td>The axis will decelerate to a stop in speed control mode, and the control mode will be changed from speed control mode to position control mode when the axis stops.
PHASE will switch to NOP when the axis stops after deceleration.

</td></tr>
<tr><td>POSING</td><td>PHASE will immediately switch to POSING, and the control mode will be changed from phase control mode to position control mode. The moving amount stored in the accel/decel filter will be reset to 0.
The value of the Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Target position – IL□□14 (DPOS)
OL□□1C = OL□□1C+ Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = Target position
• POSING switched from PHASE starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for POSING command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for POSING command (see (2).)
(1) When Using the Accel/Decel Filter for POSING Command


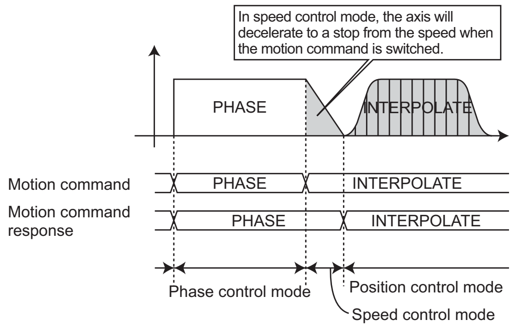
(2) When Not Using the Accel/Decel Filter for POSING Command

</td></tr>
</table>

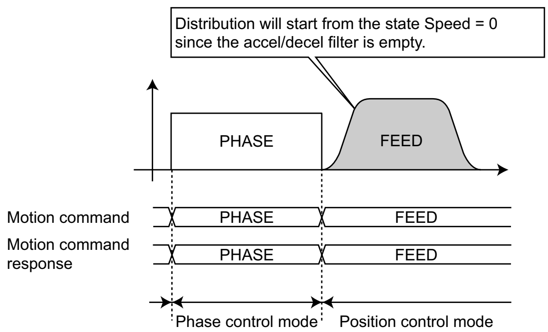
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">PHASE</td><td>EX_POSING</td><td>PHASE will immediately switch to EX_POSING, and the control mode will be changed from phase control mode to position control mode.
The value of the Position Reference Setting (OL□□1C) when the motion command is switched will be as follows.
<In Incremental Addition Mode (OW□□09, bit 5 = 0)>
Incremental value = Target position – IL□□14 (DPOS)
OL□□1C = OL□□1C+ Incremental value
<In Absolute Mode (OW□□09, bit 5 = 1)>
OL□□1C = Target position
• EX_POSING switched from PHASE starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for EX_POSING command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for EX_POSING command (see (2).)
(1) When Using the Accel/Decel Filter for EX_POSING Command


(2) When Not Using the Accel/Decel Filter for EX_POSING Command

</td></tr>
<tr><td>ZRET</td><td>The axis will decelerate to a stop in speed control mode, and the control mode will be changed from speed control mode to position control mode when the axis stops.
PHASE will switch to ZRET when the axis stops after deceleration.

</td></tr>
</table>

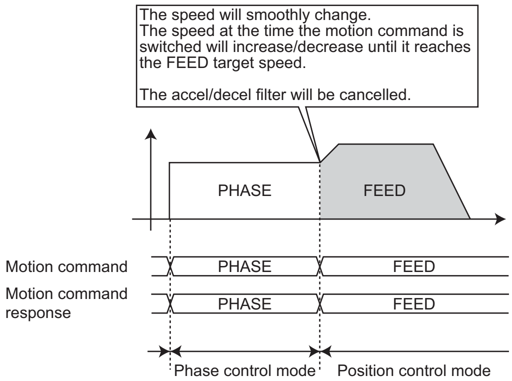
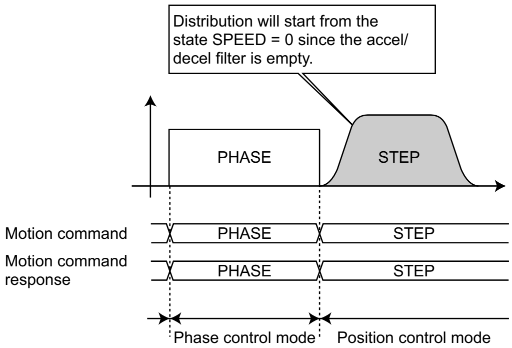
Switching Commands during Execution

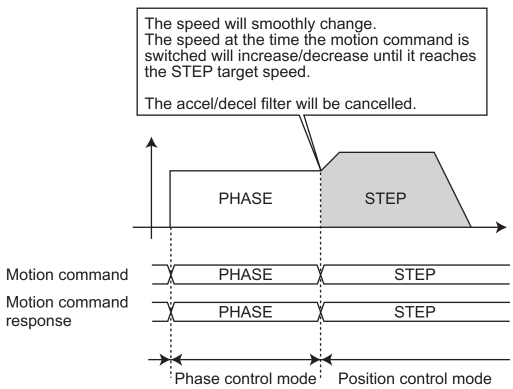
8

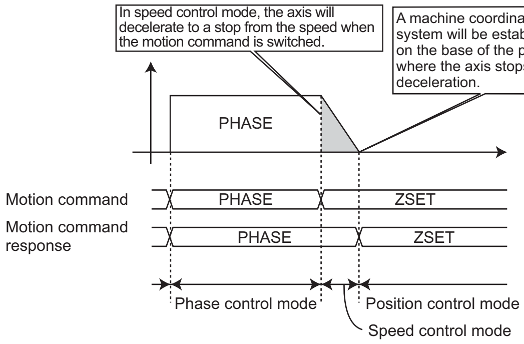
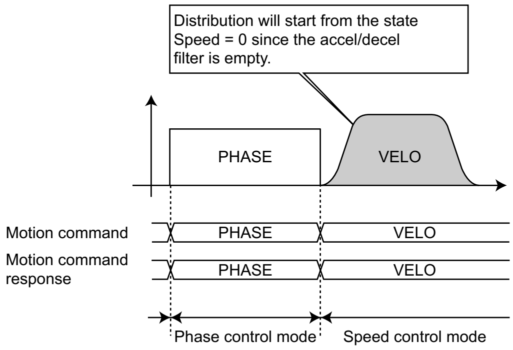
<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="4">PHASE</td><td>INTERPOLATE</td><td>The axis will decelerate to a stop in speed control mode, and the control mode will be changed from speed control mode to position control mode when the axis stops.
PHASE will switch to INTERPOLATE when the axis stops after deceleration.


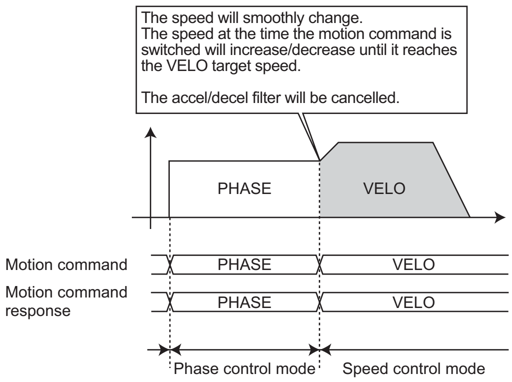
<Change in Position Reference Setting (OL□□1C) during Deceleration>
• In Incremental Addition Mode (OW□□09, bit 5 = 0)
Any change in the Position Reference Setting (OL□□1C) will be ignored.
• In Absolute Mode (OW□□09, bit 5 = 1)
The change in the Position Reference Setting (OL□□1C) will be output as soon as the first high-speed scan after INTERPOLATE execution starts.
♦ Do not change the Position Reference Setting during deceleration unless it is absolutely necessary.</td></tr>
<tr><td>ENDOF_INTERPOLATE</td><td>Same as INTERPOLATE</td></tr>
<tr><td>LATCH</td><td>Same as INTERPOLATE</td></tr>
<tr><td>FEED</td><td>PHASE will immediately switch to FEED, and the control mode will be changed from phase control mode to position control mode.
♦ FEED switched from PHASE starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for FEED command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for FEED command (see (2).)
(1) When Using the Accel/Decel Filter for FEED Command


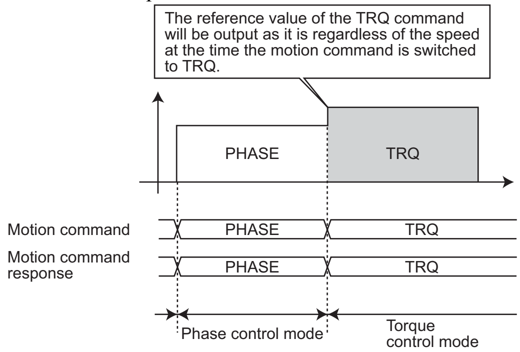
</td></tr>
</table>

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">PHASE</td><td>FEED
(cont’d)</td><td>(2) When Not Using the Accel/Decel Filter for FEED Command

</td></tr>
<tr><td>STEP</td><td>PHASE will immediately switch to STEP, and the control mode will be changed from phase control mode to position control mode.
• STEP switched from PHASE starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for STEP command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for STEP command (see (2))
(1) When Using the Accel/Decel Filter for STEP Command


(2) When Not Using the Accel/Decel Filter for STEP Command

</td></tr>
</table>

<table>
<tr><th>Switched From</th><th>Switched To</th><th>Operation</th></tr>
<tr><td rowspan="2">PHASE</td><td>ZSET</td><td>The axis will decelerate to a stop in speed control mode, and the control mode will be changed from speed control mode to position control mode when the axis stops.
PHASE will switch to ZSET when the axis stops after deceleration.

</td></tr>
<tr><td>VELO</td><td>PHASE will immediately switch to VELO, and the control mode will be changed from phase control mode to speed control mode.
• VELO switched from PHASE starts its operation with the empty accel/decel filter. Therefore, when the accel/decel filter is set for VELO command, the speed will not smoothly change, and the distribution will be started from the state Speed = 0 (see (1).) To change the speed smoothly, do not set the filter for VELO command (see (2).)
(1) When Using the Accel/Decel Filter for VELO Command


(2) When Not Using the Accel/Decel Filter for VELO Command

</td></tr>
</table>

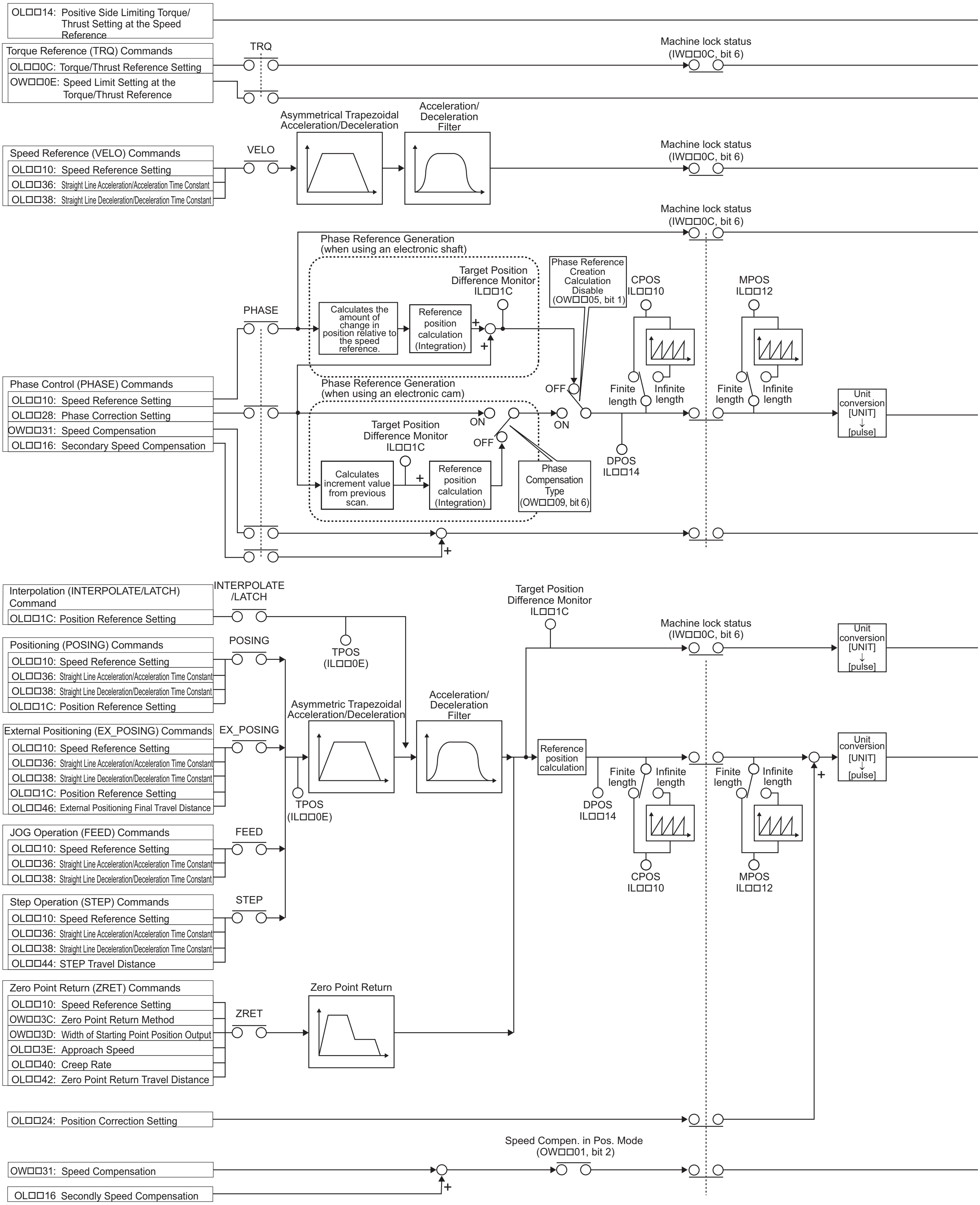
Switched From	Switched To	Operation
PHASE	TRQ	PHASE will immediately switched to TRQ, and the control mode will be changed from phase control mode to torque/thrust control mode. 
	PHASE	PHASE operation will continue.

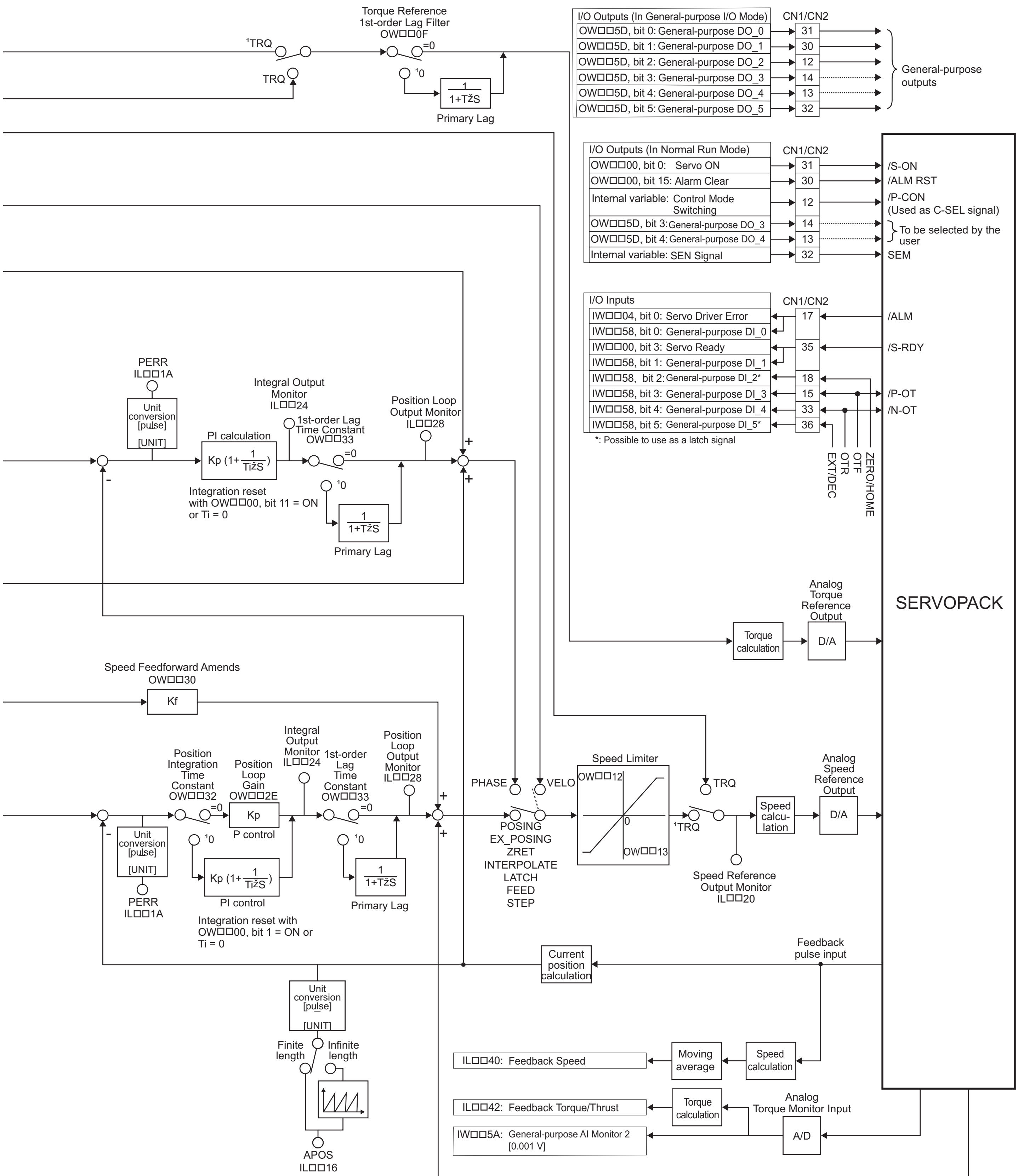
9

Control Block Diagram

This chapter explains the SVA-01 Module control block diagram.

9.1 SVA-01 Module Control Block Diagram





Torque Reference 1st-order Lag Filter OW□□0F
≠TRQ
TRQ
=0
≠0
1 / 1+T·S
Primary Lag
I/O Outputs (In General-purpose I/O Mode)
CN1/CN2
OW□□5D, bit 0: General-purpose DO_0 — 31
OW□□5D, bit 1: General-purpose DO_1 — 30
OW□□5D, bit 2: General-purpose DO_2 — 12
OW□□5D, bit 3: General-purpose DO_3 — 14
OW□□5D, bit 4: General-purpose DO_4 — 13
OW□□5D, bit 5: General-purpose DO_5 — 32
General-purpose outputs
I/O Outputs (In Normal Run Mode)
CN1/CN2
OW□□00, bit 0: Servo ON — 31 — /S-ON
OW□□00, bit 15: Alarm Clear — 30 — /ALM RST
Internal variable: Control Mode Switching — 12 — /P-CON (Used as C-SEL signal)
OW□□5D, bit 3: General-purpose DO_3 — 14
OW□□5D, bit 4: General-purpose DO_4 — 13
To be selected by the user
Internal variable: SEN Signal — 32 — SEM
I/O Inputs
CN1/CN2
IW□□04, bit 0: Servo Driver Error — 17 — /ALM
IW□□58, bit 0: General-purpose DI_0
IW□□00, bit 3: Servo Ready — 35 — /S-RDY
IW□□58, bit 1: General-purpose DI_1
IW□□58, bit 2: General-purpose DI_2* — 18
IW□□58, bit 3: General-purpose DI_3 — 15 — /P-OT
IW□□58, bit 4: General-purpose DI_4 — 33 — /N-OT
IW□□58, bit 5: General-purpose DI_5* — 36
*: Possible to use as a latch signal
EXT/DEC
OTR
OTF
ZERO/HOME
PERR IL□□1A
Unit conversion [pulse] [UNIT]
Integral Output Monitor IL□□24
PI calculation
Kp (1+ 1/Ti·S)
1st-order Lag Time Constant OW□□33
=0
≠0
Position Loop Output Monitor IL□□28
Integration reset with OW□□00, bit 11 = ON or Ti = 0
1 / 1+T·S
Primary Lag
Analog Torque Reference Output
Torque calculation
D/A
SERVOPACK
Speed Feedforward Amends OW□□30
Kf
Position Integration Time Constant OW□□32
=0
≠0
Position Loop Gain OW□□2E
Kp
P control
Kp (1+ 1/Ti·S)
PI control
Integral Output Monitor IL□□24
1st-order Lag Time Constant OW□□33
=0
≠0
1 / 1+T·S
Primary Lag
Position Loop Output Monitor IL□□28
Unit conversion [pulse] [UNIT]
PERR IL□□1A
Integration reset with OW□□00, bit 1 = ON or Ti = 0
PHASE
VELO
POSING
EX_POSING
ZRET
INTERPOLATE
LATCH
FEED
STEP
Speed Limiter
OW□□12
0
OW□□13
TRQ
≠TRQ
Speed calcu-lation
Speed Reference Output Monitor IL□□20
Analog Speed Reference Output
D/A
Feedback pulse input
Current position calculation
Unit conversion [pulse] [UNIT]
Finite length
Infinite length
APOS IL□□16
IL□□40: Feedback Speed
Moving average
Speed calculation
IL□□42: Feedback Torque/Thrust
Torque calculation
Analog Torque Monitor Input
A/D
IW□□5A: General-purpose AI Monitor 2 [0.001 V]
Analog Speed Monitor Input
A/D
IW□□59: General-purpose AI Monitor 1 [0.001 V]

10

Absolute Position Detection

This chapter explains an absolute position detection system that uses an absolute encoder. Be sure to read this chapter carefully when using a Servomotor equipped with an absolute encoder.

10.1 Absolute Position Detection Function

This section explains the Absolute Position Detection Function in the SVA-01 Module.

- Refer to *Appendix C Fixed Parameter Setting According to Encoder Type and Axis Type* on page A-10 together with this section.

10.1.1 Outline of the Function

The Absolute Position Detection Function detects the position of the machine (axis) even if the power is turned OFF. This allows it to establish the machine coordinate system automatically and to begin operating automatically without having to execute the zero point return (ZRET) command after power is turned ON.
Absolute position detection is performed using an absolute encoder built into a Servomotor.
The following are features of the system for detection of the absolute position.

- If eliminates the need for a zero point return after the power is turned ON.
- If eliminates the need for a zero point dog and overtravel limit switch.

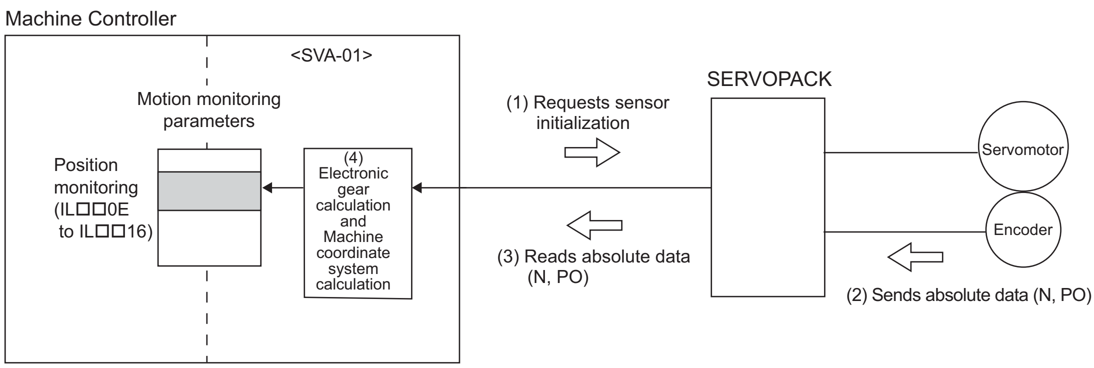
■ Terminology: Absolute Encoder

There are two types of encoders available. An incremental encoder detects position by calculating the zero point difference. An absolute encoder detects the absolute position relative to a reference position.
The absolute encoder uses a battery connected to the battery terminals of the SERVOPACK to maintain absolute data at all times even though power is turned OFF. It also updates absolute data if the position changes while the power is OFF.
The absolute encoder is comprised of a detector that is used to detect absolute position within one rotation and a counter that is used to count the number of rotations.

- After the automatic operation starts, the absolute encoder operates in the same way as an incremental encoder.

10.1.2 Reading Absolute Data

Turn ON the Machine Controller and the SERVOPACK at the same time or turn ON the SERVOPACK first to read the absolute data loaded from the absolute encoder to the Machine Controller.
The following diagram shows an overview of the absolute data read operation.



(1) The SVA-01 Module requests SERVOPACK to initialize the sensor when the power supply turns ON.

(2) SERVOPACK obtains the multiturn data (N) and initial incremental pulses (PO) at reception of the sensor initialization request from the SVA-01 Module.

(3) The SVA-01 Module reads out the position data or absolute data from SERVOPACK.

(4) The SVA-01 Module automatically sets a machine coordinate system* according to the electronic gear ratio converted from the absolute value calculated on the base of the read information and the data of Zero Point Position in Machine Coordinate System Offset (OL□□48).

* Refer to *10.3.3 (1) Calculating the Zero Point of the Machine Coordinate System* on page 10-10 for information on how to calculate the zero point of machine coordinate system.

This way the absolute machine position can be detected and automatic operation can begin immediately after power is turned ON with an automatic position detection system.

■ Terminology: Absolute Data

Absolute data that is stored in an absolute encoder has two types of data: the absolute reference position (initial incremental pulses; PO) and the number of rotations (multi-turn data; N) from the absolute reference position.
The absolute reference position is the phase-C position when the absolute encoder is initialized and is the reference position for absolute-position detection.
Only the number of rotations (N) can be cleared when the absolute encoder is initialized, and the initial incremental pulses will not change.

■ Information: Calculation of Absolute Position

We can determine the absolute position (P) using the following data.

Data stored in an absolute encoder
- Absolute reference position (initial incremental pulses): PO
- Number of rotations from the absolute reference position (multi-turn data): N

Parameter determined according to the number of bits of servomotor
- Feedback pulses per motor rotation: RP

Equation to calculate the absolute position
- Absolute position (P) = N × RP + PO

10.1.3 Finite Length/Infinite Length Axes and Absolute Position Detection

There are two types of axes. An infinite length axis resets the current position to a specified value every rotation, and the finite length axis does not.
Set a finite length axis if return and other operations are performed only within a specified range or for an axis that moves in one direction only without resetting the position every rotation.
Set an infinite length axis for conveyor belts and other operations that require the position to be reset every rotation.
There are two types of position control available with an infinite length axis. Simple Absolute Infinite Length Position Control and Infinite Length Position Control without Simple Absolute Positions.
An absolute encoder performs absolute position detection with a finite or infinite length axis depending on the Axis Selection (fixed parameter 1, bit 0) of the Machine Controller.
Set the Machine Controller fixed parameters and SERVOPACK parameters to select the absolute position detection function with an absolute encoder. The setting procedures are different for finite and infinite length axes. Refer to *10.2.1 System Startup Flowchart* on page 10-4 for details.

10.2 Setting Procedure of Absolute Position Detection Function

This section explains the procedure for setting the Absolute Position Detection Function.

10.2.1 System Startup Flowchart

Start up the system using the following procedure.

<table>
<tr><td>1</td><td>Check Devices
Check to see if the SERVOPACK, Servomotor, and cables are the right products and models for the absolute encoder.</td></tr>
</table>

↓

<table>
<tr><td>2</td><td>Initialize the Absolute Encoder
Follow the setup procedure to set the absolute encoder to default values.
(→ 10.2.2 Initializing the Absolute Encoder on page 10-5, and Appendix B Initializing the Absolute Encoder on page A-5)</td></tr>
</table>

↓

<table>
<tr><td rowspan="4">3</td><td colspan="2">Setting Parameters Related to the Machine Controller and the SERVOPACKs
Set all parameters related to the Absolute Position Detection Function of the Machine Controller and SERVOPACKs.
The setting procedure for a finite length axis is different from that for an infinite length axis.</td><td></td></tr>
<tr><td rowspan="2">When using the axis as a Finite Length Axis
→ 10.3.1 Parameter Settings for Finite Length Axes on page 10-6
→ 10.3.2 Detailed Descriptions on Parameter Settings for Finite Length Axes on page 10-8</td><td colspan="2">When using the axis as an Infinite Length Axis
→ 10.4.1 (2) Conditions to Enable the Simple Absolute Infinite Axis Position Control on page 10-14*</td></tr>
<tr><td>With simple absolute infinite length position control
→ 10.4.2 Parameters Setting for Simple Absolute Infinite Length Position Control on page 10-16</td><td>Without simple absolute infinite length position control*
→ 10.4.6 Infinite Length Position Control without Simple Absolute Positions on page 10-22</td></tr>
</table>

↓

<table>
<tr><td rowspan="2">4</td><td colspan="3">Zero Point Setting
Set the zero point as well as the absolute zero point, that is, the machine coordinate zero point.
The setting procedure for a finite length axis is different from that of an infinite length axis.</td></tr>
<tr><td>When using the axis as a Finite Length Axis
→ 10.3.3 Setting the Zero Point for a Finite Length Axis on page 10-10</td><td>With simple absolute infinite length position control
→ 10.4.4 Setting the Zero Point and Turning ON Power as Simple Absolute Positions on page 10-20</td><td>Without simple absolute infinite length position control*
→ 10.4.6 (3) Setting the Zero Point for an Infinite Length Axis without Simple Absolute Positions on page 10-22</td></tr>
</table>

* If the system does not satisfy the conditions described in *10.4.1 (2) Conditions to Enable the Simple Absolute Infinite Axis Position Control* on page 10-14 when using the axis as an infinite length axis, the Machine Controller carries out the operation without using simple absolute length position control.

After the steps 2 to 4 described above are successfully completed, the absolute position detection system will be ready for operation.

- Always perform the startup procedure of the absolute position detection system in the following situations.
  - When starting up the absolute position detection system for the first time
  - When the Servomotor is changed
  - When an absolute encoder-related alarm occurs

10.2.2 Initializing the Absolute Encoder

Absolute encoders can be initialized as follows:

- SERVOPACK Procedure
    - Refer to the manual for the SERVOPACK for details.
- Panel Operator or Digital Operator Procedure
    - Refer to the manual for the SERVOPACK for details.

For details on the procedure for initializing SERVOPACKs, refer to *Appendix B Initializing the Absolute Encoder* on page A-5.

- Initialize the absolute encoder in the following situations.
    - When the absolute position detection system is started up for the first time
    - When number of rotations from the absolute reference position needs to be initialized to 0
    - When a Servomotor has been left with no battery connected to the absolute encoder
    - When an alarm which is related the absolute position detection system occurs

10.3 Absolute Position Detection for Finite Length Axes

This section describes the procedure for setting parameters and precautions on setting zero-point and turning ON the power supply when using the axis as a finite length axis.

10.3.1 Parameter Settings for Finite Length Axes

The following parameters must be set to enable the absolute position detection function when using an axis as a finite length axis.

⚠ CAUTION	• The parameters for which precautions are provided must be set referring to *10.3.2 Detailed Descriptions on Parameter Settings for Finite Length Axes* on page 10-8. Set these parameters carefully. If they are not set correctly, the current position may not be correct after the power is turned ON. Machine damage may occur.

(1) Machine Controller Fixed Parameters for Absolute Position Detection

Fixed Parameter No.	Name	Setting/Range	Units	Reference	Caution
1, bit 0	Axis Selection	0: Finite length axis, 1: Infinite length axis	–	10.3.2 (1)	
22	Pulse Counting Mode Selection	0: Sign mode *1 1: Sign mode *2 2: Up/Down mode *1 3: Up/Down mode *2 4: A/B mode *1 5: A/B mode *2 6: A/B mode *4	–	10.3.2 (3)	
30	Encoder Selection	• Incremental encoder • Absolute encoder • Absolute encoder (used as incremental encoder)	–	10.3.2 (2)	
36	Number of Pulses per Motor Rotation	1 to 2^{31}–1 Set the value after multiplication. (For a 16-bit encoder, set 2^{14} = 16384.)	pulse	10.3.2 (3)	
38	Maximum Number of Absolute Encoder Turns Rotation	0 to 2^{31}–1	1 = 1 rotation	10.3.2 (4)	

(2) SERVOPACK Parameters for Absolute Position Detection

SERVOPACK Model	Parameter	Name	Setting Range	Units	Reference	Caution
Σ-III Series (SGDS), Σ-V Series (SGDV), Σ-7 Series (SGD7S)	Pn000.0	Direction Selection	0: Sets counterclockwise (CCW) rotation as forward direction. 1: Sets clockwise (CW) rotation as forward direction (reverse rotation mode).	–	–	–
	Pn205	Multiturn Limit Setting	0 to 65535	Rev	10.3.2 (4)	
	Pn212	PG Dividing Pulse	16 to 1073741824	P/Rev	10.3.2 (3)	
	Pn002.2	Absolute Encoder Usage	0: Uses absolute encoder as an absolute encoder. 1: Uses absolute encoder as an incremental encoder.	–	10.3.2 (2)	
Σ-II Series (SGDM, SGDH)	Pn000.0	Direction Selection	0: Sets counterclockwise (CCW) rotation as forward direction. 1: Sets clockwise (CW) rotation as forward direction (reverse rotation mode).	–	–	–
	Pn201	PG Divider	16 to 16384	P/Rev	10.3.2 (3)	
	Pn205	Multiturn Limit Setting	0 to 65535	Rev	10.3.2 (4)	
	Pn002.2	Absolute Encoder Usage	0: Uses absolute encoder as an absolute encoder. 1: Uses absolute encoder as an incremental encoder.	–	10.3.2 (2)	
Σ-I Series (SGDA, SGDB)	Cn-0001, Bit E	Encoder Selection	0: Incremental encoder 1: Absolute encoder	–	10.3.2 (2)	
	Cn-0002, bit 0	Rotation Direction Selection	0: Sets counterclockwise (CCW) rotation as forward rotation. 1: Sets clockwise (CW) rotation as forward rotation (reverse rotation mode).	–	–	–

Absolute Position Detection

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10.3.2 Detailed Descriptions on Parameter Settings for Finite Length Axes

(1) Axis Selection (Machine Controller Fixed Parameter No.1, Bit 0)

This setting is used to select either an finite or infinite length axis.
Set to 0 when using the axis as a finite length axis.

(2) Encoder Selection and Absolute Encoder Usage

For an axis performing absolute position detection, set the parameters as shown in the following table.

Model	Parameter	Setting
SVA-01 Module	Fixed parameter 30 (Encoder Selection)	1: Absolute encoder
Σ-II, Σ-III, Σ-V, or Σ-7 Series	Parameter: Pn002.2 (Absolute Encoder Usage)	0: Uses absolute encoder as an absolute encoder.
Σ-I Series	Parameter: Cn-0001 Bit E (Encoder Selection)	1: Absolute encoder

- If the above settings are not used, correct motion control will not be performed. Set the parameters carefully.
- Be sure to set both the SVA-01 Module and SERVOPACK parameters.

(3) Encoder Resolution

The methods to set the fixed parameter No. 36 and No. 22 differs depending on the connected SERVOPACK model.

■ When a Σ-I Series SERVOPACK is Connected

Number of Bits	Fixed Parameter No. 36 Number of Pulses per Motor Rotation	Fixed Parameter No. 22 Pulse Counting Mode Selection
12	1024	6: Pulse A/B mode (Input pulse multiplier: 4)
15	8192	6: Pulse A/B mode (Input pulse multiplier: 4)

■ When a Σ-II Series SERVOPACK is Connected

Number of Bits	Fixed Parameter No. 36 Number of Pulses per Motor Rotation	Fixed Parameter No. 22 Pulse Counting Mode Selection
13	2048 *1	6: Pulse A/B mode (Input pulse multiplier: 4)
16	16384 *1	6: Pulse A/B mode (Input pulse multiplier: 4)
17	16384 *1, *2	6: Pulse A/B mode (Input pulse multiplier: 4)

* 1. The actual value depends on the value of Pn201 (PG Divider). The values shown here are the max. values that can be set for each encoder.
* 2. The set value when using a 17-bit encoder is limited to 16384 max. since the max. value that can be set for Pn201 (PG Divider) is 16384.

■ When a Σ-III or Σ-V Series SERVOPACK is Connected

Number of Bits	Fixed Parameter No. 36 Number of Pulses per Motor Rotation	Fixed Parameter No. 22 Pulse Counting Mode Selection
17	16384 *	6: Pulse A/B mode (Input pulse multiplier: 4)
20	262144 *	6: Pulse A/B mode (Input pulse multiplier: 4)

* The actual value depends on the value of Pn212 (PG Dividing Pulse). The values shown here are the max. values that can be set.

■ When a Σ-7 Series SERVOPACK is Connected

Number of Bits	Fixed Parameter No. 36 Number of Pulses per Motor Rotation	Fixed Parameter No. 22 Pulse Counting Mode Selection
20	262144 *	6: Pulse A/B mode (Input pulse multiplier: 4)
22	1048576 *	6: Pulse A/B mode (Input pulse multiplier: 4)
24	4194304 *	6: Pulse A/B mode (Input pulse multiplier: 4)

* The actual value depends on the value of Pn212 (PG Dividing Pulse). The values shown here are the max. values that can be set.

- If the above settings are not used, correct motion control will not be performed. Set the parameters carefully.

(4) Maximum Number of Absolute Encoder Turns Rotation/Multiturn Limit Setting

These parameters determine the maximum value of the number of encoder turns managed by the SERVOPACK and Machine Controller.
The setting is determined by the SERVOPACK that is used and the type of axis (Machine Controller fixed parameter 1, bit 0). Set the parameters as shown in the following table when using an axis as a finite length axis.

Applicable SERVOPACK	Machine Controller Fixed Parameter 38 (Maximum Number of Absolute Encoder Turns Rotation)	SERVOPACK Parameter Pn205 (Multiturn Limit Setting)
Σ-II, Σ-III, Σ-V, or Σ-7 Series	65535	65535
Σ-I Series	99999	–

- If the above settings are not used, correct motion control will not be performed resulting in position error. Set the parameters carefully.

Absolute Position Detection

10

10.3.3 Setting the Zero Point for a Finite Length Axis

This section describes the procedure for setting the zero point (i.e., the absolute zero point or the zero point of the machine coordinate system) for a finite length axis. It also describes the procedures for storing the zero point offset.

(1) Calculating the Zero Point of the Machine Coordinate System

The Machine Controller calculates the axis position (i.e., current position for the machine coordinate system) as follows when power is turned ON if an absolute encoder is used for positioning.

Calculated Position in Machine Coordinate System (monitoring parameter IL□□10*1 or IL□□16*1) =
Encoder position when servo power is turned ON*2 + Zero Point Position in Machine Coordinate System Offset (setting parameter OL□□48)

To make the current position of the machine coordinate system the zero position, set OL□□48 (encoder position when servo power turns ON) to a negative value. In other words, set OL□□48 to the difference between OL□□48 and IL□□10 (or IL□□16).

* 1. Use the IL□□10 to make the machine coordinate reference position as a standard, and IL□□16 to make the machine coordinate current position as a standard.
* 2. The encoder position when servo power is turned ON is as follows: Multiturn data × Number of encoder pulses + initial increment pulses. Refer to your SERVOPACK manual for information on the initial increment pulses.

Example: IL□□10 = 10,000 and OL□□48 = 100
Set the encoder position when servo power is turned ON to a negative value as shown below.

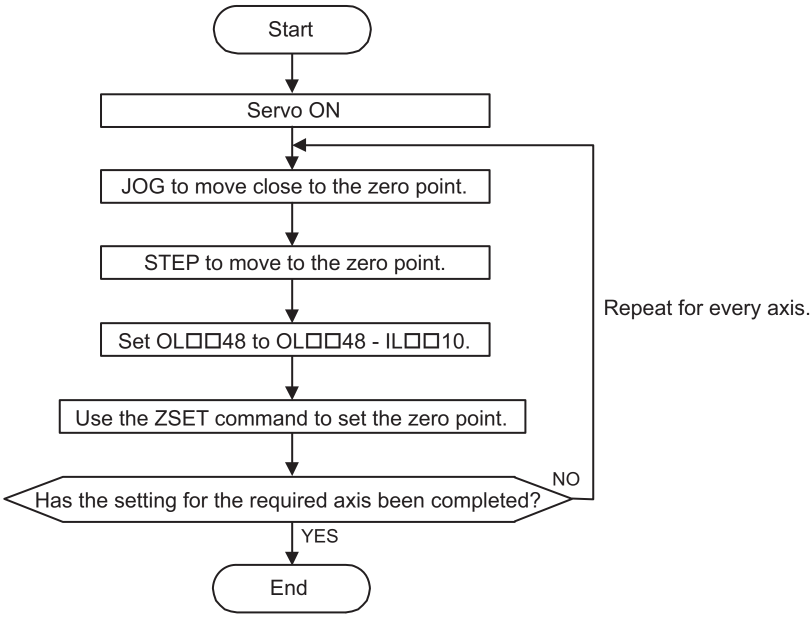
OL□□48 − IL□□10 = 100 − 10000
= − 9900

Set OL□□48 to -9900 to make the current position in the machine coordinate system the zero point.

(2) Setting the Zero Point of the Machine Coordinate System

⚠ CAUTION	• OL□□48 is always valid for a finite length axis. Do not change the Zero Point Position in Machine Coordinate System Offset (OL□□48) during the operation of a machine with a finite length axis. Otherwise the machine may be damaged or an accident may occur.

Set the zero point after initializing the absolute encoder to set the zero point of the machine coordinate system and to create the machine coordinate system. The following illustration shows the procedure for setting the zero point for a finite length axis.



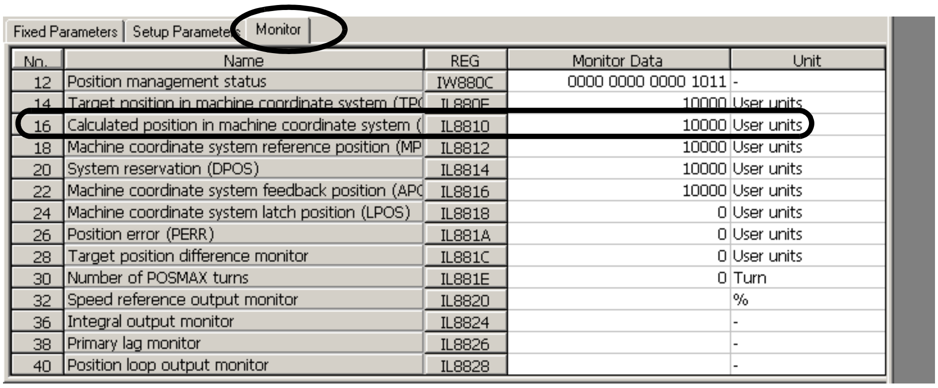
(3) Saving OL□□48 Values before Power OFF

After having set the zero point, save the value of OL□□48 before turning OFF the power of Machine Controller so that the value will be written in OL□□48 the next time the power is turned ON.
There are two ways to save the Zero Point Position in Machine Coordinate System Offset (OL□□48) value. It can be saved through a ladder program in an M Register backed up by battery or from the MPE720 Parameter Window. These ways are described below.

■ Method 1: Saving the Zero Point Position in Machine Coordinate System Offset (OL□□48) from the MPE720 Parameter Window

Open the Parameter Window for the specified axis on the MPE720 and use the following procedure to save the Zero Point Position in Machine Coordinate System Offset.

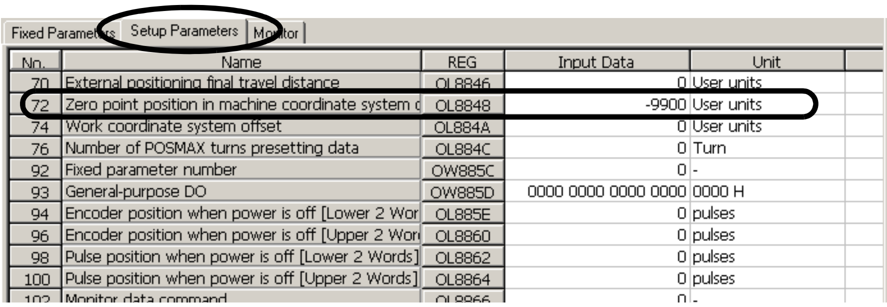
1. Check the value in IL□□10 in the Monitor Tab Page.



Fixed Parameters | Setup Parameters | Monitor

No.	Name	REG	Monitor Data	Unit
12	Position management status	IW880C	0000 0000 0000 1011	-
14	Target position in machine coordinate system (TP(	IL880E	10000	User units
16	Calculated position in machine coordinate system (	IL8810	10000	User units
18	Machine coordinate system reference position (MP	IL8812	10000	User units
20	System reservation (DPOS)	IL8814	10000	User units
22	Machine coordinate system feedback position (AP(	IL8816	10000	User units
24	Machine coordinate system latch position (LPOS)	IL8818	0	User units
26	Position error (PERR)	IL881A	0	User units
28	Target position difference monitor	IL881C	0	User units
30	Number of POSMAX turns	IL881E	0	Turn
32	Speed reference output monitor	IL8820		%
36	Integral output monitor	IL8824		-
38	Primary lag monitor	IL8826		-
40	Position loop output monitor	IL8828		-

2. Check the current value in OL□□48 in the Setup Parameters Tab Page. Subtract the Calculated Position (IL□□10) from the Zero Point Position in Machine Coordinate System Offset (OL□□48) and save the result in OL□□48.



Fixed Parameters | Setup Parameters | Monitor

No.	Name	REG	Input Data	Unit
70	External positioning final travel distance	OL8846	0	User units
72	Zero point position in machine coordinate system (	OL8848	-9900	User units
74	Work coordinate system offset	OL884A	0	User units
76	Number of POSMAX turns presetting data	OL884C	0	Turn
92	Fixed parameter number	OW885C	0	-
93	General-purpose DO	OW885D	0000 0000 0000 0000	0000 H
94	Encoder position when power is off [Lower 2 Wor	OL885E	0	pulses
96	Encoder position when power is off [Upper 2 Wor	OL8860	0	pulses
98	Pulse position when power is off [Lower 2 Words]	OL8862	0	pulses
100	Pulse position when power is off [Upper 2 Words]	OL8864	0	pulses
102	Monitor data command	OL8866	0	-

3. Check to see if the setting and current value in OL□□48 are the same. If they are the same, select ***File - Save*** and save the setting to the Machine Controller.

4. Return to Module Configuration Window and select ***Save - Save to Flash*** to save the setting in the flash memory.

5. Execute the setting with the ZSET command.

When the power is turned ON, the value that was saved will be stored automatically for Zero Point Position in Machine Coordinate System Offset (OL□□48).

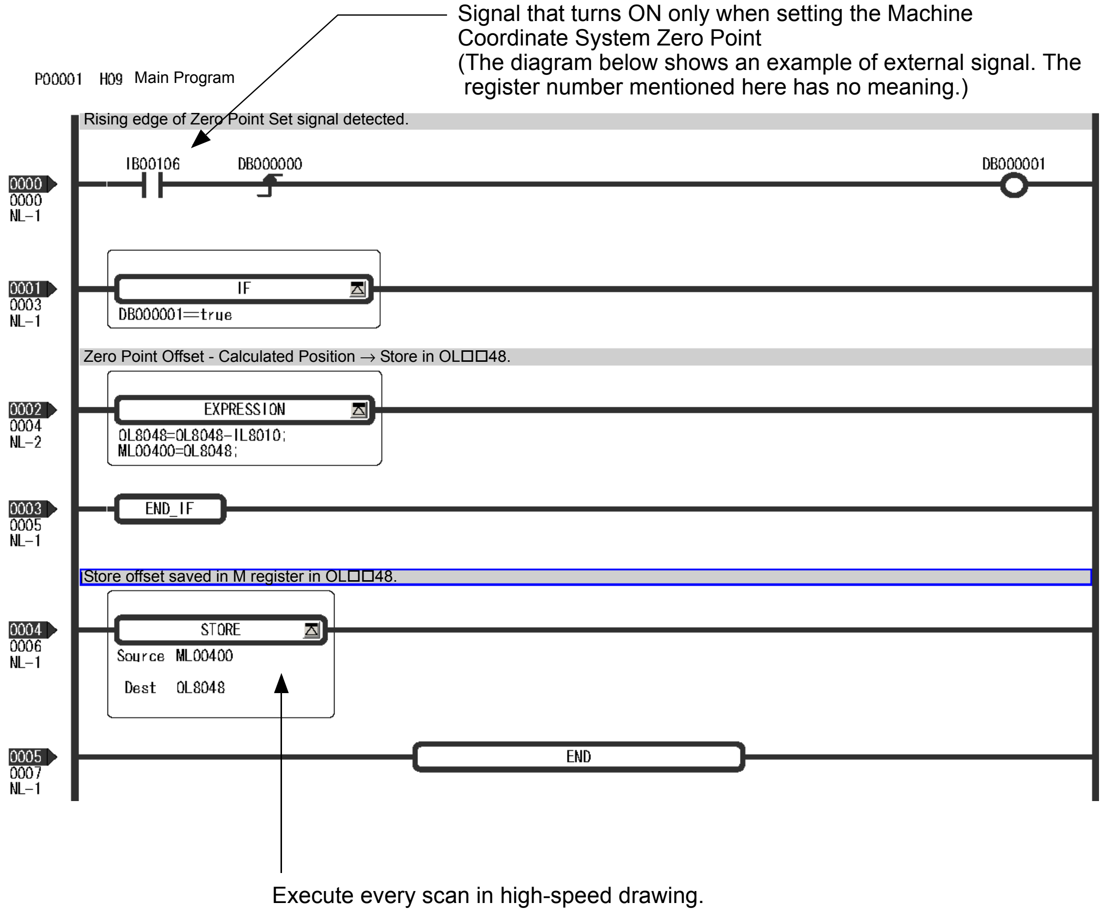
■ Method 2: Saving in an M Register with a Ladder Program

Saves the value of the zero point offset for the machine coordinate system when the zero point is set in an M register backed up by a battery. When the power to the Machine controller is turned ON, saves the value of the M register in the Zero Point Position in Machine Coordinate System Offset for the Machine Coordinate System.
Create a ladder program that automatically executes the following sequence.

Program Example

The following diagram shows an example of a ladder program used to store the offset value of axis 1 of line number 1. In a ladder program for an actual application, select a register with a different address for each axis.
The ladder program shown here is used to carry out the following processing.

- Subtracts the Calculated Position in Machine Coordinate System (IL□□10) from the Zero Point Position in Machine Coordinate System Offset (OL□□48) for the Machine Coordinate System and saves the result in OL□□48 after setting the zero point. This value is also saved in an M register at the same time.
- Saves the offset value saved in the M register and in OL□□48 after setting the zero point position.



10.3.4 Turning ON the Power after Setting the Zero Point of Machine Coordinate System

The Zero Point Return (Setting) Completed bit (IW☐☐0C, bit 5) will turn OFF when the power supply to the Machine Controller is turned OFF and ON or the communication is interrupted by turning OFF and ON the power supply to the SERVOPACK after the zero point has been set. The Zero Point Return (Setting) Completed bit must therefore be turned ON when the power supply is restored.
Use the following procedure.

1. Turn ON the power supply to the Machine Controller.

The offset saved in the M register is stored to OL☐☐48.

2. Check the Motion Controller Operation Ready (SVCRDY) bit.

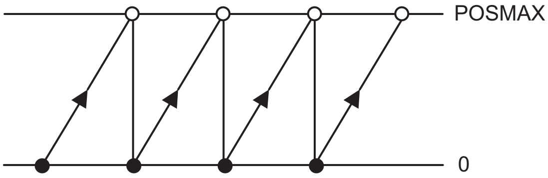
Check to see if the Motion Controller Operation Ready (SVCRDY) bit (IW☐☐00, bit 0) is ON.

3. Execute the Zero Point Setting (ZSET) motion command by setting OW☐☐08 to 9.

- Use this procedure only to turn ON the Zero Point Return (Setting) Completed bit (IW☐☐0C, bit 5). It cannot be used to set the zero point of the machine coordinate system (OL☐☐48).

10.4 Absolute Position Detection for Infinite Length Axes

Infinite length axis positioning is a function that automatically resets the machine position, program position (absolute values in the program coordinate system), and current position at regular intervals according to the Infinite Length Axis Reset Position (POSMAX) (fixed parameter 10). This function can be used for repeated positioning in one direction.



10.4.1 Simple Absolute Infinite Length Position Control

(1) Overview

The Simple Absolute Infinite Length Position Control is a position control method that can be used for infinite length axes and has the following features.

- The coordinate system can be created simply by setting the machine coordinate system zero point position offset when the power is turned ON (when the communication is restarted).
- No ladder program for position control is required.

For the system that satisfies the conditions to enable the Simple Absolute Infinite Length Position Control (described in the following section), select the Simple Absolute Infinite Length Position Control.

(2) Conditions to Enable the Simple Absolute Infinite Axis Position Control

Set the Maximum Number of Absolute Encoder Turns Rotation (fixed parameter 38) to a value that satisfies the following equation to enable the Simple Absolute Infinite Axis Position Control.

$$\frac{\text{(No.38: Maximum Number of Absolute Encoder Turns Rotation +1)}}{\text{Reset number of turns}} = \text{An integer (remainder = 0)}$$

The reset number of turns will differ depending on whether the command unit is set to pulse or millimeters/degrees/inches as shown below.

When the Reference Unit is Pulses	When the Reference Unit is mm, deg, or inch
$\dfrac{\text{No. 10: Infinite length axis rest position}}{\text{No.36: Number of pulses per motor rotation}}$	$\dfrac{\text{No. 10: Infinite length axis reset position} \times \text{No. 8: Servo motor gear ratio}}{\text{No. 6: Travel Distance per Machine Rotation} \times \text{No. 9 Machine gear ratio}}$

The settings above can be used to enable Simple Absolute Infinite Axis Position Control with a Σ-II, Σ-III, Σ-V, or Σ-7 SERVOPACK.

- Simple Absolute Infinite Length Position Control cannot be used by the Σ-I SERVOPACK.

■ System That Does Not Satisfy the Above Condition

The system that does not satisfy the above condition cannot use the Simple Absolute Infinite Length Position Control. Prepare the ladder program for position control. Refer to *10.4.6 Infinite Length Position Control without Simple Absolute Positions* on page 10-22 for details.

■ System That Satisfies the Above Condition

The following example shows the system that can use the Simple Absolute Infinite Length Position Control function.

Fixed Parameter No.	Name	Setting Value
4	Reference Unit Selection	2 (deg)
6	Travel Distance per Machine Rotation	360000
8	Servo Motor Gear Ratio	6
9	Machine Gear Ratio	5
10	Infinite Length Axis Reset Position (POSMAX)	360000
36	Number of Pulses per Motor Rotation	16384
38	Maximum Number of Absolute Encoder Turns Rotation	59705

Reset number of turns = $(360000 \times 6) / (360000 \times 5) = 6/5$
Criterion to use Simple Absolute Infinite Length Position Control: $(59705 + 1) / (6/5) = 49755$
The Simple Absolute Infinite Length Position Control can be used since the result of the above equation is an integer (remainder 0).

10.4.2 Parameters Setting for Simple Absolute Infinite Length Position Control

Set the following parameters to use the Simple Absolute Infinite Length Position Control for an infinite length axis.

⚠ CAUTION	
	• The parameters for which precautions are provided must be set referring to *10.4.3 Detailed Descriptions on Parameter Settings for Simple Absolute Infinite Length Axes* on page 10-18. Set these parameters carefully. If they are not set correctly, the current position may not be correct after the power is turned ON. Machine damage may occur.

(1) Parameter Settings for Simple Absolute Infinite Length Position Control

Set the fixed parameters No.1 bit 0 and bit 9, and No. 30 as follows to set the Simple Absolute Infinite Length Position Control for an infinite length axis.

Parameter	Fixed Parameter No. 1, Bit 0 (Axis Selection)	Fixed Parameter No. 1, Bit 9 (Simple ABS Rotary POS. Mode)	Fixed Parameter No. 30 (Encoder Selection)
Setting	1: Infinite length axis	1: Enabled	1: Absolute encoder

(2) Machine Controller Fixed Parameters for Absolute Position Detection

Fixed Parameter No.	Name	Setting/Range	Units	Reference	Caution
No. 4	Reference Unit Selection	0: pulse 1: mm 2: deg 3: inch (Electric gear is disabled when pulse is selected.)	–	–	–
No. 6	Travel Distance per Machine Rotation	1 to $2^{31}-1$	1 = 1 reference unit	–	–
No. 8	Servo Motor Gear Ratio	1 to 65535	1 = 1 rotation	–	–
No. 9	Machine Gear Ratio	1 to 65535	1 = 1 rotation	–	–
No. 10	Infinite Length Axis Reset Position (POSMAX)	1 to $2^{31}-1$	Reference unit	–	–
No. 36	Number of Pulses per Motor Rotation	1 to $2^{31}-1$ (Set the value before multiplication. For example, set $2^{(16-2)}$ = 16384 when using a 16-bit encoder)	pulse	10.4.3 (2)	
No. 38	Maximum Number of Absolute Encoder Turns Rotation	0 to $2^{31}-1$	1 = 1 rotation	10.4.3 (3)	

(3) SERVOPACK Parameters for Absolute Position Detection

SERVOPACK Model	Parameter	Name	Setting Range	Units	Reference	Caution
Σ-III Series (SGDS), Σ-V Series (SGDV), Σ-7 Series (SGD7S)	Pn000.0	Direction Selection	0: Sets counterclockwise (CCW) rotation as forward direction. 1: Sets clockwise (CW) rotation as forward direction (reverse rotation mode).	–	–	–
	Pn205	Multiturn Limit Setting	0 to 65535	Rev	10.4.3 (3)	
	Pn212	PG Dividing Pulse	16 to 1073741824	P/Rev	10.4.3 (3)	
	Pn002.2	Absolute Encoder Usage	0: Uses absolute encoder as an absolute encoder. 1: Uses absolute encoder as an incremental encoder.	–	10.4.3 (1)	
Σ-II Series (SGDM, SGDH)	Pn000.0	Direction Selection	0: Sets counterclockwise (CCW) rotation as forward direction. 1: Sets clockwise (CW) rotation as forward direction (reverse rotation mode).	–	–	–
	Pn205	Multiturn Limit Setting	0 to 65535	Rev	10.4.3 (3)	
	Pn201	PG Divider	16 to 16384	P/Rev	10.4.3 (2)	
	Pn002.2	Absolute Encoder Usage	0: Uses absolute encoder as an absolute encoder. 1: Uses absolute encoder as an incremental encoder.	–	10.4.3 (1)	
Σ-I Series (SGDA, SGDB)	Cn-0001, Bit E	Encoder Selection	0: Incremental encoder 1: Absolute encoder	–	10.4.3 (1)	
	Cn-0002, Bit 0	Rotation Direction Selection	0: Sets counterclockwise (CCW) rotation as forward rotation. 1: Sets clockwise (CW) rotation as forward rotation (reverse rotation mode).	–	–	–

10.4.3 Detailed Descriptions on Parameter Settings for Simple Absolute Infinite Length Axes

(1) Encoder Selection/Encoder Selection/ Absolute Encoder Usage

For an axis performing absolute position detection, set the parameters as shown in the table below.

Model	Parameter	Setting
SVA-01 Module	Fixed parameter 30: Encoder Selection	1: Absolute encoder
Σ-II, Σ-III, Σ-V, or Σ-7 Series	Parameter Pn002.2: Absolute Encoder Usage	0: Uses absolute encoder as an absolute encoder
Σ-I Series SERVOPACK	Parameter Cn-0001, Bit E: Encoder Selection	1: Absolute encoder

- If the above settings are not used, correct motion control will not be performed. Set the parameters carefully.
- Be sure to set both the SVA-01 Module and SERVOPACK parameters.

(2) Encoder Resolution

The methods to set the fixed parameter No. 36 and No. 22 differs depending on the connected SERVOPACK model.

■ When a Σ-I Series SERVOPACK is Connected

Number of Bits	Fixed Parameter No. 36 Number of Pulses per Motor Rotation	Fixed Parameter No. 22 Pulse Counting Mode Selection
12	1024	6: Pulse A/B mode (Input pulse multiplier: 4)
15	8192	6: Pulse A/B mode (Input pulse multiplier: 4)

■ When a Σ-II Series SERVOPACK is Connected

Number of Bits	Fixed Parameter No. 36 Number of Pulses per Motor Rotation	Fixed Parameter No. 22 Pulse Counting Mode Selection
13	2048 *1	6: Pulse A/B mode (Input pulse multiplier: 4)
16	16384 *1	6: Pulse A/B mode (Input pulse multiplier: 4)
17	16384 *1, *2	6: Pulse A/B mode (Input pulse multiplier: 4)

* 1. The actual value depends on the value of Pn201 (PG Divider). The values shown here are the max. values that can be set for each encoder.
* 2. The set value when using a 17-bit encoder is limited to 16384 max. since the max. value that can be set for Pn201 (PG Divider) is 16384.

■ When a Σ-III or Σ-V Series SERVOPACK is Connected

Number of Bits	Fixed Parameter No. 36 Number of Pulses per Motor Rotation	Fixed Parameter No. 22 Pulse Counting Mode Selection
17	16384 *	6: Pulse A/B mode (Input pulse multiplier: 4)
20	262144 *	6: Pulse A/B mode (Input pulse multiplier: 4)

* The actual value depends on the value of Pn212 (PG Dividing Pulse). The values shown here are the max. values that can be set.

■ When a Σ-7 Series SERVOPACK is Connected

Number of Bits	Fixed Parameter No. 36 Number of Pulses per Motor Rotation	Fixed Parameter No. 22 Pulse Counting Mode Selection
20	262144 *	6: Pulse A/B mode (Input pulse multiplier: 4)
22	1048576 *	6: Pulse A/B mode (Input pulse multiplier: 4)
24	4194304 *	6: Pulse A/B mode (Input pulse multiplier: 4)

* The actual value depends on the value of Pn212 (PG Dividing Pulse). The values shown here are the max. values that can be set.

- If the above settings are not used, correct motion control will not be performed. Set the parameters carefully.

(3) Maximum Number of Absolute Encoder Turns Rotation/Multiturn Limit Setting

These parameters determine the maximum value of the number of encoder turns managed by the SERVOPACK and Machine Controller.

For an infinite length axis, set the parameters as shown in the table below.

Applicable SERVOPACK	Fixed Parameter 38 (Maximum Number of Absolute Encoder Turns Rotation)	SERVOPACK Parameter Pn205 (Multiturn Limit Setting)
Σ-II, Σ-III, Σ-V, or Σ-7 Series	Set the same value as Pn205 *	65534 max. *
Σ-I Series	99999	–

* If the Machine Controller fixed parameter 38 is set to 65535 when using a Σ-II, Σ-III, Σ-V, or Σ-7 series SERVOPACK for an infinite axis, a fixed parameter setting error will occur.

- If the above settings are not used, correct motion control will not be performed resulting in position error. Set the parameters correctly.

10.4.4 Setting the Zero Point and Turning ON Power as Simple Absolute Positions

(1) Calculating the Zero Point of the Machine Coordinate System

If using the simple absolute infinite length position control, the Machine Controller calculates the axis position (i.e., current position for the machine coordinate system) as follows when the power is turned ON.

Calculated Position in Machine Coordinate System (monitoring parameter IL□□10*1 or IL□□16*1) = Encoder position when servo power is turned ON*2 + Zero Point Position in Machine Coordinate System Offset (setting parameter OL□□48)

To assign the current position of the machine coordinate system as the zero position, set the OL□□48 (encoder position when servo power turns ON) to a negative value. In other words, set OL□□48 to the difference between OL□□48 and IL□□10 (or IL□□16).

* 1. Use the IL□□10 to make the machine coordinate reference position as a standard, and IL□□16 to make the machine coordinate current position as a standard.
* 2. The encoder position when the servo power is turned ON is the value that is calculated with the following equation and converted to reference unit: Multiturn data × Number of encoder pulses + initial increment pulses. Refer to your SERVOPACK manual for information on the initial increment pulses.

Example: IL□□10 = 10,000 and OL□□48 = 100

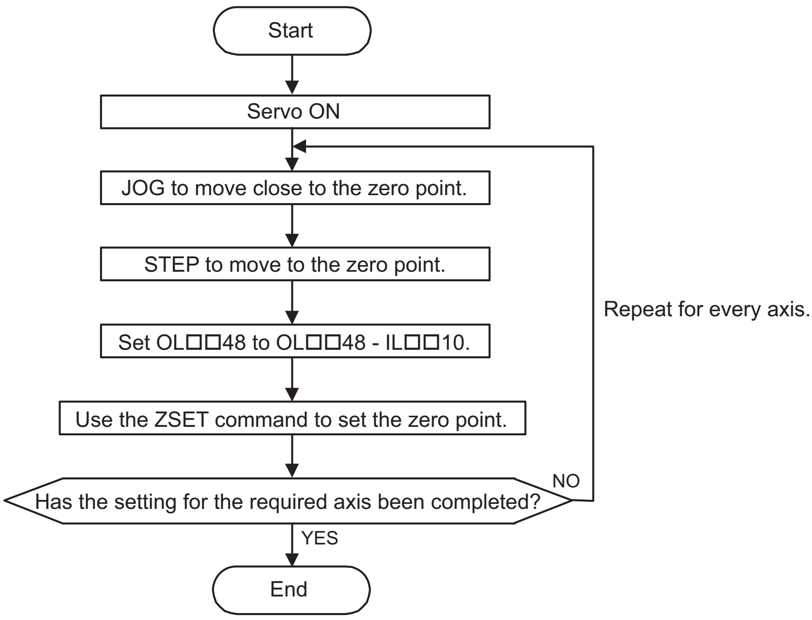
Set the encoder position when servo power is turned ON to a negative value as shown below.

OL□□48 − IL□□10 = 100 − 10000
= − 9900

Set OL□□48 to -9900 to assign the current position in the machine coordinate system as the zero point.

(2) Setting the Zero Point for Simple Absolute Infinite Axis Position Control

The procedure to set the zero point for a simple absolute infinite axis position control is shown below.



(3) Saving OL□□48 Values at Power OFF

After having set the zero point, save the value of OL□□48 before turning OFF the power of Machine Controller so that the value will be written in OL□□48 the next time the power is turned ON.
There are two ways to save the Zero Point Position in Machine Coordinate System Offset (OL□□48) value. It can be saved through a ladder program in an M register backed up by battery or from the MPE720 Parameter Window.
Refer to ■ *Method 1: Saving the Zero Point Position in Machine Coordinate System Offset (OL□□48) from the MPE720 Parameter Window* on page 10-11 and ■ *Method 2: Saving in an M Register with a Ladder Program* on page 10-12 for more details.

10.4.5 Turning ON the Power after Setting the Zero Point for Simple Absolute Infinite Length Axes

The Zero Point Return (Setting) Completed bit (IW□□0C, bit 5) will turn OFF when the power supply to the Machine Controller is turned OFF and ON, the communication are interrupted by the power OFF to the SERVOPACK, or communication are interrupted in any other reason after the zero point has been set. The Zero Point Return (Setting) Completed bit must therefore be turned back ON when the power supply is restored.
Use the following procedure.

1. Turn ON the power supply to the Machine Controller.

The offset saved in the M register is stored in OL□□48.

2. Check the Motion Controller Operation Ready (SVCRDY) bit.

Check to see if the Motion Controller Operation Ready (SVCRDY) bit (IW□□00 bit 0) is ON.

3. Execute the Zero Point Setting (ZSET) motion command by setting OW□□08 to 9.

- Use this procedure only to turn ON the Zero Point Return (Setting) Completed bit (IW□□0C, bit 5). It cannot be used to set the zero point of the machine coordinate system (OL□□48).

10.4.6 Infinite Length Position Control without Simple Absolute Positions

(1) Parameter Settings for Infinite Length Position Control without Simple Absolute Positions

Set the infinite length position control without simple absolute positions by setting the fixed parameters No. 1 bit 0 and bit 9, and No. 30 as shown in the table below when the simple absolute infinite length position control function cannot be used.

Parameter	Fixed Parameter No.1, Bit 0 (Axis Selection)	Fixed Parameter No. 1, Bit 9 (Simple ABS Rotary POS. Mode)	Fixed Parameter No. 30 (Encoder Selection)
Setting	1: Infinite length axis	0: Disabled	1: Absolute encoder

(2) Infinite Length Axis Position Control without Simple Absolute Positions

The SVA-01 Module performs the following infinite length position control when the Simple Absolute Infinite Length Position Control Function is not used.
The pulse position and encoder position are always stored as paired information in backup memory. This information is used the next time power is turned ON as the pulse position and the encoder position at shutdown to find the relative encoder position in pulses.

- Pulse position = Pulse position at power OFF + (Encoder position - Encoder position at power OFF)*
  * The portion in parentheses ( ) represents the moving amount while the power is OFF.

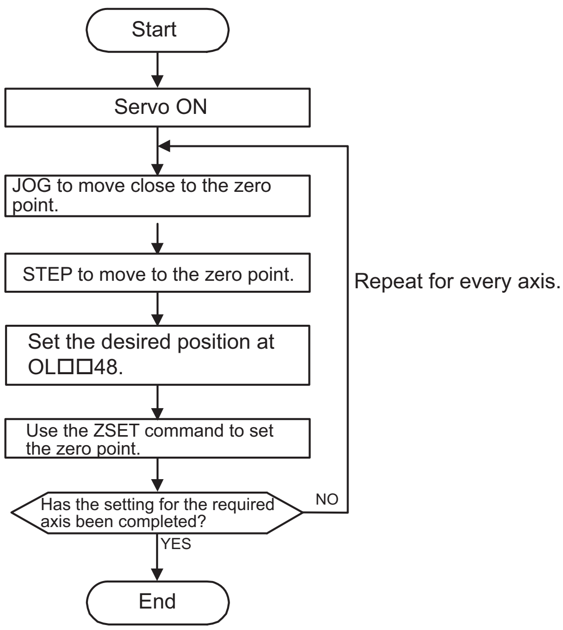
■ Terminology: Encoder position

Absolute encoder position information (Multiturn data × Number of encoder pulses + Initial increment pulses)

■ Terminology: Pulse Position

The position information from the Machine Controller converted to pulses

(3) Setting the Zero Point for an Infinite Length Axis without Simple Absolute Positions



Perform the procedure shown in the figure on the left to set the zero point for infinite length position control without simple absolute positions.
The OL□□48 value (zero point data) does not have to be stored in an M register with this method. Set a desired position in OL□□48 and execute the ZSET command to set the zero point. With this setting, the current position of the machine coordinate system will be set.
OL□□48 is valid only when executing a ZSET command.

Example:
To set the current position of the machine coordinate system to 0 when executing the ZSET command, set OL□□48 to 0.

(4) Ladder Program for Infinite Length Axis Position Control

If the Simple Absolute Infinite Length Position Control Function is not used, a special ladder program is needed for normal operation and for operation when system power is turned ON.

[a] Normal Operation

1. Check the status of the Zero Point Return (Setting) Completed bit.

Check to see if the Zero Point Return (Setting) Completed bit (monitoring parameter IW□□0C, bit 5) is ON. If it is, go to step 2.
If it is not, it means that the pulse position at power OFF, encoder position at power OFF and all position data was not settled. In that case, restart the system and set up the position data again or execute the ZSET (zero point setting) motion command to settle the position data all over from the start.

2. Save the pulse position at power OFF and encoder position at power OFF.

Use the ladder program to save the following monitoring parameters with high-speed scan timing at an M register backed up by battery.

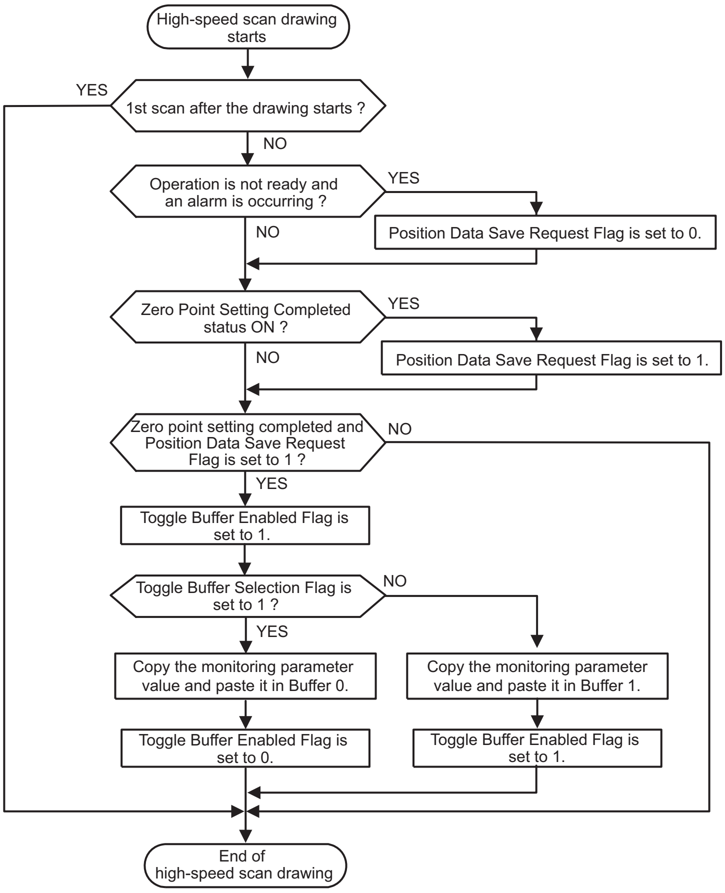
- Monitoring Parameter: Encoder Position when the Power is OFF (All four words at IL□□5E to IL□□60)
- Monitoring Parameter: Pulse Position when the Power is OFF (All four words at IL□□62 to IL□□64)

The M register that is used to save the above monitoring parameters is structured as shown below.

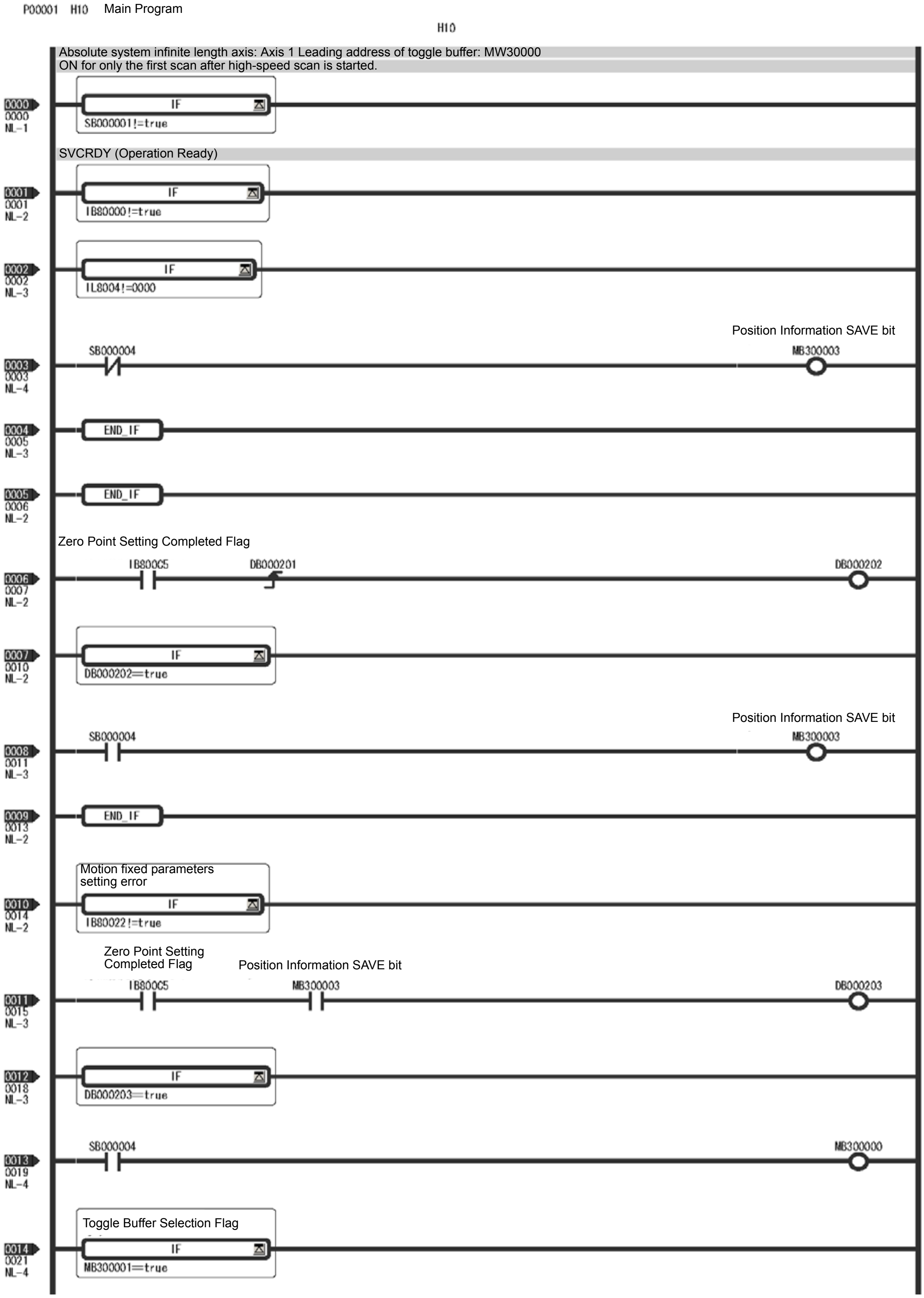
<table>
<tr><td rowspan="4">MW□□□□□</td><td>Bit 0</td><td colspan="2">Toggle Buffer Enabled Flag (0: Disabled, 1: Enabled)</td></tr>
<tr><td>Bit 1</td><td colspan="2">Toggle Buffer Selection Flag (0: Buffer 0, 1: Buffer 1)</td></tr>
<tr><td>Bit 2</td><td colspan="2">Position Data Re-setup Request Flag (0: Complete, 1: Request)</td></tr>
<tr><td>Bit 3</td><td colspan="2">Position Data Save Request Flag (0: Prohibited, 1: Request)</td></tr>
<tr><td>MW□□□□□ +1</td><td colspan="3">Not used</td></tr>
<tr><td rowspan="2">ML□□□□□ +2
ML□□□□□ +4</td><td rowspan="4">Buffer 0</td><td rowspan="2">Monitoring Parameter:
Encoder Position when the Power is OFF</td><td>Lower-place two words (IL□□5E)</td></tr>
<tr><td>Upper-place two words (IL□□60)</td></tr>
<tr><td rowspan="2">ML□□□□□ +6
ML□□□□□ +8</td><td rowspan="2">Monitoring Parameter:
Pulse Position when the Power is OFF</td><td>Lower-place two words (IL□□62)</td></tr>
<tr><td>Upper-place two words (IL□□64)</td></tr>
<tr><td rowspan="2">ML□□□□□ +10
ML□□□□□ +12</td><td rowspan="4">Buffer 1</td><td rowspan="2">Monitoring Parameter:
Encoder Position when the Power is OFF</td><td>Lower-place two words (IL□□5E)</td></tr>
<tr><td>Upper-place two words (IL□□60)</td></tr>
<tr><td rowspan="2">ML□□□□□ +14
ML□□□□□ +16</td><td rowspan="2">Monitoring Parameter:
Pulse Position when the Power is OFF</td><td>Lower-place two words (IL□□62)</td></tr>
<tr><td>Upper-place two words (IL□□64)</td></tr>
</table>

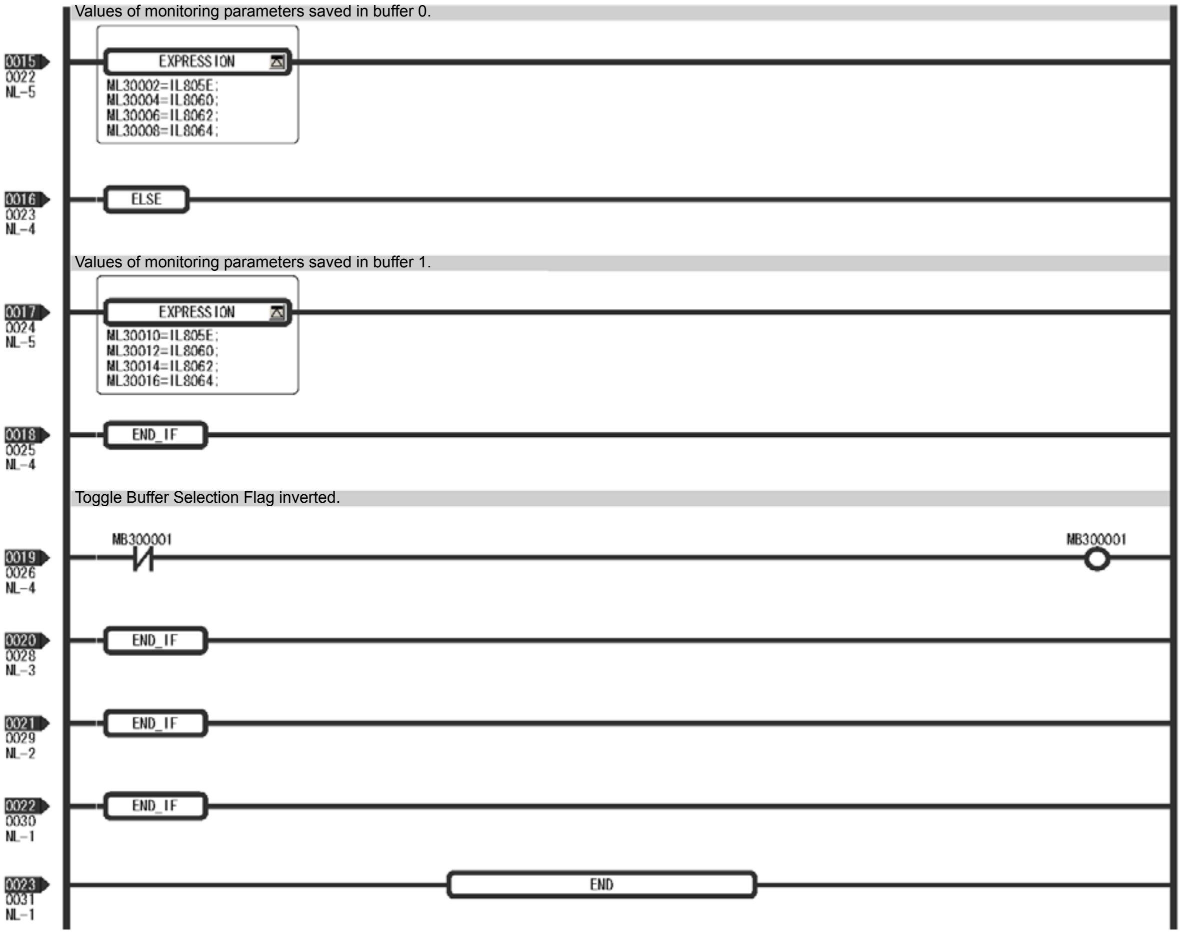
- Two buffers are needed to save the encoder position and the pulse position at power OFF because the program may be exited without settling position data at all four words if power is turned OFF during the high-speed scan.

Use the following flowchart to store values in buffers.



The following programming example (ladder program) is for the flowchart shown on the previous page. The axis used here is axis 1 of circuit number 1. Change the motion parameter register number if the circuit and axis numbers are different.





[b] Turning the System Back ON (Turning the Servo Back ON)

Set up position data again from the ladder program using high-speed scan timing as shown below. This is done when Machine Controller power or servo power is turned ON.

1. Store the pulse position at power OFF and encoder position at power OFF to setting parameters.

Store the pulse position at power OFF and encoder position at power OFF values saved in M register to the following setting parameters.

- Setting parameter: Encoder Position when the Power is OFF (All four words, form OL□□5E to OL□□60.)
- Setting parameter: Pulse Position when the Power is OFF (All four words, from OL□□62 to OL□□64.)

Store the contents of the buffer selected by the Toggle Buffer Selection Flag.

2. Request ABS Rotary Pos. Load bit

Reset the Request ABS Rotary Pos Load bit (setting parameter OW□□00, bit 7) to 0, 1 and 0 again. This will allow all position data to be settled. The following monitoring parameters will then be enabled and the Zero Point Return (Setting) Completed bit (monitoring parameter IW□□0C, bit 5) will turn ON.

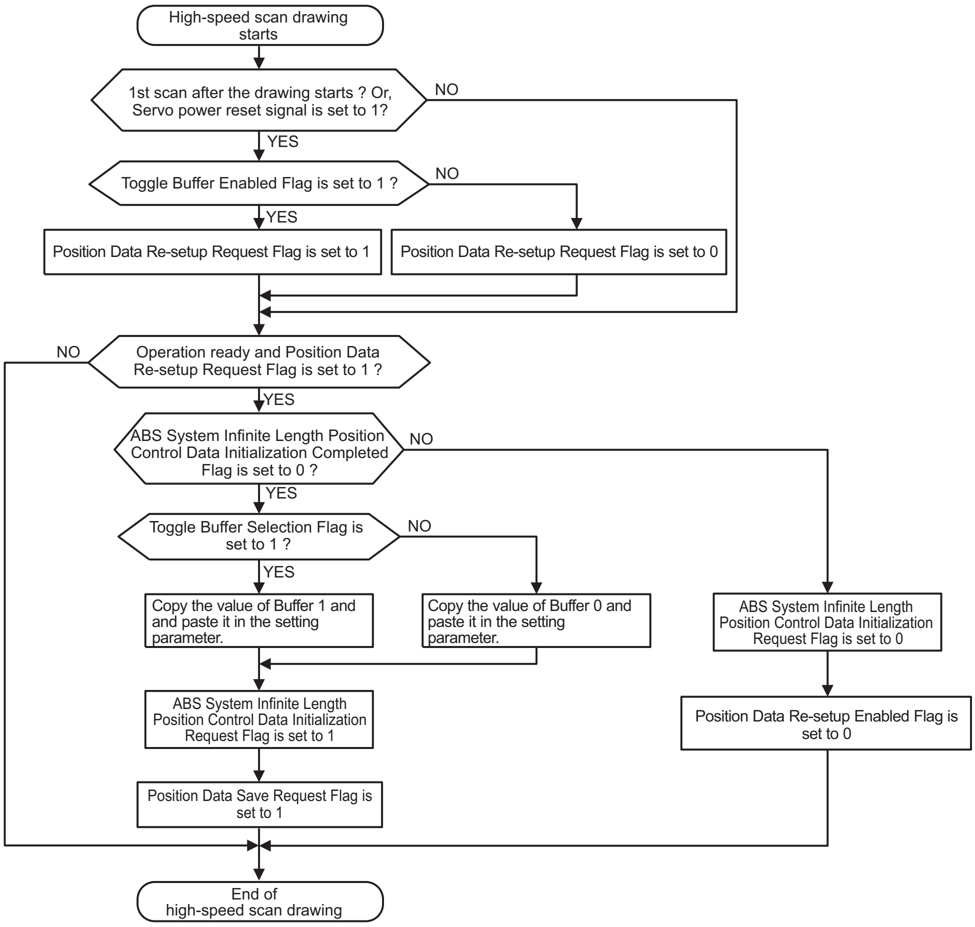
- Monitoring Parameter: Encoder Position when the Power is OFF (All four words, from IL□□5E to IL□□60.)
- Monitoring Parameter: Pulse Position when the Power is OFF (All four words, from IL□□62 to IL□□64.)

The system will create position data using the following equation when Request ABS Rotary Pos. Load bit is set to 1.

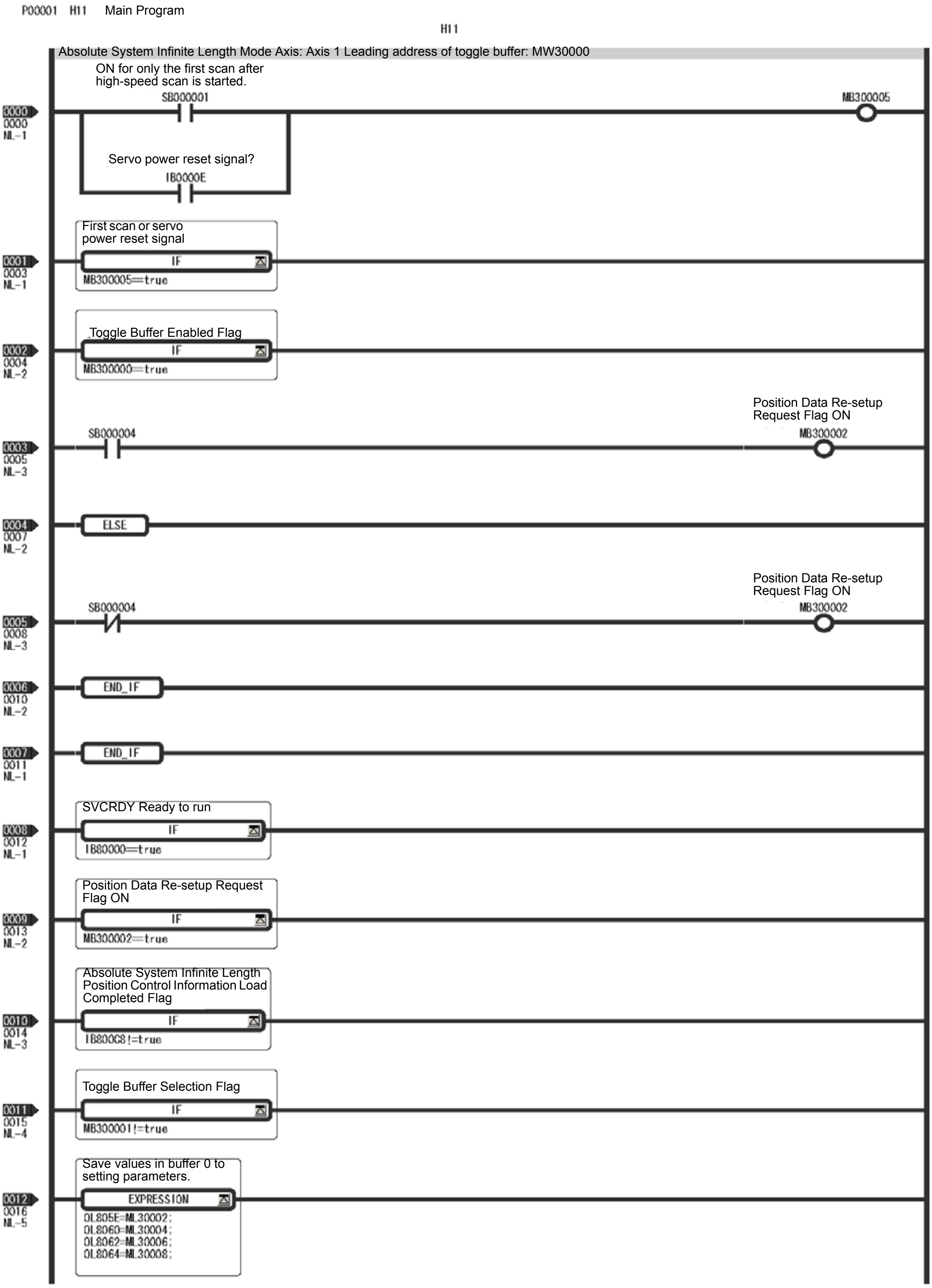
- Pulse position = pulse position at power OFF + (encoder position – encoder position at power OFF)*

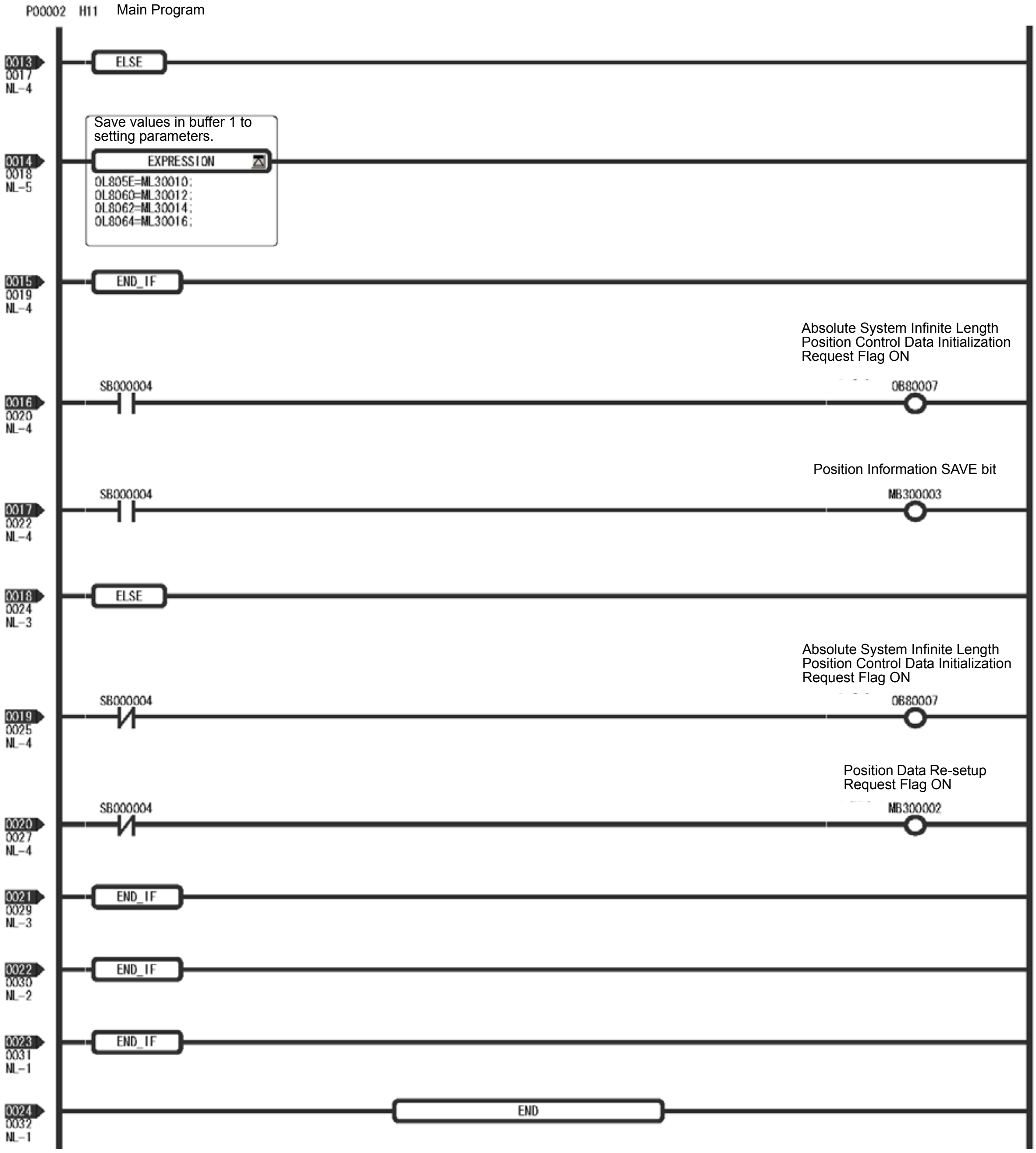
* The portion in parentheses ( ) represents the moving amount while power is OFF.

Use the following flowchart for storing the position data in the setting parameters and for Request ABS Rotary Pos. Load requests.



The following programming example (ladder program) is for the flowchart shown above. The axis used here is axis 1 of circuit number 1. Change the motion parameter register number if the circuit and axis numbers are different.





- There are no restrictions in the executing order for ladder programs H10 and H11 when an absolute encoder is used for an infinite length axis.

11

Utility Functions

This chapter describes MP2000-series Machine Controller and SERVOPACK utility functions such as vertical axis control, overtravel, and software limits, and the utility functions the SVA-01 Module is provided with.

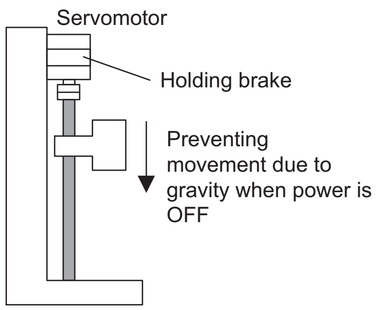
11.1 Controlling Vertical Axes

This section explains connection methods and parameter settings required to use the SERVOPACK to control a vertical axis.

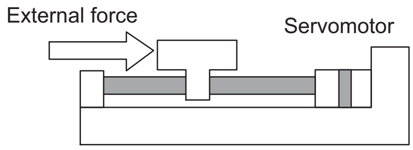
11.1.1 Holding Brake Function of the SERVOPACK

When using a SERVOPACK to control a vertical axis or an axis to which an external force is being applied, a Servomotor with a brake must be used to prevent the axis from dropping or moving due to gravity or the external force when the system power is turned OFF.

• Vertical Axis



• Axis Subject to External Force



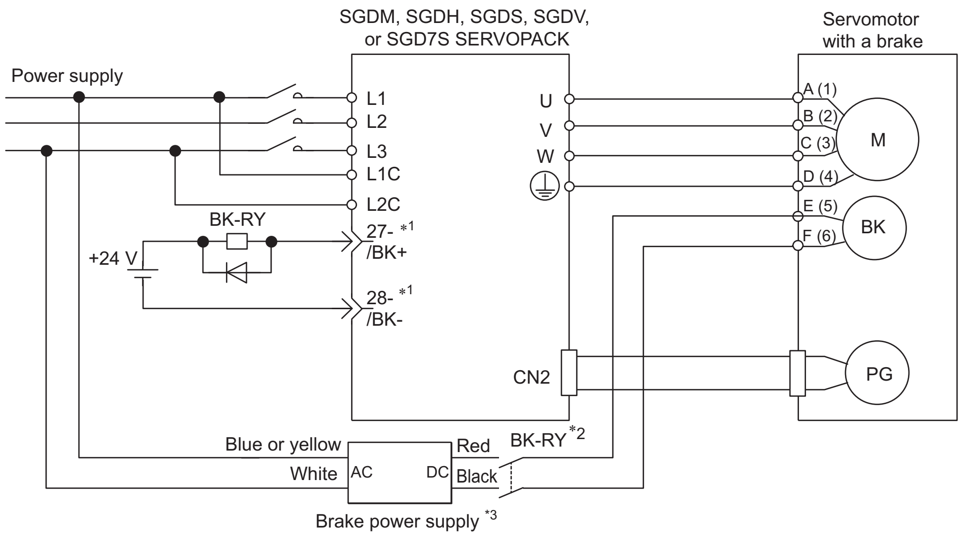
The holding brake of the Servomotor is controlled through the brake interlock output (/BK) signal from the SERVOPACK. The brake is not controlled from the Machine Controller.

- The brake built into a Servomotor with a brake uses non-excitation operation and is for use as a holding brake only. It cannot be used to control or stop axis movement. Use the holding brake only to hold the axis in a stopped state after the motor has stopped. The torque of the brake is 100% or higher of the rated torque of the motor.

11.1.2 Connections to Σ-II, Σ-III, Σ-V, or Σ-7 Series SGDM, SGDH, SGDS, SGDV, and SGD7S SERVOPACKs

(1) Example of a Brake ON and OFF Circuit

A circuit is configured to turn the brake ON and OFF using the /BK contact output signal from the SERVOPACK and a brake power supply. The following diagram shows the standard connections. Refer to the manual for your SERVOPACK for details.



* 1. The output terminals are allocated using parameter Pn50F.2. A setting of 1 (terminal numbers 1 and 2) is selected in the example above.
* 2. Brake control relay contact
* 3. There are 200-V and 100-V brake power supplies.

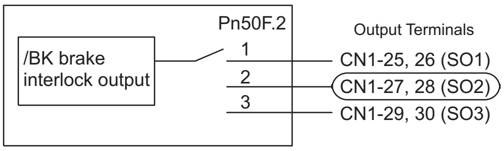
(2) Parameter Settings

The SERVOPACK parameters related to control the holding brake are described below.

Parameter	Name	Unit	Setting/Range	Default	Control Mode
Pn50F.2	Output Signal Selection 2	–	0: Brake not used 1: Terminal numbers 1 and 2 2: Terminal numbers 23 and 24 3: Terminal numbers 25 and 26	1	Speed, torque, position control

Details

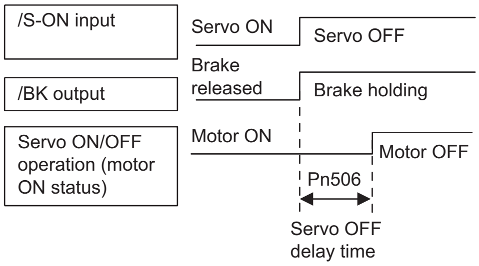
The following parameter determines which CN1 pin (0 to 3 above) will be used to output the /BK signal.



Parameter	Name	Unit	Setting/Range	Default	Control Mode
Pn506	Brake ON Timing after Motor Stops	10 ms	0 to 50	0	Speed, torque, position control

Details

This parameter adjusts the delay time from /BK Signal Output until Servo OFF (stopping Servomotor output), and it is used to be set when the machine moves slightly due to gravity or other factors after turning the brake ON.

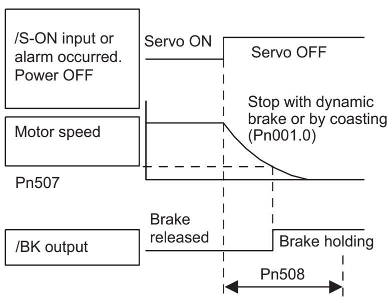


- This parameter is used to set the timing when the motor is stopped. Brake operation while the motor is running is set in Pn507 and Pn508.
- For the standard settings, the Servo will turn OFF simultaneously with the /BK output (Brake Operation). If gravity causes the machine to move slightly at this time due to machine configuration or brake characteristics, turning OFF the Servo can be delayed to reduce the movement.

Parameter	Name	Unit	Setting/Range	Default	Control Mode
Pn507	Brake ON Timing when Motor Running	min^{-1}	0 to 10000	100	Speed, torque, position control
Pn508		10 ms	0 to 100	50	Speed, torque, position control

Details

Pn507: Speed Level for BK Signal Output when Motor Running
Pn508: Timing of BK Signal Output when Motor Running
These settings are used to set the timing for applying the brake when the Servo turns OFF due to an /S-ON input signal or alarm.

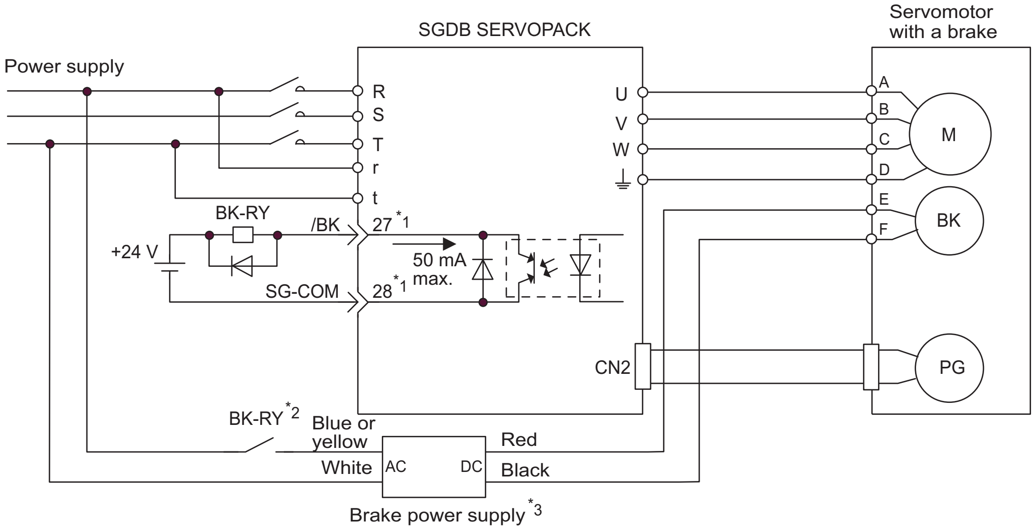


- The brake on the Servomotor is designed as a holding brake and it must be applied only after the motor has stopped. Adjust this parameter while observing machine operation.

11.1.3 Connections to Σ-I Series SGDB SERVOPACK

(1) Example of a Brake ON and OFF Circuit

A circuit is configured to turn the brake ON and OFF using the /BK contact output signal from the SERVOPACK and a brake power supply. The following diagram shows the standard connections.



* 1. The terminal is allocated using parameter Cn-2D. In the example above, /BK signal 4 is set in the 2nd digit.
* 2. Brake control relay contact
* 3. There are 200-V and 100-V brake power supplies.

(2) Parameter Settings

The SERVOPACK parameters related to control the holding brake are described below.

Parameter	Name	Unit	Setting/Range	Default	Control Mode
Cn-2D	OUTSEL Output Signal Selection	–	110 to 666	210	Speed, torque, position control

Details

The following parameter determines which pin of the 1CN will be used to output the /BK signal (4 in the lower right column). In the figure above, 4 is allocated to the 2nd digit and the setting is □4□. So, the /BK signal is output to pins 27 and 28.

Allocation

1st digit: CN1-25, 26 (Factory setting: 0)
2nd digit: CN1-27, 28 (Factory setting: 1)
3rd digit: CN1-29, 30 (Factory setting: 2)

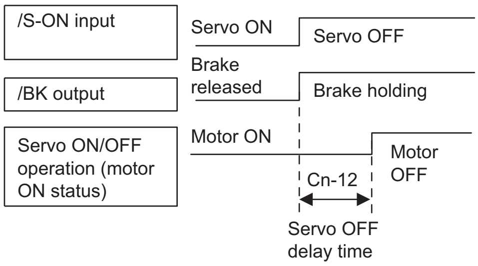
Set Value and Function

0: /COIN/ /V-CMP (Valid only at the 1st digit.)
1: /TGON
2: /S-RDY
3: /CLT
4: /BK
5: OL warning
6: OL alarm

Parameter	Name	Unit	Setting/Range	Default	Control Mode
Cn-12	Brake ON Timing after Motor Stops	10 ms	0 to 50	0	Speed, torque, position control

Details

This parameter adjusts the Delay Time from /BK Signal Output until Servo OFF (stopping Servomotor output), and it is used to be set when the machine moves slightly due to gravity or other factors after turning the brake ON.



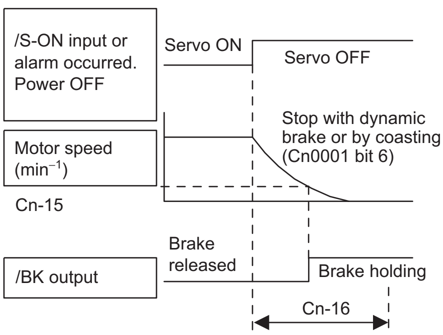
- This parameter is used to set the timing when the motor is stopped. Brake operation while the motor is running is set in Cn-15 and Cn-16.
- For the standard settings, the Servo will turn OFF simultaneously with the /BK output (Brake Operation). If gravity causes the machine to move slightly at this time due to machine configuration or brake characteristics, turning OFF the Servo can be delayed to reduce the movement.

Parameter	Name	Unit	Setting/Range	Default	Control Mode
Cn-15	Brake ON Timing when Motor Running	min^{-1}	0 to max. speed	100	Speed, torque, position control
Cn-16		10 ms	0 to 100	50	Speed, torque, position control

Details

Cn-15: Speed Level for BK Signal Output when Motor Running
Cn-16: Timing of BK Signal Output when Motor Running

These settings are used to set the timing for applying the brake when the Servo turns OFF due to an /S-ON input signal or alarm.

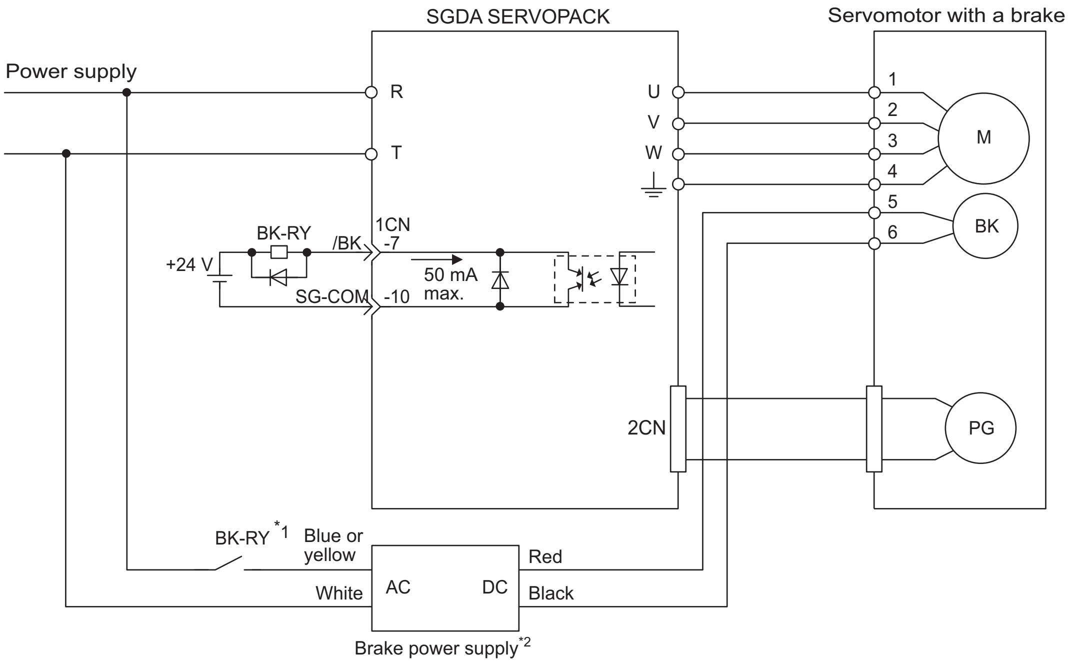


- The brake on the Servomotor is designed as a holding brake and it must be applied only after the motor has stopped. Adjust this parameter while observing machine operation.

11.1.4 Connections to Σ-I Series SGDA SERVOPACK

(1) Brake ON and OFF Circuit Example

A circuit is configured to turn the brake ON and OFF using the /BK contact output signal from the SERVOPACK and a brake power supply. The standard connections are shown in the following diagram.



* 1. Brake control relay contact
* 2. There are 200-V and 100-V brake power supplies.

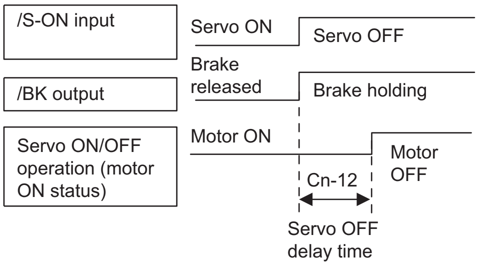
(2) Parameter Settings

The SERVOPACK parameters related to controlling the brake are described below.

Parameter	Name	Unit	Setting/Range	Default	Control Mode
Cn-12	Brake ON Timing after Motor Stops	10 ms	0 to 50	0	Speed, torque, position control

Details

This parameter adjusts the Delay Time from /BK Signal Output until Servo OFF (stopping Servomotor output), and it is used to be set when the machine moves slightly due to gravity or other factors after turning the brake ON.



- This parameter is used to set the timing when the motor is stopped. Brake operation while the motor is running is set in Cn-15 and Cn-16.
- For the standard settings, the Servo will turn OFF simultaneously with the /BK output (Brake Operation). If gravity causes the machine to move slightly at this time due to machine configuration or brake characteristics, turning OFF the Servo can be delayed to reduce the movement.

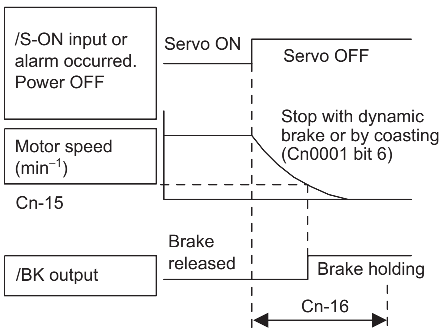
Parameter	Name	Unit	Setting/Range	Default	Control Mode
Cn-15	Brake ON Timing when Motor Running	min^{-1}	0 to max. speed	100	Speed, torque, position control
Cn-16		10 ms	10 to 100	50	Speed, torque, position control

Details

Cn-15: Speed Level for BK Signal Output when Motor Running

Cn-16: Timing of BK Signal Output when Motor Running

These settings are used to set the timing for applying the brake when the Servo turns OFF due to an /S-ON input signal or alarm.



- The brake on the Servomotor is designed as a holding brake and it must be applied only after the motor has stopped. Adjust this parameter while observing machine operation.

11.2 Overtravel Function

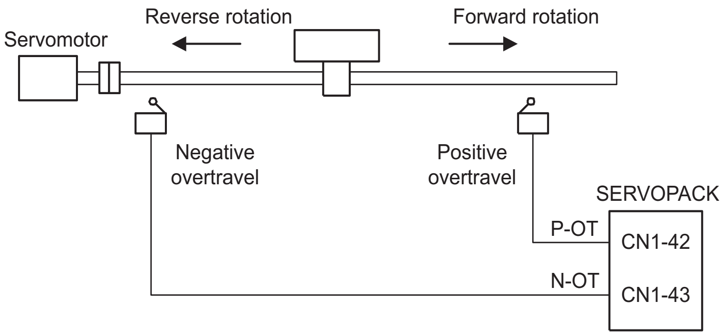
The overtravel function forces the machine to stop when the moving part of the machine exceeds the range of movement. With the MP2000-series Machine Controller, processing for stopping as a result of overtravel is achieved by using SERVOPACK functions.
The SERVOPACK connections and parameter setting depend on the model of SERVOPACK. The connections and parameter settings are described in the following sections.

11.2.1 Connections to Σ-II, Σ-III, Σ-V, or Σ-7 Series SGDH, SGDS, SGDV, and SGD7S SERVOPACKs

The following parameters must be set to ensure the overtravel input signals are connected correctly for the overtravel function.

(1) Overtravel Input Signal Connections

Correctly connect the input signals for the overtravel limit switches shown below to the corresponding pins on the SERVOPACK CN1 or 1CN connector.



P-OT	When ON CN1-42 is low.	Forward drive enabled. Normal operating condition
	When OFF CN1-42 is high.	Forward drive disabled. (Reverse movement possible.)
N-OT	When ON CN1-43 is low.	Reverse drive enabled. Normal operating condition
	When OFF CN1-43 is high.	Reverse drive disabled. (Forward movement possible.)

(2) Parameter Settings

[a] Use/Not Use Overtravel Input Signals

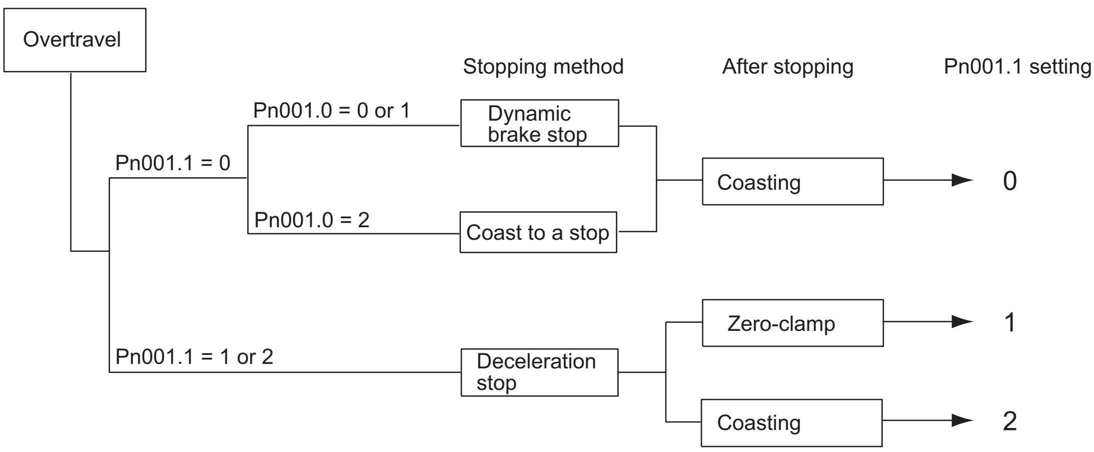
The following parameters are used to enable and disable the overtravel input signals.

Parameter	Name	Set Value	Item	Default
Pn50A.3	P-OT Signal Mapping	2 (Recom-mended)	Enables use of Positive Prohibit Input Signal (P-OT). (Forward rotation prohibited when open, allowed for 0 V.)	2
		8	Disables the P-OT signal.	
Pn50B.0	N-OT Signal Mapping	3 (Recom-mended)	Enables use of Negative Prohibit Input Signal (N-OT). (Reverse rotation prohibited when open, allowed for 0 V.)	3
		8	Disables the N-OT signal.	

[b] Selecting Motor Stopping Methods for Overtravel

When using the overtravel function has been enabled, the following parameters are used to set the methods for stopping the motor. Select the methods for stopping when the P-OT or N-OT is input during motor running.

Parameter	Name	Set Value	Item	Default
Pn001.1	Overtravel Stop Mode	0 (Recom-mended)	Stops the motor according to Pn001.0 setting (dynamic brake or coasting) when overtravel is detected.	0
		1	Decelerates the motor to a stop by applying the torque specified in Pn406 (Emergency Stop Torque) when overtravel is detected, and then sets it to zero clamp (servolock) mode.	
		2	Decelerates the motor to a stop by applying the torque specified in Pn406 (Emergency Stop Torque) when overtravel is detected, and then sets it to coast (servo OFF) mode.	
Pn001.0	Servo OFF Stop Mode	0 (Recom-mended)	Stops the motor by applying dynamic brake (DB) and then holds the DB.	0
		1	Stops the motor by applying dynamic brake (DB) and then releases the DB.	
		2	Makes the motor coast to a stop. Current is not supplied to the motor and the machine stops due to friction.	



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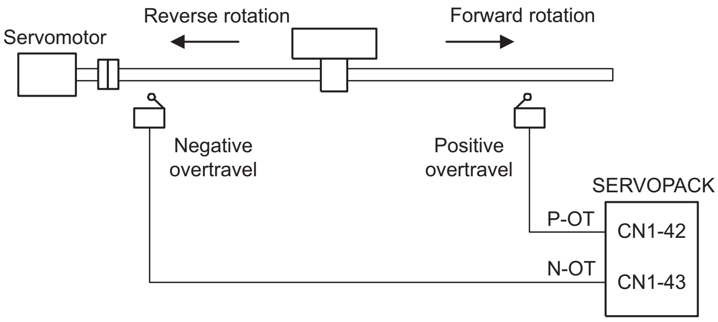
11.2.2 Connections to Σ-I Series SGDB or SGDA SERVOPACK

The following parameters must be set to ensure the overtravel input signals are connected correctly for the overtravel function.

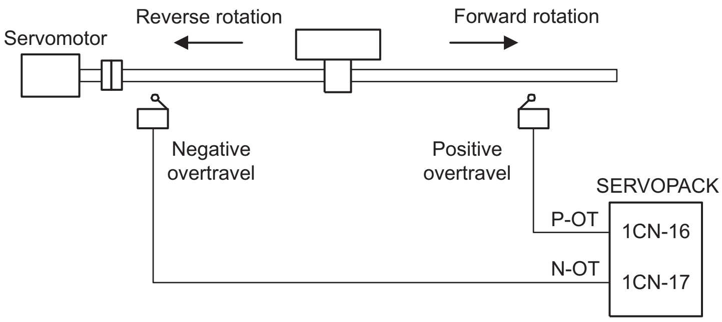
(1) Overtravel Input Signal Connections

Connect the input signals for the overtravel limit switches to the corresponding pins on the SERVOPACK CN1 or 1CN connector as shown below.

■ Connections to SGDB SERVOPACK



■ Connections to SGDA SERVOPACK



P-OT	When ON CN1-42 (1CN-16) is low.	Forward drive enabled. Normal operating condition
	When OFF CN1-42 (1CN-16) is high.	Forward drive disabled. (Reverse movement possible.)
N-OT	When ON CN1-43 (1CN-17) is low.	Reverse drive enabled. Normal operating condition
	When OFF CN1-43 (1CN-17) is high.	Reverse drive disabled. (Forward movement possible.)

(2) Parameter Settings

[a] Use/Not Use Overtravel Input Signals

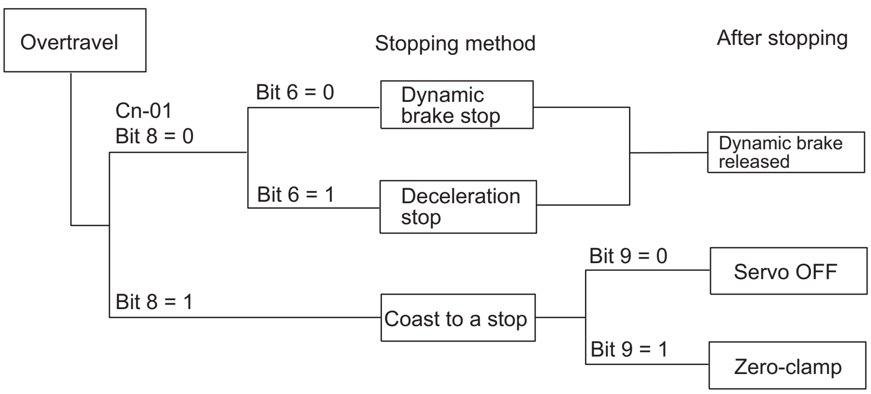
The following parameters are used to enable and disable the overtravel input signals.

Parameter	Name	Set Value	Item	Default
Cn-01 Bit 2	Use/Not Use P-OT Input Signal	0 (Recommended)	Enables use of Positive Prohibit Input Signal (P-OT). (Forward rotation prohibited when open, allowed for 0 V.)	0
		1	Disables use of Positive Prohibit Input Signal (P-OT). (Forward rotation always allowed.)	
Cn-01 Bit 3	Use/Not Use N-OT Input Signal	0 (Recommended)	Enables use of Negative Prohibit Input Signal (N-OT). (Reverse rotation prohibited when open, allowed for 0 V.)	0
		1	Disables use of Negative Prohibit Input Signal (N-OT). (Reverse rotation always allowed.)	

[b] Selecting Motor Stopping Methods for Overtravel

When using the overtravel function has been enabled, the following parameters are used to set the methods for stopping the motor. Select the methods for stopping when the P-OT or N-OT is input during motor running.

Parameter	Name	Set Value	Item	Default
Cn-01 Bit 8	Selection of stopping method for overtravel	0 (Recommended)	Uses the same stopping method as for Servo OFF. Stops the motor according to Cn-01 bit 6 setting (dynamic brake or coasting) when overtravel is detected.	0
		1	Decelerates the motor to a stop by applying the torque specified in Cn-06 (EMGTRQ Emergency Stop Torque) when overtravel is detected.	
Cn-01 Bit 9	Selection of processing after stopping for overtravel	0 (Recommended)	Decelerates the motor to a stop and then turns OFF the Servo.	0
		1	Decelerates the motor to a stop and then sets it in the zero-clamp mode.	
Cn-01 Bit 6	Selection of stopping method for motor when servo turns OFF	0	Stops the motor by applying dynamic brake (DB).	0
		1	Makes the motor coast to a stop. Current is not supplied to the motor and the machine stops due to friction.	
Cn-01 Bit 7	Selection of processing after stopping for overtravel	0	Stops the motor by applying dynamic brake (DB) and then releases the DB.	0
		1	Stops the motor by applying dynamic brake (DB) and then holds the DB.	



Utility Functions

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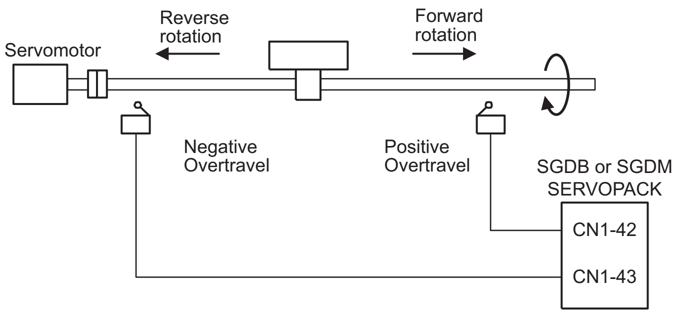
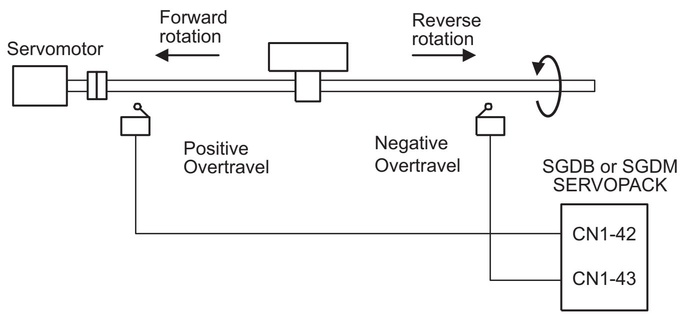
11.2.3 Rotation Direction Selection

The SVA-01 Module provides a rotation direction selection that can be used to reverse the direction of rotation of the servomotor without changing the motor wiring at the SGDA, SGDB, SGDH, SGDM, SGDS, SGDV, or SGD7S SERVOPACK.
The rotation direction selection only reverses the direction of rotation of the servomotor. The direction (–, +) of axis travel will change. Nothing else will change.

<Operation in Standard Mode>



<Operation in Reverse Rotation Mode>



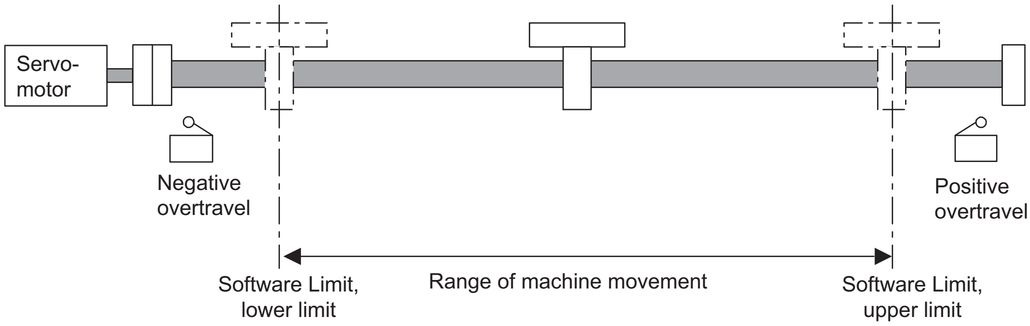
■ Settings for Reverse Rotation Mode

Set the SERVOPACK parameter and the SVA-01 Module fixed parameter as shown below to use the servomotor in Reverse Rotation Mode.

Item		Parameter No.	Description	Set Value	Factory Setting
Parameter	For SGDA and SGDB	Cn-02, bit 0	Direction Selection	1: Reverse rotation mode	0: Standard mode
	For SGDH, SGDM, SGDS, SGDV, and SGD7S	Pn000.0			
SVA-01 Module Fixed Parameter		No. 31	Rotation Direction Selection with an Absolute Encoder	1: Reverse	0: Forward

11.3 Software Limit Function

The software limit function is used to set upper and lower limits for the range of machine movement in fixed parameters so the SVA-01 Module can constantly monitor the operating range of the machine. When the software limit function is enabled, the SVA-01 Module will generate an alarm to stop the axis if it receives a position reference value that exceeds the software upper and lower limits. Thus, the machine runaway or damage due to incorrect operation as well as incorrect references in a motion program can be avoided.



11.3.1 Parameter Settings

The following parameters must be set in order to use the software limit function.

Parameter Number	Name	Unit	Setting/Range
Fixed Parameter No. 1	Function Selection Flag 1 Bit 1: Soft Limit (Positive Direction) Enable/Disable Bit 2: Soft Limit (Negative Direction) Enable/Disable	–	0: Disable, 1: Enable 0: Disable, 1: Enable
Fixed Parameter No. 12	Positive Software Limit Value	Reference unit	–2147483648 to 2147483647
Fixed Parameter No. 14	Negative Software Limit Value	Reference unit	–2147483648 to 2147483647
Setting Parameter OL□□6E	System Reservation (Stop Distance)	–	-2^{31} to $+2^{31}-1$

- The software limit function is enabled only after completing a Zero Point Return or Zero Point Setting operation. If any fixed parameters are changed and saved or the power is turned ON, the Zero Point Return or Zero Point Setting operation must be performed again.

11.3.2 Software Limit Detection Function

The software limit alarm will occur if the following conditions and Equation 1 are satisfied. The excess by which the amount of movement exceeds the software limit value will be cleared if Equation 2 is satisfied.

<Conditions>

- The Soft Limit bits (fixed parameter No.1, bit 1 and 2) are set to 1 (enabled).
- The Zero Point Return (Setting) Completed bit (IL□□0C, bit 5) is ON.
- The servo is ON.
- A motion command other than Zero Point Return (ZRET) command is being executed.

<Equation 1>

Forward Software Limit:
MPOS (IL□□12) + OL□□6E (Stop Distance) ≥ Fixed Parameter No.12 (Forward Software Limit Value)
Reverse Software Limit:
MPOS (IL□□12) + OL□□6E (Stop Distance) ≤ Fixed Parameter No. 14 (Reverse Software Limit Value)

<Equation 2>

Forward Software Limit: MPOS (IL□□12) ≥ Fixed Parameter No.12 (Forward Software Limit Value)
Reverse Software Limit: MPOS (IL□□12) ≤ Fixed Parameter No. 14 (Reverse Software Limit Value)

11.3.3 Axis Stopping Operation at Alarm Occurrence

The way the axis stops at occurrence of alarm differs depending on the motion command that is being executed as shown in the table below.

Motion Command	Stop Operation
POSING EX_POSING FEED STEP	The axis will start decelerating before the software limit position and stop at the software limit position.
INTERPOLATE ENDOF_INTERPOLATE LATCH	The pulse distribution command will stop executing at the software limit position. The Servo will perform an emergency stop.
VELO TRQ PHASE	The axis will start decelerating the software limit position and stop beyond the software limit position.

- The software limit settings is disabled for ZRET operation.

11.3.4 Processing after an Alarm Occurs

(1) Monitoring Alarms

If an axis exceeds a software limit, a Positive/Negative Soft Limit (Positive/Negative Software Limit) alarm will occur. This alarm can be monitored in the monitoring parameter (IL☐☐04).

Name	Parameter No.	Meaning	
Alarm	IL☐☐04	Bit 3:	Positive Direction Software Limit
		Bit 4:	Negative Direction Software Limit

(2) Clearing Software Limit Alarms

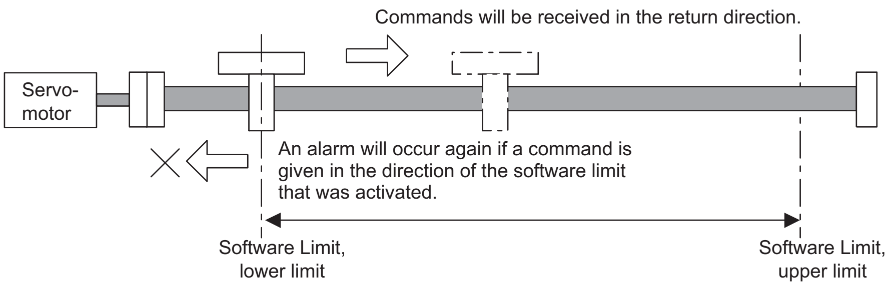
Clear software limit alarms using the procedure below.

1. Set the Clear Alarm bit to 1 in the RUN Command Setting (OW☐☐00, bit F) to clear the alarm.

The alarm (IL☐☐04) will be cleared.

Name	Parameter No.	Meaning	
RUN Command Setting	OW☐☐00	Bit F:	Alarm Clear

2. Use the FEED or STEP command to return past the software limit.



11.4 Other Utility Functions

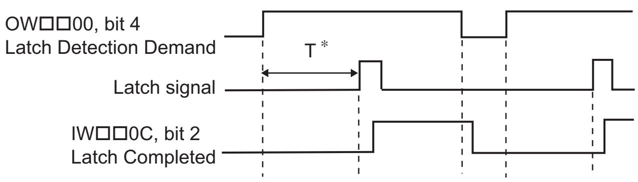
11.4.1 Modal Latch Function

The Modal Latch function can be executed to latch a position independently from the motion command being executed as long as the motion command being executed is not a motion command with latch function such as EX_POSING, ZRET, and LATCH.

- If a motion command with latch function, such as EX_POSING, ZRET, and LATCH, is executed while the modal latch function is being executed, the motion command has priority over the modal latch function, therefore, the motion command will be executed first.

■ Latch Request

A latch request is sent at the moment the Latch Detection Demand bit (setting parameter OW☐☐00, bit 4) turns ON from OFF.
When the latch is completed, the Latch Completed bit (monitoring parameter IW☐☐0C, bit 2) will turn ON.
The latched position will be written in the monitoring parameter IL☐☐18 Machine Coordinate System Latch Position.



* $T \geq t_1 + t_2 + t_3$ where
T: Latch processing time
t_1: Communication cycle
t_2: 2 scans
t_3: SERVOPACK preparation tim
latch processing (≤4 ms)

■ Cancelling Latch Request

Set the Latch Detection Demand bit (setting parameter OW☐☐00, bit 4) to OFF to cancel the latch request.

■ Signals Used for Latch

DI_5, DI_2, and Phase-C signals can be used as a latch signal. Use the setting parameter Latch Detection Signal Selection (OW☐☐04, bits 0 to 3) to select a signal to be used as a latch signal.

■ Related Parameters

The following table lists the related parameters.

Parameter Type	Parameter No.	Parameter Name	Description
Setting parameter	OW☐☐00, bit 4	Latch Detection Demand	Executed when the bit 4 turns ON from OFF. Cancelled when the bit 4 turns OFF from ON.
	OW☐☐04, bits 0 to 3	Latch Detection Signal Selection	0: DI_5 (DEC/EXIT) 1: DI_2 (ZERO/HOME LS) 2: Phase-C pulse input signal
Monitoring parameter	IW☐☐0C, bit 2	Latch Completed	–
	IL☐☐18	Machine Coordinate System Latch Position	1 = 1 reference unit

11.4.2 Reading Absolute Data After Power is Turned ON

When using an absolute encoder, the absolute data can be read out from the absolute encoder when the power supply is turned ON and when saving the fixed parameters. The processing required to read out the data, will be repeated a maximum of two times, including one retry.
The time required to complete this processing two times is approximately 3 seconds for one axis and 6 seconds for two axes, because it takes approximately 1.5 seconds to read out the data one time.

■ Read Absolute Data Function is Disabled

This function can be disabled by setting the Absolute Position Data Read-out at Power ON bit (fixed parameter No. 1, bit 7) to 1 (Not execute). If so, the ABS Total Rev. Receive Error bit (monitoring parameter IL□□04, bit 15) will be ON, and an alarm will occur.
If an alarm occurs, clear the alarm, and then change the setting of the Absolute Position Reading Demand bit (setting parameter OW□□00, bit 5) from 0 (OFF) to 1 (ON) to read out the absolute data (refer to *11.4.3 Reading Absolute Data Online* on page 11-16 for details on Absolute Position Reading Demand.)

- If an alarm code in stead of the absolute data is received from the absolute data, the alarm code will be reported in the monitoring parameter IW□□2D (Servo Driver Alarm Code).

■ Related Parameters

The following table lists the related parameters.

Parameter Type	Parameter No.	Parameter Name	Description
Fixed parameter	No.1, bit7	Absolute Position Data Read-out at Power ON	0: Execute (default) 1: Not execute
Setting parameter	OW□□00, bit 5	Absolute Position Reading Demand	Executed at rising edge (OFF→ ON).
Monitoring parameter	IL□□04, bit 15	ABS Total Rev. Receive Error	0: No alarm 1: Alarm occurrence
	IW□□2D	Servo Driver Alarm Code	

11.4.3 Reading Absolute Data Online

The ladder program can start reading out the absolute data by setting the Absolute Position Reading Demand bit (setting parameter OW□□00, bit 5) to 1 (ON). The processing required to read out the data will be repeated a maximum of two times, including one retry. After this process has been completed, the Absolute Position Read-out Completed bit (monitoring parameter IW□□0C, bit 7) will be ON.
If the SVA-01 Module failed to read the absolute data, the ABS Total Rev. Receive Error bit (monitoring parameter IL□□04, bit 15) will be ON.

- Absolute data can be read out for only one axis at a time.
- Absolute data cannot be read out in the following conditions. If executed, the ABS Total Rev. Receive Error will occur.
  - While the servo is ON
  - While the parameters from MPE720 are being saved

■ Related Parameters

The following table lists the related parameters.

Parameter Type	Parameter No.	Parameter Name	Description
Setting parameter	OW□□00, bit 5	Absolute Position Reading Demand	Executed at rising edge (OFF→ ON)
Monitoring parameter	IL□□04, bit 15	ABS Total Rev. Receive Error	0: No alarm 1: Alarm occurrence
	IW□□0C, bit 7	Absolute Position Read-out Completed	This bit turns OFF after the absolute data has been read out (OW□□00, bit 5 = OFF).

11.4.4 General-purpose DO_2 Signal Selection

In normal operation mode, the general-purpose DO_2 signal (pin No. 12 of CN1/CN2) can be used as a general-purpose output signal by setting the General-purpose DO_2 Signal Selection bit (fixed parameter No. 21, bit 5) to 1 (Use as a general-purpose signal). The user can directly control the general-purpose DO_2 signal (pin No. 12 of CN1/CN2) by using the General-purpose DO_2 bit (setting parameter OW☐☐5D, bit 2).

(1) Supported Firmware and Engineering Tool Versions

The following firmware and engineering tool versions support this function.

Type	Model	Model Number	Version
Optional module	SVA-01	JAPMC-MC2300(-E)	Ver.1.05 or later
Engineering tool	MPE720 Ver.5	CPMC-MPE720	Ver.5.42 or later
	MPE720 Ver.6	CPMC-MPE770	Ver.6.08 or later

⚠ CAUTION	♦ The following restrictions apply when using MPE720 Ver. 5.41 or earlier or MPE720 Ver. 6.07 or earlier to change a definition created using the MPE720 Ver.5.42 or later or MPE720 Ver. 6.08 or later. • The setting of the bit 5 of fixed parameter No. 21 cannot be changed. The original setting (the set value created using the MPE720 Ver.5.42 or later or MPE720 Ver.6.08 or later) will be displayed on the MPE720 screen. • Overwriting and saving a change in the setting will not replace the original setting, and the original setting will remain unchanged.

(2) Related Parameters

The following table lists the related parameters.

Parameter Type	Parameter No.	Parameter Name	Description
Fixed parameter	No.21, bit 5	General-purpose DO_2 Signal Selection	0: Use as a system exclusive signal (default). *1 1: Use as a general-purpose signal.*2
Setting parameter	OW☐☐5D, bit 2	General-purpose DO_2	0: OFF 1: ON

* 1. The system automatically controls this output signal according to the motion command setting.
When using a standard cable, this signal is connected to the /P-CON or C-SEL signal of the SERVOPACK to switch the control mode. The user cannot directly control this signal.

* 2. The user can directly control the general-purpose DO_2 signal (pin No. 12 of CN1/CN2) by using the General-purpose DO_2 bit (setting parameter OW☐☐5D, bit 2).

⚠ CAUTION	♦ Do not use the Torque Reference command (motion command 24) when the General-purpose DO_2 Signal Selection bit (fixed parameter No. 21, bit 5) is set to 1 (Use as a General-purpose Signal). Always follow the instructions described in *(3) Precautions When Using the General-purpose DO_2 Signal (Pin No. 12 of CN1/CN2) as a General-purpose Output Signal* on page 11-18.

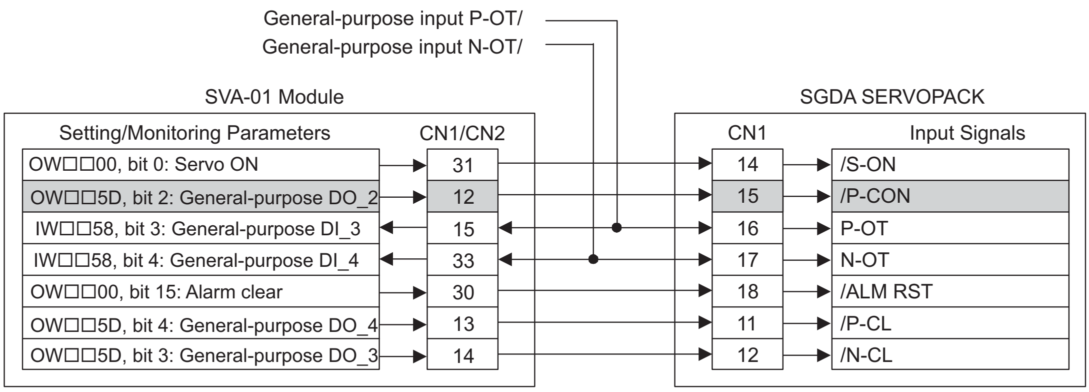
(3) Precautions When Using the General-purpose DO_2 Signal (Pin No. 12 of CN1/CN2) as a General-purpose Output Signal

Always set the parameters of the connected SERVOPACK as follows when using the general-purpose DO_2 signal (pin No. 12 of CN1/CN2) as a general-purpose output signal.

■ SGDA SERVOPACK Parameter Settings

Parameter No.	Name	Default Value	Set Value	Setting Contents
Cn-01, bit A	Control mode selection	0	0	Speed control
Cn-01, bit B		0	0	
Cn-01, Bit F	Torque feed forward function	0	0	Disables the torque feed forward function.
Cn-02, bit F	Torque reference input selection	0	1	In speed control mode, TREF is used as the torque limit.

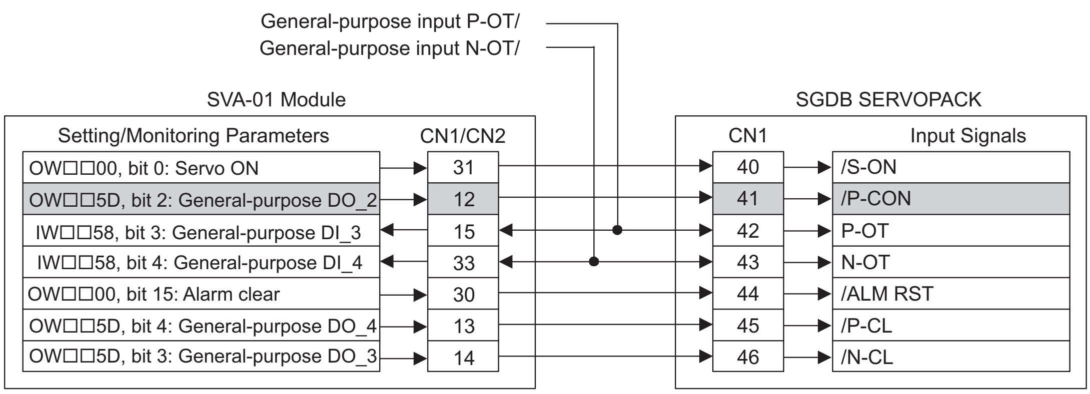
The following diagram shows a connection example of the SVA-01 Module and the SGDA SERVOPACK input signals. Refer to *2.5.3 (3) SGDA-□□□S Connection Diagram* on page 2-15.
The general-purpose DO_2 signal (pin No. 12 of CN1/CN2) is connected to the /P-CON signal of the SGDA SERVOPACK.



■ SGDB SERVOPACK Parameter Settings

Parameter No.	Name	Default Value	Set Value	Setting Contents
Cn-02, bit 8	Analog current limit function	0	1	In speed control mode, TREF is used as the analog current limit (torque limit).
Cn-02, bit 9	Torque feed-forward function	0	0	Disables the torque feed forward function.
Cn-2B	Control method selection	0	0	Speed control (analog reference)

The following diagram shows a connection example of the SVA-01 Module and the SGDB SERVOPACK input signals. Refer to *2.5.3 JEPMC-W2041-□□-E Details* on page 2-16.
The general-purpose DO_2 signal (pin No. 12 of CN1/CN2) is connected to the /P-CON signal of the SGDB SERVOPACK.

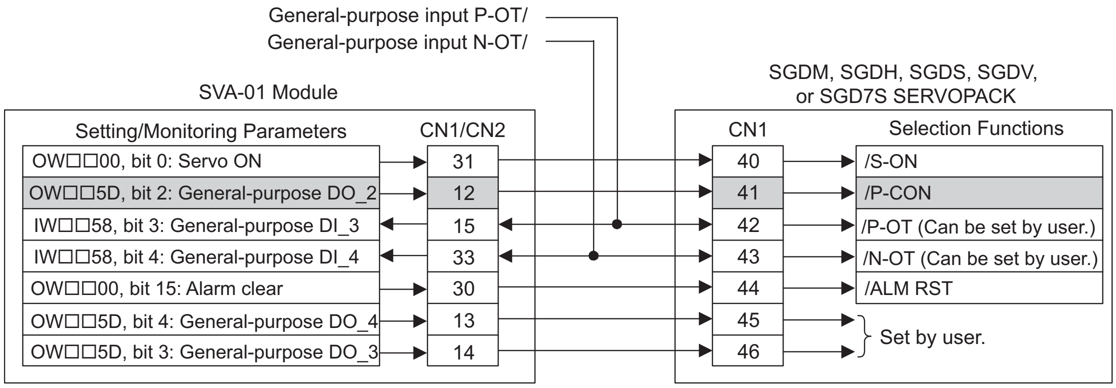


■ SGDM, SGDH, SGDS, SGDV, and SGD7S SERVOPACK Parameter Settings

Parameter No.	Name	Default Value	Set Value	Setting Contents	Remarks
Pn000.1	Control method selection	0	0	Speed control (analog voltage reference)	
Pn002.0	Speed control option	0	1	Use T-REF as external torque limit input.	
Pn50A.0	Input signal allocation mode	0	1	Enables free allocation of input signals.	
Pn50A.1	/S-ON signal mapping	0	0	Input signal from CN1-40 input terminal.	Used by SVA-01 system
Pn50A.2	/P-CON signal mapping	1	1	Input signal from CN1-41 input terminal.	*
Pn50A.3	P-OT signal mapping	2	2	Input signal from CN1-42 input terminal.	*
Pn50B.0	N-OT signal mapping	3	3	Input signal from CN1-43 input terminal.	*
Pn50B.1	/ALM-RST signal mapping	4	4	Input signal from CN1-44 input terminal.	Used by SVA-01 system
Pn50B.2	/P-CL signal mapping	5	8	Signal always disabled.	*
Pn50B.3	/N-CL signal mapping	6	8	Signal always disabled.	*
Pn50C.0	/SPD-D signal mapping	8	8	Signal always disabled.	Cannot be used.
Pn50C.1	/SPD-A signal mapping	8	8	Signal always disabled.	Cannot be used.
Pn50C.2	/SPD-B signal mapping	8	8	Signal always disabled.	Cannot be used.
Pn50C.3	/C-SEL signal mapping	8	8	Signal always disabled.	Cannot be used.
Pn50D.0	/ZCLAMP signal mapping	8	8	Signal always disabled.	Cannot be used.
Pn50D.1	/INHIBIT signal mapping	8	8	Signal always disabled.	Cannot be used.
Pn50D.2	/G-SEL signal mapping	8	8	Signal always disabled.	*

* The user can freely allocate functions to the following input terminals: CN1-41, CN1-42, CN1-43, CN1-45, and CN1-46. Of these, CN1-42 and CN1-43 are for external input signals. Data is input into CN1-41, CN1-45, and CN1-46 as signals by the SVA-01 setting parameters.

The following diagram shows a connection example of the SVA-01 Module and the SGDM, SGDH, SGDS, SGDV, or SGD7S SERVOPACK input signals when using a standard cable.
The general-purpose DO_2 signal (pin No. 12 of CN1/CN2) is connected to the /P-CON signal of the SGDM, SGDH, SGDS, SGDV, or SGD7S SERVOPACK.



Utility Functions

11

12

Troubleshooting

This chapter explains error details and corrective actions for each error.

12.1 Troubleshooting

This section describes the basic troubleshooting methods and provides a list of errors.

12.1.1 Basic Flow of Troubleshooting

When problems occur, it is important to quickly find the cause of the problems and get the system running again as soon as possible. The basic flow of troubleshooting is illustrated below.

Step 1	Visually confirm the following items.

- Machine movement (or status if stopped)
- Power supply
- I/O device status
- Wiring status
- Indicator status (LED indicators on each Module)
- Switch settings (e.g., DIP switches)
- Parameter settings and program contents

↓

Step 2	Monitor the system to see if the problem changes for the following operations.

- Switching the Controller to STOP status
- Resetting alarms
- Turning the power supply OFF and ON

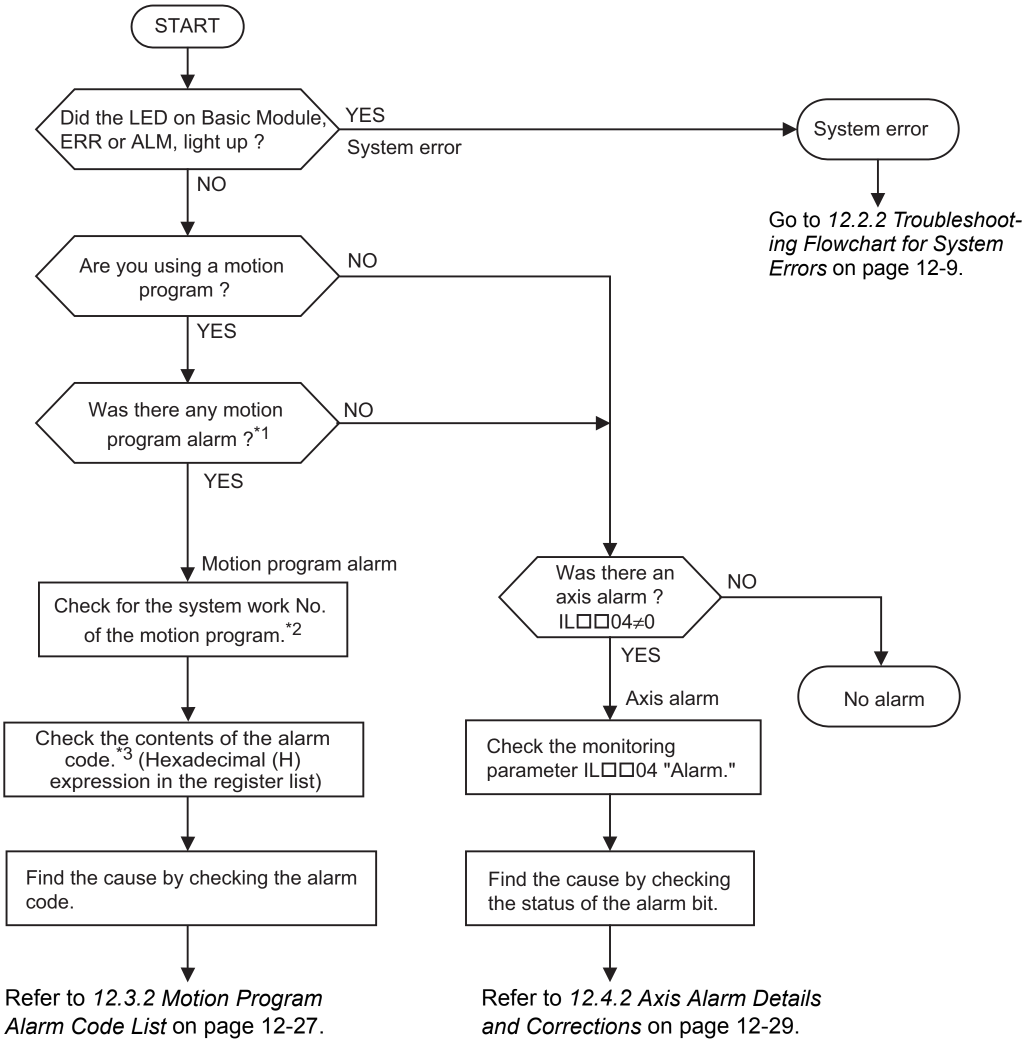
↓

Step 3	Determine the location of the cause from the results of steps 1 and 2.

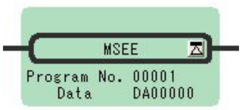
- Controller or external?
- Sequence control or motion control?
- Software or hardware?

12.1.2 MP2000 Series Machine Controller Error Check Flowchart

Find the correction to the problem using the following flowchart if the cause of the problem is thought to be the Machine Controller or SERVOPACK.



* 1. Check the status flag Program Alarm Occurrence (MSEE work, bit 8 of the 0 word) to see whether a motion program alarm is occurring or not.
<Example> When an MSEE instruction is executed in the ladder program shown below, bit 8 of DW00000 indicates an alarm occurrence.



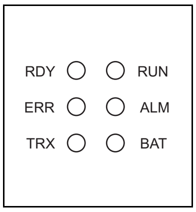
* 2. To find the system work number, find the SW register that stores the motion program number where the alarm is occurring from the Main Program Number in Execution (SW03200 to SW03215), and obtain the system work number from the SW register.
Refer to *12.2.4 (9) Motion Program Execution Information* on page 12-26 for the relationship between SW register and system work number.

* 3. Obtain the motion program alarm code from Work Using Program Information (58 words). Obtain the system work number and then determine the contents of the alarm code referring to *12.2.4 (9) Motion Program Execution Information* on page 12-26.
An alarm code is prepared for each Parallel. When a parallel execution instruction such as PFORK, JOINTO, PJOINT is not used, the alarm code will be stored in Parallel 0.

12.1.3 LED Indicators (MP2200/MP2300)

- For explanations of the LED indicators on MP2100M and MP2500MD respectively, refer to Machine Controller MP2100/MP2100M User's Manual Design and Maintenance (manual number SIEP C880700 01) and Machine Controller MP2500/MP2500M/MP2500D/MP2500MD User's Manual (manual number SIEP C880752 00).

(1) LED Indicators



The status of the LED indicators on the front of the MP2200/MP2300 can be used to determine the error status and meaning.
The locations in the program that need to be corrected can be determined by using the LED indicator status to determine the general nature of the error, using the contents of system (S) registers to check drawings and function numbers causing the error, and knowing the meaning of operation errors.

(2) LED Indicator Meanings

The following table shows how to use the LED indicators to determine the operating status of the MP2200/MP2300, as well as relevant error information when the LED indicator status indicates an error.

Classification	LED Indicator					Indicator Details	Countermeasures
	RDY	RUN	ALM	ERR	BAT		
Normal operation	Not lit	Not lit	Lit	Lit	Not lit	Hardware reset status	Usually the CPU will start within 10 seconds. If this status continues for more than 10 seconds, either a program error or hardware failure has occurred. Refer to *12.2 Troubleshooting System Errors* on page 12-6 and correct any system errors.
	Not lit	Not lit	Not lit	Not lit	Not lit	Initialization	
	Not lit	Lit	Not lit	Not lit	Not lit	Drawing A (DWG.A) being executed.	
	Lit	Not lit	Not lit	Not lit	Not lit	User program stopped. (Offline Stop Mode)	This status occurs • When the stop operation is executed from the MPE720 • When the STOP switch is turned ON This status does not indicate an error.
	Lit	Lit	Not lit	Not lit	Not lit	User program being executed normally.	This is the normal status.

(cont'd)

Classification	LED Indicator					Indicator Details	Countermeasures
	RDY	RUN	ALM	ERR	BAT		
Errors	Not lit	Not lit	Not lit	Lit	Not lit	A serious error has occurred.	Refer to *12.2.3 Correcting User Program Errors* on page 12-10.
	Not lit	Not lit	Lit	Not lit	Not lit		
	Not lit	Not lit	Not lit	Blinking	Not lit	Software Error Number of LED blinks indicates error type. 3: Address error (read) exception 4: Address error (write) exception 5: FPU exception 6: Illegal general command exception 7: Illegal slot command exception 8: General FPU inhibited exception 9: Slot FPU inhibited exception 10: TLB multibit exception 11: LTB error (read) exception 12: LTB error (write) exception 13: LTB protection violation (read) exception 14: LTB protection violation (write) exception 15: Initial page write exception	A hardware error has occurred. Replace the Module.
	Not lit	Not lit	Blinking	Blinking	Not lit	Hardware Error Number of LED blinks indicates error type. 2: RAM diagnostic error 3: ROM diagnostic error 4: CPU function diagnostic error 5: FPU function diagnostic error	
Warnings	–	–	–	–	Lit	Battery alarm	Replace the battery to save the memory.
	Lit	Lit	Lit	Not lit	Not lit	Operation error I/O error	Refer to *12.2.4 (3) Ladder Program User Operation Error Status* on page 12-13 and *12.2.4 (4) System Service Execution Status* on page 12-15.

Troubleshooting

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12.2 Troubleshooting System Errors

This section provides troubleshooting information for system errors.

12.2.1 Outline of System Errors

The LED indicators on the front of the Basic Module can be used to determine Machine Controller operating status and error status. To obtain more detailed information on errors, the system (S) registers can be used. A detailed check of the contents of system registers can be used to determine the location of the error and take the corrective measures.
Details on system registers are provided below.

(1) System Register Allocations

The following table shows the overall structure of the system registers. Refer to the sections given on the right for details.

SW00000	System Service Register	
SW00030	System Status	→ *12.2.4 (1) System Status* on page 12-11
SW00050	System Error Status	→ *12.2.4 (2) System Error Status* on page 12-12
SW00080	User Operation Error Status	→ *12.2.4 (3) Ladder Program User Operation Error Status* on page 12-13
SW00090	System Service Execution Status	→ *12.2.4 (4) System Service Execution Status* on page 12-15
SW00110	User Operation Error Status Details	→ *12.2.4 (3) Ladder Program User Operation Error Status* on page 12-13
SW00190	Alarm Counter and Alarm Clear	→ *12.2.4 (5) Alarm Counter and Alarm Clear* on page 12-15
SW00200	System I/O Error Status	→ *12.2.4 (6) System I/O Error Status* on page 12-16
SW00504	Reserved by the system	
SW00698	Interrupt Status	
SW00800	Module Information	→ *12.2.4 (8) Module Information* on page 12-21
SW01312	Reserved by the system	
SW02048	Reserved by the system	
SW03200	Motion Program Information	→ *12.3 Motion Program Alarms* on page 12-27
SW05200 to SW08191	Reserved by the system	

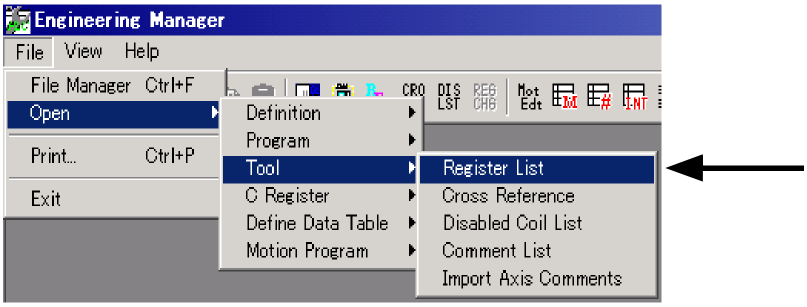
(2) Accessing System Registers

To access the contents of system registers, start the MPE720 Programming Tool and use the Register List or Quick Reference function.
The Register List on the MPE720 version 5.☐☐ is displayed differently from that on the MPE720 version 6.☐☐. The display of each version is as follows.

[a] Register List Display Procedure (MPE720 Version 5.☐☐)

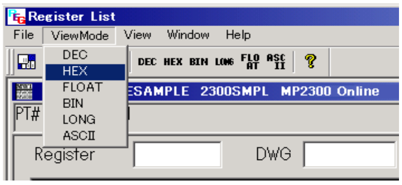
Use the following procedure to display the register list on the MPE720 version 5.☐☐.

1. Select ***File*** – ***Open*** – ***Tool*** – ***Register List*** from the MPE720 Engineering Manager Window to open the **Register List** Window.

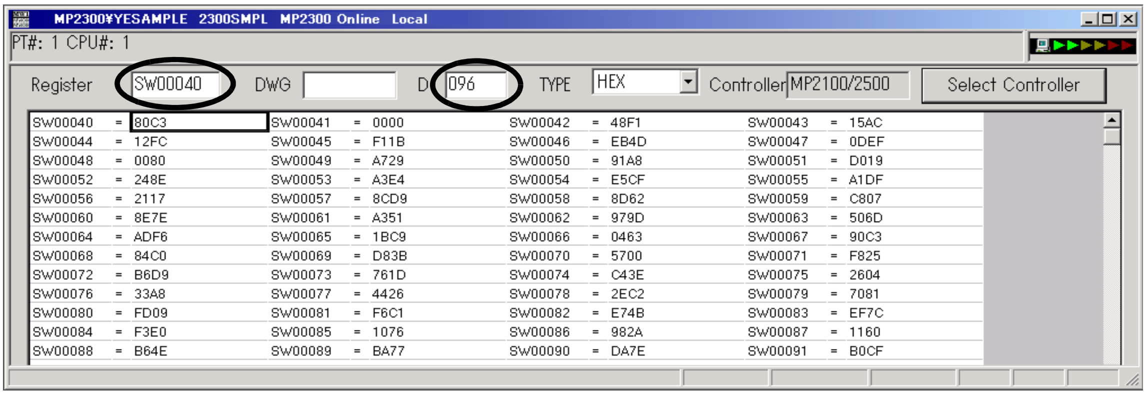


- Refer to *3.2.2 Opening the Module Configuration Window* on page 3-4 for details on how to display the **Engineering Manager** Window.

2. Select ***View Mode*** – ***HEX*** to change the view mode to hexadecimal.



3. Input the register number of the first system register to be accessed for *Register*, input the register number of the last system register to be accessed for *D*, and click anywhere in the list. The contents of the specified range of register numbers will be displayed.



[b] Displaying a Register List with the Quick Reference (MPE720 Version 5.□□)

Register lists can also be accessed with the Quick Reference.

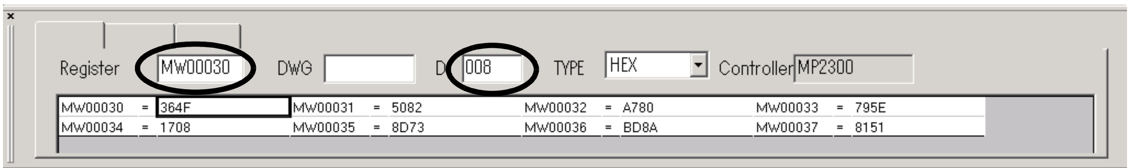
1. Select ***View*** – ***Quick Reference*** from the MPE720 Engineering Manager Window.

The Quick Reference will be displayed at the bottom of the **Engineering Manager** Window.

- Refer to *3.2.2 Opening the Module Configuration Window* on page 3-4 for details on how to display the **Engineering Manager** Window.

2. Click the **Register List** Tab to switch to the register list.

3. Enter the register number of the first system register to be accessed for *Register*, input the register number of the last system register to be accessed for *D*, and click anywhere in the list. The contents of the specified range of register numbers will be displayed.

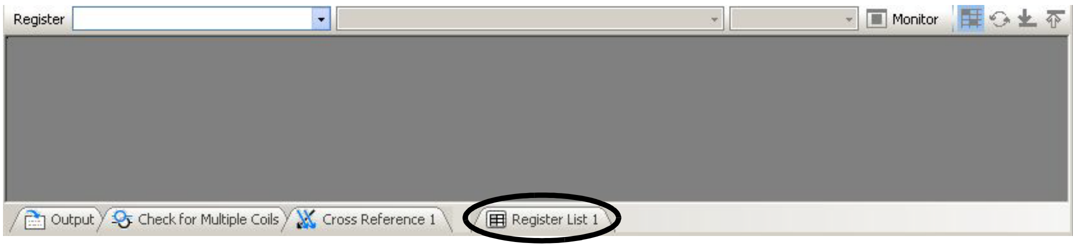


[c] Register List Display Procedure (MPE720 Version 6.□□)

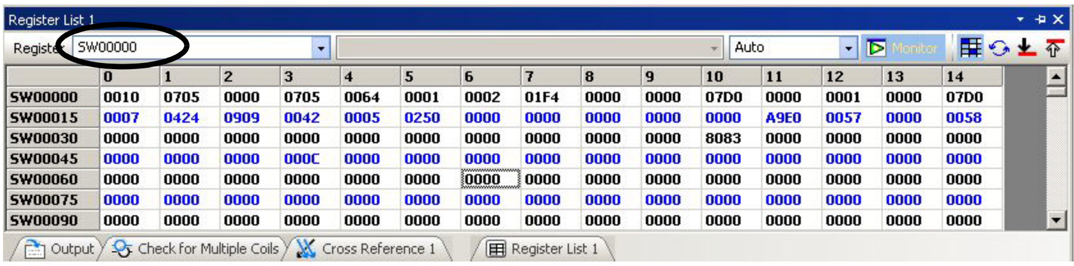
Use the following procedure to display the register list.

1. Open the Register List Subwindow on MPE720 version 6.□□.

The **Register List** Tab will appear by default on the bottom of the subwindow.



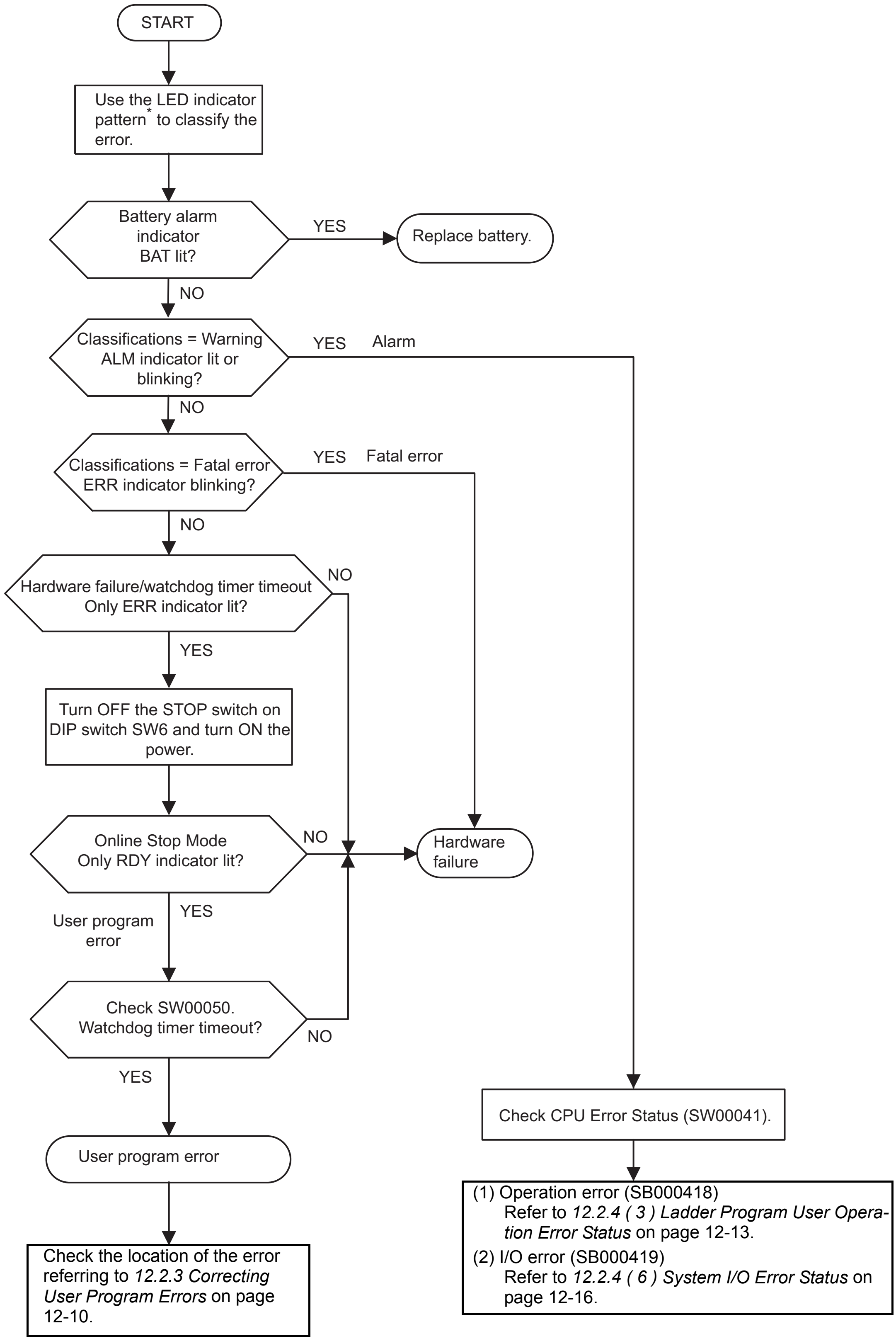
2. Enter the first register number SW□□□□□ of the system registers to be accessed in the ***Register*** input field. The contents of system registers from the first register number will be displayed.



- The data type is set by default to decimal. To display data in hexadecimal as shown above, right-click anywhere in the list and select ***Hexadecimal*** from the pop-up menu that opens.

12.2.2 Troubleshooting Flowchart for System Errors

A troubleshooting flowchart for system errors is provided below.



* For LED indicator pattern, refer to *12.1.3 (2) LED Indicator Meanings* on page 12-4.

12.2.3 Correcting User Program Errors

A serious error may have occurred if the ALM and ERR indicators on the front of the Machine Controller Basic Module are lit red. Set the Machine Controller in stop status (STOP switch on DIP switch 6: ON) and investigate the error. Use the following procedure to investigate ladder program errors.

■ When the ERR LED Lights Up

(1) Investigate type of serious error	Check the contents of SW00050 (Error Type) to determine if the type of the serious error is a system error or a user program error.

↓

(2) Investigate type of program in which there is an error	Check the contents of SW00055 (Program Type) to determine if the error is in a drawing or function.

↓

(3) Investigate the drawing with the error	Check the contents of SW00054 (Error Task) and SW00056 (Drawing Number) to determine the drawing with the error.

↓

(4) Investigate the function with the error	If SW00056 (Drawing Number) contains 0100H, the error is in a function. Check the contents of SW00057 (Error Task) and SW00058 (Drawing Number) to determine the drawing with the error. Check the contents of SW00059 (Function Referencing Drawing Step No.) to determine the step number with the operation error.

↓

(5) Correct the program	Correct the program at the point where the error occurred.

■ When the ALM LED Lights Up

(1) Check to see whether an operation error has occurred	Check the error count for each drawing in SW00080 to SW00088. If errors have been counted, an operation error has occurred. Go to (2).

↓

(2) Investigate the type of operation error and its location If an operation error occurs, the □00 (H00, L00, I00, and A00) drawings will execute. These drawings can also be used to correct or confirm operation.	1. Check Error Details Check error codes for drawings where the error is counted. DWG.A: SW00111, DWG.H: SW00143 DWG.I: SW00127, DWG.L: SW00175 2. Check the Drawing Number Check the error drawing number for the drawing number where an error occurred. DWG.A: SW00122, DWG.H: SW00154 DWG.I: SW00138, DWG.L: SW00186 3. Errors in Functions Check the Function Referencing Drawing Number and Function Referencing STEP Number. DWG.A: SW00123, SW00124, DWG.H: SW00155, SW00156 DWG.I: SW00139, SW00140, DWG.L: SW00187, SW00188

↓

(3) Correct the Program	Correct the program at the point where the error occurred.

12.2.4 System Register Configuration and Error Status

(1) System Status

System operating status and error status is stored in registers SW00040 to SW00048. Checking of system status details are used to determine whether hardware or software is the cause of an error.

Name	Register No.	Description		
Reserved by the system	SW00030 to SW00039			
CPU Status	SW00040	SW00040, bit 0	READY	0: Failure 1: Normal
		SW00040, bit 1	RUN	0: Stopped, 1: Running
		SW00040, bit 2	ALARM	0: Normal, 1: Alarm
		SW00040, bit 3	ERROR	0: Normal, 1: Error
		SW00040, bit 4	Reserved by the system	
		SW00040, bit 5	Reserved by the system	
		SW00040, bit 6	FLASH	1: Flash operation
		SW00040, bit 7	WEN	0: Write-disabled, 1: Write-enabled
		SW00040, bit 8 to SW00040, bit D	Reserved by the system	
		SW00040, bit E	Operation Stop Request	0: RUN selection, 1: STOP selection
		SW00040, bit F	Run Switch Status at Power ON	0: STOP 1: RUN
CPU Error Status	SW00041	SW00041, bit 0	Serious Failure	1: WDGE, undefined command See SW00050 for details.
		SW00041, bit 1	Reserved by the system	
		SW00041, bit 2	Reserved by the system	
		SW00041, bit 3	Exception Error	
		SW00041, bit 4 to SW00041, bit 7	Reserved by the system	
		SW00041, bit 8	User operation error	1: User operation error
		SW00041, bit 9	I/O Error	1: I/O error
		SW00041, bit A to SW00041, bit F	Reserved by the system	
H Scan Time Over Counter	SW00044			
L Scan Time Over Counter	SW00046			
Reserved by the system	SW00047	SW00047, bit 0 to SW00047, bit F	Reserved by the system	
Hardware Configuration Status	SW00048	SW00048, bit 0	TEST	DIP switch status 0: ON, 1: OFF
		SW00048, bit 1	MON	
		SW00048, bit 2	CNFG	
		SW00048, bit 3	INIT	
		SW00048, bit 4	SUP	
		SW00048, bit 5	STOP	
		SW00048, bit 6	–	
		SW00048, bit 7	Battery Alarm	
		SW00048, bit 8 to SW00048, bit F	Reserved by the system	
Reserved by the system	SW00049	SW00049, bit 0 to SW00049, bit F	Reserved by the system	

(2) System Error Status

System error status is stored in registers SW00050 to SW00060.

Name	Register No.	Description		
32-bit Error Code	SW00050	0001H	Watchdog timer timeout error	
		0041H	ROM diagnosis error	
		0042H	RAM diagnosis error	
		0043H	CPU diagnosis error	
		0044H	FPU diagnosis error	
		00E0H	Address read exception error	
		0100H	Address write exception error	
		0120H	FPU exception error	
		0180H	Illegal general command error	
		01A0H	Illegal slot command error	
		01E0H	User break after command execution	
		0800H	General FPU inhibited exception error	
		0820H	Slot FPU inhibited exception error	
	SW00051	For system error analysis		
32-bit Error Addresses	SW00052 SW00053	For system error analysis		
Ladder Program Error Task	SW00054	0000H: System 0001H: DWG.A	0002H: DWG.I 0003H: DWG.H	0005H: DWG.L
Ladder Program Type	SW00055	0000H: System 0001H: DWG.A	0002H: DWG.I 0003H: DWG.H	0005H: DWG.L 0008H: Function
Ladder Program Error Drawing Number	SW00056	Ladder program parent drawing: FFFFH Ladder program function: 8000H Ladder program child drawing: □□00H (H□□: Child drawing number) Ladder program grandchild drawing: □□yyH (Hyy: Grandchild drawing number) Motion program: F0□□H (H□□: Program number)		
Ladder Program Function Calling Drawing Type	SW00057	Type of drawing that calls the ladder program function in which an error occurred.		
		0001H: DWG.A 0002H: DWG.I 0003H: DWG.H	0005H: DWG.L 0008H: Ladder program function	0010H: Reserved by system. 0011H: Reserved by system.
Ladder Program Function Calling Drawing Number	SW00058	Number of drawing that calls the ladder program function in which an error occurred.		
		Parent drawing: FFFFH Function: 0100H	Child drawing: □□00H (H□□: Child drawing number) Grandchild drawing: □□yyH (Hyy: Grandchild drawing number)	
Ladder Program Function Calling Drawing Number	SW00059	STEP number of the drawing that calls the ladder program function in which an error occurred. 0 when there is an error in the drawing.		
Error Data	SW00060 and SW00061	Reserved by the system		
	SW00062 to SW00065	Name of Task Generating Error		
	SW00066 and SW00067	Reserved by the system		
	SW00068	Year Generated		
	SW00069	Month Generated		
	SW00070	Day of Week Generated		
	SW00071	Day of Month Generated		
	SW00072	Hour Generated		
	SW00073	Minutes Generated		
	SW00074	Seconds Generated		
	SW00075	Milliseconds Generated (Not used)		
	SW00076 to SW00079	Reserved by the system		

(3) Ladder Program User Operation Error Status

Error information for user operation errors in ladder programs is stored in registers SW00080 to SW00089 (Error Status 1) and SW00110 to SW00189 (Error Status 2).

[a] Ladder Program User Operation Error Status 1

Name	Register No.	Description
DWG.A Error Count Error Code	SW00080	Operation error code: See *Ladder Program User Operation Error Codes 1*. Error code when an index error occurs: See *Ladder Program User Operation Error Codes 2*.
	SW00081	
DWG.I Error Count Error Code	SW00082	
	SW00083	
DWG.H Error Count Error Code	SW00084	
	SW00085	
Reserved by the system.	SW00086	
	SW00087	
DWG.L Error Count Error Code	SW00088	
	SW00089	

[b] Ladder Program User Operation Error Status 2

Name	Register No.				Remarks
	DWG.A	DWG.I	DWG.H	DWG.L	
Error Count	SW00110	SW00126	SW00142	SW00174	<Error Drawing Number > Parent drawing: FFFFH Child drawing: □□00H (H□□: Child drawing number) Grandchild drawing: □□yyH (Hyy: Grandchild drawing number) Function: 8000H Motion program: F0□□H (H□□: Program number) <Function Calling Drawing Number> Number of the drawing that calls the function in which an error occurred. <Function Calling DWG Step Number> Step number of the drawing that calls the function in which an error occurred. 0 when there is an error in the parent drawing.
Error Code	SW00111	SW00127	SW00143	SW00175	
Error A Register	SW00112	SW00128	SW00144	SW00176	
	SW00113	SW00129	SW00145	SW00177	
Modification A Register	SW00114	SW00130	SW00146	SW00178	
	SW00115	SW00131	SW00147	SW00179	
Error F Register	SW00116	SW00132	SW00148	SW00180	
	SW00117	SW00133	SW00149	SW00181	
Modification F Register	SW00118	SW00134	SW00150	SW00182	
	SW00119	SW00135	SW00151	SW00183	
Error Address	SW00120	SW00136	SW00152	SW00184	
	SW00121	SW00137	SW00153	SW00185	
Error Drawing Number	SW00122	SW00138	SW00154	SW00186	
Function Calling Drawing Number	SW00123	SW00139	SW00155	SW00187	
Function Calling DWG Step Number	SW00124	SW00140	SW00156	SW00188	
Reserved by the system.	SW00125	SW00141	SW00157	SW00189	

[c] Ladder Program User Operation Error Codes 1

	Error Code	Error Contents		User*	System Default Value	
Integer Operations	0001H	Integer operation - underflow		Yes	–32768 [–32768]	
	0002H	Integer operation - overflow		Yes	32767 [32767]	
	0003H	Integer operation - division error		Yes	The A register remains the same.	
	0009H	Double-length integer operation - underflow		Yes	–2147483648 [–2147483648]	
	000AH	Double-length integer operation - overflow		Yes	2147483647 [2147483647]	
	000BH	Double-length integer operation - division error		Yes	The A register remains the same.	
	010xH	Operation error drawing - integer operation error (x = 1 to B)		No	Default indicated above.	
Real Number Operation	0010H	Integer storage - non-numeric error		Yes	Store not executed. [00000]	
	0011H	Integer storage - underflow		Yes	Store not executed. [–32768]	
	0012H	Integer storage - overflow		Yes	Store not executed. [+32767]	
	0021H	Real number storage - underflow		Yes	Store not executed. [–1.0E+38]	
	0022H	Real number storage - overflow		Yes	Store not executed. [1.0E+38]	
	0023H	Real number operation - division-by-zero error		Yes	Operation not executed. The F register remains the same.	
	0030H	Real number operation - invalid operation (non-numeric)		No	Operation not executed.	
	0031H	Real number operation - exponent underflow		No	0.0	
	0032H	Real number operation - exponent overflow		No	Maximum value	
	0033H	Real number operation - division error (non-numeric 0/0)		No	Operation not executed.	
	0034H	Real number storage - exponent underflow		No	Stores 0.0.	
	0035H	Real number operation - stack error				
	0040H to 0059H	Standard System Functions Real number operation errors		No	Interrupt operation and output = 0.0	
		0040H: SQRT	0041H: SIN	0042H: COS	0043H: TAN	
		0044H: ASIN	0045H: ACOS	0046H: ATAN	0047H: EXP	
		0048H: LN	0049H: LOG	004AH: DZA	004BH: DZB	
		004CH: LIM	004DH: PI	004EH: PD	004FH: PID	
		0050H: LAG	0051H: LLAG	0052H: FGN	0053H: IFGN	
		0054H: LAU	0055H: SLAU	0056H: REM	0057H: RCHK	
		0058H: BSRCH	0059H: SQRT			
		1000H or 2000H is added for an index error.				

* Yes: Can be set to value other than system default from the user program.
No: The system default cannot be changed from the user program.

[d] Ladder Program User Operation Error Codes 2

	Error Code	Error Contents		User*	System Default
Integer - Real Number Operations	1000H	Index error within drawing		No	Execute again with i, j = 0. The i and j register remains the same.
	2000H	Index error within function		No	Execute again with i, j = 0. The i and j register remains the same.
Integer Operation	□060H to □077H (□ = 1,2)	Integer system functions Index error		No	Operation stopped and output = input. The A register remains the same.
		□06DH: PI	□06DH: PD	□06FH: PID	□070H: LAG
		□071H: LLAG	□072H: FGN	□073H: IFGN	□074H: LAU
		□075H: SLAU	□076H: FGN	□077H: IFGN	

* No: The system default cannot be changed from the user program.

(4) System Service Execution Status

[a] Data Trace Execution Status

Name	Register No.	Remarks
Reserved by the system	SW00090 to SW00097	
Existence Of Data Trace Definition	SW00098	Bits 0 to 3 = Group 1 to 4 Definition exists = 1, No definition = 0
Data Trace Execution Status	SW00099	Bits 0 to 3 = Group 1 to 4 Trace stopped = 1, Trace executing = 0

[b] Latest Data Trace Record Numbers

Name	Register No.	Remarks
Data Trace Group 1	SW00100	Latest record number
Data Trace Group 2	SW00101	Latest record number
Data Trace Group 3	SW00102	Latest record number
Data Trace Group 4	SW00103	Latest record number

(5) Alarm Counter and Alarm Clear

Name	Register No.	Remarks
Number of Alarm Occurrences	SW00190	Number of alarm occurrences
Number of Alarm Histories	SW00191	Number of alarm histories
Clear Alarm	SW00192	1: Clear alarm 2: Clear the number of alarm occurrences and alarm histories

(6) System I/O Error Status

[a] MP2100M Machine Controller

Name	Register No.	Remarks
I/O Error Count	SW00200	Number of I/O error occurrences
Number of Input Errors	SW00201	Number of input error occurrences
Input Error Address	SW00202	Address of the latest input error (IW□□□□ register number)
Number of Output Errors	SW00203	Number of output error occurrences
Output Error Address	SW00204	Address of the latest output error (OW□□□□ register number)
Reserved for the system	SW00205	Not used.
	SW00206	
	SW00207	
I/O Error Status	SW00208 to SW00215	MP2100M Machine Controller error status
	SW00216 to SW00223	Reserved for the system
	SW00224 to SW00228	SVB-01 Module error status
	SW00229 to SW00239	Reserved for the system
	SW00240 to SW00247	Error status of slot 1 of rack 2 * (Depends on the mounted module and error code.)
	SW00248 to SW00255	Error status of slot 2 of rack 2 * (Depends on the mounted module and error code.)
	SW00256 to SW00263	Error status of slot 3 of rack 2 * (Depends on the mounted module and error code.)
	SW00264 to SW00271	Error status of slot 4 of rack 2 * (Depends on the mounted module and error code.)
	⋮	⋮
	SW00448 to SW00455	Error status of slot 9 of rack 4 * (Depends on the mounted module and error code.)

* Racks 2 to 4 can be used only when using MP2100MEX.

[b] MP2200 Machine Controller

Name	Register No.	Remarks
I/O Error Count	SW00200	Number of I/O error occurrences
Number of Input Errors	SW00201	Number of input error occurrences
Input Error Address	SW00202	Address of the latest input error (IW□□□□ register number)
Number of Output Errors	SW00203	Number of output error occurrences
Output Error Address	SW00204	Address of the latest output error (OW□□□□ register number)
Reserved for the system	SW00205	Not used.
	SW00206	
	SW00207	
I/O Error Status	SW00208 to SW00215	Not used.
	SW00216 to SW00223	Reserved for the system
	SW00224 to SW00228	Error status of slot 1 of rack 1 (Depends on the mounted module and error code.)
	SW00229 to SW00239	Error status of slot 2 of rack 1 (Depends on the mounted module and error code.)
	SW00240 to SW00247	Error status of slot 3 of rack 1 (Depends on the mounted module and error code.)
	SW00248 to SW00255	Error status of slot 4 of rack 1 (Depends on the mounted module and error code.)
	⋮	⋮
	SW00496 to SW00503	Error status of slot 9 of rack 4 * (Depends on the mounted module and error code.)

* Racks 2 to 4 can be used only when using EXIOIF.

[c] MP2300 Machine Controller

Name	Register No.	Remarks
I/O Error Count	SW00200	Number of I/O error occurrences
Number of Input Errors	SW00201	Number of input error occurrences
Input Error Address	SW00202	Address of the latest input error (IW□□□□ register number)
Number of Output Errors	SW00203	Number of output error occurrences
Output Error Address	SW00204	Address of the latest output error (OW□□□□ register number)
Reserved for the system	SW00205	Not used.
	SW00206	
	SW00207	
I/O Error Status	SW00208 to SW00215	Slot 0 error status (Depends on the mounted module and error code)
	SW00216 to SW00223	Reserved for the system
	SW00224 to SW00231	Slot 1 error status (Depends on the mounted module and error code.)
	SW00232 to SW00239	Slot 2 error status (Depends on the mounted module and error code.)
	SW00240 to SW00247	Slot 3 error status (Depends on the mounted module and error code.)

(7) Details on I/O Error Status

When a system I/O error occurs, the error status will be written in the system register.

[a] Modules Whose I/O Error Status Are Written in the System Register

The table below shows whether the I/O error status of each module is written in the system register or not.

Classification	Module Name	I/O Error Status is Written or Not	Remarks
CPU Module	CPU-01	No	Not equipped with external I/O interface
Motion Module	SVA-01	No	Use the monitoring parameter to obtain error information.
	SVB-01	Yes	
Communication Module	217IF-01	No	No I/O
	218IF-01	No	No I/O
	260IF-01	Yes	
	261IF-01	Yes	
I/O Module	LIO-01	Yes	
	LIO-02	Yes	
	LIO-04	Yes	
Expansion IF Module	EXIOIF	No	

[b] MP2300 Machine Controller Basic Module Error Status

The registers allocated for each error status when an I/O Module (LIO-01/02), SVB-01 Module, and Communication Module (260IF-01) are mounted in slots 1, 2, and 3 of the MP2300 Machine Controller respectively are described below.

Name	Register No.	Remarks
Slot 0 Error Status	SW00208 to SW00215	(Depends on the mounted module and error code.)
Reserved by the system	SW00216 to SW00223	(Depends on the mounted module and error code.)
Slot 1 Error Status	SW00224 to SW00231	(Depends on the mounted module and error code.)
Slot 2 Error Status	SW00232 to SW00239	(Depends on the mounted module and error code.)
Slot 3 Error Status	SW00240 to SW00247	(Depends on the mounted module and error code.)

■ Register Allocation Details: Slot 0 (Reserved for Basic Module)

(Bit No.)	F ······ 8	7 ······ 0
SW00208	Error code (I/O error = 2)	Subslot No. (= 2)
SW00209	Error code (Station error = 1)	Subslot No. (= 3)

SW00210	ST#15	············	ST#2	ST#1	Not used
SW00211	Not used	ST#30	············	ST#17	ST#16
SW00212	Not used	············			Not used
SW00213	Not used	············			Not used
SW00214	Not used	············			Not used
SW00215	Not used	············			Not used

■ LIO-01/LIO-02 Module Error Status (Slot 1)

(Bit No.)	F ······ 8	7 ······ 0
SW00224	Error code (I/O error = 2)	Subslot No. (= 1)
SW00225	Error code (I/O error = 2)	Subslot No. (= 2)

SW00226	ST#15	············	ST#2	ST#1	Not used
SW00227	Not used	············			Not used
SW00228	Not used	············			Not used
SW00229	Not used	············			Not used
SW00230	Not used	············			Not used
SW00231	Not used	············			Not used

■ SVB-01 Module Error Status (Slot 2)

(Bit No.)	F	···	8 7	···	0
SW00232	Error code (Station error = 1)		Subslot No. (= 1)		
SW00233	ST#15	············	ST#2	ST#1	Not used
SW00234	Not used	ST#30	············	ST#17	ST#16
SW00235	Not used	············			Not used
SW00236	Not used	············			Not used
SW00237	Not used	············			Not used
SW00238	Not used	············			Not used
SW00239	Not used	············			Not used

■ 260IF-01 Module Error Status (Slot 3)

(Bit No.)	F	···	8 7	···	0
SW00240	Error code (Station error = 1)		Subslot No. (= 2)		
SW00241	ST#15	············			ST#0
SW00242	ST#31	············			ST#16
SW00243	ST#47	············			ST#32
SW00244	ST#63	············			ST#48

<Error Status Details>

Item	Code	Description
ST#n	0	Normal communication
	1	Communication error at the station n (n = local station number in slave mode)

(8) Module Information

[a] MP2100M Machine Controller

Name	Register No.	Description
CPU Information	SW00800	MP2100M ID (C181H)
	SW00801	Reserved by the system
	SW00802	CPU Software version (BCD)
	SW00803	Number of subslots (Version 2.45 or before: 0004H, Version 2.46 or later: 0007H)
	SW00804	CPU Function Module ID (C110H)
	SW00805	CPU Function Module status
	SW00806	I/O Function Module ID (8070H)
	SW00807	I/O Function Module status
	SW00808	SVB Function Module ID (9112H)
	SW00809	SVB Function Module status
	SW00810	SVR Function Module ID (9210H)
	SW00811	SVR Function Module status
	SW00812 to SW00815	Reserved by the system
SVB-01 Information	SW00816	SVB-01 (9195H)
	SW00817	Hardware version (BCD)
	SW00818	SVB-01 Software version (BCD)
	SW00819	Number of subslots (0001H)
	SW00820	SVB-01 Function Module ID (9115H)
	SW00821	SVB-01 Function Module status
	SW00822 to SW00823	Reserved by the system
EXIOIF Information	SW00824	EXIOIF (808FH)
	SW00825	Hardware version (BCD)
	SW00826	Reserved by the system
	SW00827	Number of subslots (0001H)
	SW00828	EXIOIF Function Module ID (800FH)
	SW00829	EXIOIF Function Module status
	SW00830 to SW00831	Reserved by the system
Rack 2, Slot 1 Information	SW00832	Module ID
	SW00833	Hardware version (BCD)
	SW00834	Software version (BCD)
	SW00835	Number of subslots
	SW00836	Subslot 1 Function Module ID
	SW00837	Subslot 1 Function Module status
	SW00838	Subslot 2 Function Module ID
	SW00839	Subslot 2 Function Module status
Rack 2, Slot 2 Information	SW00840 to SW00847	Same as above
Rack 2, Slot 3 Information	SW00848 to SW00855	Same as above
Rack 2, Slot 4 Information	SW00856 to SW00863	Same as above
Rack 2, Slot 5 Information	SW00864 to SW00871	Same as above
Rack 2, Slot 6 Information	SW00872 to SW00879	Same as above
Rack 2, Slot 7 Information	SW00880 to SW00887	Same as above

Name	Register No.	Description
Rack 2, Slot 8 Information	SW00888 to SW00895	Same as above
Rack 2, Slot 9 Information	SW00896 to SW00903	Same as above
Rack 3, Slot 1 Information	SW00904	Module ID
	SW00905	Hardware version (BCD)
	SW00906	Software version (BCD)
	SW00907	Number of subslots
	SW00908	Subslot 1 Function Module ID
	SW00909	Subslot 1 Function Module status
	SW00910	Subslot 2 Function Module ID
	SW00911	Subslot 2 Function Module status
Rack 3, Slot 2 Information	SW00912 to SW00919	Same as above
Rack 3, Slot 3 Information	SW00920 to SW00927	Same as above
Rack 3, Slot 4 Information	SW00928 to SW00935	Same as above
Rack 3, Slot 5 Information	SW00936 to SW00943	Same as above
Rack 3, Slot 6 Information	SW00944 to SW00951	Same as above
Rack 3, Slot 7 Information	SW00952 to SW00959	Same as above
Rack 3, Slot 8 Information	SW00960 to SW00967	Same as above
Rack 3, Slot 9 Information	SW00968 to SW00975	Same as above
Rack 4, Slot 1 Information	SW00976	Module ID
	SW00977	Hardware version (BCD)
	SW00978	Software version (BCD)
	SW00979	Number of subslots
	SW00980	Subslot 1 Function Module ID
	SW00981	Subslot 1 Function Module status
	SW00982	Subslot 2 Function Module ID
	SW00983	Subslot 2 Function Module status
Rack 4, Slot 2 Information	SW00984 to SW00991	Same as above
Rack 4, Slot 3 Information	SW00992 to SW00999	Same as above
Rack 4, Slot 4 Information	SW01000 to SW01007	Same as above
Rack 4, Slot 5 Information	SW01008 to SW01015	Same as above
Rack 4, Slot 6 Information	SW01016 to SW01023	Same as above
Rack 4, Slot 7 Information	SW01024 to SW01031	Same as above
Rack 4, Slot 8 Information	SW01032 to SW01039	Same as above
Rack 4, Slot 9 Information	SW01040 to SW01047	Same as above

- Information of EXIOIF and Racks 2 through 4 is available only when MP2100MEX is used.

[b] MP2200 Machine Controller

<table>
<tr><th>Name</th><th>Register No.</th><th colspan="2">Description</th></tr>
<tr><td rowspan="15">CPU Information</td><td rowspan="2">SW00800</td><td rowspan="2">Module ID</td><td>CPU-01: (C280H)</td></tr>
<tr><td>CPU-02: (C281H)</td></tr>
<tr><td>SW00801</td><td colspan="2">Reserved by the system</td></tr>
<tr><td>SW00802</td><td colspan="2">CPU Software version (BCD)</td></tr>
<tr><td rowspan="2">SW00803</td><td rowspan="2">Number of subslots</td><td>CPU-01: (0002H)</td></tr>
<tr><td>CPU-02: (0004H)</td></tr>
<tr><td>SW00804</td><td colspan="2">CPU Function Module ID (C210H)</td></tr>
<tr><td>SW00805</td><td colspan="2">CPU Function Module status</td></tr>
<tr><td>SW00806</td><td colspan="2">SVR Function Module ID (9210H)</td></tr>
<tr><td>SW00807</td><td colspan="2">SVR Function Module status</td></tr>
<tr><td>SW00808</td><td>CPU-02: CARD Function Module ID (8170H)</td><td rowspan="4">CPU-01:
Reserved by the system</td></tr>
<tr><td>SW00809</td><td>CPU-02: CARD Function Module status</td></tr>
<tr><td>SW00810</td><td>CPU-02: USB Function Module ID (8F20H)</td></tr>
<tr><td>SW00811</td><td>CPU-02: USB Function Module status</td></tr>
<tr><td>SW00812 to SW00815</td><td colspan="2">Reserved by the system</td></tr>
<tr><td rowspan="8">Rack 1, Slot 1 Information</td><td>SW00816</td><td colspan="2">Module ID</td></tr>
<tr><td>SW00817</td><td colspan="2">Hardware version (BCD)</td></tr>
<tr><td>SW00818</td><td colspan="2">Software version (BCD)</td></tr>
<tr><td>SW00819</td><td colspan="2">Number of subslots</td></tr>
<tr><td>SW00820</td><td colspan="2">Subslot 1 Function Module ID</td></tr>
<tr><td>SW00821</td><td colspan="2">Subslot 1 Function Module status</td></tr>
<tr><td>SW00822</td><td colspan="2">Subslot 2 Function Module ID</td></tr>
<tr><td>SW00823</td><td colspan="2">Subslot 2 Function Module status</td></tr>
<tr><td>Rack 1, Slot 2 Information</td><td>SW00824 to SW00831</td><td colspan="2">Same as above</td></tr>
<tr><td>Rack 1, Slot 3 Information</td><td>SW00832 to SW00839</td><td colspan="2">Same as above</td></tr>
<tr><td>Rack 1, Slot 4 Information</td><td>SW00840 to SW00847</td><td colspan="2">Same as above</td></tr>
<tr><td>Rack 1, Slot 5 Information</td><td>SW00848 to SW00855</td><td colspan="2">Same as above</td></tr>
<tr><td>Rack 1, Slot 6 Information</td><td>SW00856 to SW00863</td><td colspan="2">Same as above</td></tr>
<tr><td>Rack 1, Slot 7 Information</td><td>SW00864 to SW00871</td><td colspan="2">Same as above</td></tr>
<tr><td>Rack 1, Slot 8 Information</td><td>SW00872 to SW00879</td><td colspan="2">Same as above</td></tr>
<tr><td rowspan="8">Rack 2, Slot 1 Information</td><td>SW00880</td><td colspan="2">Module ID</td></tr>
<tr><td>SW00881</td><td colspan="2">Hardware version (BCD)</td></tr>
<tr><td>SW00882</td><td colspan="2">Software version (BCD)</td></tr>
<tr><td>SW00883</td><td colspan="2">Number of subslots</td></tr>
<tr><td>SW00884</td><td colspan="2">Subslot 1 Function Module ID</td></tr>
<tr><td>SW00885</td><td colspan="2">Subslot 1 Function Module status</td></tr>
<tr><td>SW00886</td><td colspan="2">Subslot 2 Function Module ID</td></tr>
<tr><td>SW00887</td><td colspan="2">Subslot 2 Function Module status</td></tr>
<tr><td>Rack 2, Slot 2 Information</td><td>SW00888 to SW00895</td><td colspan="2">Same as above</td></tr>
<tr><td>Rack 2, Slot 3 Information</td><td>SW00896 to SW00903</td><td colspan="2">Same as above</td></tr>
<tr><td>Rack 2, Slot 4 Information</td><td>SW00904 to SW00911</td><td colspan="2">Same as above</td></tr>
<tr><td>Rack 2, Slot 5 Information</td><td>SW00912 to SW00919</td><td colspan="2">Same as above</td></tr>
</table>

Name	Register No.	Description
Rack 2, Slot 6 Information	SW00920 to SW00927	Same as above
Rack 2, Slot 7 Information	SW00928 to SW00935	Same as above
Rack 2, Slot 8 Information	SW00936 to SW00943	Same as above
Rack 2, Slot 9 Information	SW00944 to SW00951	Same as above
Rack 3, Slot 1 Information	SW00952	Module ID
	SW00953	Hardware version (BCD)
	SW00954	Software version (BCD)
	SW00955	Number of subslots
	SW00956	Subslot 1 Function Module ID
	SW00957	Subslot 1 Function Module status
	SW00958	Subslot 2 Function Module ID
	SW00959	Subslot 2 Function Module status
Rack 3, Slot 2 Information	SW00960 to SW00967	Same as above
Rack 3, Slot 3 Information	SW00968 to SW00975	Same as above
Rack 3, Slot 4 Information	SW00976 to SW00983	Same as above
Rack 3, Slot 5 Information	SW00984 to SW00991	Same as above
Rack 3, Slot 6 Information	SW00992 to SW00999	Same as above
Rack 3, Slot 7 Information	SW01000 to SW01007	Same as above
Rack 3, Slot 8 Information	SW01008 to SW01015	Same as above
Rack 3, Slot 9 Information	SW01016 to SW01023	Same as above
Rack 4, Slot 1 Information	SW01024	Module ID
	SW01025	Hardware version (BCD)
	SW01026	Software version (BCD)
	SW01027	Number of subslots
	SW01028	Subslot 1 Function Module ID
	SW01029	Subslot 1 Function Module status
	SW01030	Subslot 2 Function Module ID
	SW01031	Subslot 2 Function Module status
Rack 4, Slot 2 Information	SW01032 to SW01039	Same as above
Rack 4, Slot 3 Information	SW01040 to SW01047	Same as above
Rack 4, Slot 4 Information	SW01048 to SW01055	Same as above
Rack 4, Slot 5 Information	SW01056 to SW01063	Same as above
Rack 4, Slot 6 Information	SW01064 to SW01071	Same as above
Rack 4, Slot 7 Information	SW01072 to SW01079	Same as above
Rack 4, Slot 8 Information	SW01080 to SW01087	Same as above
Rack 4, Slot 9 Information	SW01088 to SW01095	Same as above

- Information of Racks 2 through 4 are available only when EXIOIF is used.

[c] MP2300 Machine Controller

Name	Register No.	Description
Module Information	SW00800	Basic Module (C380H)
	SW00801	Reserved by the system
	SW00802	CPU Software version (BCD)
	SW00803	Number of subslots (0004H)
	SW00804	CPU Function Module ID (C310H)
	SW00805	CPU Function Module status
	SW00806	I/O Function Module ID (8070H)
	SW00807	I/O Function Module status
	SW00808	SVB Function Module ID (9113H)
	SW00809	SVB Function Module status
	SW00810	SVR Function Module ID (9210H)
	SW00811	SVR Function Module status
	SW00812 to SW00815	Reserved by the system
	SW00816 to SW00823	Slot 1 Information
	SW00824 to SW00831	Slot 2 Information
	SW00832 to SW00839	Slot 3 Information
	⋮	
	SW01008 to SW01015	Reserved by the system (Slot 26)

[d] SVA-01 Module Information

- Module ID = 9093H
- SVA Function Module ID = 9013H

9093H will be written as Module ID, and 9013H as Function Module ID in the SVA-01 Module mounted slot description.

For example, when an SVA-01 Module is mounted in Slot 1 of Rack 1,

SW00816 = 9093H
SW00820 = 9013H

(9) Motion Program Execution Information

System Work	Main Program No. in Execution	Program Information Used by Work	Motion Program Alarm							
			Parallel 0	Parallel 1	Parallel 2	Parallel 3	Parallel 4	Parallel 5	Parallel 6	Parallel 7
			Offset * +4	Offset +7	Offset +10	Offset +13	Offset +16	Offset +19	Offset +22	Offset +25
1	SW3200	SW03264 to SW03321	SW03268	SW03271	SW03274	SW03277	SW03280	SW03283	SW03286	SW03289
2	SW3201	SW03322 to SW03379	SW03326	SW03329	SW03332	SW03335	SW03338	SW03341	SW03344	SW03347
3	SW3202	SW03380 to SW03437	SW03384	SW03387	SW03390	SW03393	SW03396	SW03399	SW03402	SW03405
4	SW3203	SW03438 to SW03495	SW03442	SW03445	SW03448	SW03451	SW03454	SW03457	SW03460	SW03463
5	SW3204	SW03496 to SW03553	SW03500	SW03503	SW03506	SW03509	SW03512	SW03515	SW03518	SW03521
6	SW3205	SW03554 to SW03611	SW03558	SW03561	SW03564	SW03567	SW03570	SW03573	SW03576	SW03579
7	SW3206	SW03612 to SW03669	SW03616	SW03619	SW03622	SW06325	SW03628	SW03631	SW03634	SW03637
8	SW3207	SW03670 to SW03727	SW03674	SW03677	SW03680	SW03683	SW03686	SW03689	SW03692	SW03695
9	SW3208	SW03728 to SW03785	SW03732	SW03735	SW03738	SW03741	SW03744	SW03747	SW03750	SW03753
10	SW3209	SW03786 to SW04843	SW03790	SW03793	SW03796	SW03799	SW03802	SW03805	SW03808	SW03811
11	SW3210	SW03844 to SW03901	SW03848	SW03851	SW03854	SW03857	SW03860	SW03863	SW03866	SW03869
12	SW3211	SW03902 to SW03959	SW03906	SW03909	SW03912	SW03915	SW03918	SW03921	SW03924	SW03927
13	SW3212	SW03960 to SW04017	SW03964	SW03967	SW03970	SW03973	SW03976	SW03979	SW03982	SW03985
14	SW3213	SW04018 to SW04075	SW04022	SW04025	SW04028	SW04031	SW04034	SW04037	SW04040	SW04043
15	SW3214	SW04076 to SW04133	SW04080	SW04083	SW04086	SW04089	SW04092	SW04095	SW04098	SW04101
16	SW3215	SW04134 to SW04191	SW04138	SW04141	SW04144	SW04147	SW04150	SW04153	SW04156	SW04159

* Offset: Offset value from the first register number of Program Information Used by Work

12.3 Motion Program Alarms

If the result of investigation using *12.1.2 MP2000 Series Machine Controller Error Check Flowchart* on page 12-3 indicates that a motion program alarm has occurred, use the alarm code to determine the cause of the error.

12.3.1 Motion Program Alarm Configuration

Motion program alarms stored in the alarm output register (default: SW03268) are displayed as shown in the following diagram.

Bit 15	Bit 12 – Bit 8	Bit 7 – Bit 0
	Alarm axis information (1 to 16)	Alarm code (Axis alarm when bit 7 turns ON.)

- Refer to the relevant Machine Controller user's manual for information on finding the alarm output register.

12.3.2 Motion Program Alarm Code List

The motion program alarm codes are listed in the following table.

- When displaying these on the register list, set the view mode to hexadecimal.

	Alarm Code	Description	Correction
Program alarms	0	No alarm	Check the specifications for the instruction that was being executed in the motion program when the alarm occurred according to the meaning of the alarm code.
	10h	Complete circle specified for radius designation	
	11h	Interpolation feed speed exceeded	
	12h	Interpolation feed speed not specified	
	13h	Range exceeded after acceleration/deceleration speed parameter conversion	
	14h	LONG_MAX exceeded for circular arc length	
	15h	No vertical specification for circular plane designation	
	16h	No horizontal specification for circular plane designation	
	17h	Specified axes exceeded	
	18h	Specified number of turns exceeded	
	19h	LONG_MAX exceeded for radius	
	1Bh	Emergency stop in progress	
	1Ch	LONG_MAX exceeded for linear interpolation block moving amount	
	1Dh	FMX not defined	
	1Eh	Address T out of range	
	1Fh	Address P out of range	
	20h	REG data error	
	21h	Function work duplication (Function work in second PFORK column was used at a different nesting level.)	
	22h	Indirect register designation range error	
	23h	Overflow when converting reference unit	
Axis alarms*	80h	During use of logical axis prohibited	
	81h	Specifications exceeding POSMAX made for infinite length axis designation	
	82h	LONG_MAX exceeded for axis moving distance	
	84h	Motion command duplication	
	85h	Motion command response duplication	
	87h	VEL setting data out of range	
	88h	INP setting data out of range	
	89h	ACC/SCC/DCC setting data out of range	
	8Ah	T reference for MVT instruction is 0	
	8Bh	Instruction designated that cannot be executed for the Motion Module model	
	8Ch	Prohibition command executed when pulse distribution was not completed	
	8Dh	Motion command error end status	

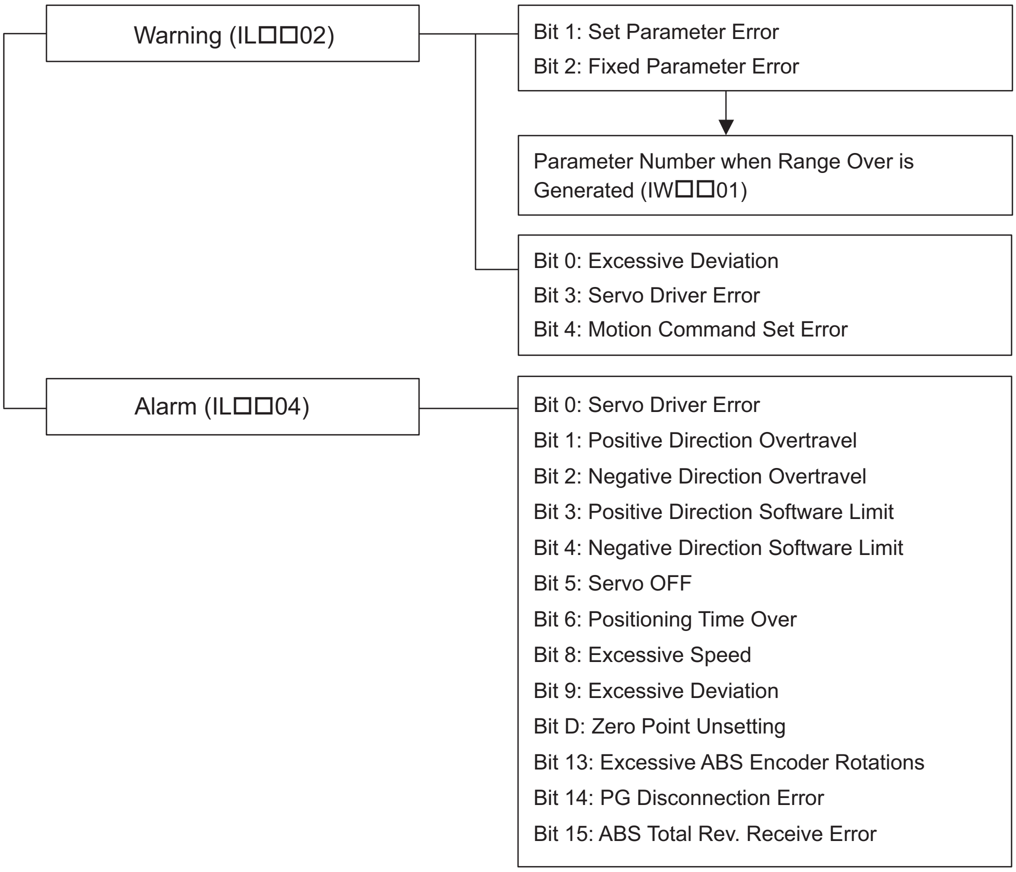
* The axis number is stored in bits 8 to 12 for axis alarms.

12.4 Troubleshooting Motion Errors

This section explains the details and corrective actions for errors that occur in motion control functions.

12.4.1 Overview of Motion Errors

Motion errors in the MP2000-series Machine Controller include axis alarms detected for individual SERVOPACKs. The failure location can be determined and appropriate corrections can be taken simply by checking the contents of the Warning (IL□□02) and Alarm (IL□□04) monitoring parameters.
The motion alarms for the SVA-01 Module are shown below.



12.4.2 Axis Alarm Details and Corrections

The following tables show the details of the axis alarms (IL☐☐04).

(1) Bit 0: Servo Driver Error

Detection Timing	• SERVOPACK alarms are continuously monitored by the alarm management section.
Processing when Alarm Occurs	• The current command will be aborted. If a SERVOPACK error is detected during execution of a POSING command, the positioning will be aborted and the axis will decelerate to a stop. • The Command Error Completed Status in the Motion Command Status (IW☐☐09,bit 3) will turn ON.
Error and Cause	One of the following is possible. • An alarm is occurring in the SERVOPACK. • SVALM signal (pin No. 17 of CN1/2) is incorrectly connected. • The 24-V power is not being supplied.
Correction	• Confirm the SERVOPACK alarm and remove the cause. • Check the SVALM signal connection to see if it is correctly made. • Check the 24-V input. • Reset the alarm.

(2) Bit 1: Positive Direction Overtravel and Bit 2: Negative Direction Overtravel

Detection Timing	• Overtravel is continuously monitored by the position management section during execution of a motion command. • Overtravel is detected when the overtravel signal in the direction of movement turns OFF.
Processing when Alarm Occurs	• The SERVOPACK performs stop processing. The stop method and processing after stopping depends on the SERVOPACK parameter settings. • The Command Error Completed Status in the Motion Command Status (IW☐☐09, bit 3) will turn ON. • Machine Controller Processing The command is canceled and the axis decelerates to a stop. Follow-up processing (each scan the current position of the machine is adjusted to the reference position) is executed.
Error and Cause	One of the following is possible. • A move command that exceeded the travel limit of the machine was executed as follows: A user program command exceeded the travel limit. The software limit was exceeded in manual operation. • Overtravel signal malfunction.
Correction	• Check the following. Check the overtravel signal. Check the program or manual operation. • Then, after clearing the motion command code and resetting the alarm, use a return operation to eliminate the overtravel status. (Commands in the overtravel direction will be disabled and an alarm will occur again if one is executed.)

- For a vertical axis, the following should be set at the SERVOPACK to avoid dropping and vibration at the overtravel limit.
  - An emergency deceleration to a stop
  - Zero clamp status after the deceleration to a stop

(3) Bit 3: Positive Direction Software Limit and Bit 4: Negative Direction Software Limit

Detection Timing	• Enabled when using a motion command and detected by the position management section. • The software limits are valid after a ZRET or ZSET command has been completed.
Processing when Alarm Occurs	• The axis decelerates to a stop at the software limit. • The Command Error Completed Status in the Motion Command Status (IW□□09, bit 3) will turn ON.
Error and Cause	• A move command that exceeded a software limit of the machine was executed as follows: A user program command exceeded the software limit. The software limit was exceeded in manual operation.
Correction	• Check the program or manual operation. • Then, after clearing the motion command code and resetting the alarm, use a return operation to eliminate the software limit status. (Commands in the direction of the software limit will be disabled and an alarm will occur again if one is executed.)

(4) Bit 5: Servo OFF

Detection Timing	• Servo OFF status is detected when a move command is executed.
Processing when Alarm Occurs	• The specified movement command will not be executed. • The Command Error Completed Status in the Motion Command Status (IW□□09, bit 3) will turn ON.
Error and Cause	• A move command (commands for positioning, external positioning, STEP operation, JOG operation, etc.) was executed when the SERVOPACK was Servo OFF status.
Correction	• After clearing the motion command and resetting the alarm, turn the SERVOPACK to the Servo ON status.

(5) Bit 6: Positioning Time Over

Detection Timing	• Positioning was not completed within the time specified in OW□□26 (Positioning Completion Check Time) after completing pulse distribution.
Processing when Alarm Occurs	• The current command was ended forcibly. • The Command Error Completed Status in the Motion Command Status (IW□□0,9 bit 3) will turn ON.
Error and Cause	One of the following is possible. • The position loop gain and speed loop gain are not set correctly, creating poor response. Or, there is oscillation. • The Positioning Completion Check Time (OW□□26) is too short. • The capacity of the motor is insufficient for the machine load. • Connections are not correct between the SERVOPACK and the motor.
Correction	Check the following. • Check the SERVOPACK gain parameters. • Check connections between the SERVOPACK and the motor. • Check the motor capacity. • Check the Positioning Completion Check Time (OW□□26).

- The above check is not performed if the Positioning Completion Check Time (OW□□26) is set to 0.

(6) Bit 8: Excessive Speed

Detection Timing	• When the electronic gear is used and a move command is executed.
Processing when Alarm Occurs	• The move command is not executed. • The Command Error Completed Status in the Motion Command Status (IW□□09, bit 3) will turn ON.
Error and Cause	• The speed (movement output for one scan in case of interpolation) exceeds the upper limit.
Correction	• Check the settings for speed reference, interpolation command movement per scan, and speed compensation.

(7) Bit 9: Excessive Deviation

Detection Timing	• Always, except during speed control and torque control
Processing when Alarm Occurs	• The move command is not executed. • The Command Error Completed Status in the Motion Command Status (IW☐☐09, bit 3) will turn ON.
Error and Cause	One of the following is possible. • The position loop gain and speed loop gain are not set correctly, creating poor response. • The Error Count Alarm Detection (OL☐☐22) is too small. • The capacity of the motor is insufficient for the machine load. • SERVOPACK failure
Correction	Check the following and correct the problem. If the problem persists, contact the maintenance department. • Check the position loop gain and speed loop gain. • Check the Error Count Alarm Detection (OL☐☐22). • Check the motor capacity.

- The above check is not performed if the Error Count Alarm Detection (OL☐☐22) is set to 0.

(8) Bit D: Zero Point Unsetting

Detection Timing	• Enabled only when an absolute encoder is used for an infinite length axis and detected when the next command is set in the Motion Command (OW☐☐08). Commands: Positioning, External Positioning, Interpolation, Interpolation with position detection function, Phase reference
Processing when Alarm Occurs	• The set command will not be executed. • The Command Error Completed Status in the Motion Command Status (IW☐☐09, bit 3) will turn ON.
Error and Cause	• A move command was set without executing the ZSET command (IW☐☐0C, bit 5 is OFF).
Correction	• After clearing the motion command and resetting the alarm, execute a Zero Point Setting operation.

(9) Bit 13: Excessive ABS (Absolute) Encoder Rotations

Detection Timing	• Enabled only when an absolute encoder is used for a finite length axis, and the electronic gear is used. Detected by the position management section when power is turned ON.
Processing when Alarm Occurs	• The absolute position information read from the absolute encoder when the SEN signal turned ON is ignored.
Error and Cause	• An operation error occurred when the absolute position information read from the absolute encoder is converted from pulses to reference units at power ON.
Correction	• Check the gear ratio, number of encoder pulses for other motion fixed parameters.

(10) Bit 14: PG Disconnection Error

Detection Timing	• Any time
Processing when Alarm Occurs	• The command in execution is forcibly terminated. • The Command Error Completed Status in the Motion Command Status (IW☐☐09, bit 3) will turn ON.
Error and Cause	One of the following is possible. • Any of the following pulse input signals are incorrectly connected or disconnected. PA (pin No. 3), PAL (pin No. 4), PB (pin No. 23), PBL (pin No. 24) • The SERVOPACK control power supply is OFF.
Correction	• Check the pulse input signal connections to see if they are correctly connected. • Check the SERVOPACK control power supply.

12.4.3 Analog Servo Alarm List

The Servo Driver Error Flag (IL□□04, bit 0) turns ON when an alarm has occurred in a SERVOPACK connected to the SVA-01 Module.
The content of the alarm can be confirmed by connecting a Digital Operator to the SERVOPACK.
The following tables show the alarms that can occur in the SGDA, SGDB, SGDM, SGDH, SGDS, SGDV, and SGD7S SERVOPACKs.

(1) Alarm List for the SGDA, SGDB, SGDM, and SGDH SERVOPACKs

- ○: Alarm displayed
  ×: No alarm displayed

Alarm Display	Alarm Name	Alarm Content	SGDA	SGDB	SGDM	SGDH
A.00	Absolute Value Data Error	Absolute data cannot be received or the received absolute data is invalid.	○	○	×	×
A.02	Parameter Corrupted	A parameter checksum error was detected.	○	○	○	○
A.03	Main Circuit Detector Error	There was an error in the power circuit's detection data.	×	×	○	○
A.04	Parameter Setting Error	A parameter value setting exceeded the allowed setting range.	○	○	○	○
A.05	Combination Error	The motor and SERVOPACK capacity settings are incompatible.	×	×	○	○
A.09	Divider Setting Error	An invalid Divider Setting (Pn212) was set (between increments) or the setting exceeds the connected Encoder's resolution.	×	×	○	×
		When a linear motor is connected, the setting exceeds the maximum dividing ratio (Pn281), which was calculated from the linear motor's maximum speed.	×	×	○	×
A.0A	Encoder Type Mismatch	A serial encoder has been mounted that is not supported by the Σ-II.	×	×	○	×
A.10	Overcurrent or Heat Sink Overheat	There was an overcurrent in the power transistor. The heat sink overheated (SGDM).	○	○	○	○
A.30	Regeneration Error	An error occurred in the regeneration processing circuit.	○	○	○	○
A.31	Position Error Pulse Overflow	The position error pulses exceeded the “Overflow” limit set in the parameters.	○	○	×	×
A.32	Regeneration Overload	The regenerative energy exceeds the regenerative resistor's capacity.	×	×	○	○
A.33	Main Circuit Wiring Error	The power supply method used to supply the main circuit does not match the setting in parameter Pn001.	×	×	○	○
A.40	Overvoltage	The power supply voltage to the main circuit is excessively high.	○	○	○	○
A.41	Undervoltage	The power supply voltage to the main circuit is too low.	×	×	○	○
A.51	Overspeed	The motor's speed is too high.	○	○	○	○
A.70	Overload	The torque exceeded the rated torque (high or low load).	○	×	×	×
A.71	Overload (High Load)	The torque significantly exceeded the rated torque for several seconds to several dozen seconds.	×	○	○	○
A.72	Overload (Low Load)	The motor is operating continuously at a torque exceeding the rated torque.	×	○	○	○
A.73	DB Overload	During dynamic braking operation, the rotating energy exceeds the DB resistor's capacity.	×	×	○	○
A.74	Inrush Resistance Overload	The main circuit power supply was turned OFF and ON repeatedly.	×	×	○	○
A.7A	Heat Sink Overheat	The SERVOPACK’s heat sink overheated.	×	×	○	○
A.80	Absolute Encoder Error	The “Number of Pulses per Absolute Encoder Rotation” value is incorrect.	○	○	×	×

Alarm Display	Alarm Name	Alarm Content	SGDA	SGDB	SGDM	SGDH
A.81	Absolute Encoder Backup Error	The encoder power supplies are all down and the position data was cleared.	○	○	○	○
A.82	Absolute Encoder Checksum Error	A checksum error was detected in the encoder's memory.	○	○	○	○
A.83	Absolute Encoder Battery Error	The voltage is too low in the absolute encoder's backup battery.	○	○	○	○
A.84	Absolute Encoder Data Error	The received absolute data is invalid.	○	○	○	○
A.85	Absolute Encoder Overspeed	The encoder was rotating at high-speed when the power was turned ON.	○	○	○	○
A.86	Encoder Overheat	The encoder's internal temperature is too high.	×	×	○	○
A.A1	Heat Sink Overheat	The SERVOPACK’s heat sink overheated.	×	○	×	×
A.b1	Speed Reference A/D Error (Reference mechanism read error)	There is an error in the speed reference input's A/D converter.	○	○	○	○
A.b2	Torque Reference A/D Error	There is an error in the torque reference input's A/D converter.	×	×	○	○
A.b3	Current Sensor Error	There is an error in the current sensor system or a motor power line is disconnected.	×	×	○	○
A.bF	System Alarm	A SERVOPACK system alarm occurred.	×	×	○	○
A.c1	Servo Run-away	The Servomotor was overrunning.	○	○	○	○
A.c2	Encoder Phase Error Detected	An error occurred in the phase of the encoder's phase-A, phase-B, or phase-C output.	○	○	×	×
A.c3	Encoder Phase-A or -B Broken	The encoder's phase-A or phase-B is disconnected.	○	○	×	×
A.c4	Encoder Phase-C Broken	The encoder's phase-C is disconnected.	○	○	×	×
A.c8	Encoder Clear Error Multiturn Limit Setting Error	The absolute encoder's multiturn count could not be cleared or it could not be set properly.	×	×	○	○
A.c9	Encoder Communication Error	Communication could not be established between the Encoder and SERVOPACK.	×	×	○	○
A.cA	Encoder Parameter Error	The Encoder's parameters are corrupted.	×	×	○	○
A.cb	Encoder Echoback Error	The contents of communication with the encoder are incorrect.	×	×	○	○
A.cc	Multiturn Limit Mismatch	The Encoder and SERVOPACK Multiturn Limit Values do not agree.	×	×	○	○
A.do	Excessive Position Error	The position error pulses exceeded the setting in parameter Pn505.	×	×	○	○
A.E7	Application Module Detection Failure	Detection of the Application Module failed.	×	×	×	○
A.F1	Broken Phase in Power Line	One phase is open in the main power supply.	×	○	○	○
A.F3	Power Loss Alarm	There was a power interruption of more than 1 cycle in the AC power supply.	○	○	×	×
A.F5 A.F6	Motor Wire Disconnection	Power is not being applied to the Servomotor even though the SERVOPACK received the Servo ON reference.	×	×	○	×
CPF00	Digital Operator Communication Error	Communication could not be established between the JUSP-OP02A-2 Digital Operator and SERVOPACK due to a CPU Error or other problem.	×	×	○	○
CPF01			×	×	○	○
A99	No error display	Indicates normal operating status.	○	○	×	×
A.– –	No error display	Indicates normal operating status.	×	×	○	○

(2) Alarm List for the SGDS, SGDV, and SGD7S SERVOPACKs

- ○: Alarm displayed
  ×: No alarm displayed

Code	Alarm Name	Alarm Content	SGDS	SGDV	SGD7S
A.020	Parameter Checksum Error	There is an error in the parameter data in the SERVOPACK.	○	○	○
A.021	Parameter Format Error	There is an error in the parameter data format in the SERVOPACK.	○	○	○
A.022	System Checksum Error	There is an error in the parameter data in the SERVOPACK.	○	○	○
A.023	Parameter Password Error	There is an error in the parameter data in the SERVOPACK.	○	×	×
A.024	System Alarm	An internal program error occurred in the SERVOPACK.	×	×	○
A.025	System Alarm	An internal program error occurred in the SERVOPACK.	×	×	○
A.030	Main Circuit Detector Error	There is an error in the detection data for the main circuit.	○	○	○
A.040	Parameter Setting Error	A parameter setting is outside of the setting range.	○	○	○
A.041	Encoder Output Pulse Setting Error	The setting of Pn212 (Encoder Output Pulses) or Pn281 (Encoder Output Resolution) is outside of the setting range or does not satisfy the setting conditions.	○	○	○
A.042	Parameter Combination Error	The combination of some parameters exceeds the setting range.	○	○	○
A.044	Semi-Closed/Fully-Closed Loop Control Parameter Setting Error	The settings of the Option Module and Pn002 = n.X□□□ (External Encoder Usage) do not match.	×	○	○
A.050	Combination Error	The capacities of the SERVOPACK and Servomotor do not match.	○	○	○
A.051	Unsupported Device Alarm	An unsupported device was connected.	○	○	○
A.070	Motor Type Change Detected	The connected motor is a different type of motor from the previously connected motor.	×	×	○
A.080	Linear Encoder Pitch Setting Error	The setting of Pn282 (Linear Encoder Pitch) has not been changed from the default setting.	×	×	○
A.0b0	Invalid Servo ON Command Alarm	The /S-ON (Servo ON) signal was input from the host controller after a utility function that turns ON the Servomotor was executed.	○	○	○
A.100	Overcurrent Detected	An overcurrent flowed through the power transformer or the heat sink overheated.	○	○	○
A.101	Motor Overcurrent Detected	The current to the motor exceeded the allowable current.	×	×	○
A.300	Regeneration Error	There is an error related to regeneration.	○	○	○
A.320	Regenerative Overload	A regenerative overload occurred.	○	○	○
A.330	Main Circuit Power Supply Wiring Error	The AC power supply input setting or DC power supply input setting is not correct. The power supply wiring is not correct.	○	○	○
A.400	Overvoltage	The main circuit DC voltage is too high.	○	○	○
A.410	Undervoltage	The main circuit DC voltage is too low.	○	○	○
A.450	Main-Circuit Capacitor Overvoltage	The capacitor of the main circuit has deteriorated or is faulty.	×	○	×
A.510	Overspeed	The motor exceeded the maximum speed.	○	○	○
A.511	Encoder Output Pulse Overspeed	Rotary Servomotor: The pulse output speed for the setting of Pn212 (Encoder Output Pulses) was exceeded. Linear Servomotor: The motor speed upper limit for the setting of Pn281 (Encoder Output Resolution) was exceeded.	○	○	○

Code	Alarm Name	Alarm Content	SGDS	SGDV	SGD7S
A.520	Vibration Alarm	Abnormal oscillation was detected in the motor speed.	○	○	○
A.521	Autotuning Alarm	Vibration was detected during autotuning for the tuning-less function.	○	○	○
A.550	Maximum Speed Setting Error	The setting of Pn385 (Maximum Motor Speed) is greater than the maximum motor speed.	×	×	○
A.710	Instantaneous Overload	The Servomotor was operating for several seconds to several tens of seconds under a torque that largely exceeded the rating.	○	○	○
A.720	Continuous Overload	The Servomotor was operating continuously under a torque that exceeded the rating.	○	○	○
A.730	Dynamic Brake Overload	When the dynamic brake was applied, the rotational or linear kinetic energy exceeded the capacity of the dynamic brake resistor.	○	○	○
A.731			×		○
A.740	Inrush Current Limiting Resistor Overload	The main circuit power supply was frequently turned ON and OFF.	○	○	○
A.7A0	Heat Sink Overheated	The heat sink of the SERVOPACK exceeded 100°C.	○	○	×
A.7A1	Internal Temperature Error 1 (Control Board Temperature Error)	The surrounding temperature of the control PCB is abnormal.	×	×	○
A.7A2	Internal Temperature Error 2 (Power Board Temperature Error)	The surrounding temperature of the power PCB is abnormal.	×	×	○
A.7A3	Internal Temperature Sensor Error	An error occurred in the temperature sensor circuit.	×	×	○
A.7Ab	SERVOPACK Built-in Fan Stopped	The fan inside the SERVOPACK stopped.	×	○	○
A.810	Encoder Backup Alarm	The power supplies to the encoder all failed and the position data was lost.	○	○	○
A.820	Encoder Checksum Alarm	There is an error in the checksum results for encoder memory.	○	○	○
A.830	Encoder Battery Alarm	The battery voltage was lower than the specified level after the control power supply was turned ON.	○	○	○
A.840	Encoder Data Alarm	There is an internal data error in the encoder.	○	○	○
A.850	Encoder Overspeed	The encoder was operating at high speed when the power was turned ON.	○	○	○
A.860	Encoder Overheated	The internal temperature of the rotary encoder or linear encoder is too high.	○	○	○
A.861	Motor Overheated	The internal temperature of motor is too high.	×	×	○
A.890	Encoder Scale Error	A failure occurred in the linear encoder.	×	×	○
A.891	Encoder Module Error	An error occurred in the linear encoder.	×	×	○
A.8A0	External Encoder Error	An error occurred in the external encoder.	×	○	○
A.8A1	External Encoder Module Error	An error occurred in the Serial Converter Unit.	×	○	○
A.8A2	External Incremental Encoder Sensor Error	An error occurred in the external encoder.	×	○	○
A.8A3	External Absolute Encoder Position Error	An error occurred in the position data of the external encoder.	×	○	○
A.8A5	External Encoder Overspeed	An overspeed error occurred in the external encoder.	×	○	○
A.8A6	External Encoder Overheated	An overheating error occurred in the external encoder.	×	○	○
A.b10	Speed Reference A/D Error	An error occurred in the A/D converter for the speed reference input.	○	○	○
A.b11	Speed Reference A/D Data Error	An error occurred in the A/D conversion data for the speed reference.	○	○	○
A.b20	Torque Reference A/D Error	An error occurred in the A/D converter for the torque reference input.	○	○	○
A.b31	Current Detection Error 1	The current detection circuit for phase U is faulty.	○	○	×

Code	Alarm Name	Alarm Content	SGDS	SGDV	SGD7S
A.b32	Current Detection Error 2	The current detection circuit for phase V is faulty.	○	○	×
A.b33	Current Detection Error 3	An error occurred in the current detection circuit.	○	○	○
A.bF0	System Alarm 0	Internal program error 0 occurred in the SERVOPACK.	○	○	○
A.bF1	System Alarm 1	Internal program error 1 occurred in the SERVOPACK.	○	○	○
A.bF2	System Alarm 2	Internal program error 2 occurred in the SERVOPACK.	○	○	○
A.bF3	System Alarm 3	Internal program error 3 occurred in the SERVOPACK.	○	○	○
A.bF4	System Alarm 4	Internal program error 4 occurred in the SERVOPACK.	○	○	○
A.C10	Servomotor Out of Control	The Servomotor ran out of control.	○	○	○
A.C20	Phase Detection Error	The detection of the phase is not correct.	×	×	○
A.C21	Polarity Sensor Error	An error occurred in the polarity sensor.	×	×	○
A.C22	Phase Information Disagreement	The phase information does not match.	×	×	○
A.C50	Polarity Detection Failure	The polarity detection failed.	×	×	○
A.C51	Overtravel Detected during Polarity Detection	The overtravel signal was detected during polarity detection.	×	×	○
A.C52	Polarity Detection Not Completed	The servo was turned ON before the polarity was detected.	×	×	○
A.C53	Out of Range of Motion for Polarity Detection	The travel distance exceeded the setting of Pn48E (Polarity Detection Range).	×	×	○
A.C54	Polarity Detection Failure 2	The polarity detection failed.	×	×	○
A.C80	Encoder Clear Error or Multiturn Limit Setting Error	The multiturn data for the absolute encoder was not correctly cleared or set.	○	○	○
A.C90	Encoder Communications Error	Communications between the encoder and SERVOPACK is not possible.	○	○	○
A.C91	Encoder Communications Position Data Acceleration Rate Error	An error occurred in calculating the position data of the encoder.	○	○	○
A.C92	Encoder Communications Timer Error	An error occurred in the communications timer between the encoder and SERVOPACK.	○	○	○
A.CA0	Encoder Parameter Error	The parameters in the encoder are corrupted.	○	○	○
A.Cb0	Encoder Echoback Error	The contents of communications with the encoder are incorrect.	○	○	○
A.CC0	Multiturn Limit Disagreement	Different multiturn limits have been set in the encoder and the SERVOPACK.	○	○	○
A.CF1	Reception Failed Error in Feedback Option Module Communications	Receiving data from the Feedback Option Module failed.	×	○	○
A.CF2	Timer Stopped Error in Feedback Option Module Communications	An error occurred in the timer for communications with the Feedback Option Module.	×	○	○
A.d00	Position Deviation Overflow	The setting of Pn520 (Excessive Position Deviation Alarm Level) was exceeded by the position deviation while the servo was ON.	○	○	○
A.d01	Position Deviation 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.	○	○	○
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) limits the speed when the servo is turned ON. This alarm occurs if reference pulses are input and the setting of Pn520 (Excessive Position Deviation Alarm Level) is exceeded before the limit is cleared.	○	○	○

Code	Alarm Name	Alarm Content	SGDS	SGDV	SGD7S
A.d10	Motor-Load Position Deviation Overflow	There was too much position deviation between the motor and load during fully-closed loop control.	×	○	○
A.d30	Position Data Overflow	The position feedback data exceeded ±1,879,048,192.	×	×	○
A.E71	Safety Option Module Detection Failure	Detection of the safety option module failed.	×	○	×
A.E72	Feedback Option Module Detection Failure	Detection of the Feedback Option Module failed.	×	○	○
A.E74	Unsupported Safety Option Module	An unsupported safety option module was connected.	×	○	×
A.E75	Unsupported Feedback Option Module	An unsupported feedback option module was connected.	×	○	×
A.Eb1	Safety Function Signal Input Timing Error	An error occurred in the input timing of the safety function signal.	×	○	○
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 circuit.	×	×	○
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.	○	○	○
A.F50	Servomotor Main Circuit Cable Disconnection	The Servomotor did not operate or power was not supplied to the Servomotor even though the /S-ON (Servo ON) signal was input when the Servomotor was ready to receive it.	×	○	○
FL-1	System Alarm	An internal program error occurred in the SERVOPACK.	×	○	○
FL-2			×	○	○
FL-3			×	×	○
FL-4			×	×	○
FL-5			×	×	○
CPF00	Digital Operator Communications Error 1	Communications were not possible between the Digital Operator (model: JUSP-OP05A-1-E) and the SERVOPACK (e.g., a CPU error occurred).	○	○	○
CPF01	Digital Operator Communications Error 2		○	○	○
A.– –	No error display	Indicates normal operation status	○	○	○

Troubleshooting

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Appendices

Appendix A System Registers Lists

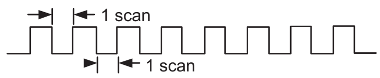
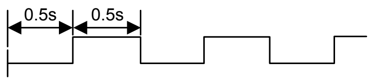
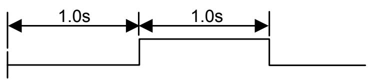
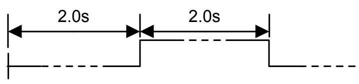
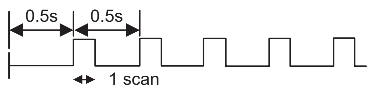
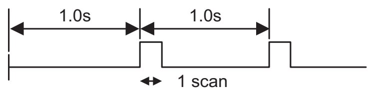
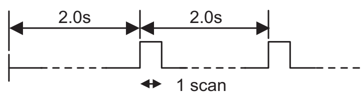
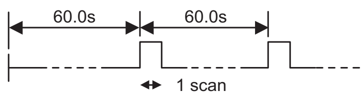
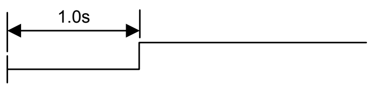
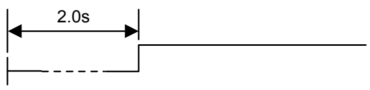
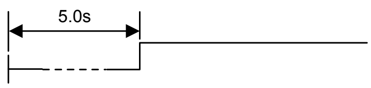
A.1 System Service Registers

(1) Shared by All Drawings

Name	Register No.	Remarks
Reserved (Reserved for the system)	SB000000	(Not used)
First High-speed Scan	SB000001	ON for only the first scan after high-speed scan is started.
First Low-speed Scan	SB000003	ON for only the first scan after low-speed scan is started.
Always ON	SB000004	Always ON (= 1)
Reserved (Reserved for the system)	SB000005 to SB00000F	(Not used)

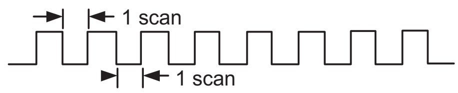
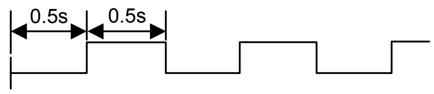
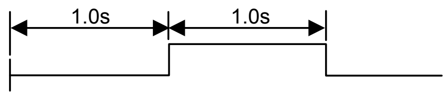
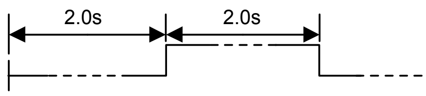
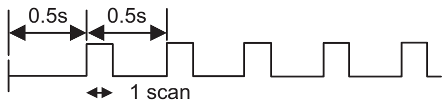
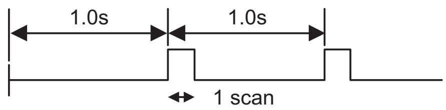
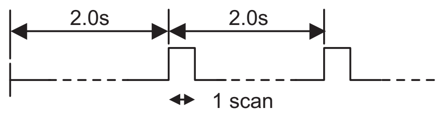
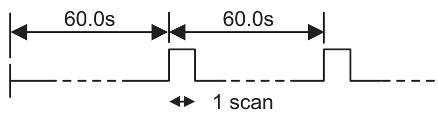
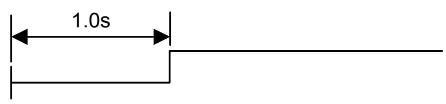
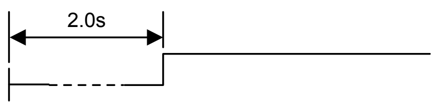
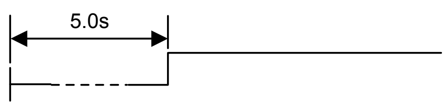
(2) DWG.H Only

Operation starts when high-speed scan starts.

Name	Register No.	Remarks
1-scan Flicker Relay	SB000010	
0.5-s Flicker Relay	SB000011	
1.0-s Flicker Relay	SB000012	
2.0-s Flicker Relay	SB000013	
0.5-s Sampling Relay	SB000014	
1.0-s Sampling Relay	SB000015	
2.0-s Sampling Relay	SB000016	
60.0-s Sampling Relay	SB000017	
1.0 s After Start of Scan Relay	SB000018	
2.0 s After Start of Scan Relay	SB000019	
5.0 s After Start of Scan Relay	SB00001A	

(3) DWG.L Only

Operation starts when low-speed scan starts.

Name	Register No.	Remarks
1-scan Flicker Relay	SB000030	
0.5-s Flicker Relay	SB000031	
1.0-s Flicker Relay	SB000032	
2.0-s Flicker Relay	SB000033	
0.5-s Sampling Relay	SB000034	
1.0-s Sampling Relay	SB000035	
2.0-s Sampling Relay	SB000036	
60.0-s Sampling Relay	SB000037	
1.0 s After Start of Scan Relay	SB000038	
2.0 s After Start of Scan Relay	SB000039	
5.0 s After Start of Scan Relay	SB00003A	

A.2 Scan Execution Status and Calendar

Name	Register No.	Remarks
High-speed Scan Set Value	SW00004	High-speed Scan Set Value (0.1 ms)
High-speed Scan Current Value	SW00005	High-speed Scan Current Value (0.1 ms)
High-speed Scan Maximum Value	SW00006	High-speed Scan Maximum Value (0.1 ms)
Reserved by the system	SW00007 to SW00009	(Not used)
Low-speed Scan Set Value	SW00010	Low-speed Scan Set Value (0.1 ms)
Low-speed Scan Current Value	SW00011	Low-speed Scan Current Value (0.1 ms)
Low-speed Scan Maximum Value	SW00012	Low-speed Scan Maximum Value (0.1 ms)
Reserved by the system.	SW00013	(Not used)
Executing Scan Current Value	SW00014	Executing Scan Current Value (0.1 ms)
Calendar: Year	SW00015	1999: 0099 (BCD) (Last two digits only)
Calendar: Month Day	SW00016	December 31: 1231 (BCD)
Calendar: Hours Minutes	SW00017	23 hours 59 minutes: 2359 (BCD)
Calendar: Seconds	SW00018	59 s: 59 (BCD)
Calendar: Day of Week	SW00019	0 to 6: Sun., Mon. to Sat.

A.3 Program Software Numbers and Remaining Program Memory Capacity

Name	Register No.	Remarks
System Program Software Number	SW00020	S□□□□ (□□□□ is stored as BCD)
System Number	SW00021 to SW00025	(Not used)
Remaining Program Memory Capacity	SL00026	Unit: Bytes
Total Memory Capacity	SL00028	Unit: Bytes

Appendix B Initializing the Absolute Encoder

The procedure for initializing an absolute encoder for a Σ-I, Σ-II, or Σ-III series SERVOPACK is given below.

- Refer to *10.2.1 System Startup Flowchart* on page 10-4 for the procedure for absolute-position detection.

B.1 Σ-III, Σ-V, or Σ-7 Series SERVOPACK

- Refer to the following manuals for information on Σ-III series SERVOPACKs:
  AC Servo Drives Σ-III Series SGM□□/SGDS User's Manual (Manual No. SIEP S800000 00)
  Σ-III Series SGM□S/SGDS Digital Operator Instructions (TOBP S800000 01)
- Refer to the following manuals for information on Σ-V series SERVOPACKs:
  AC Servodrive Σ-V Series SGM□□/SGDV User's Manual Design and Maintenance Rotational Motor Analog Voltage and Pulse Train Reference (Manual No. SIEP S800000 45)
  AC Servodrive Σ-V Series User's Manual Design and Maintenance Linear Motor Analog Voltage and Pulse Train Reference (Manual No. SIEP S800000 47)
- Refer to the following manual for information on Σ-7 series SERVOPACKs:
  AC Servo Drive Σ-7S SERVOPACK with Analog Voltage/Pulse Train References Product Manual (Manual No.: SIEP S800001 26).

Follow the setup procedure below using a Digital Operator.

1. Press the [MODE/SET] Key to display the Utility Function Mode main menu. Use the [∧] Key or [∨] Key to select Fn008.

```
BB      －FUNCTION－
Fn007
Fn008
Fn009
Fn00A
```

2. Press the [DATA] Key.

The display is switched to the execution display of Fn008 (Absolute encoder multi-turn reset and encoder alarm reset).

```
BB

 Multiturn Clear

      PGCL1
```

- If the display is not switched and "NO_OP" is displayed in the status display, the Write Prohibited setting (Fn010 = 0001) is set. Check the status and reset. Then clear the Write Prohibited setting.

3. Keep pressing the [∧] Key until "PGCL1" is changed to "PGCL5."

```
BB

 Multiturn Clear

      PGCL5
```

4. Press the [DATA] Key.

"BB" in the status display changes to "Done."

```
Done

 Multiturn Clear

      PGCL5
```

Appendices

App

5. Press the MODE/SET Key. The display returns to the Utility Function Mode main menu.

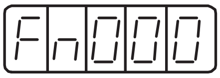
This completes setting up the absolute encoder. Turn the power supply OFF and then back ON to reset the SERVOPACK.

B.2 Σ-II Series SERVOPACKs

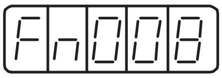
- Refer to the following manuals for information on Σ-II SERVOPACKs:
  Σ-II Series SGM□H/SGDH User's Manual (SIEPS800000005)
  Σ-II Series SGM□/SGDB/SGM□H/SGDM User's Manual (SIEPS80000015)

(1) Initialization Using a Hand-held Digital Operator

1. Press the DSPL/SET Key to select the Auxiliary Function Mode.

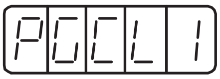


2. Select parameter Fn008 by pressing the LEFT (<) and RIGHT (>) Keys to select the digit to be changed and then using the UP (∧) and DOWN (∨) Keys to change the value of the digit.



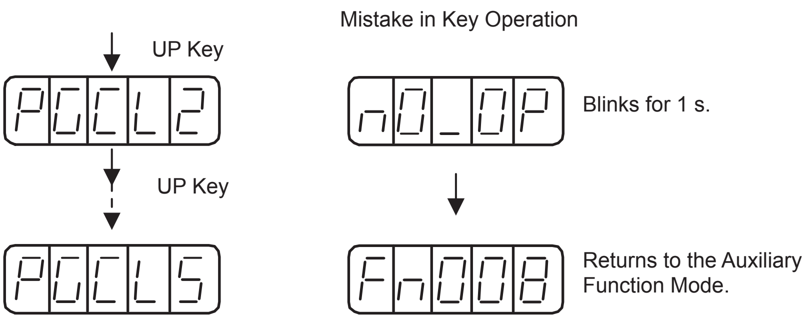
3. Press the DATA/ENTER Key.

The following display will appear.



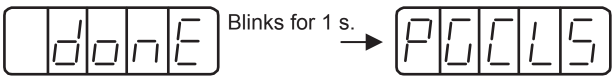
4. The rightmost digit will be incremented each time the UP (∧) Key is pressed. Press the UP (∧) Key several times until "PGCL5" is displayed.

If a mistake is made in the key operation, "nO_OP" will blink on the display for 1 second and then the display will return to the Auxiliary Function Mode. If this happens, return to step 3, above, and repeat the operation.



5. Press the DSPL/SET Key.

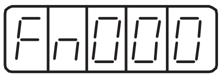
The display will change as shown below and the clear operation will be performed for multiturn data for the absolute encoder.



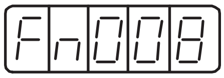
This completes initializing the absolute encoder. Reset the SERVOPACK to turn the power supply OFF and then back ON.

(2) Initialization Using the Built-in Panel Operator

1. Press the MODE/SET Key to select the Auxiliary Function Mode.

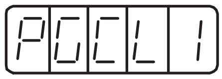


2. Press the UP (▲) and DOWN (▼) Keys to select parameter Fn008.



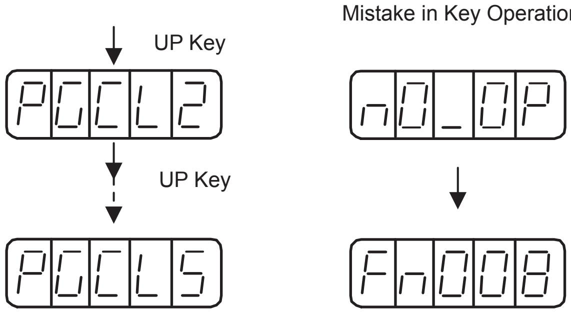
3. Press the DATA/ < Key for more than one second.

The following display will appear.



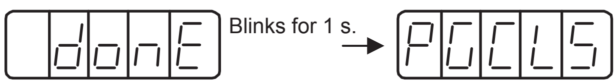
4. The rightmost digit will be incremented each time the UP (▲) Key is pressed. Press the UP (▲) Key several time until "PGCL5" is displayed.

If a mistake is made in the key operation, "nO_OP" will blink on the display for 1 second and then the display will return to the Auxiliary Function Mode. If this happens, return to step 3, above, and repeat the operation.



5. Press the MODE/SET Key.

The display will change as shown below and the clear operation will be performed for multiturn data for the absolute encoder.



This completes initializing the absolute encoder. Reset the SERVOPACK to turn the power supply OFF and then back ON.

B.3 Σ-I Series SERVOPACK

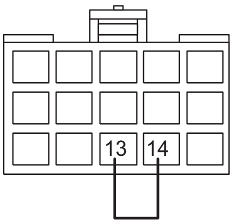
- Refer to the following manual for information on Σ-I series SERVOPACKs:
  Σ Series SGM□/SGD User's Manual (Manual No. SIE-S800-26.3)

(1) Initializing a 12-bit Absolute Encoder

Use the following procedure to initialize a 12-bit absolute encoder.

1. Properly connect the SERVOPACK, Servomotor, and Machine Controller.

2. Disconnect the connector on the encoder end and short-circuit pins 13 and 14 on the encoder end connector for 2 seconds or more.



3. Remove the short piece and insert the connector securely in its original position.

4. Connect the cables using normal wiring and make sure the encoder battery is connected.

5. Turn ON the system.

Repeat the procedure starting from step 1 if an Absolute Encoder Alarm occurs, so the system has been successfully initialized.

(2) Initializing a 15-bit Absolute Encoder

Use the following procedure to initialize a 15-bit absolute encoder.

1. Turn OFF the SERVOPACK and Machine Controller.

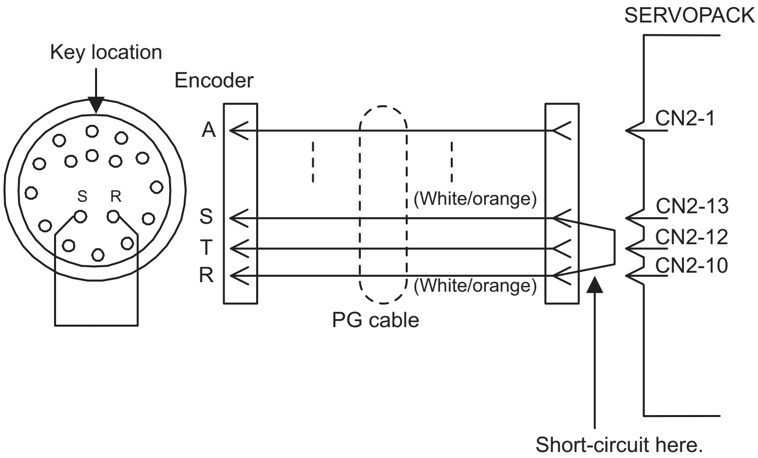
2. Discharge the large-capacity capacitor in the encoder using one of the following methods.

■ At the SERVOPACK End Connector

a) Disconnect the connector on the SERVOPACK end.
b) Use a short piece to short-circuit together connector pins 10 and 13 on the encoder end and leave the pins short-circuited for at least 2 minutes.
c) Remove the short piece and insert the connector securely in its original position.

■ At the Encoder End Connector

a) Disconnect the connector on the encoder end.
b) Use a short piece to short-circuit together connector pins R and S on the encoder end and leave the pins short-circuited for at least 2 minutes.
c) Remove the short piece and insert the connector securely in its original position.



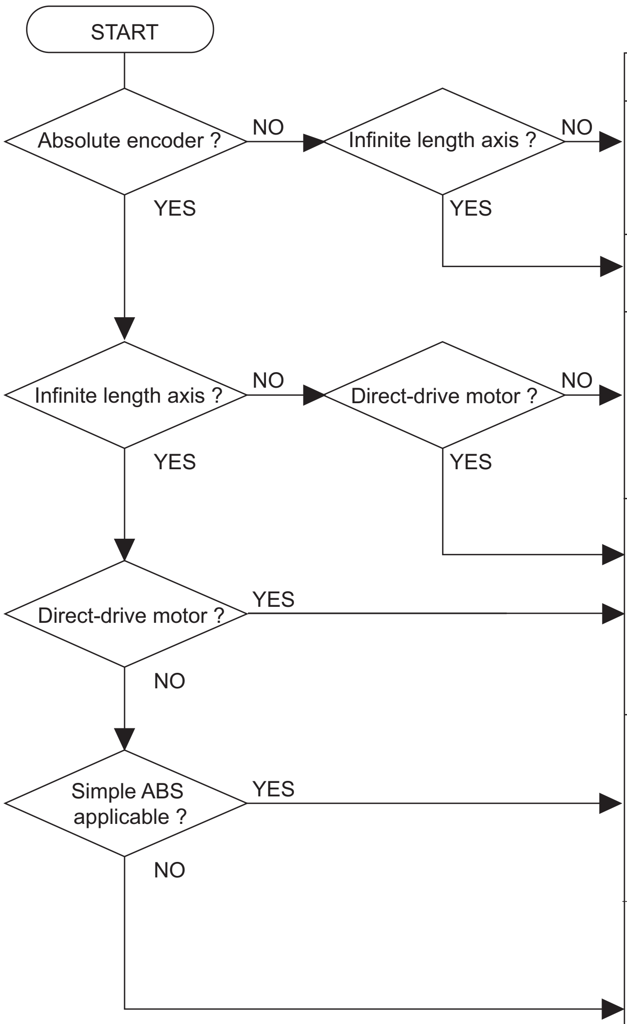
3. Connect the cables using normal wiring and make sure the encoder battery is connected.

4. Turn ON the system.

Repeat the procedure starting from step 1 if an Absolute Encoder Alarm occurs, so the system has been successfully initialized.

Appendix C Fixed Parameter Setting According to Encoder Type and Axis Type

The method of setting or changing the coordinate zero point differs depending on the encoder type, motor type, and axis type (infinite length axis or finite length axis) to be used. Use the flowchart below to correctly set the fixed parameter according to your application.



Encoder Type	Motor Type	Fixed Parameter Setting
Incremental encoder	Any type	No.1, bit 0 = 0 (Finite length axis)
Incremental encoder	Any type	No.1, bit 0 = 1 (Infinite length axis)
Absolute encoder	Any type other than direct-drive motor	No.1, bit 0 = 0 (Finite length axis)
Absolute encoder	Direct-drive motor	No.1, bit 0 = 1 (Infinite length axis) + No.1, bit 9 = 1 (Simple ABS enabled)
Absolute encoder	Any type other than direct-drive motor	No.1, bit 0 = 1 (Infinite length axis) + No.1, bit 9 = 1 (Simple ABS enabled)
Absolute encoder	Any type other than direct-drive motor	No.1, bit 0 = 1 (Infinite length axis) + No.1, bit 9 = 0 (Simple ABS disabled)

Coordinate Zero Point is Determined By	Precautions When Turning the Power ON/OFF	Setting Mode	How to Change the Coordinate Zero Point
Zero point return method and zero point position offset (OL□□48). The way the axis returns to zero point depends on the motion pattern. (See the relevant SERVOPACK manual.)	Requires zero point return operation after turning ON the power. When zero point return operation is not performed, the position when the power is turned ON becomes the coordinate zero point. In this case, if ZSET (Set Zero Point) command is not executed, the software limit function will not be valid.	Either Absolute mode or in Incremental Addition mode (relative value). Depends on the setting of OW□□09, bit 5. Setting range: -2^{31} to $2^{31}-1$ In Incremental Addition mode (relative value)	The coordinate zero point offset is always calculated. The coordinate zero point will be changed whenever the OL□□48 is changed. When setting the current position as the zero point, set OL□□48 to the result of OL□□48 − IL□□10.
Encoder zero-point position (incremental pulses) and Machine Controller coordinate zero point offset (OL□□48). Encoder zero-point position is set by encoder initialization.	Requires no special processing since the encoder retains the position data while the power to the Machine Controller is OFF. However, the ZSET (Set Zero Point) command must be executed to validate the software limit function.	Either Absolute mode or in Incremental Addition mode (relative value). Depends on the setting of OW□□09, bit 5. Setting range: -2^{31} to $2^{31}-1$	
Encoder zero-point position (incremental pulses) and Machine Controller coordinate zero point offset (OL□□48). Encoder zero-point position is set by encoder initialization.	While the power to the Machine Controller is OFF, the encoder retains the position data within one turn (incremental pulses), however, it does not retain multiturn data. Requires to execution of the ZSET (Set Zero Point) command after turning ON the power.	Incremental Addition mode (relative value)	
Encoder zero-point position (incremental pulses) and Machine Controller coordinate zero point offset (OL□□48). Encoder zero-point position is set by encoder initialization.	Requires no special processing since the encoder retains the position data while the power to the Machine Controller is OFF. However, the ZSET (Set Zero Point) command must be executed after turning ON the power. (If not an alarm will occur.)	Incremental Addition mode (relative value)	
Encoder zero-point position (incremental pulses) and by executing ZSET (Set Zero Point) command.	Requires processing to request coordinate setup (set bit 7 of OW□□00 to ON.) The current position coordinate must be backed up even during normal operation. Both processes can be implemented by using a ladder program.	Incremental Addition mode (relative value)	Executing ZSET (Set Zero Point) command will re-set the coordinate system. Set OL□□48 to the coordinate value to be set, and then execute ZSET command.

Appendix D Terminology

■ Phase-C Pulse

The encoders mounted on Yaskawa's servomotors output three types of pulse data, phase-A, -B, and -C. Phase-C pulse is a signal that reverses once per motor rotation and is called Zero-point Pulse.

■ POSMAX

Reset position of infinite length axis
Refer to *5.4.1 Motion Fixed Parameter Details* on page 5-17 for details.

■ Override

The original meaning of Override is annulling. In descriptions on Machine Controllers, override means overwriting the setting.

■ Machine Coordinate System

The basic coordinate system set by executing the motion command ZRET (Zero Point Return) or ZSET (Set Zero Point). The Machine Controller manages positions using the Machine Coordinate System.
With a system using an incremental encoder, or absolute encoder as the incremental encoder, the Machine Coordinate System is automatically set by the first zero point return operation after the power turns ON.
With the system using an absolute encoder, it is automatically set after the power turns ON.

■ Deceleration LS

Limit switch for deceleration.
For SERVOPACKs, deceleration LS for zero point return is connected to the Zero Point Return Deceleration signal DEC.

■ Absolute Mode

One of target position coordinate data setting methods for position control. Target position coordinate data is directly set in Absolute Mode.
Refer to *6.1.4 Position Reference* on page 6-5 for details.

■ Incremental Addition Mode

One of the target position coordinate data setting methods for position control. Target position coordinate data is set by adding the movement amount to the previous position reference value in Incremental Addition Mode.
Refer to *6.1.4 Position Reference* on page 6-5 for details.

■ Infinite Length Axis

An axis that employs the infinite length position control method, which resets the position data after one motor rotation.
Refer to *6.1.3 Axis Type Selection* on page 6-4 for details.

■ Infinite Length Position Control

This control method is used to perform position control without limiting the movement range for movements such as rotation in one direction.
Refer to *6.1.3 Axis Type Selection* on page 6-4 for details.

■ Finite Length Axis

An axis that employs the finite length position control method or infinite length position control that does not reset the position data after one motor rotation to move in one direction.
Refer to *6.1.3 Axis Type Selection* on page 6-4 for details.

■ Finite Length Position Control

This control method is used to perform position control within a specified section for movements such as go-and-return motions.
Refer to *6.1.3 Axis Type Selection* on page 6-4 for details.

■ Work Coordinate System

The coordinate system used in motion programs. It is called the Work Coordinate System to distinguish it from the Machine Coordinate System. The work coordinate system can be set by executing the Change Current Value (POS) instruction of the motion program.
Refer to *Machine Controller MP900/MP2000 Series User's Manual Motion Program* (Manual No. SIE-C887-1.2) for details.

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Revision History

The date of publication, revision number, and web revision number are given at the bottom right of the back cover.
Refer to the following example.

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July 2018	<6>	1	2.4.1	Revision: Connector Specifications
February 2018		0	1.2.1	Revision: Pollution Level, Noise Resistance
			2.2	Revision: Applicable Machine Controllers for SVA-01 Modules
			Back cover	Revision: Address
December 2017	<5>	0	Back cover	Revision: Address
December 2016	<4>	0	Front cover	Revision: Format
			1.2.3	Revision: Information on D/A (output delay time, accuracy, and temperature drift) and A/D (input delay time and accuracy)
			2.1.3	Addition: Information on hardware errors (8: Internal power supply error)
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			Back cover	Revision: Address, format
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			Back cover	Revision: Address
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			Back cover	Revision: Address

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			9.1	Revision: Diagram of phase reference generation (when using an electronic shaft)
			Back cover	Revision: Address
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			Back cover	Revision: Address
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August 2011		8	5.4.2 (4)	Revision: Default value of motion setting parameter OW□□04 0033H → 0000H
June 2011		7	2.4.1 (3) 2.5.2 (2)	Revision: Plug model numbers 10136-3000VE → 10136-3000PE 10150-3000VE → 10150-3000PE
March 2011		6	Front cover	Revision: Format
			6.1.5 (2)	Revision: The value of fixed parameter No.36
			Back cover	Revision: Address, format
May 2010		5	5.4.1 (10)	Revision: Description of <Example> in motion fixed parameter no.24
March 2010		4	1.2.1	Addition: Description of input/output impedance
			2.5.2 (2)	Addition: Remarks of ⑥
			3.4.2	Revision: Description of *.
			Back cover	Revision: Address
January 2010		3	5.4.3 (12), (16)	Revision: IL□□5A → IW□□5A, IL□□59 → IW□□59
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			Back cover	Revision: Address
September 2008		0	All Chapters	Addition: Description of Σ-V series
				Addition: Description of general-purpose DO_2 signal selection
				Term changed: Torque/thrust → torque
			Back cover	Revision: Address
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Machine Controller MP2000 Series

SVA-01 Motion Module

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Specifications are subject to change without notice for ongoing product modifications and improvements.

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