SYSMAC
CJ1W-NC214/NC234/NC414/NC434

Position Control Units

OPERATION MANUAL

OMRON

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Introduction

Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠️ **DANGER**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Additionally, there may be severe property damage.

⚠️ **WARNING**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.

⚠️ **Caution**

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word "Unit" is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation "Ch" which appears in some displays and on some OMRON products, often means "word" and is abbreviated "Wd" in documentation in this sense.

The abbreviation "PLC" means Programmable Controller. "PC" is used, however, in some Programming Device displays to mean Programmable Controller.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note

Indicates information of particular interest for efficient and convenient operation of the product.

1,2,3...

1. Indicates lists of one sort or another, such as procedures, checklists, etc.

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Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

Errors and Omissions

Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Precautions

This section provides general precautions for using the Position Control Units and related devices. The information contained in this section is important for the safe and reliable application of the Position Control Unit. You must read this section and understand the information contained before attempting to set up or operate a Position Control Unit.

1. Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of installing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of managing FA systems and facilities.

2. General Precautions

The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

This manual provides information for using the Position Control Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.

⚠ **WARNING**

It is extreme important that Position Control Units and related devices be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying Position Control Units and related devices to the above mentioned applications.

3. Safety Precautions

⚠ **WARNING**

Never attempt to disassemble any Units while power is being supplied. Doing so may result in serious electric shock.

⚠ **WARNING**

Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.

⚠ **WARNING**

Never touch any of the terminals while power is being supplied. Doing so may result in serious electric shock.

⚠ **WARNING**

Provide safety measures in external circuits (i.e., not in the Programmable Controller or Position Control Unit) to ensure safety in the system if an abnormality occurs due to malfunction of the PLC, malfunction of the PCU (Position Control Unit), or external factors affecting the operation of the PLC or PCU.

Not providing sufficient safety measures may result in serious accidents.

- Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.
- The PLC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed.
  Unexpected operation, however, may still occur for errors in the I/O control section, errors in I/O memory, and other errors that cannot be detected by the self-diagnosis function. As a countermeasure for all such errors, external safety measures must be provided to ensure safety in the system.
- The PLC or PCU outputs may remain ON or OFF due to deposits on or burning of the output relays, or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- When the 24-V DC output (service power supply to the PLC) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- External safety measures must also be taken to ensure safety in the event of unexpected operation when connecting or disconnecting the PCU's connectors.

⚠ **Caution**

When positioning to a position determined using the teaching function, set the position designation setting in the positioning sequence to absolute positioning.

If it is set to relative positioning, positioning will be performed to a position other than the one obtained with the teaching function.

⚠ **Caution**

Execute online edit only after confirming that no adverse effects will be caused by extending the cycle time. Otherwise, the input signals may not be readable.

⚠ **Caution**

Confirm the safety of the destination node before transferring a program to the node or changing the contents of I/O memory. Doing either of these without confirming safety may result in injury.

⚠ **Caution**

Do not save data into the flash memory during memory operation or while the motor is running. Otherwise, unexpected operation may be caused.

⚠ **Caution**

Do not reverse the polarity of the 24-V power supply. The polarity must be correct.

Otherwise, the motor may start running unexpectedly and may not stop.

⚠ **Caution**

Make sure the unit version of the Position Control Unit is 2.3 or later before using the CW/CCW Pulse Output Selection Function. Otherwise, the pulse output may be in the opposite direction from what was intended and the machine may be damaged.

4. Operating Environment Precautions

⚠️ **Caution**

Do not operate the control system in the following locations:

- Locations subject to direct sunlight.
- Locations subject to temperatures or humidity outside the range specified in the specifications.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

⚠️ **Caution**

Take appropriate and sufficient countermeasures when installing systems in the following locations:

- Locations subject to static electricity or other forms of noise.
- Locations subject to strong electromagnetic fields.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supplies.

⚠️ **Caution**

The operating environment of the PLC System can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the PLC System. Be sure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system.

5. Application Precautions

Observe the following precautions when using the PCU or the PLC.

⚠️ **WARNING**

Failure to abide by the following precautions could lead to serious or possibly fatal injury. Always heed these precautions.

- Always connect to a ground of 100 Ω or less when installing the Units. Not connecting to a ground of 100 Ω or less may result in electric shock.
- Always turn OFF the power supply to the PLC before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
  - Mounting or dismounting Power Supply Units, I/O Units, CPU Units, Memory Cassettes, or any other Units.
  - Assembling the Units.
  - Setting DIP switches or rotary switches.
  - Connecting cables or wiring the system.
  - Connecting or disconnecting the connectors.

⚠️ **Caution**

Failure to abide by the following precautions may lead to faulty operation of the PLC, the PCU, or the system, or could damage the PLC or PCU. Always heed these precautions.

- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.
- Interlock circuits, limit circuits, and similar safety measures in external circuits (i.e., not in the Programmable Controller) must be provided by the customer.
- Install external breakers and take other safety measures against short-circuiting in

external wiring. Insufficient safety measures against short-circuiting may result in burning.

- Install the PLC Unit as far as possible from sources of strong harmonic noise.
- Lock the sliders securely until the click into place when connecting the Power Supply Unit, CPU Unit, I/O Units, Special I/O Units, or CPU Bus Units. Functions may not work correctly if the sliders are not locked properly.
- Always attach the End Cover provided with the CPU Unit to the Unit on the right end of the PLC. The CJ-series PLC will not operate properly if the End Cover is not attached.
- Be sure that the external I/O connector lock screws are tightened to the torque specified in the relevant manuals. Incorrect tightening torque may result in malfunction.
- Always use the power supply voltages specified in the operation manuals. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.
- Leave the label attached to the Unit when wiring. Removing the label may result in malfunction if foreign matter enters the Unit.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Do not apply voltages to the Input Units in excess of the rated input voltage. Excess voltages may result in burning.
- Do not apply voltages or connect loads to the Output Units in excess of the maximum switching capacity. Excess voltage or loads may result in burning.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Be sure that the terminal blocks, Memory Units, expansion cables, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Disconnect the LR and GR terminals when performing insulation resistance or withstand voltage tests. Not disconnecting the functional ground terminal may result in burning.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
    - Changing the operating mode of the PLC (including the operating mode at power up).
    - Force-setting/force-resetting any bit in memory.
    - Changing the present value of any word or any set value in memory.
- Resume operation only after transferring to the new CPU Unit the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in an unexpected operation.
- Do not pull on the cables or bend the cables beyond their natural limit. Doing either of these may break the cables.
- Do not place objects on top of the cables or other wiring lines. Doing so may break the cables.
- Resume operation only after transferring the system parameter data to the PCU and saving the data to flash memory. Not doing so may result in an unexpected operation.
- Confirm that set parameters and data operate properly.
- Check the pin numbers before wiring the connectors.
- Perform wiring according to specified procedures.
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static build-up. Not doing so may result in malfunction or damage.
- Do not drop the Unit or subject it to abnormal shock or vibration.

6. Conformance to EC Directives

Applicable Directives

- EMC Directives

Concepts

EMC Directives

OMRON devices that comply with EC Directives also conform to the related EMC standards so that they can be more easily built into other devices or machines. The actual products have been checked for conformity to EMC standards (see the following note). Whether the products conform to the standards in the system used by the customer, however, must be checked by the customer.

EMC-related performance of the OMRON devices that comply with EC Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel in which the OMRON devices are installed.

The customer must, therefore, perform final checks to confirm that devices and the overall machine conform to EMC standards.

Note

Applicable EMC (Electromagnetic Compatibility) standards are as follows:

EMS (Electromagnetic Susceptibility): EN61000-6-2
EMI (Electromagnetic Interference): EN61000-6-4

(Radiated emission: 10-m regulations)

Conformance to EC Directives

The PCUs comply with EC Directives. To ensure that the machine or device in which a PCU is used complies with EC Directives, the PCU must be installed as follows:

1,2,3...

1. The PCU must be installed within a control panel.

2. Reinforced insulation or double insulation must be used for the DC power supplies used for the communications and I/O power supplies.

3. PCUs complying with EC Directives also conform to the Common Emission Standard (EN61000-6-4). With regard to the radiated emission (10-m regulations), countermeasures will vary depending on the devices connected to the control panel, wiring, the configuration of the system, and other conditions. The customer must, therefore, perform final checks to confirm that devices and the overall machine conform to EC Directives.

Installation within Control Panel

Unnecessary clearance in cable inlet or outlet ports, operation panel mounting holes, or in the control panel door may cause electromagnetic wave leakage or interference. In this case, the product may fail to meet EC Directives. In order to prevent such interference, fill clearances in the control panel with conductive packing. (In places where conductive packing comes in contact with the control panel, ensure electrical conductivity by removing the paint coating or masking these parts when painting.)

Items to Check When Unpacking

Check the items below after unpacking:

⋅ Is this the correct model you ordered?
⋅ Do you find any damage which was sustained during transportation?

Accessory of This Product

1. Safety Precautions document × 1 copy

⋅ Connectors and mounting screws, etc. are not supplied and must be provided by the customer.
⋅ If you find any missing item or any problem such as damage to the PCU, contact the OMRON dealer or sales office from which you purchased your product.

How to Read the Model Number

▌Model of PCUs

You can identify the number of axes and output pattern from the model number.

C J 1 W – N C 2 1 4

CJ-series
   PCU

Number of axes
   2: 2-axis type
   4: 4-axis type

Output pattern
   1: Open collector output type
   3: Line driver output type

Development number
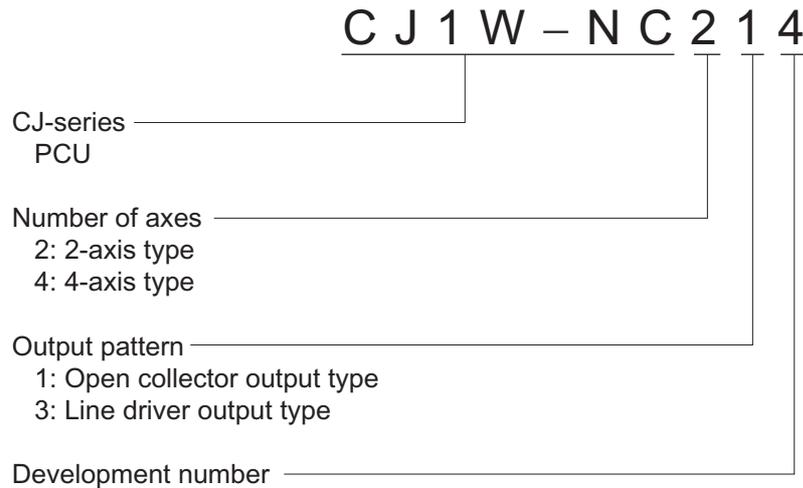
Manual Revision History

The revised code of the manual is added by an alphabet at the end of the manual number written in the bottom left-hand corner of the front and back covers.

| Cat. No. | W477-E1-07 |

Revised code

Revised code	Revision date	Contents and revised page
01	April 2009	First print
02	January 2010	Added information on monitoring memory operation with the CX-Programmer. Improved and corrected manual contents. Relevant pages: 1-14, 2-32 to 2-34, 2-37, 2-40 to 2-42, 2-47 to 2-50, 4-6, 4-37, 4-41 to 4-43, 5-31, 5-43, 5-59, 5-70, 5-78, 5-83, 6-6, 6-17, 7-6, 7-12, 7-21 to 7-22, 7-24, 7-54, 7-60 to 7-69, 8-21, 8-26, 9-3, 9-7, 9-19 to 9-20, 11-13 to 11-14, A-18, A-22, and A-26
03	July 2010	Added information on unit version 1.1 and improved/corrected previous information. Relevant pages: 1-11, 1-16, 2-5, 3-8, 3-11, 3-15, 4-2, 4-6, 4-8, 4-12, 4-36, 4-38, 4-41, 5-17, 5-30 to 5-31, 5-62, 5-65, 5-69, 5-73, 5-80, 5-100, 6-3, 6-6, 6-9, 6-15 to 6-19, 6-29, 6-34 to 6-35, 7-6 to 7-9, 7-12, 7-19 to 7-20, 7-25 to 7-28, 7-33, 7-44 to 7-47, 7-54, 7-61, 8-45, 8-50 to 8-51, 9-6, 10-14, 11-5, 11-8, 11-10, 11-16, 11-22, 11-27, 11-32, and 12-47
04	June 2011	Improved/corrected previous information. Relevant pages: 4-28, 5-30, 6-22, 6-28 to 6-30, 6-35, 7-23, 7-48, 9-2, 10-1, 12-48, Appendix-26, Appendix-27
05	August 2014	Improved/corrected previous information. Relevant pages: 1-12, 1-14, 1-15, 1-17, 3-16, 3-18, 4-36, 4-43, 5-19 to 5-22 , 5-94, 6-39 to 6-40, 7-21, 7-30, 7-42, 7-67, 7-69, 9-3, 9-24 to 9-25, 12-31, and 12-34
06	February 2016	Improved/corrected previous information. Relevant pages: 2-10, 2-13, 2-15, 2-18, 4-39, 5-29, 5-66, 12-37, and Appendix-3
07	February 2022	Improved/corrected previous information. Relevant pages: 4-43, 5-25, 5-26 to 5-27, 5-49, 6-12, 7-34, 9-28, 12-19, and 12-38

Structure of This Document

This manual consists of the chapters as follows.
Use this as a guide to find and read the necessary locations.

		Outline
Chapter 1	Product Outline	This chapter explains the features, operating procedures, unit version and other aspects of this product.
Chapter 2	Installation and Wiring	This chapter explains the names and functions, installation method and wiring method, among others.
Chapter 3	Manual Operation	This chapter explains the manual operation such as JOG operation, inching operation, etc.
Chapter 4	Defining the Origin	This chapter explains how to determine the origin, such as the origin search procedure as well as origin return, present position preset and absolute encoder settings.
Chapter 5	Setting Data	This chapter explains the overall data configuration, common parameters, each axis parameter and other data which you use on the PCU.
Chapter 6	Direct Operation	This chapter explains the procedure to perform direct operation, setting of operation data, operation method, etc.
Chapter 7	Memory Operation	This chapter explains the procedure to perform memory operation, setting of memory data, and operating methods, etc.
Chapter 8	Transferring and Saving Data	This chapter explains the data transfer method from the PLC CPU Unit and the data transfer method with CX-Programmer.
Chapter 9	Operating Functions	This chapter explains the auxiliary operation functions such as teaching, interrupt constant-pitch feed and override.
Chapter 10	Synchronous Unit Operation Function	This chapter explains an outline of the synchronous unit operation function and procedure to use this function.
Chapter 11	Program Example	This chapter contains program examples to perform linear interpolation control, circular interpolation control, Origin Search, etc.
Chapter 12	Troubleshooting	This chapter explains the items to check upon occurrence of problems, error diagnosis based on the alarm display as well as its countermeasures, and error diagnosis based on the operating condition as well as its countermeasures.
Chapter 13	Maintenance and Inspection	This chapter explains periodic maintenance and inspection.
Appendix		This appendix contains a performance list and describes how this PCU is different from other existing models.

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Product Outline

This chapter explains the features, operating procedures, performance specifications and other aspects of this unit.

1

Product Outline

1-1   Features

The SYSMAC CJ-series Position Control Unit (CJ1W-NC214/234/414/434) is a Position Control Unit of pulse-output type (hereinafter called as "PCU") which is developed exclusively for the CJ-series.
This PCU has built-in pulse counters, which have not been available before, to realize position check and detection of displacement of the machine.
This PCU also supports high-speed, high-accuracy positioning control and a full range of positioning functions.

Function

This PCU has the features and functions below.

Quick Start in 0.1 ms or Less

If the CPU Unit issues a command, the PCU starts in just 0.1 ms or less when the high-speed PTP starts (when the PCU is combined with a CJ2-series CPU).

Built-in Feedback Pulse Counters

The PCU has feedback pulse counters that correspond to the number of controlled axes. These counters permit input of feedback pulses from encoders to the PCU.
This lets you reflect the present command position and feedback position in both ways, and use the feedback position in position monitoring.

Supporting Servomotors with Absolute Encoder

The PCU supports absolute encoders for OMRON OMNUC G5-series, G-series, and W-series Servomotors.
A Servomotor with absolute encoder eliminates the need for Origin Search at start, thereby it allows the system to become ready faster.

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Error between Axes Monitor Function for Linear Interpolation

The PCU can monitor feedback positions for desired 2 to 4 axes during linear interpolation. Because of this monitor function, the PCU can detect an error when the error between axes exceeds the set value.

High-speed, Accurate Positioning Control at the Maximum Speed of 4 Mpps

The PCU supports pulse output at the maximum speed of 4 Mpps for the line driver output, or 500 kpps for the open collector output.
As a result, even high-accuracy actuators such as linear motors and DD motors can operate at high speed.

Selectable Phase Difference Pulse Output

In addition to the traditional forward/reverse direction pulse output method and pulse/direction output method, the PCU now supports the phase difference pulse output method. You can select a desired output method appropriate for the input method of the connected driver.

Versatile Positioning Operations

Linear interpolation and circular interpolation are now possible, along with switching from position control to speed control and vice versa. A selection of acceleration/deceleration methods in continuous patterns also makes it possible to satisfy diverse applications.

More User-friendly Positioning Function

You can now set a desired unit for commands. The ability to perform settings and issue commands in a specified unit makes this PCU easier to use.
Setting of rotation coordinates is also possible, so settings for index operation and feeder operation have become much easier.

Synchronous Multi-axis Control Possible for Up to 20 Axes

When you combine the PCU with a CJ2-series CPU (unit version 1.1 or later), you can synchronize up to 5 PCUs.
Use of a 4-axis PCU allows for synchronized, multi-axis control of up to 20 axes.
You can perform synchronous operation easily by use of electronic CAMs, electronic shafts and other function blocks.

1

1-2   System Configuration

This PCU inputs control signals from a system or control panel and outputs pulse trains to a stepping motor drive and Servomotor Drive.

Control signals include the forward direction limit input, reverse direction limit input, origin input, origin proximity input, emergency stop input and interrupt input.

Example of System Configuration (Example of CJ1W-NC414)

Product Outline
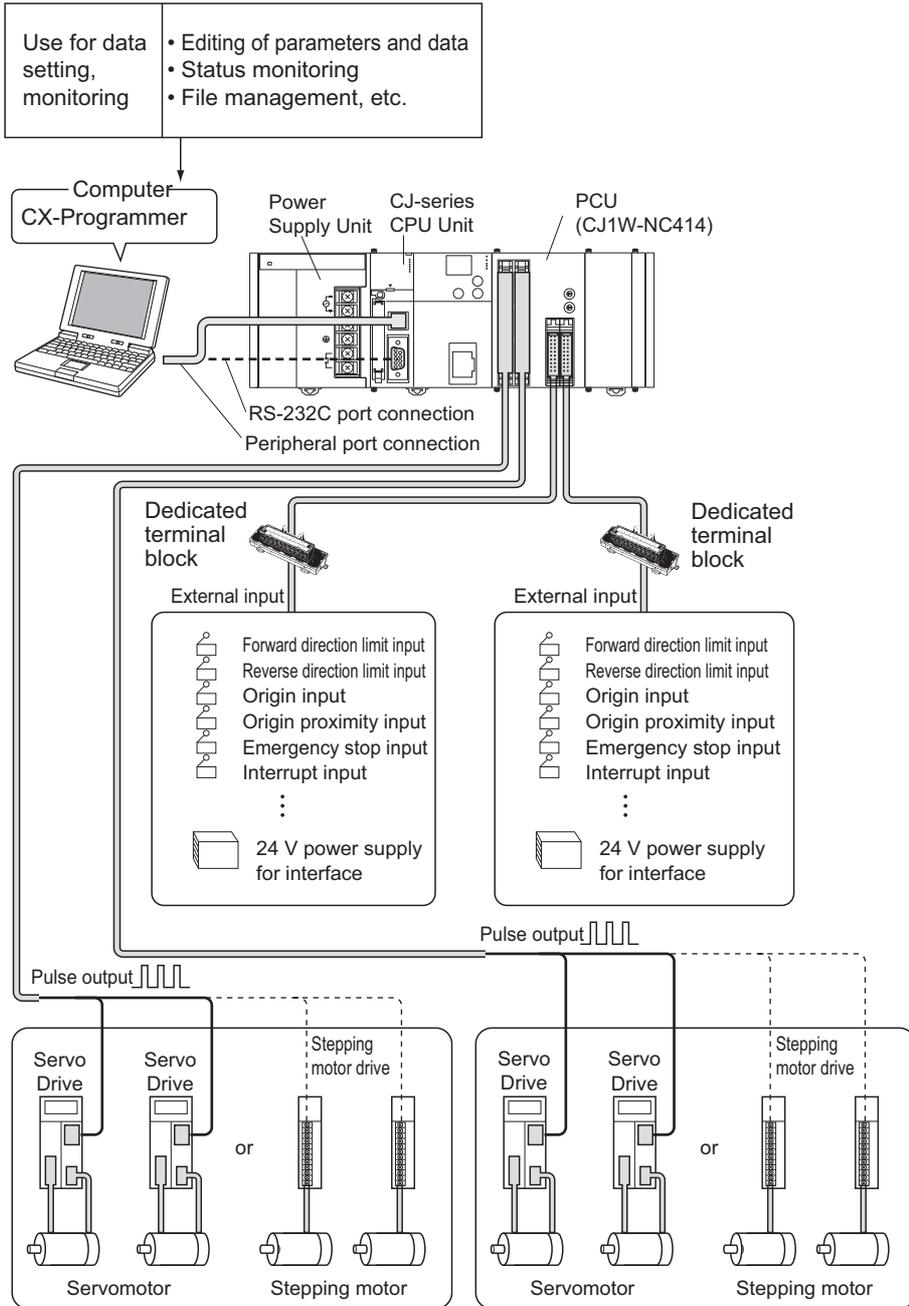
1-3   Basic Functions

This PCU provides functions largely classified into two groups. One group includes direct operation, while the other group includes memory operation.
Direct operation and memory operation encompass position control, speed control, interrupt constant-pitch feed control, etc.

Operation Functions List

The table below summarizes the functions of the PCU.

Function name		Direct operation	Memory operation	Remarks
Position control	Absolute movement	Yes	Yes	
	Relative movement	Yes	Yes	
	Interrupt feeding for absolute movement	Yes	Yes	
	Interrupt feeding for relative movement	Yes	Yes	
	Synchronous feeding	Yes	No	Available during synchronous unit operation
Speed control	Speed control	Yes	Yes	
	Interrupt feeding for speed control	Yes	Yes	
Control change	Target position change during operation	Yes	No	Executable by the duplicate start of direct operations.
	Target speed change during operation	Yes	No	Executable by the change of the command speed.
	Acceleration/ deceleration change during operation	Yes	No	Executable by the change of the acceleration/deceleration time.
	Present position change	Yes	No	Executable by the present position preset.
Multi-axis coordinated control	Linear interpolation	No	Yes	Linear interpolation of up to 4 axes.
	Circular interpolation	No	Yes	Circular interpolation of 2 axes.
	Error between axes monitor	No	Yes	Available only during linear interpolation.
Sequence control	Positioning by continuous pattern	No	Yes	
	Positioning start by external input	No	Yes	

1

Function Category by Application

Direct operation is suitable for some applications, while memory operation is suitable for others.

Applications for Which Direct Operation is Suitable

⬩ Use a ladder program to perform PTP operation.
⬩ Change the target position, target speed and other command values whenever necessary during operation.

Applications for Which Memory Operation is Suitable

⬩ Input the target position by teaching, etc. before you perform positioning.
⬩ Perform continuous speed changes, interpolation operation of multiple axes, etc., based on a specified operation pattern.

Applications for Which Synchronous Unit Operation Control is Suitable

⬩ Use electronic CAMs to control multiple axes synchronously.

Position Control

Absolute movement where you specify absolute positions from the origin (absolute positioning), and relative movement where you specify relative positions from the present position (incremental positioning), are available.
There are two types of positioning methods: direct operation and memory operation.
Supported operation patterns include interrupt feeding where the machine moves by a specific amount due to an interrupt input and then stops.

Direct Operation

Direct operation is a method to set position data and speed data from the CPU Unit (ladder) to perform positioning.
You can also change the speed or target position during positioning operation.
Note that direct operation does not support linear interpolation and circular interpolation.
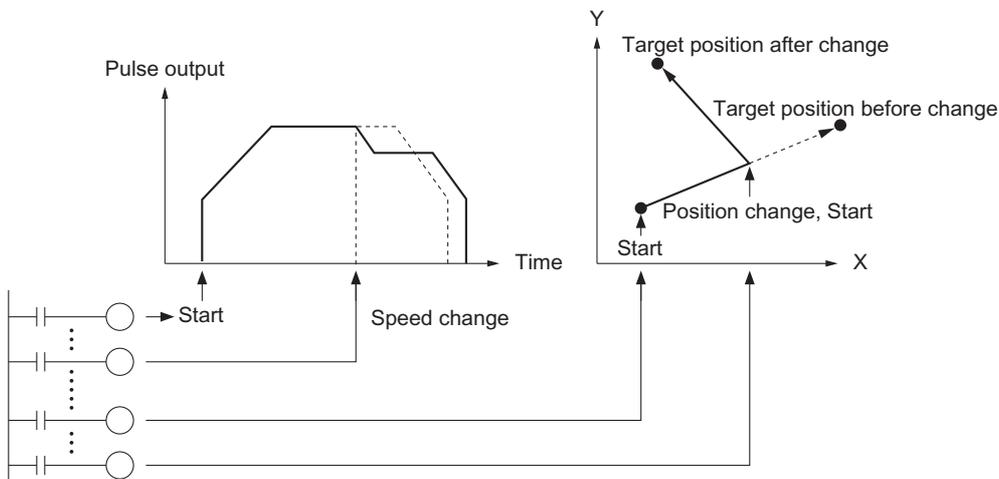
Memory Operation

Memory operation is a method to perform positioning by specifying the data in the PCU from the CPU Unit.

In memory operation, you can select desired patterns that include independent positioning, automatic positioning and continuous positioning.

Memory operation also supports 4-axis linear interpolation and 2-axis circular interpolation.
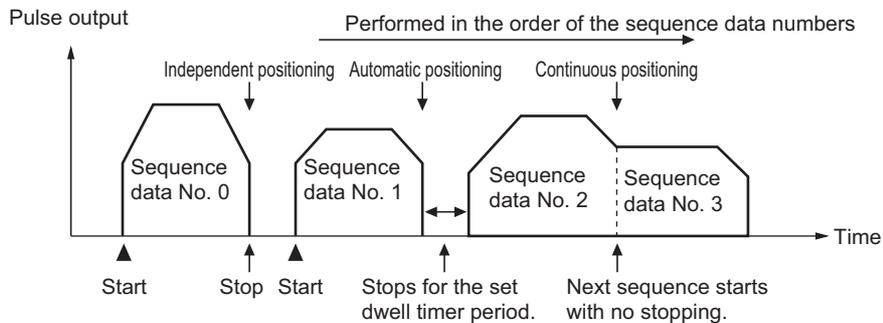
Interrupt Feeding

An operation where the machine moves by a specified amount and then stops when an interrupt input is input during positioning, and another operation where the machine continues to turn at a constant speed until an interrupt input is input, upon which it moves by a specified amount and then stops, are available.

Both direct operation and memory operation support the interrupt feeding.
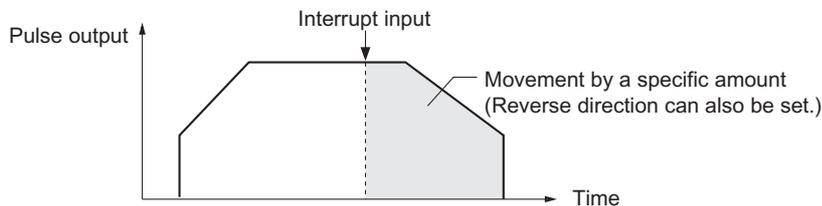
Speed Control

After a single start, you can output pulses continuously at a constant speed. Use a deceleration stop command to stop the machine.

Both direct operation and memory operation support the speed control.

1

Product Outline
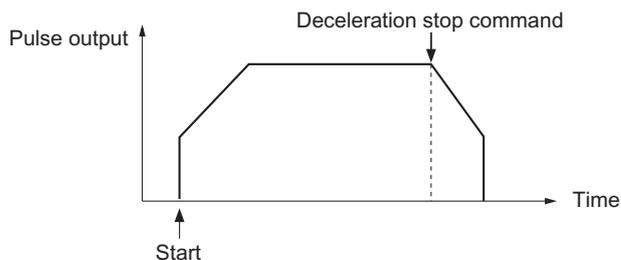
Synchronous Operation

This control synchronizes the slave axis with inputs to the master axis. For the master axis, you can specify an external encoder axis, command position or feedback position for each axis, or an axis that is connected to another PCU.
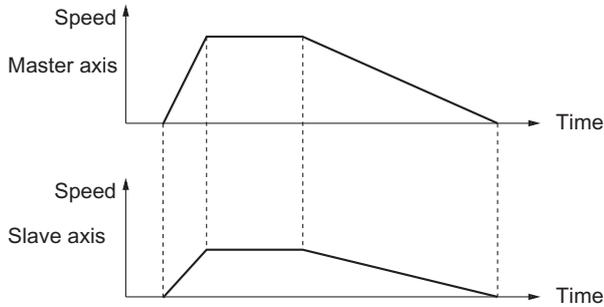
Other Operations

Origin Search

This function is for the origin adjustment of the specified axis.

JOG Operation

This function starts/stops the specified axis at the specified speed.
Use it during manual operation.

Teaching

This is a function that moves the machine to a desired position which you want to load as data by JOG operation, etc., and then loads the applicable position into the specified position data.
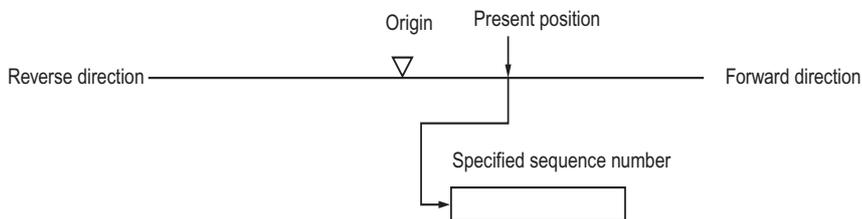
Override Function

This function changes the target speed during start.
Speed change is also possible during JOG operation.
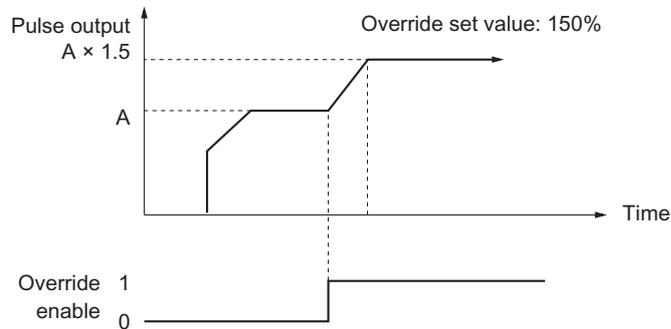
Present Position Preset

You can change the data of the present position to the desired data you specify.

Backlash Compensation

This function compensates for the meshing error of mechanical parts.

1

Product Outline

1-4 Operating Procedures

This section explains the basic operating procedures of the PCU.

	START	
Installation	Install the PCU	2-2 Installation of PCU
	Set the PCU unit number (MACHINE No.)	2-1 Name of Each Part and Area Allocation
Wiring	Connect the PCU and the external input equipment	2-3 External I/O Circuit 2-4 Wiring 2-5 Connection Examples for Different Types of Motor Drive
	Connect the motor and drive (*1)	
	Connect the drive and the PCU	2-4 Wiring 2-5 Connection Examples for Different Types of Motor Drive
Power ON	Turn ON the CPU Unit power supply	
	Create the CPU Unit I/O table (*2)	
Setting the PCU	Set common parameters for the PCU	5-2 Common Parameters
	Set axis parameter for the PCU	5-3 Axis Parameter
Manual operation	Perform JOG operation	3-2 JOG Operation
Programming/ Test Run	Define the origin of the motor shaft that will operate	Chap. 4 Defining the Origin
	Perform direct operation Directly set the target position and speed from the CPU Unit to make the motor operate	Chap. 6 Direct Operation
	A	

A

Perform memory operation

| Set task parameter for the PCU |

5-4
Task Parameter

| Set the memory operation data for the PCU |

5-6
Memory Operation Data

| Set the memory operation conditions data for the PCU |

5-7
Memory Operation Conditions Data

| Save written data to the PCU |

8-7
Saving Data

Debugging — Error occurred — Yes

| Confirm through the LED indicator on the PCU front face |

Chap. 11
Troubleshooting

| Read the PCU error code |

| Eliminate the cause of the error to release the error |

Operation — Operate the CPU Unit to make the PCU operate — Chap. 10 Program Example

Maintenance — Perform periodic maintenance — Chap. 12 Maintenance and Inspection

END

*1: Perform wiring in accordance with the User's Manual for the motor and drive.
*2: Refer to the Operation Manual for the CPU Unit.

1

Product Outline

1-5   Specifications

General Specifications

Specification item	Model	
	CJ1W-NC214/234	CJ1W-NC414/434
Power supply voltage	5 VDC (unit)	
	24 VDC (external power supply)	
Allowable power supply voltage range	21.6 to 26.4 VDC (external power supply)	
Internal current consumption	5 VDC, 270 mA maximum	5 VDC, 310 mA maximum
Current consumption of external power supply	24 VDC NC214 13 mA maximum NC234 44 mA maximum	24 VDC NC414 26 mA maximum NC434 90 mA maximum
Dimensions	90 × 51 × 65 (H × W × D)	90 × 62 × 65 (H × W × D)
Weight	170 g maximum	220 g maximum
Ambient operating temperature	0 to 55°C	
Mounting position	CJ-series CPU Rack or CJ-series Expansion Rack	
Maximum number of units per system	5 units	
Maximum number of units per CJ system	20 units (when up to 3 expansion racks are connected)	
Occupied unit	No. 2	
Applicable standards	cULus, EC directives	

Models other than above conform to the general specifications of the SYSMAC CJ series.

Performance Specifications

Specification item		Model	
		CJ1W-NC214/234	CJ1W-NC414/434
Applicable PLCs		CJ-series	
Number of occupied inputs/outputs	Number of words	18CH[*1]	
Controlled drivers		Servo Drive of pulse train input type or stepping motor drives NC214/414: Open collector output type NC234/434: Line driver output type	
Pulse output method		Phase difference pulse output, forward/reverse direction pulse output, pulse + direction output	
Controls	Control method	Open-loop control by pulse train output	
	Number of controlled axes	2 axes	4 axes
Control cycle		Operation using the synchronous unit operation function: the control cycles that correspond to the synchronous cycle time of the CPU Unit Operation condition other than above: 1 ms	
Units of control		Pulse, mm, inch, degree	
Positioning functions		Memory operation, direct operation	
	Independent operation	Independent, 2 axes	Independent, 4 axes
	Linear interpolation	2 axes maximum	4 axes maximum
	Circular interpolation	2 axes maximum	2 axes maximum
	Speed control	Independent, 2 axes	Independent, 4 axes
	Interrupt feeding	Independent, 2 axes	Independent, 4 axes
Position command	Data	−2147483648 to +2147483647	
	Number of data	500 per task (4 tasks per unit)	
Speed command	Data	Position control: 1 to 2147483647 Speed control: −2147483648 to 2147483647 However, this limits the maximum output frequency based on whether the maximum speed is 4 Mpps (NC234/434) or 500 kpps (NC214/414).	
	Number of data	500 per task	
Acceleration/ deceleration time	Data	0 to 250000 ms	
	Number of data	500 per task	
Function	Override	0.01% to 500.00% (settable for each axis)	
	Software limits	−2147483647 to 2147483646 command unit (Settable for each axis)	
	Backlash compensation	0 to 50000 command unit (settable for each axis)	
MPG and external encoder counter input	Number of input words	1 word (switchable for each controlled axis)	
	Input interface	Photocoupler input	
	Maximum response frequency	500 kHz	

Specification item		Model	
		CJ1W-NC214/234	CJ1W-NC414/434
Feedback pulse counter input	Number of input words	4 words (1 word per axis)	
	Input interface	Line receiver input	
	Maximum response frequency	NC234/434: 4 MHz (phase difference multiplication of 4 times: 1 MHz) NC214/414: 500 kHz (phase difference multiplication of 4 times: 125 kHz)	

*1. This indicates the number of occupied words of special I/O Unit area. In addition, this occupies areas that correspond to up to 144 words according to the number of axes and functions which you use.

Functional Specifications

Function item			Description
Control function	Control cycle		1 ms[*1]
	Single axis control	Absolute movement	Specify the absolute/relative target position and target speed directly in the ladder program to perform positioning.
		Relative movement	
		Speed control	Specify the target speed directly in the ladder program to perform speed feed.
		Interrupt feeding	Externally issue an interrupt input during absolute movement, relative movement or speed control to feed the machine by a constant amount to perform positioning.
		Rotation axis control	Rotational axes suitable for feeder and index table control are supported. In addition to forward/reverse direction positioning, you can also specify short-cut operation.
		Target position and target speed change	Change the target position or target speed during absolute movement, relative movement or speed control.
	Multi-axis control	Linear interpolation	This control starts/ends the operations of multiple axes simultaneously and connects the start position to target position of each axis by a straight line. Linear interpolation of up to 4 axes is possible.
		Circular interpolation	You can combine 2 desired axes and control each axis in a manner which the axes draw a circular path. Three methods are available to specify a circular arc: "Specification of target position and center point", "specification of target position, radius and direction" and "target position and passing points".
	Memory operation	Automatic operation and continuous operation	Set the target positions, target speeds and operation patterns in the PCU beforehand to perform a series of operations automatically. Continuous positioning and speed changes are also possible.
		Sequence function	Memory operation data incorporates a sequence feature that allows for repetition of a given operation, start/end of operation data via external inputs, and so on. Accordingly, the PCU can perform various operation sequences without affecting the ladder program of PLC.
Manual operation function	Origin Search		This function uses an external sensor, etc. to detect the mechanical origin of the system. You can select a desired origin search operation for your system from 15 different origin search operation patterns.
	Origin Return		This function performs the return operation to the established mechanical origin.
	Present position preset		It changes the present position to the specified data and establishes the origin.
	Deceleration stop		The operating axis decelerates to a stop.
	JOG operation		This function feeds the axis in the forward/reverse direction at a constant speed.
	Inching operation		The axis inches in the forward/reverse direction.

Function item		Description
Manual operation function	MPG operation	Connect a manual pulsar and perform manual feed.
Auxiliary control function	Command unit setting	You can set a desired unit of control for each axis according to the machine.
	Acceleration/ deceleration control — Automatic acceleration/ deceleration control	This function automatically generates an acceleration/deceleration curve for axis operation. You can select the trapezoidal curve or the S-curve based on a tertiary function.
	Acceleration/ deceleration speed change	You can change the acceleration/deceleration speed during acceleration/deceleration.
	Acceleration/ deceleration point switch	You can select one of three methods to connect speeds in different operation patterns during continuous-pattern memory operation.
	Override	This function changes the speed of the axis which is currently in positioning operation.
	Backlash compensation	This compensates for the mechanical plays to increase the positioning accuracy.
	M code	You can output M codes to implement interlocking with external machines during memory operation.
	Zone setting	You can set a desired zone and assess whether the present position is inside the zone. Up to 3 zones are settable for each axis.
	Feedback pulse counter	A feedback pulse counter input is available for each axis. You can connect encoder pulse outputs from a Servo Drive to monitor deviation from the command position, etc.
	Absolute encoder	You can input encoder pulses from a Servo Drive to a feedback pulse counter to use a motor with absolute encoder. This function supports OMRON G5-series, G-series and W-series Servomotors with absolute encoders.[2]
	Teaching	This function enables loading of the present position into memory operation position data. It supports not only the present command position, but also the present position from the feedback pulse counter.
	Torque limit output	An output signal is available for operating the torque limit switch input of a Servo Drive. You can turn this output signal ON/OFF directly in the ladder program. Also, Origin Search by holding supports automatic switching of torque limits.
	Monitor function — Software limit	You can set forward/reverse direction software limits of axis operation. If the positioning target exceeds software limit, it is detectable at the start through a command value check.
	Position and speed error monitor	The PCU can monitor the position or speed error between the present command position and present feedback position to generate an error and stop the axis operation upon detection of an excessive error.
	Error between axes monitor	It can also monitor the error between axes during linear interpolation to generate an error and stop the axes operation upon detection of an excessive error.

*1. Enabling the synchronous unit operation functions will synchronize the internal control cycles of the PCU Unit with the synchronized control cycle of the CPU Unit. Because of this, the responsiveness for the PCU Unit will vary depending on the synchronized control cycle.

*2. A motor with absolute encoder cannot be installed to the system where both the rotation axes and decelerators are used.

1

1-6 Unit Version

The CJ-series Position Control Unit (PCU) adopts the concept of "unit version."
The purpose of assigning a unit version is to manage differences in the functions available in each unit that result from version upgrades, etc.

Check Method

Three methods below are available to check and identify the unit version.

Confirming on the Product

The CJ-series PCU shows the unit version on the product nameplate, as follows.

CJ-series Position Control Unit

Product nameplate

OMRON CJ1W-NC214

NC UNIT

Indicates that the unit version is Ver. 1.0.

Lot No. 031001   0000 (Ver.1.0)

OMRON Corporation   MADE IN JAPAN
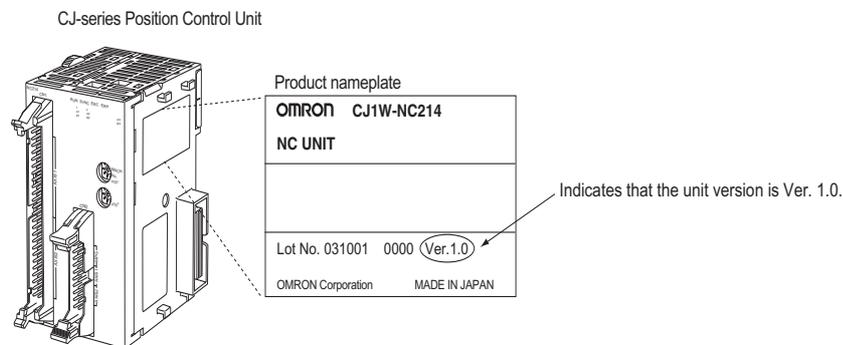
Confirming in the Support Software

For CX-Programmer version 4.0 or later, you can confirm the unit version under [Unit Manufacturing Information].

1. **Right-click the applicable Position Control Unit in the I/O Table Window and select [Unit Manufacturing Information].**
2. **The [Unit Manufacturing Information] dialog box appears.**
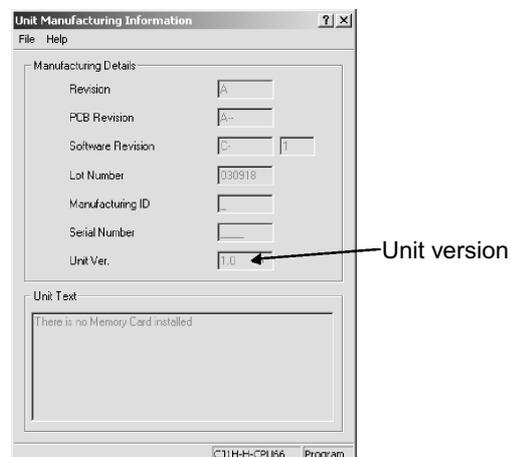
Unit version

Check the unit version of the Position Control Unit connected online.

1

Identification by the Unit Version Label

Each product comes with a unit version label.
Attach it on the front face of the unit if you want to identify the unit from old PCU only by seeing the front of the unit.

Unit Versions

❍: Exists, ---: Does not exist

Unit	Model	Unit versions	
		Version 1.0	Version 1.1
Position Control Units	CJ1W-NC214	❍	❍
	CJ1W-NC234	❍	❍
	CJ1W-NC414	❍	❍
	CJ1W-NC434	❍	❍
Compatible CX-Programmer version		Version 8.10 or higher	Version 9.12 or higher
Version compatible for an OMNUC G5-series absolute encoder connection		---	❍

Function Support According to Unit Versions

❍: Supported, ---: Not supported

Function	Unit versions	
	Version 1.0	Version 1.1
High-speed PTP Start Acknowledged Flags in command status of Axis Status Memory Areas	---	❍

1

1-7 Compliant Directives

This section describes the concepts of EMC directives, points to note, and requests.

Compliance with the EMC Directives

Compliant Directives

  ◆ EMC directives

Concept of Compliance

EMC Directives

OMRON products are electrical devices that are embedded in various machines and manufacturing systems. Accordingly, each product is designed to comply with the relevant EMC standards (*) so that the machines and systems in which it is embedded can easily comply with the EMC standards.

However, different customers manufacture different machines and systems, and their EMC performance changes according to the configuration, wiring condition, layout and other aspects of the equipment and control panel which embeds each OMRON product compliant with the EC directives. Accordingly, we are unable to confirm compliance in the condition in which customers actually use our products. Accordingly, we would request that each customer confirms final EMC compliance of the entire machine and system.

* Among the EMC (Electro-Magnetic Compatibility) standards, EN61000-6-2 specifies EMS (Electro-Magnetic Susceptibility), while EN61000-6-4 specifies (Electro-Magnetic Interference).
The 10-m law specifies EN61000-6-4 Radiated emission.

Compliance with the EC Directives

The CJ-series products comply with the EC directives. However, customers should note the points below in order to ensure compliance of their machine and system with the EC directive.
  ◆ Always install CJ-series product in a control panel.
  ◆ Use a DC power supply of reinforced insulation or double insulation for connection to a DC Power Supply Unit or I/O Unit.
  ◆ CJ-series products compliant with the EC directives meet the common emission standard for EMI (EN61000-6-4). With Radiated emission (10-m law), however, the performance may change depending on the configuration of the control panel which you use, relationship with other connected equipment, wirings, and so on.

Accordingly, even if the CJ-series product which you use is compliant with the relevant EC directives, the customer must still check the entire machine and system for compliance with the EC directives and take appropriate actions if necessary.

1

1-8 Control System Configuration and Principles

This section explains the configuration and operating principles of the control system of the PCU.

Control System Configuration
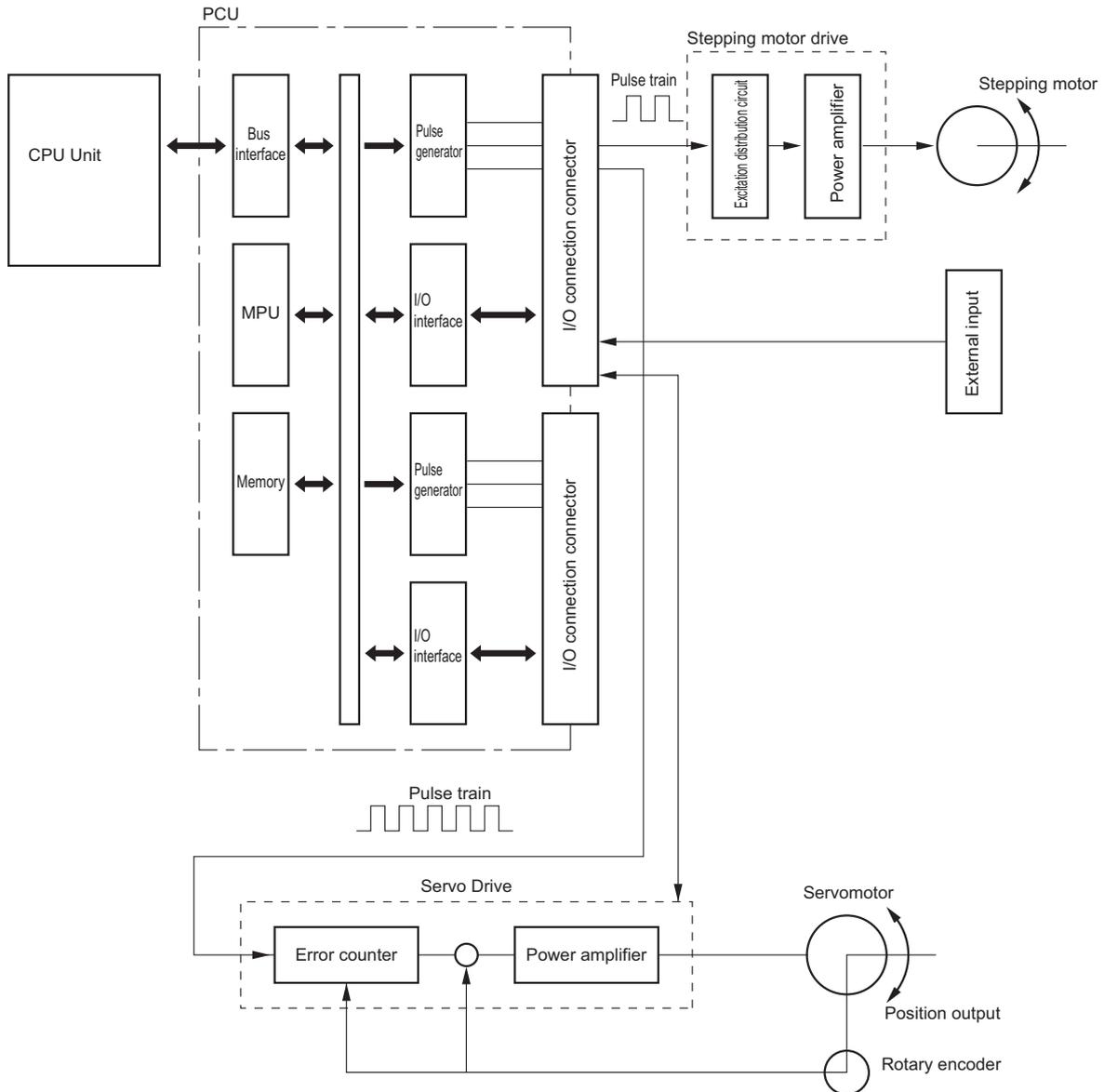
Control System Principles

Open-loop Control

Open-loop control is a control method that operates the motor according to received input pulses. It does not feedback positions or speeds.

The motor speed is proportional to the number of pulses in the pulse train from the PCU, while the rotation speed is proportional to the frequency of the pulse train.

Stepping motors are often used under this type of control method.

A stepping motor turns by a specified angle for each received pulse signal.

Stepping motor or
pulse train input
Servomotor

Table

Position Controller

Pulse train

Ball screw

Decelerator
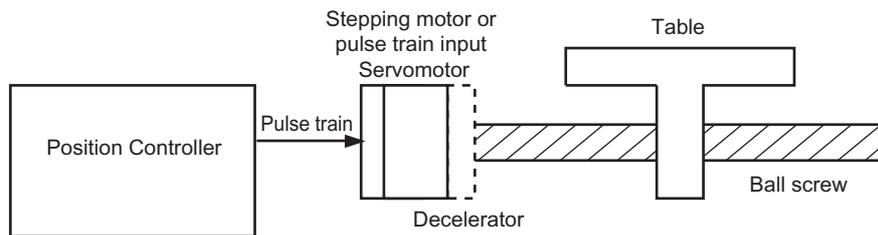
Closed-loop Control

In this control, the PCU not only issues commands, but also position and speed feedback is performed.

As with open-loop control, the motor speed is proportional to the number of pulses, while the rotation speed is proportional to the frequency of the pulse train.

Servomotors are often used under this type of control method.

Stepping motor or
pulse train input
Servomotor

Table

Position Controller

Pulse train

Feedback pulse

Ball screw

Encoder   Decelerator
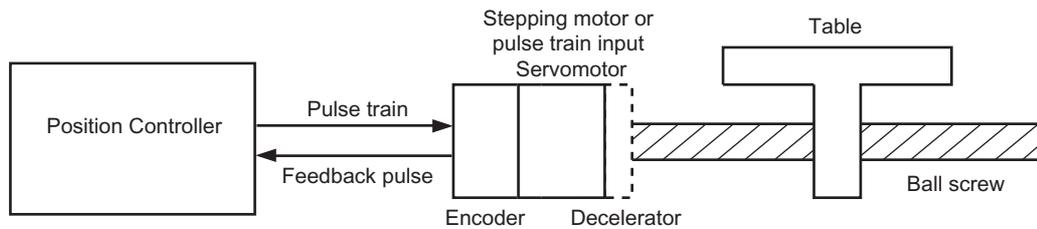
Simplified Positioning System Design

The figure below shows the positioning which uses a stepping motor.

N

V

M : Reduction gear ratio
V : Feed speed of moving object (mm/s)
P : Feed screw pitch (mm/rotation)
θs : Step angle per pulse (degrees/pulse)

M

P

Stepping motor   Reduction gear ratio   Moving object   Feed screw pitch
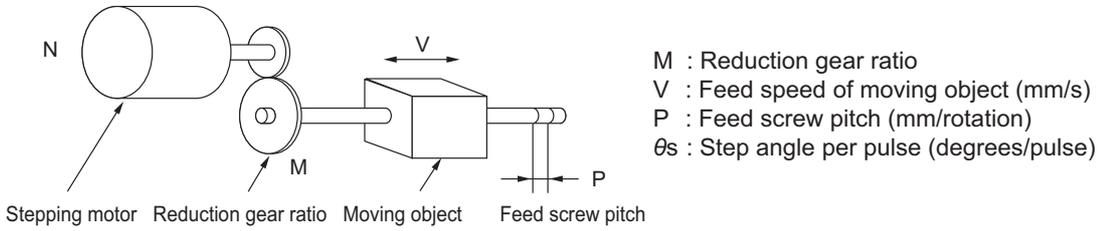
The formula below describes the travel distance per pulse relative to the motor driver which is called pulse rate.

$$\text{Pulse rate} = \frac{\text{Feed screw pitch}}{(\text{Number of pulses per rotation}) \times (\text{Reduction gear ratio})} = \frac{P \ (\text{mm/rotation})}{\left(\dfrac{360}{\theta s}\right)(\text{pulses/rotation}) \times M}$$

$$= \frac{P \times \theta s}{360 \times M} \ (\text{mm/pulse})$$

You can calculate the number of pulses required to move the load by L (mm) as follows from the pulse rate:

$$\text{Number of pulses} = \frac{\text{Travel distance}}{\text{Pulse rate}} = \frac{L(\text{mm})}{\dfrac{P \times \theta s (\text{mm/pulse})}{360 \times M}} = \frac{360 \times M \times L}{\theta s \times P} \ (\text{pulses})$$

The pulse speed required to move the load at the feed speed of V mm/second is as follows:

$$\text{Pulse speed} = \frac{\text{Feed speed}}{\text{Pulse rate}} = \frac{V \ (\text{mm/s})}{\text{Pulse rate (mm/pulse)}} = \frac{V}{\dfrac{P \times \theta s}{360 \times M}}$$

$$= \frac{360 \times M \times V}{P \times \theta s} \ (\text{pulses/s})$$

The PCU gives the above number of pulses and pulse speed as a position command and a speed command, respectively, to perform positioning control.

1-9 Support Software

For setting data in the PCU and performing manual operations, etc., use CX-Programmer. You need CX-One version 3.1 or later (CX-Programmer version 8.1 or later).

CX-Programmer supports the operations below.

- ◆ Confirming wirings
- ◆ Manual operation
- ◆ Defining the origin
- ◆ Setting data
- ◆ Transferring and saving data
- ◆ Monitoring
- ◆ Confirming error log

Operating Procedure

This section explains the procedure to use CX-Programmer in order to set data in the PCU and perform other operations.

1. **Open the PLC's I/O table in CX-Programmer.**
2. **Transfer the I/O table from the PLC to a computer or register the PCU.**
3. **Right-click the PCU and select [Edit Special Unit Setting], or double-click the PCU.**
4. **The following window appears. Perform all operations about the PCU on this window.**
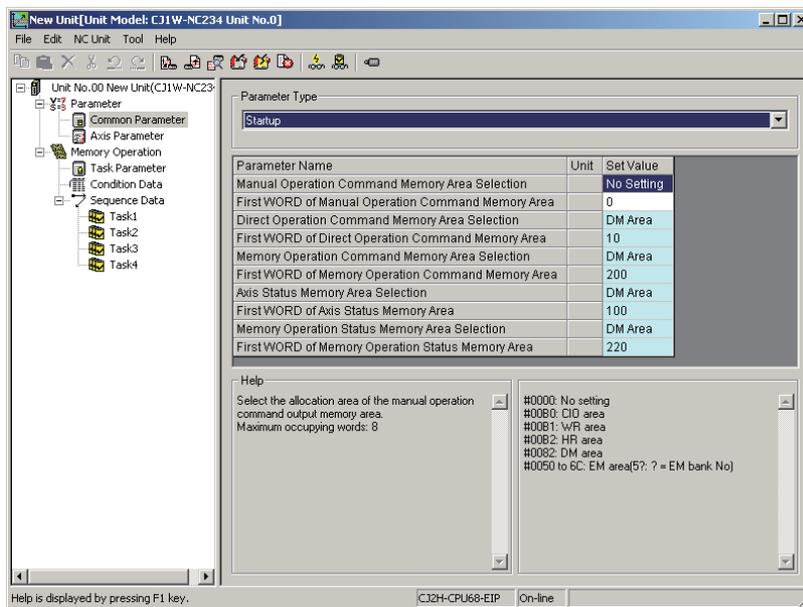
For details on how to operate CX-Programmer, refer to "CX-Programmer Operation Manual (W446)."

For details on how to set data in the PCU and perform other operations, refer to Online Help on the data setting window of the PCU.

2

Installation and Wiring

This chapter explains the names and functions, installation method and wiring method, among others.

2-1 Name of Each Part and Area Allocation

This section explains the name of each part of the PCU, and allocation of Special I/O Unit areas.

Name of Each Part

CJ1W-NC414/-NC434

CJ1W-NC214/-NC234

CJ1W-NC414/-NC434:

Axes 1 and 2 connector
Connects to the Servo Drive or stepping motor drive (2-axis control).

Axes 3 and 4 connector
Connects to the Servo Drive or stepping motor drive (2-axis control).

LED indicator
Indicates the operation status of the PCU.

Unit number setting switch
Set the PCU unit number.

External signal connector for axes 1 and 2
Connects to external input.

External signal connector and MPG connector for axes 3 and 4
Connects to external input and MPG.

CJ1W-NC214/-NC234:

Axes 1 and 2 connector
Connects to the Servo Drive or stepping motor drive (2-axis control).

External signal connector and MPG connector for Axes 1 and 2
Connects to external input and MPG.

LED Display

LED name	Display color	Status	Explanation
RUN	Green	Lit	Normal operation
		Unlit	The power supply is OFF, a hardware error has occurred, or the PLC detects a PCU error.
ERC	Red	Lit	An error is occurring.
		Unlit	Other than the above
ERH	Red	Lit	An error is occurring in the PLC.
		Unlit	Other than the above

Note. For details on actions upon occurrence of errors, refer to Chapter 12, Troubleshooting.

CJ Position Control Units OPERATION MANUAL (CJ1W-NC214/234/414/434)

LED name	Display color	Status		Explanation
1	Orange	Lit		Pulse output to Axis 1 in progress (forward/reverse direction)
		Flashing		An error related to a connection cable, data, etc. of axis 1 has occurred.[1]
		Unlit		Other than the above
2	Orange	Lit		Pulse output to Axis 2 in progress (forward/reverse direction)
		Flashing		An error related to a connection cable, data, etc. of axis 2 has occurred.[1]
		Unlit		Other than the above
3	Orange	Lit		Pulse output to Axis 3 in progress (forward/reverse direction)
		Flashing		An error related to a connection cable, data, etc. of axis 3 has occurred.[1]
		Unlit		Other than the above
4	Orange	Lit		Pulse output to Axis 4 in progress (forward/reverse direction)
		Flashing		An error related to a connection cable, data, etc. of axis 4 has occurred.[1]
		Unlit		Other than the above
A1, B1	Orange	Lit	ON	Phase A/B-input status of the Axis 1 feedback counter ON when lit, OFF when unlit
		Unlit	OFF	
A2, B2	Orange	Lit	ON	Phase A/B-input status of the Axis 2 feedback counter ON when lit, OFF when unlit
		Unlit	OFF	
A3, B3	Orange	Lit	ON	Phase A/B-input status of the Axis 3 feedback counter ON when lit, OFF when unlit
		Unlit	OFF	
A4, B4	Orange	Lit	ON	Phase A/B-input status of the Axis 4 feedback counter ON when lit, OFF when unlit
		Unlit	OFF	
AS, BS	Orange	Lit	ON	Phase A/B-input status of the MPG input ON when lit, OFF when unlit
		Unlit	OFF	
SYNC	Green	Lit		In the SYNCHRONOUS OPERATION mode
		Unlit		Other than the above

*1. For details on actions upon occurrence of errors, refer to Chapter 12, Troubleshooting.

- On the CJ1W-NC214/NC234, only the LEDs for axes 1 and 2 are available.

Precautions for Correct Use

- Specify [Unused Axis] for each axis which you do not use.
- If there is any axis which you do not use as [Physical Axis], connect the emergency stop input and forward/reverse direction limit input to the input power supply and turn them ON, or set their contact logic to N.O.

2

Installation and Wiring

Unit Number Setting Switch (MACHINE No.)

This is a switch to set the unit number (MACHINE No.) for the Special I/O Unit that comprises the PCU.
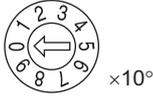
MACH
No.
$\times 10^1$

$\times 10^0$

Special I/O Unit Memory areas are allocated in the CPU Unit according to the specified unit number.

The CJ1W-NC214/NC234/NC414/NC434 are No. 2 occupied PCUs, and occupy the Special I/O Unit Memory area 18 word.

Accordingly, you can set only unit No. 0 to 94.

You can set a desired unit number within the setting range, unless the selected number is already in use by other Special I/O Unit which is installed in the same PLC.

Precautions for Correct Use

⬩ Make sure that the power supply is OFF when you perform settings.

Memory Area Allocation List

Special I/O Unit Memory areas are allocated in the CPU Unit according to the specified unit number.

Special I/O Unit Memory Area

The CJ1W-NC214/NC234/NC414/NC434 occupy 18 word as a Unit Control Memory area.

Unit number	CJ1W-NC214/NC234/NC414/NC434
No. 0	2000 to 2019
No. 1	2010 to 2029
No. 2	2020 to 2039
No. 3	2030 to 2049
:	:
No. 93	2930 to 2949
No. 94	2940 to 2959
No. 95	Setting not possible

Precautions for Correct Use

• The CJ1W-NC214/NC234/NC414/NC434 occupy the above areas for 2 units. Since they occupy the area next to the one for the unit number you set, set each unit number so that area duplication does not occur with other Special Units.

• Since the CJ1W-NC214/NC234/NC414/434 are occupied areas for 2 units, you cannot set them to No. 95.

• Do not set the same unit number or Special I/O Unit memory area which is already in use by other Special I/O Unit. If you set a duplicate unit number or area, the fatal error "Unit number duplication error" occurs and the operation stops.

• To perform axis control, direct operation or memory operation, you also need to set Direct Operation Command Memory areas and Memory Operation Command Memory areas, in addition to Unit Control Memory areas. For details, refer to "Operating Memory Area" on page 5-60.

2

2-2   Installation of PCU

This section explains the installation method of PCU, as well as its dimensions, etc.

System Configuration Precautions

* The I/O Memory area numbers for a Special I/O Unit are allocated not based on the installed position, but according to the unit number setting switch on the front panel of the unit.
* This PCU can connect to a CPU Rack or Expansion Rack, and you can connect up to 20 PCUs per CPU.
  You can install up to 10 CJ-series Component Units in 1 CPU Rack or Expansion Rack.
  For this PCU, however, 1 Unit must be counted as 2 Component Units. Accordingly, design an appropriate configuration that meets the formula below:

  Number of this PCUs installed $\times$ 2 + Number of other PCUs installed $\leq$ 10

  For example, if you install 5 PCUs in 1 rack, you cannot install other PCUs.

Precautions for Correct Use

* The upper limit of the current or power that can be supplied to mounted Units is determined by the model of the Power Supply Unit that is mounted to the CPU Rack or Expansion Rack of the PLC.
* Design your system so that the total current consumption of the mounted Units does not exceed the maximum current for each voltage group and the total power consumption does not exceed the upper limit for the Power Supply Unit.
* Refer to the manual for the CPU Unit for the method to calculate the current consumption of mounted Units.

PCU Installation Method

Follow the procedure below to install the PCU.

1. Confirm that the connectors are engaged properly before you install the PCU.

Connector
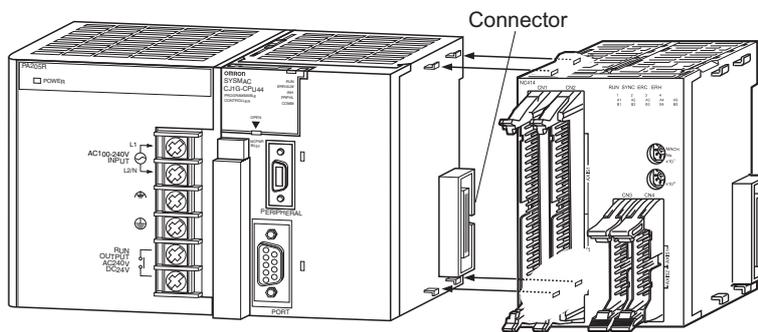
2. Slide the yellow sliders at the top and bottom until you hear a click sound to lock the sliders.

Slider
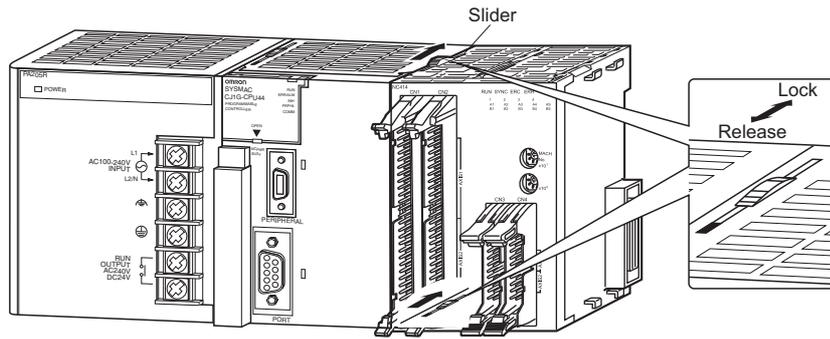
Lock

Release

Precautions for Correct Use

⬧ If you do not lock the sliders properly, the PCU may not function fully.

To remove the PCU, slide the sliders in the "released" direction to unlock the sliders first.

PCU Handling Precautions

⬧ Be sure to install, remove the PCU or connect, and disconnect its wires after you turn OFF the CPU Unit power supply.
⬧ To prevent negative effect of noise, wire the I/O lines separately from high-voltage lines and power lines in ducts.
⬧ Wire offcuts may scatter during wiring. To prevent wire offcuts from entering the PCU, do not remove the label on the top face of the PCU. Once wiring is complete, however, be sure to remove the label for heat radiation.

Remove the label once wiring is complete.

2
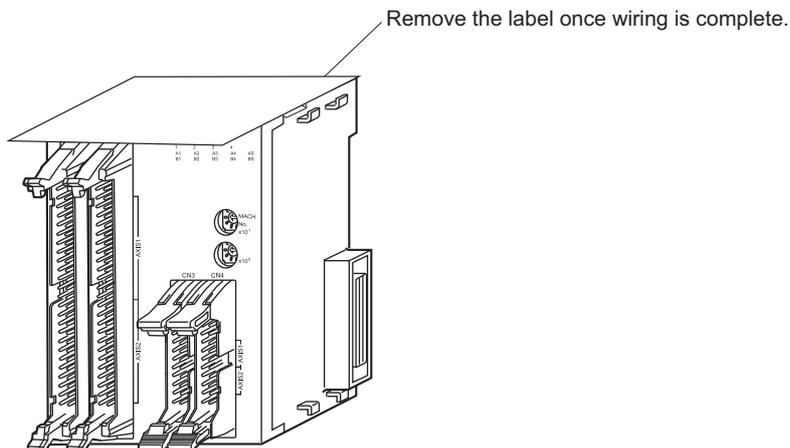
Dimensions

CJ1W-NC214/-NC234

CJ1W-NC414/-NC434

2
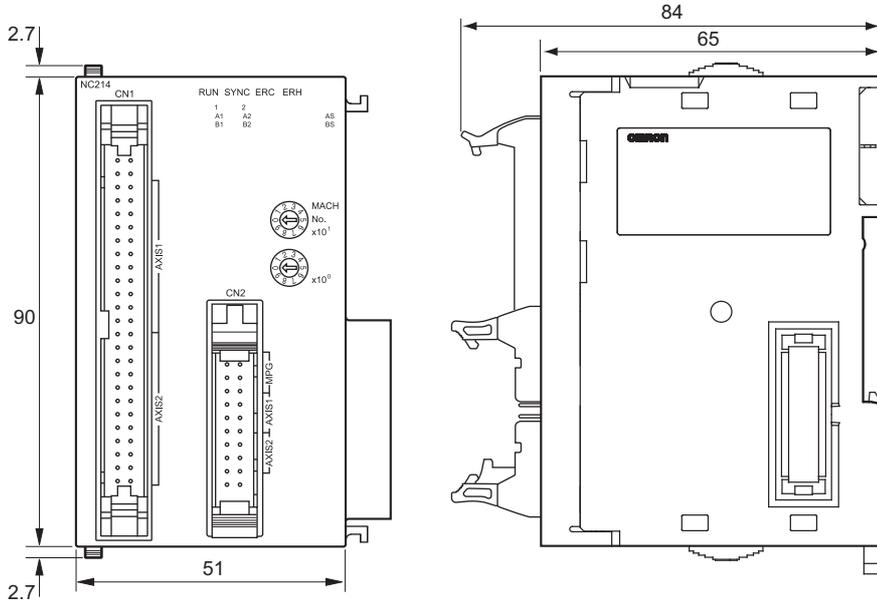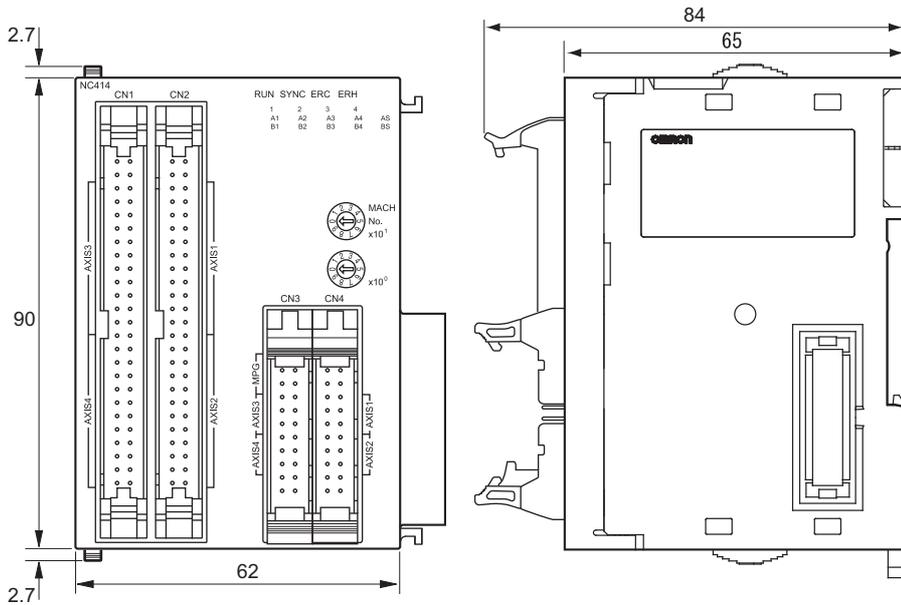
2-3 External I/O Circuit

This section explains the connector pin arrangement, wiring method, electrical specifications, etc.

Connector Pin Arrangement

There are 2 types of connectors.
One group includes Servo Drive connectors that connect to a Servo Drive or stepping motor drive.
The other group includes external signal connectors that connect the origin input, limit input, interrupt input or other external input.

Servo Drive Connector

Axes 3 and 4   Axes 1 and 2

CN1   CN2

AXIS3   AXIS1

AXIS4   AXIS2

CJ1W-NC414/434

Axes 1 and 2

CN1

AXIS1
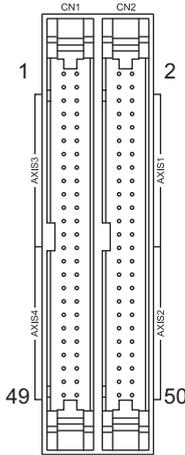
AXIS2
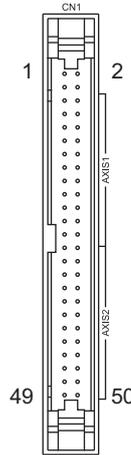
CJ1W-NC214/234

External Signal Connector

Axes 3 and 4   Axes 1 and 2

CN3   CN4

AXIS4   AXIS3   MPG   AXIS2   AXIS1   MPG

CJ1W-NC414/434

Axes 1 and 2

CN2

AXIS2   AXIS1   MPG

CJ1W-NC214/234

2
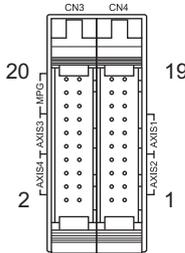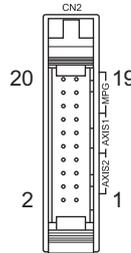
CJ1W-NC234 (Line Driver Output Type)

Servo Drive Connector

CN1: For axes 1 and 2

Allocation	Pin number	I/O	Name	Pin number	I/O	Name
Common	1	IN	24-V power supply for output	2	IN	24-V power supply for output
	3	IN	24-V ground for output	4	IN	24-V ground for output
Pin arrangement for axis 1	5	IN	Input common	6	IN	General-purpose input
	7	IN	Positioning completed input	8	IN	Origin input (24 V)
	9	IN	Alarm input	10	OUT	General-purpose output
	11	OUT	RUN output	12	OUT	Alarm reset output
	13	OUT	Torque limit output	14	OUT	Error counter reset output (with 1.6 kΩ limit resistance)
	15	OUT	Error counter reset output	16	OUT	Forward direction pulse output (-)
	17	OUT	Forward direction pulse output (+)	18	OUT	Reverse direction pulse output and direction output (-)
	19	OUT	Reverse direction pulse output and direction output (+)	20	IN	Encoder phase A (-)
	21	IN	Encoder phase A (+)	22	IN	Encoder phase B (-)
	23	IN	Encoder phase B (+)	24	IN	Encoder phase Z (-)
	25	IN	Encoder phase Z (+)	26	OUT	SEN output
	27	OUT	Signal ground (axis 1)	28	OUT	Signal ground (axis 2)
Pin arrangement for axis 2	29	OUT	SEN output	30	IN	Encoder phase Z (-)
	31	IN	Encoder phase Z (+)	32	IN	Encoder phase B (-)
	33	IN	Encoder phase B (+)	34	IN	Encoder phase A (-)
	35	IN	Encoder phase A (+)	36	OUT	Reverse direction pulse output and direction output (-)
	37	OUT	Reverse direction pulse output and direction output (+)	38	OUT	Forward direction pulse output (-)
	39	OUT	Forward direction pulse output (+)	40	OUT	Error counter reset output (with 1.6 kΩ limit resistance)
	41	OUT	Error counter reset output	42	OUT	Alarm reset output
	43	OUT	Torque limit output	44	OUT	General-purpose output
	45	OUT	RUN output	46	IN	Origin input (24 V)
	47	IN	Alarm input	48	IN	General-purpose input
	49	IN	Positioning completed input	50	IN	Input common

External Signal Connector

CN2: For axes 1 and 2

Allocation	Pin number	I/O	Name	Pin number	I/O	Name
Common	1	IN	Input common	2	IN	Input common
Axis 2	3	IN	Forward direction limit input	4	IN	Reverse direction limit input
	5	IN	Origin input (24 V)	6	IN	Origin proximity input
	7	IN	Emergency stop input	8	IN	Interrupt input
Axis 1	9	IN	Forward direction limit input	10	IN	Reverse direction limit input
	11	IN	Origin input (24 V)	12	IN	Origin proximity input
	13	IN	Emergency stop input	14	IN	Interrupt input
MPG	15		Not used (Do not use.)	16		Not used (Do not use.)
	17	IN	MPG phase B (+) and encoder phase B (+)	18	IN	MPG phase B (-) and encoder phase B (-)
	19	IN	MPG phase A (+) and encoder phase A (+)	20	IN	MPG phase A (-) and encoder phase A (-)

📖 **Reference**

- The pin numbers on the external signal connector and the terminal numbers on the terminal block (XW2B-20G4, XW2B-20G5, or XW2D-20G6) correspond as follows:

   XW2B-20G4 or XW2B-20G5 Terminal Block
      The pin numbers on the external signal connector are the same as the terminal numbers on the terminal block.

   XW2D-20G6 Terminal Block
      The odd pin numbers on the external signal connector correspond to the terminal numbers in the A row on the terminal block.
      The even pin numbers on the external signal connector correspond to the terminal numbers in the B row on the terminal block.

Pin number on external signal connector	Corresponding terminal number on terminal block
1	A1
2	B1
3	A2
4	B2
5	A3
6	B3
. . .	. . .

2

Installation and Wiring

CJ1W-NC434 (Line Driver Output Type)

Servo Drive Connector

CN2: For axes 1 and 2
CN1: For axes 3 and 4

Allocation	Pin number	I/O	Name	Pin number	I/O	Name
Common	1	IN	24-V power supply for output	2	IN	24-V power supply for output
	3	IN	24-V ground for output	4	IN	24-V ground for output
Pin arrangement for axes 1 and 3	5	IN	Input common	6	IN	General-purpose input
	7	IN	Positioning completed input	8	IN	Origin input (24 V)
	9	IN	Alarm input	10	OUT	General-purpose output
	11	OUT	RUN output	12	OUT	Alarm reset output
	13	OUT	Torque limit output	14	OUT	Error counter reset output (with 1.6 kΩ limit resistance)
	15	OUT	Error counter reset output	16	OUT	Forward direction pulse output (-)
	17	OUT	Forward direction pulse output (+)	18	OUT	Reverse direction pulse output and direction output (-)
	19	OUT	Reverse direction pulse output and direction output (+)	20	IN	Encoder phase A (-)
	21	IN	Encoder phase A (+)	22	IN	Encoder phase B (-)
	23	IN	Encoder phase B (+)	24	IN	Encoder phase Z (-)
	25	IN	Encoder phase Z (+)	26	OUT	SEN output
	27	OUT	Signal ground (axis 1 and axis 3)	28	OUT	Signal ground (axis 2 and axis 4)
Pin arrangement for axes 2 and 4	29	OUT	SEN output	30	IN	Encoder phase Z (-)
	31	IN	Encoder phase Z (+)	32	IN	Encoder phase B (-)
	33	IN	Encoder phase B (+)	34	IN	Encoder phase A (-)
	35	IN	Encoder phase A (+)	36	OUT	Reverse direction pulse output and direction output (-)
	37	OUT	Reverse direction pulse output and direction output (+)	38	OUT	Forward direction pulse output (-)
	39	OUT	Forward direction pulse output (+)	40	OUT	Error counter reset output (with 1.6 kΩ limit resistance)
	41	OUT	Error counter reset output	42	OUT	Alarm reset output
	43	OUT	Torque limit output	44	OUT	General-purpose output
	45	OUT	RUN output	46	IN	Origin input (24 V)
	47	IN	Alarm input	48	IN	General-purpose input
	49	IN	Positioning completed input	50	IN	Input common

External Signal Connector

CN4: For axes 1 and 2

Allocation	Pin number	I/O	Name	Pin number	I/O	Name
Common	1	IN	Input common	2	IN	Input common
Axis 2	3	IN	Forward direction limit input	4	IN	Reverse direction limit input
	5	IN	Origin input (24 V)	6	IN	Origin proximity input
	7	IN	Emergency stop input	8	IN	Interrupt input
Axis 1	9	IN	Forward direction limit input	10	IN	Reverse direction limit input
	11	IN	Origin input (24 V)	12	IN	Origin proximity input
	13	IN	Emergency stop input	14	IN	Interrupt input
–	15		Not used (Do not use.)	16		Not used (Do not use.)
	17			18		
	19			20		

CN3: For axes 3 and 4

Allocation	Pin number	I/O	Name	Pin number	I/O	Name
Common	1	IN	Input common	2	IN	Input common
Axis 4	3	IN	Forward direction limit input	4	IN	Reverse direction limit input
	5	IN	Origin input (24 V)	6	IN	Origin proximity input
	7	IN	Emergency stop input	8	IN	Interrupt input
Axis 3	9	IN	Forward direction limit input	10	IN	Reverse direction limit input
	11	IN	Origin input (24 V)	12	IN	Origin proximity input
	13	IN	Emergency stop input	14	IN	Interrupt input
MPG	15		Not used (Do not use.)	16		Not used (Do not use.)
	17	IN	MPG phase B (+) and encoder phase B (+)	18	IN	MPG phase B (-) and encoder phase B (-)
	19	IN	MPG phase A (+) and encoder phase A (+)	20	IN	MPG phase A (-) and encoder phase A (-)

📑 **Reference**

•The pin numbers on the external signal connector and the terminal numbers on the terminal block (XW2B-20G4, XW2B-20G5, or XW2D-20G6) correspond as follows:

XW2B-20G4 or XW2B-20G5 Terminal Block
The pin numbers on the external signal connector are the same as the terminal numbers on the terminal block.

XW2D-20G6 Terminal Block
The odd pin numbers on the external signal connector correspond to the terminal numbers in the A row on the terminal block.
The even pin numbers on the external signal connector correspond to the terminal numbers in the B row on the terminal block.

Pin number on external signal connector	Corresponding terminal number on terminal block
1	A1
2	B1
3	A2
4	B2
5	A3
6	B3
. . .	. . .

CJ1W-NC214 (Open Collector Output Type)

Servo Drive Connector

CN1: For axes 1 and 2

Allocation	Pin number	I/O	Name	Pin number	I/O	Name
Common	1	IN	24-V power supply for output	2	IN	24-V power supply for output
	3	IN	24-V ground for output	4	IN	24-V ground for output
Pin arrangement for axis 1	5	IN	Input common	6	IN	General-purpose input
	7	IN	Positioning completed input	8	IN	Origin input (24 V)
	9	IN	Alarm input	10	OUT	General-purpose output
	11	OUT	RUN output	12	OUT	Alarm reset output
	13	OUT	Torque limit output	14	OUT	Error counter reset output (with 1.6 kΩ limit resistance)
	15	OUT	Error counter reset output	16	OUT	Forward direction pulse output (with 1.6 kΩ limit resistance)
	17	OUT	Forward direction pulse output	18	OUT	Reverse direction pulse output (with 1.6 kΩ limit resistance)
	19	OUT	Reverse direction pulse output and direction output	20	IN	Encoder phase A (-)
	21	IN	Encoder phase A (+)	22	IN	Encoder phase B (-)
	23	IN	Encoder phase B (+)	24	IN	Encoder phase Z (-)
	25	IN	Encoder phase Z (+)	26	OUT	SEN output
	27	OUT	Signal ground (axis 1)	28	OUT	Signal ground (axis 2)
Pin arrangement for axis 2	29	OUT	SEN output	30	IN	Encoder phase Z (-)
	31	IN	Encoder phase Z (+)	32	IN	Encoder phase B (-)
	33	IN	Encoder phase B (+)	34	IN	Encoder phase A (-)
	35	IN	Encoder phase A (+)	36	OUT	Reverse direction pulse output (with 1.6 kΩ limit resistance)
	37	OUT	Reverse direction pulse output and direction output	38	OUT	Forward direction pulse output (with 1.6 kΩ limit resistance)
	39	OUT	Forward direction pulse output	40	OUT	Error counter reset output (with 1.6 kΩ limit resistance)
	41	OUT	Error counter reset output	42	OUT	Alarm reset output
	43	OUT	Torque limit output	44	OUT	General-purpose output
	45	OUT	RUN output	46	IN	Origin input (24 V)
	47	IN	Alarm input	48	IN	General-purpose input
	49	IN	Positioning completed input	50	IN	Input common

External Signal Connector

CN2: For axes 1 and 2

Allocation	Pin number	I/O	Name	Pin number	I/O	Name
Common	1	IN	Input common	2	IN	Input common
Axis 2	3	IN	Forward direction limit input	4	IN	Reverse direction limit input
	5	IN	Origin input (24 V)	6	IN	Origin proximity input
	7	IN	Emergency stop input	8	IN	Interrupt input
Axis 1	9	IN	Forward direction limit input	10	IN	Reverse direction limit input
	11	IN	Origin input (24 V)	12	IN	Origin proximity input
	13	IN	Emergency stop input	14	IN	Interrupt input
MPG	15		Not used (Do not use.)	16		Not used (Do not use.)
	17	IN	MPG phase B (+) and encoder phase B (+)	18	IN	MPG phase B (-) and encoder phase B (-)
	19	IN	MPG phase A (+) and encoder phase A (+)	20	IN	MPG phase A (-) and encoder phase A (-)

📑 **Reference**

♦The pin numbers on the external signal connector and the terminal numbers on the terminal block (XW2B-20G4, XW2B-20G5, or XW2D-20G6) correspond as follows:

XW2B-20G4 or XW2B-20G5 Terminal Block
  The pin numbers on the external signal connector are the same as the terminal numbers on the terminal block.

XW2D-20G6 Terminal Block
  The odd pin numbers on the external signal connector correspond to the terminal numbers in the A row on the terminal block.
  The even pin numbers on the external signal connector correspond to the terminal numbers in the B row on the terminal block.

Pin number on external signal connector	Corresponding terminal number on terminal block
1	A1
2	B1
3	A2
4	B2
5	A3
6	B3
. . .	. . .

CJ1W-NC414 (Open Collector Output Type)

Servo Drive Connector

CN2: For axes 1 and 2
CN1: For axes 3 and 4

Allocation	Pin number	I/O	Name	Pin number	I/O	Name
Common	1	IN	24-V power supply for output	2	IN	24-V power supply for output
	3	IN	24-V ground for output	4	IN	24-V ground for output
Pin arrangement for axes 1 and 3	5	IN	Input common	6	IN	General-purpose input
	7	IN	Positioning completed input	8	IN	Origin input (24 V)
	9	IN	Alarm input	10	OUT	General-purpose output
	11	OUT	RUN output	12	OUT	Alarm reset output
	13	OUT	Torque limit output	14	OUT	Error counter reset output (with 1.6 kΩ limit resistance)
	15	OUT	Error counter reset output	16	OUT	Forward direction pulse output (with 1.6 kΩ limit resistance)
	17	OUT	Forward direction pulse output	18	OUT	Reverse direction pulse output (with 1.6 kΩ limit resistance)
	19	OUT	Reverse direction pulse output and direction output	20	IN	Encoder phase A (-)
	21	IN	Encoder phase A (+)	22	IN	Encoder phase B (-)
	23	IN	Encoder phase B (+)	24	IN	Encoder phase Z (-)
	25	IN	Encoder phase Z (+)	26	OUT	SEN output
	27	OUT	Signal ground (axis 1 and axis 3)	28	OUT	Signal ground (axis 2 and axis 4)
Pin arrangement for axes 2 and 4	29	OUT	SEN output	30	IN	Encoder phase Z (-)
	31	IN	Encoder phase Z (+)	32	IN	Encoder phase B (-)
	33	IN	Encoder phase B (+)	34	IN	Encoder phase A (-)
	35	IN	Encoder phase A (+)	36	OUT	Reverse direction pulse output (with 1.6 kΩ limit resistance)
	37	OUT	Reverse direction pulse output and direction output	38	OUT	Forward direction pulse output (with 1.6 kΩ limit resistance)
	39	OUT	Forward direction pulse output	40	OUT	Error counter reset output (with 1.6 kΩ limit resistance)
	41	OUT	Error counter reset output	42	OUT	Alarm reset output
	43	OUT	Torque limit output	44	OUT	General-purpose output
	45	OUT	RUN output	46	IN	Origin input (24 V)
	47	IN	Alarm input	48	IN	General-purpose input
	49	IN	Positioning completed input	50	IN	Input common

2

Installation and Wiring

External Signal Connector

CN4: For axes 1 and 2

Allocation	Pin number	I/O	Name	Pin number	I/O	Name
Common	1	IN	Input common	2	IN	Input common
Axis 2	3	IN	Forward direction limit input	4	IN	Reverse direction limit input
	5	IN	Origin input (24 V)	6	IN	Origin proximity input
	7	IN	Emergency stop input	8	IN	Interrupt input
Axis 1	9	IN	Forward direction limit input	10	IN	Reverse direction limit input
	11	IN	Origin input (24 V)	12	IN	Origin proximity input
	13	IN	Emergency stop input	14	IN	Interrupt input
–	15		Not used (Do not use.)	16		Not used (Do not use.)
	17			18		
	19			20		

CN3: For axes 3 and 4

Allocation	Pin number	I/O	Name	Pin number	I/O	Name
Common	1	IN	Input common	2	IN	Input common
Axis 4	3	IN	Forward direction limit input	4	IN	Reverse direction limit input
	5	IN	Origin input (24 V)	6	IN	Origin proximity input
	7	IN	Emergency stop input	8	IN	Interrupt input
Axis 3	9	IN	Forward direction limit input	10	IN	Reverse direction limit input
	11	IN	Origin input (24 V)	12	IN	Origin proximity input
	13	IN	Emergency stop input	14	IN	Interrupt input
MPG	15		Not used (Do not use.)	16		Not used (Do not use.)
	17	IN	MPG phase B (+) and encoder phase B (+)	18	IN	MPG phase B (-) and encoder phase B (-)
	19	IN	MPG phase A (+) and encoder phase A (+)	20	IN	MPG phase A (-) and encoder phase A (-)

📑 **Reference**

⬩The pin numbers on the external signal connector and the terminal numbers on the terminal block (XW2B-20G4, XW2B-20G5, or XW2D-20G6) correspond as follows:

XW2B-20G4 or XW2B-20G5 Terminal Block
The pin numbers on the external signal connector are the same as the terminal numbers on the terminal block.

XW2D-20G6 Terminal Block
The odd pin numbers on the external signal connector correspond to the terminal numbers in the A row on the terminal block.
The even pin numbers on the external signal connector correspond to the terminal numbers in the B row on the terminal block.

Pin number on external signal connector	Corresponding terminal number on terminal block
1	A1
2	B1
3	A2
4	B2
5	A3
6	B3
. . .	. . .

2

Output Circuit

Servo Drive Connector Section

Open Collector Output (CJ1W-NC214/NC414)

1, 2	24-V power supply for output
3, 4	24-V ground for output
17/39	Forward direction pulse output
16/38	Forward direction pulse output (with 1.6-kΩ resistance)
19/37	Reverse direction pulse output and direction output
18/36	Reverse direction pulse output and direction output (with 1.6-kΩ resistance)
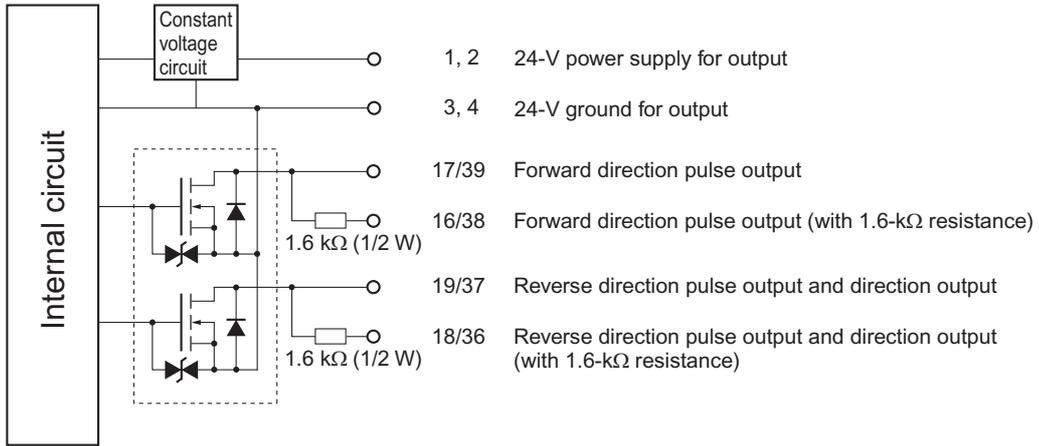
Precautions for Correct Use

• For the pulse output and error counter reset output, there are 2 types of circuits: one with a 1.6-kΩ (1/2-W) resistance (terminal with limit resistance) and the other without resistance. Use either type according to the specifications of the power supply and motor driver that you use.

• Connect a load of 7 mA minimum, but 30 mA maximum (terminal with 1.6-kΩ limit resistance: 7 mA minimum, 16 mA maximum) to the output part. If greater current flows, components in the PCU may malfunction. If you use a pulse output terminal with limit resistance, be sure to select the forward/reverse direction output method.
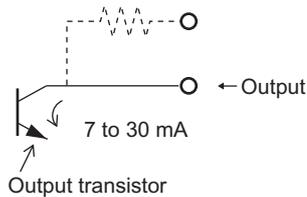
(1) Open collector output   (2) Open collector output with 1.6-kΩ limit resistance
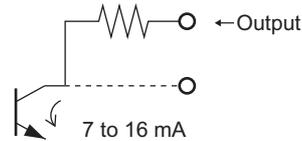
• If the current becomes smaller than 7 mA, install a bypass resistor.
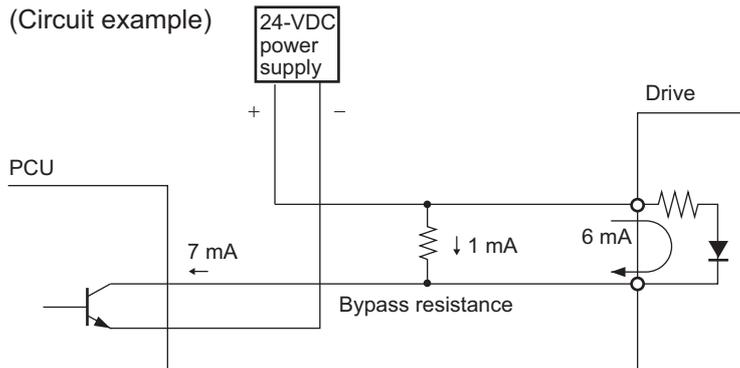
Line Driver Output (CJ1W-NC234/NC434)

17/39	Forward direction pulse output (+)
16/38	Forward direction pulse output (−)
19/37	Reverse direction pulse output and direction output (+)
18/36	Reverse direction pulse output and direction output (−)
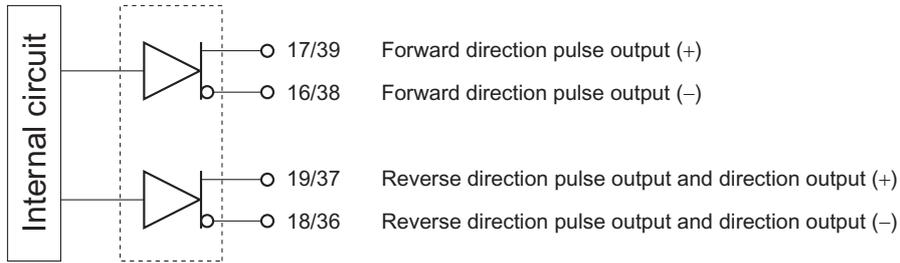
Precautions for Correct Use

• Connect a load of 20 mA maximum to the output part. If greater current flows, components in the PCU may malfunction.

RUN Output, Error Counter Reset Output, Torque Limit Output, General-purpose Output

1, 2	24-V power supply for output
3, 4	24-V ground for output
11/45	RUN output
13/43	Torque limit output
15/41	Error counter reset output
14/40	Error counter reset output (with 1.6-kΩ resistance)
10/44	General-purpose output
12/42	Alarm reset output

1.6 kΩ (1/2 W)

2

Installation and Wiring
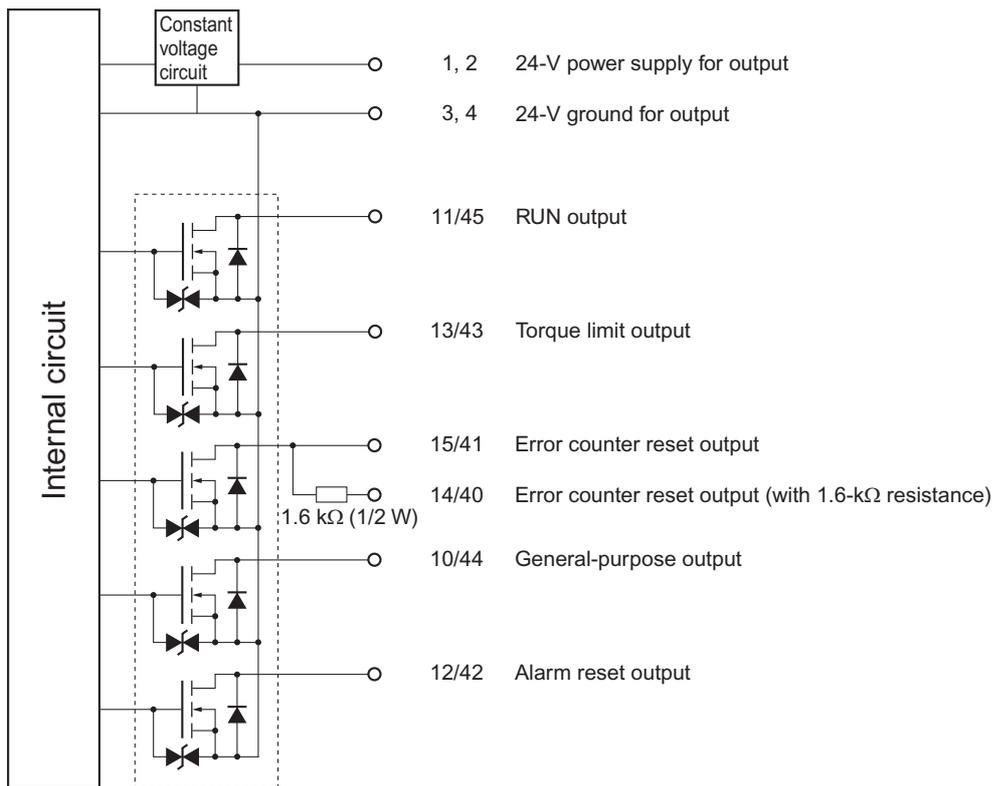
SEN Output
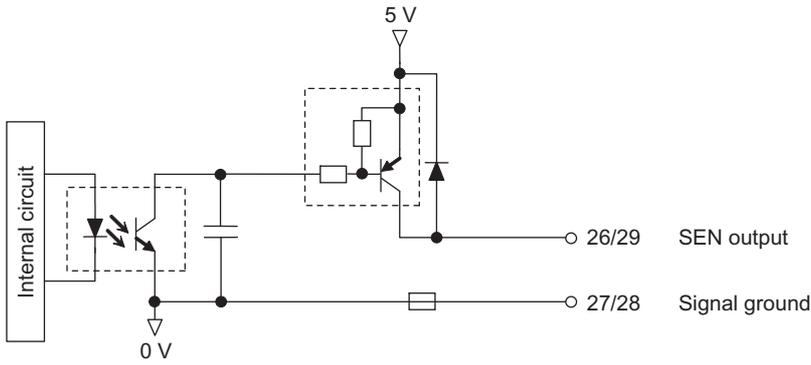
Input Circuit

Servo Drive Connector Section

Encoder Input
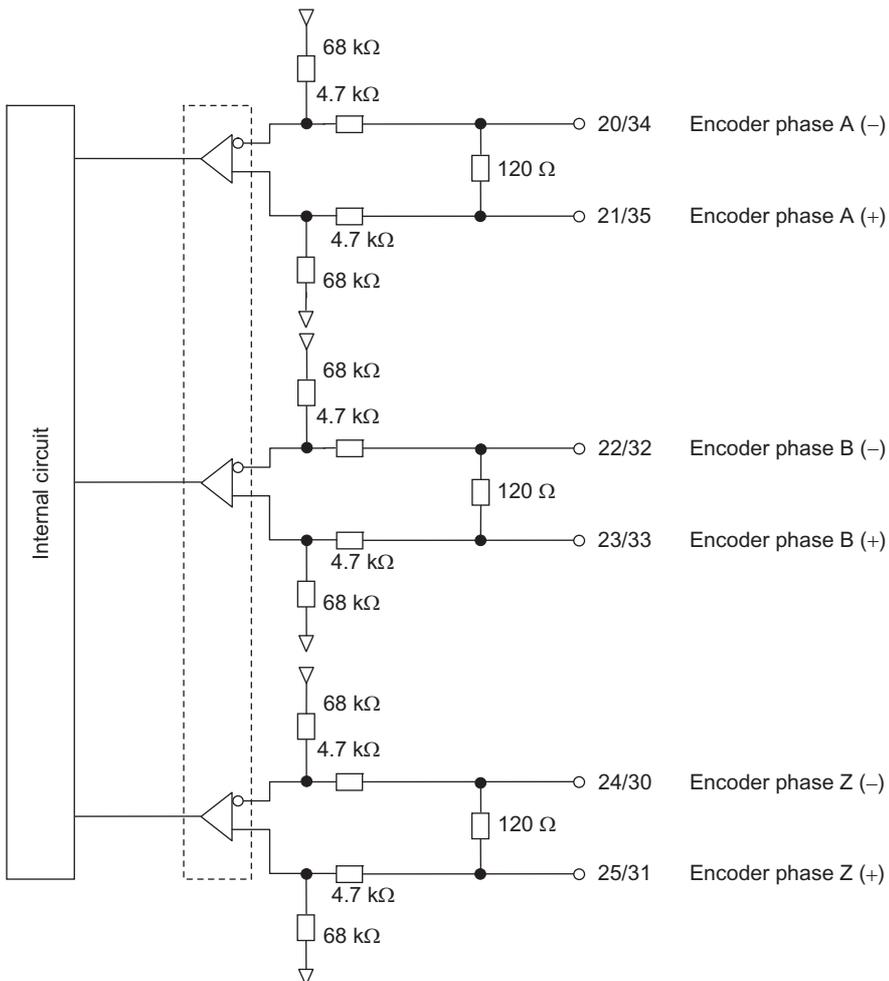
Origin Input, Positioning Completed Input, Alarm Input, General-Purpose Input
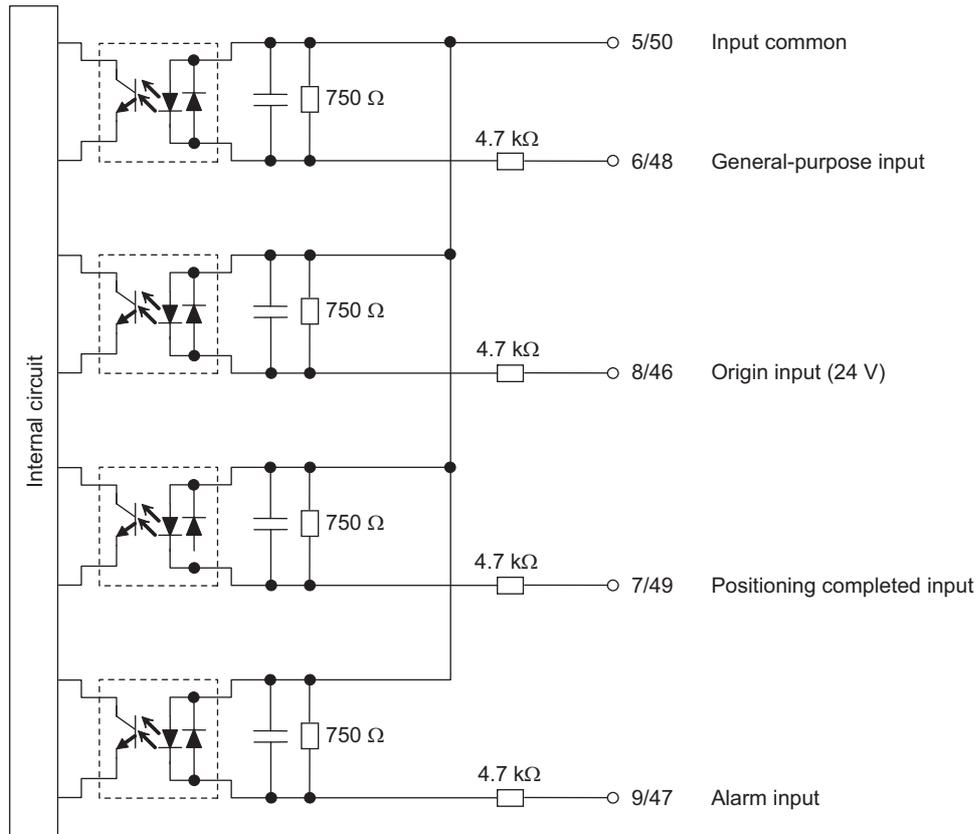
*1. You can specify N.C. or N.O. by setting axis parameters. For details, refer to "I/O Function Setting" on page 5-18.

2

External Signal Connector Section

Limit Input, Origin Proximity Input, Origin Input, Emergency Stop Input, Interrupt Input

MPG and External Encoder Input


```
                330 Ω
                ┌──[====]──┐
                │          │
     ☀︎ ⟱      ⟰ ⟰  ═╪═  [680 Ω]      ○ 19/39   MPG phase A (+) and encoder phase A (+)
                │          │
                └──[====]──┘          ○ 20/40   MPG phase A (−) and encoder phase A (−)
                330 Ω
```

```
                330 Ω
                ┌──[====]──┐
                │          │
     ☀︎ ⟱      ⟰ ⟰  ═╪═  [680 Ω]      ○ 17/37   MPG phase B (+) and encoder phase B (+)
                │          │
                └──[====]──┘          ○ 18/38   MPG phase B (−) and encoder phase B (−)
                330 Ω
```

2
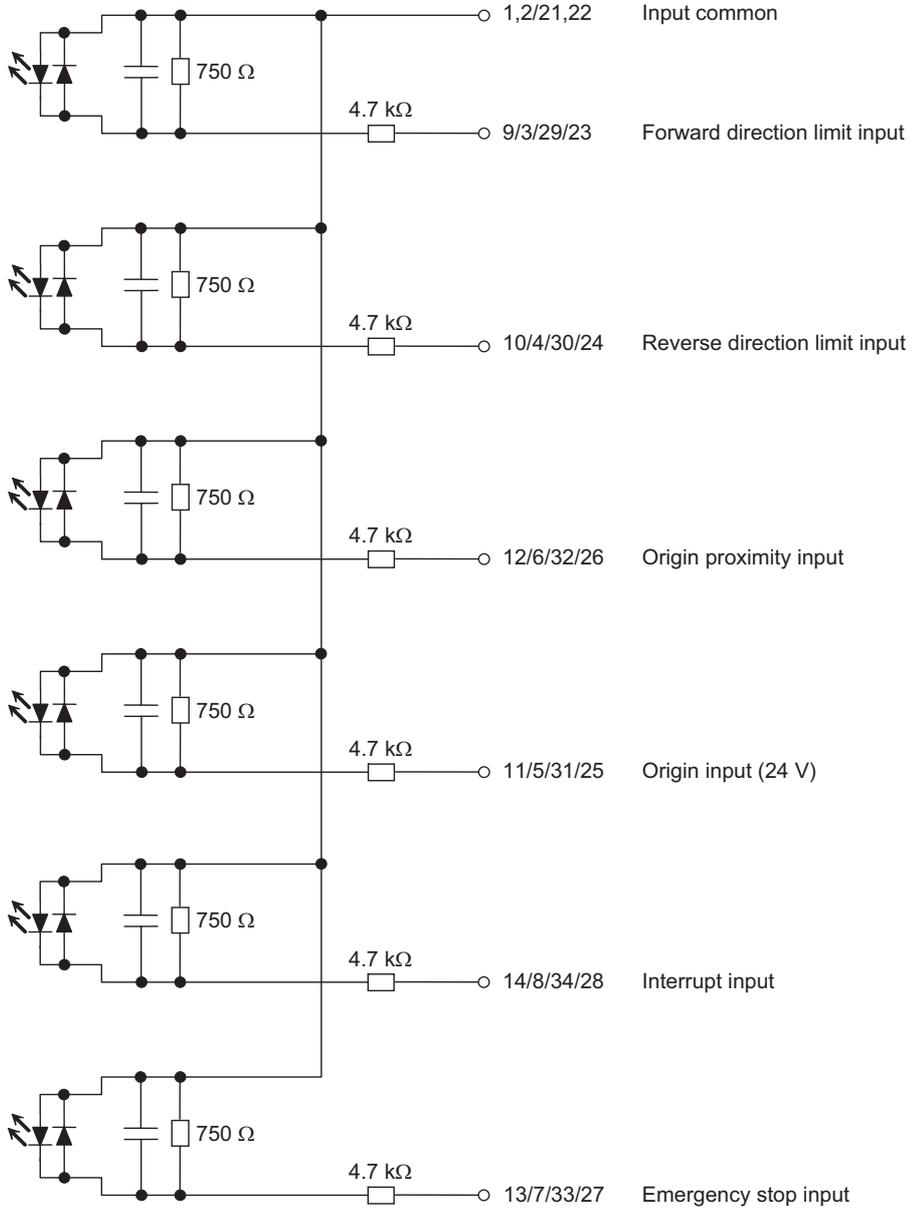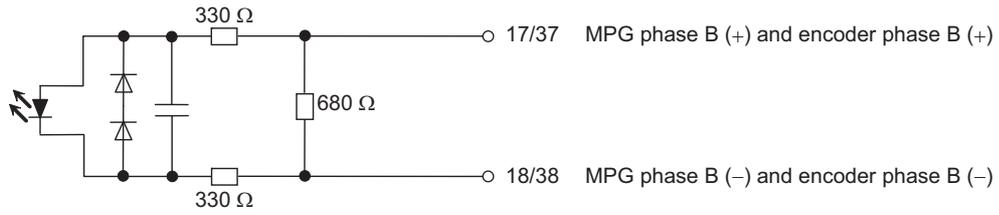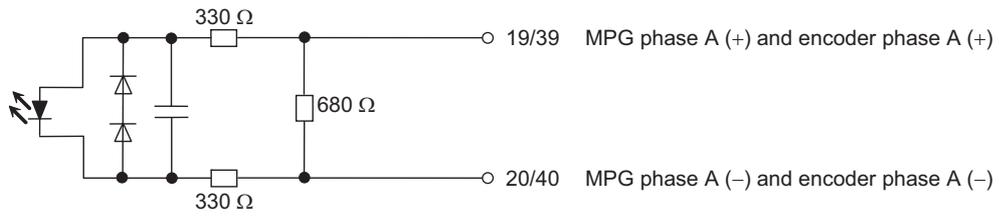
Electrical Specifications of I/Os

Output Specifications

External Power Supply

Item	Specification
Rated voltage	24 VDC
Allowable power supply voltage range	21.6 to 26.4 VDC

Pulse Output

Item		Specification
Line driver output	Output voltage	RS-422-A line driver level (AM26C31 or equivalent)
	Maximum load current	20 mA
	Maximum output frequency	4 Mpps
Open collector output	Rated voltage	5 to 24 VDC
	Load voltage range	4.75 to 26.4 VDC
	Maximum load current	30 mA 16 mA (terminal with 1.6-kΩ limit resistance)
	Leakage current	0.1 mA maximum
	Residual voltage	0.2 V maximum
	Maximum output frequency	500 kpps

Error Counter Reset Output

Item	Specification
Rated voltage	5 to 24 VDC
Load voltage range	4.75 to 26.4 VDC
Maximum load current range	30 mA 16 mA (terminal with 1.6-kΩ limit resistance)
Leakage current	0.1 mA maximum
Residual voltage	1.0 V maximum

2

SEN Output

Item	Specification
Maximum load current	10 mA
Leakage current	10 μA maximum
Residual voltage	0.8 V maximum

Other Control Outputs

Item	Specification
Rated voltage	12 to 24 VDC
Load voltage range	10.2 to 26.4 VDC
Maximum load current	0.1 A/point, 1.0 A/common
Leakage current	0.1 mA maximum
Residual voltage	1.5 V maximum
ON response time	0.1 ms maximum
OFF response time	1 ms maximum

Input Specifications

Encoder Input

Item		Specification
Line receiver input (Servo Drive connector)	Input voltage	RS-422-A line driver level (AM26C31 or equivalent)
	Input impedance	120 Ω
	Maximum input frequency	Single-phase: 4 MHz Phase difference input: 1 MHz (multiplication of 4 times: 4 MHz)

MPG and External Encoder Input

Item		Specification
Photocoupler input (External signal connector)	Input voltage	RS-422-A line driver level (AM26C31 or equivalent)
	Input current	10 mA typ
	Maximum input frequency	Single-phase: 1 MHz Phase difference input: 500 kHz (Quadruple: 2 MHz)

2

Installation and Wiring

Other Control Inputs

Item	Specification
Input voltage	20.4 to 26.4 VDC
Input current	4.9 mA typ (24 VDC)
ON voltage/current	19 VDC minimum/3 mA minimum
OFF voltage/current	5.0 VDC maximum/1 mA maximum
ON response time	50 µs maximum
OFF response time	0.2 ms maximum

2-4 Wiring

This section explains connection examples for a motor driver.
Before you actually connect the motor driver, check the specifications of the motor driver which you will use.
The wiring length between the PCU and motor driver should be maximum 3 m in the case of open collector output, or maximum 10 m in the case of line driver output.

Output Connection Examples

If the output transistor at the pulse output part is OFF, pulses are not output.
When the direction output of the pulse and direction output combination is OFF, it indicates the reverse direction pulse being output.
Do not share the 24-VDC power supply for pulse output with any other I/O power supply.

Output transistor

ON

OFF

Pulse output in progress
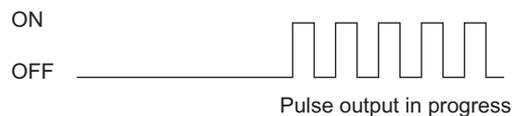
When there is a phase difference

Forward   Reverse

Forward direction pulse output

Reverse direction pulse output
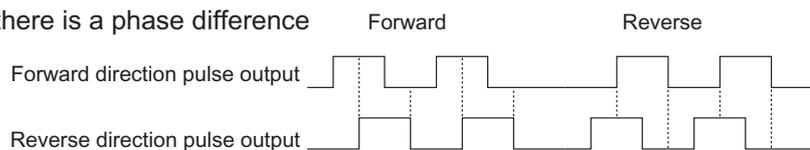
When there is forward direction/reverse direction pulse output

Forward   Reverse

Forward direction pulse output

Reverse direction pulse output
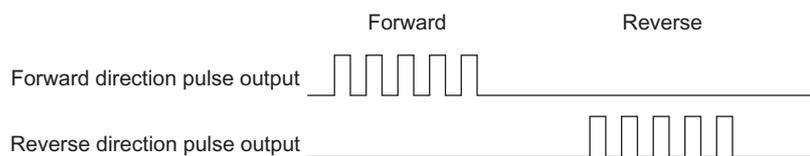
When there is pulse or direction output

Forward   Reverse

Pulse output

Direction output   Output ON   Output OFF

2
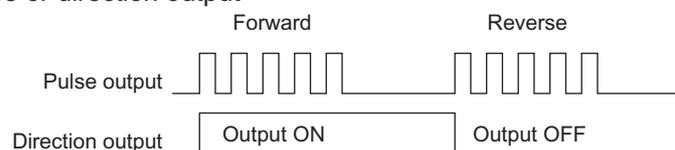
Connection with Line Driver Output

Connection with Motor Driver of Line Receiver Input Specifications
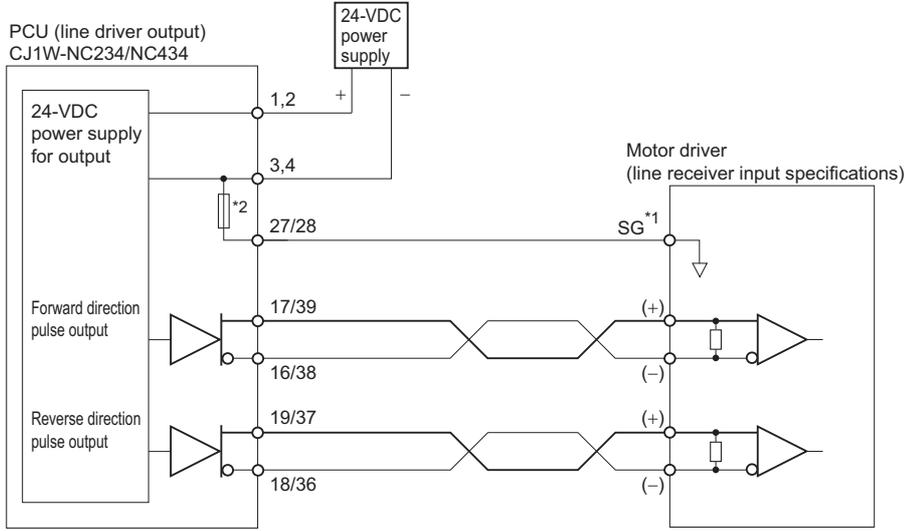
*1. For line receiver connection, connect the signal ground (SG) for the motor driver line receiver input with the signal ground of the PCU.

*2. This is an auto-reset fuse.

Precautions for Correct Use

♦ Make sure the polarities of the 24-V power supply for line driver pulse output are correct. If you connect the polarities in reverse, components in the PCU may malfunction.

Connection with Motor Driver of 5-VDC Photocoupler Input Specifications
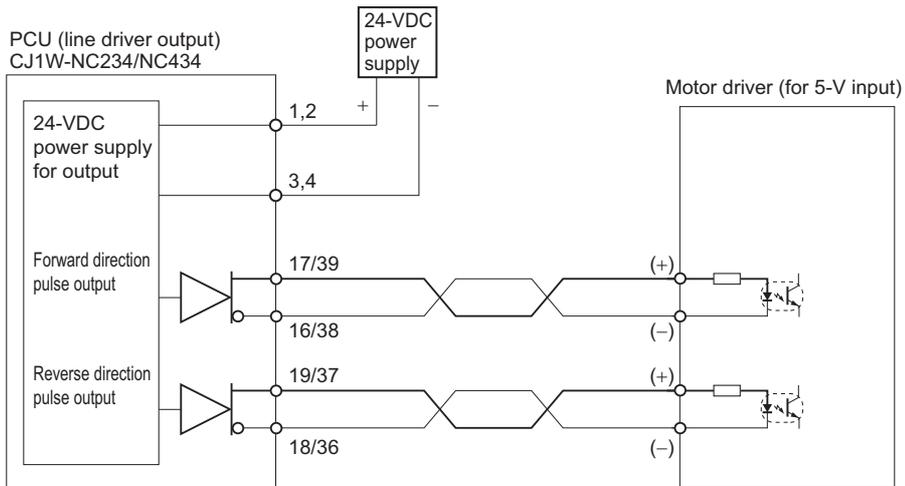
Connection with Open Collector Output

Connection with Open Collector Output

![Precautions for Correct Use]
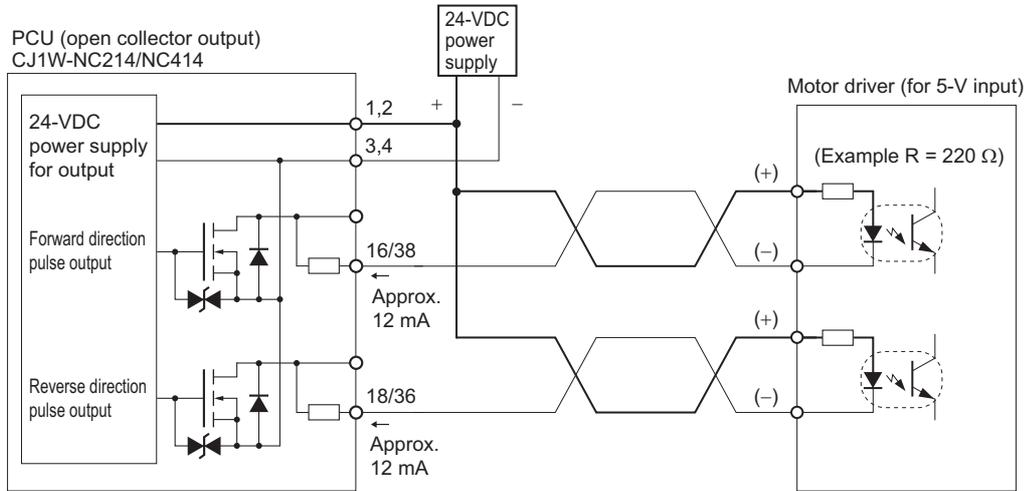
Precautions for Correct Use

⬧ In this example, a motor driver of 5-V input drives with a 24-VDC power supply.
Exercise due caution so that the output current of the PCU does not damage the input circuit on the motor driver side, and there should be enough current to turn ON the circuit.

Connection with Motor Driver of 5-V TTL Input Specifications
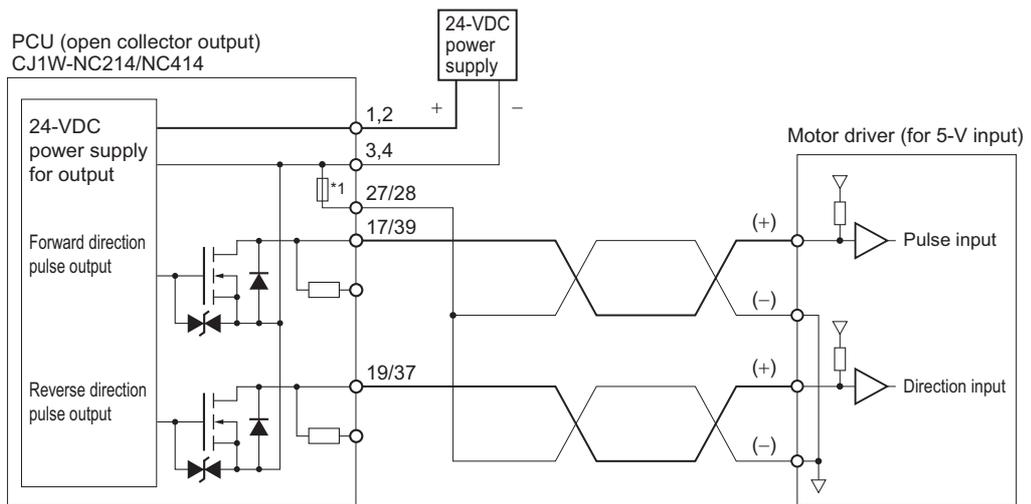
*1. This is an auto-reset fuse.

2

Output Part of Servo Drive Connector

This section shows connection examples of the RUN output, torque limit output, error counter output, alarm reset output and general-purpose output on the Servo Drive connector.

Connection with 24-VDC Power Supply
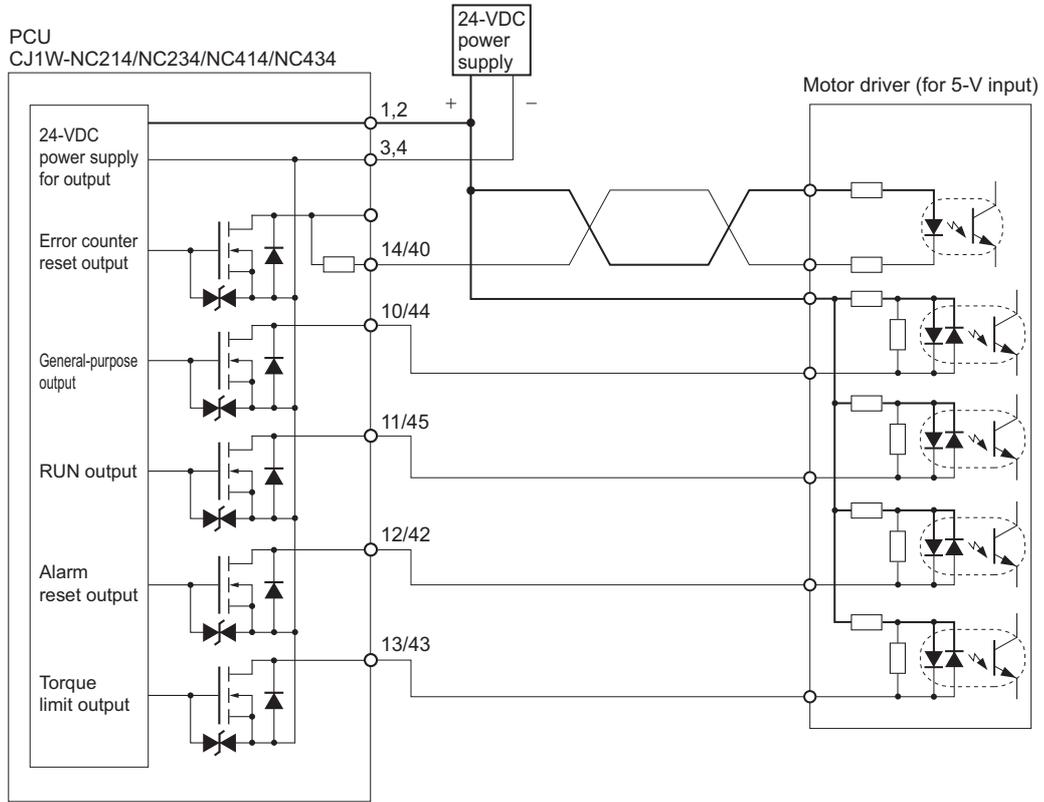
Connection with the Parallel Use of 5-VDC Power Supply
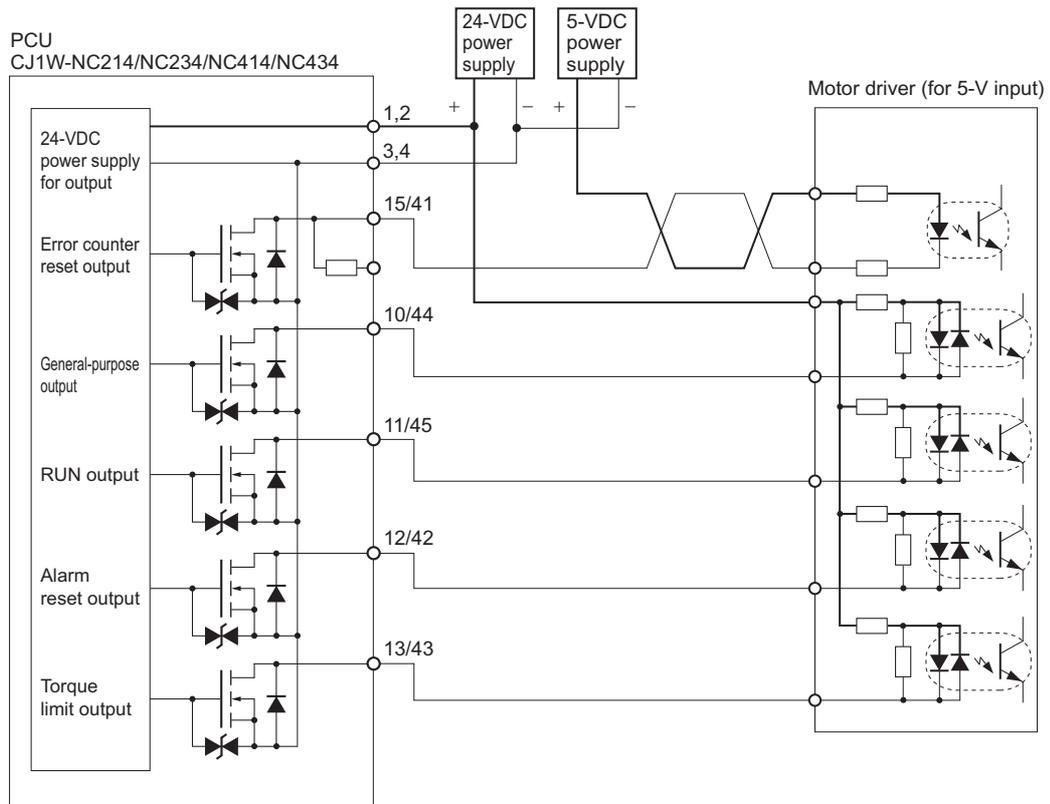
Connection with SEN Output

2
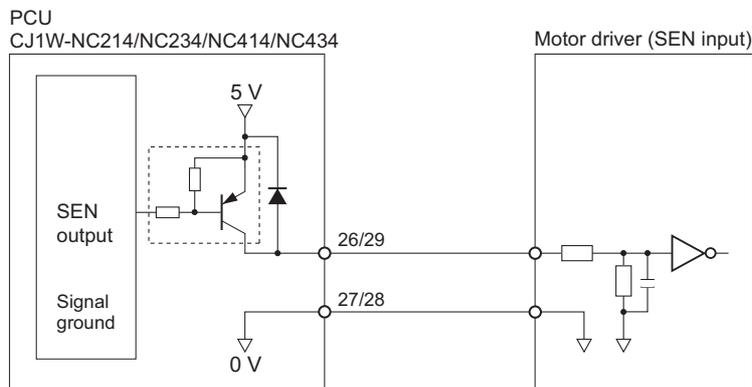
Input Connection Example

This section shows connection examples of the forward/reverse direction limit input, origin proximity input, origin input, interrupt input, emergency stop input and encoder input.

Input Signal

There are an N.O. input or N.C. input for an input. You can use either type by setting axis parameters. For details, refer to "I/O Function Setting" on page 5-18.

Precautions for Correct Use

- If the switch capacity is small, it may damage the switch. For each input, connect a switch whose switch capacity is at least 5 mA.
- Depending on the setting of the origin search operation pattern, the point at which the origin proximity input or forward/reverse limit input changes from ON to OFF is used as the timing for the origin detection. In this case, use a proximity sensor or other chatter-free sensor for the input. If you use a switch with contacts, the origin position may deviate due to chattering. For information on setting the origin search operation pattern, refer to "Origin Search Operation" on page 4-24.
- Use a proximity sensor or other chatter-free sensor for the origin input (24 V).
- If the signal width of the forward/reverse direction limit input is small, the axis movement may stop at a position beyond the signal detection position upon limit input. In this case, the limit input may not function as intended after the reset. Provide a sufficient signal width for the forward/reverse direction limit input.

Name	Connection Pattern	Default setting
Forward direction limit input	N.C. or N.O.	N.C.
Reverse direction limit input	N.C. or N.O.	N.C.
Origin proximity input	N.C. or N.O.	N.O.
Origin input (24 V)	N.C. or N.O.	N.O.
Interrupt input	N.C. or N.O.	N.O.
Emergency stop input	N.C. or N.O.	N.C.
General-purpose input	N.C. or N.O.	N.O.
Positioning completed input	N.C. or N.O.	N.O.
Drive alarm input	N.C. or N.O.	N.C.

Servo Drive Connector

Encoder Input
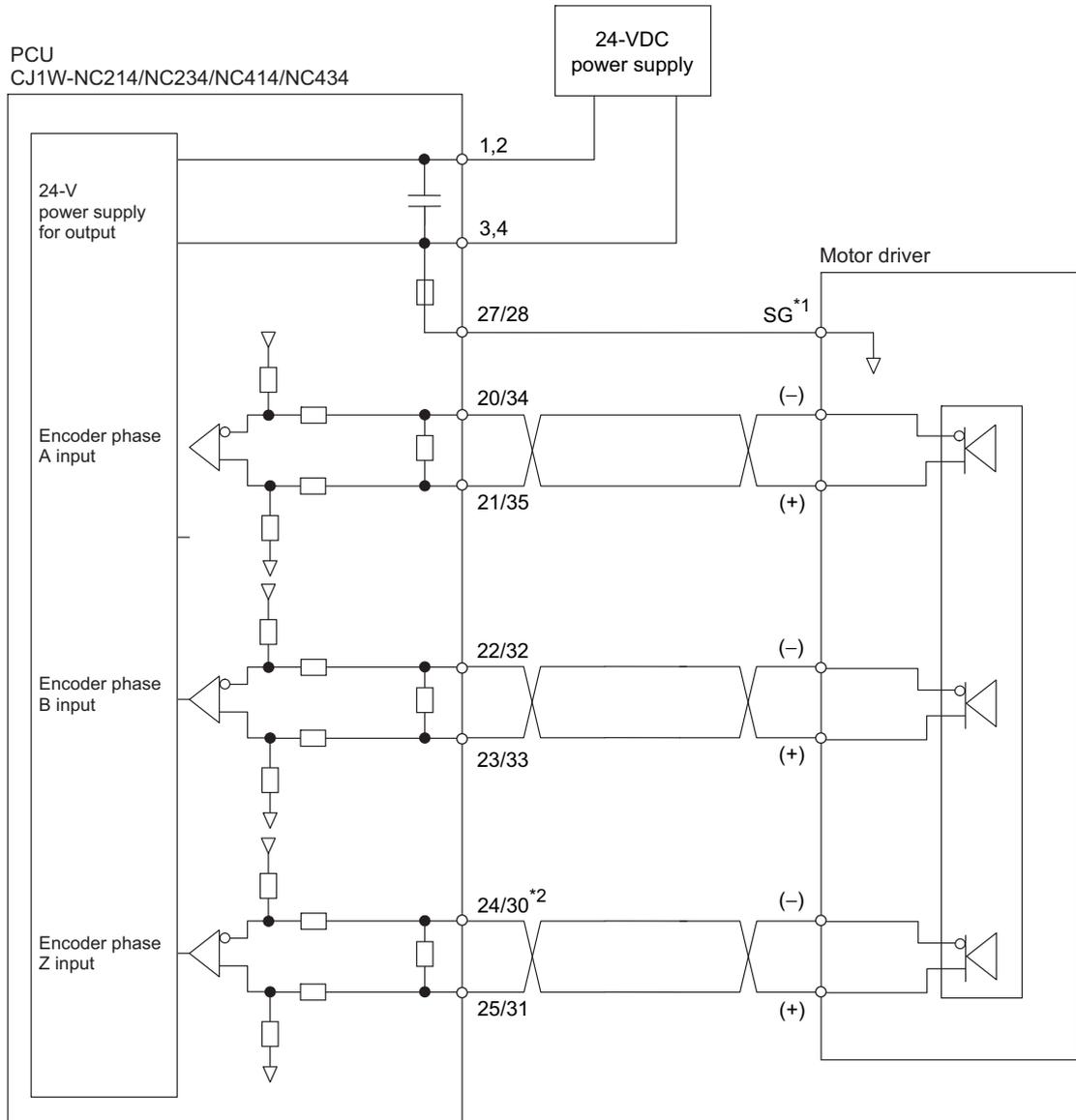
*1. For line receiver connection, connect the signal ground (SG) for the motor driver line receiver input with the signal ground of the PCU.

*2. One of the following can be selected as the origin input: Encoder phase Z (+, −) on the Servo Drive connector, origin input (24 V) on the Servo Drive connector, or the origin input (24 V) on the external signal connector. If the phase Z output from the Servo Drive is a line-driver output, use the encoder phase Z (+, −). Also, set the Origin Input Signal Selection axis parameter to 0 (use Z-phase input as the origin).

Origin Input, Positioning Completed Input, Alarm Input, General Purpose Inputs
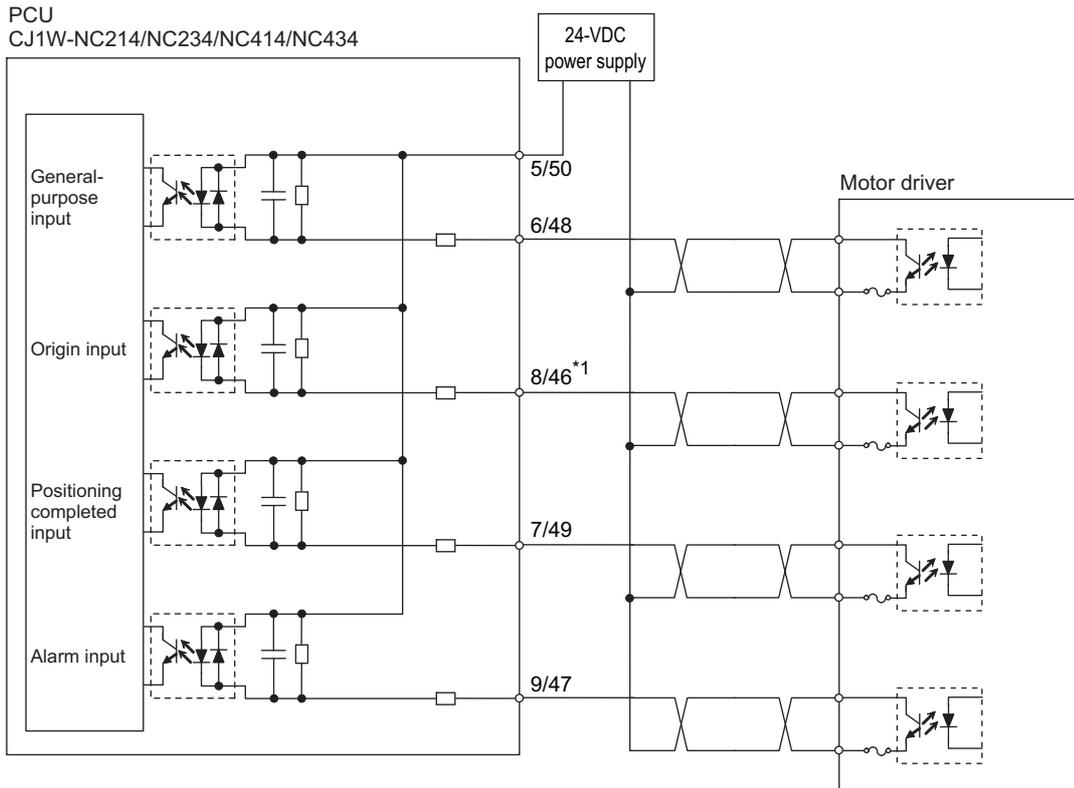
*1. One of the following can be selected as the origin input: Encoder phase Z (+, −) on the Servo Drive connector, origin input (24 V) on the Servo Drive connector, or the origin input (24 V) on the external signal connector. If the phase Z output from the Servo Drive is an open-collector output, use the origin input (24 V). Also, set the Origin Input Signal Selection axis parameter to 0 (use Z-phase input as the origin).

External Signal Connector

Limit Input, Origin Proximity Input, Origin Input, Emergency Stop Input, Interrupt Input
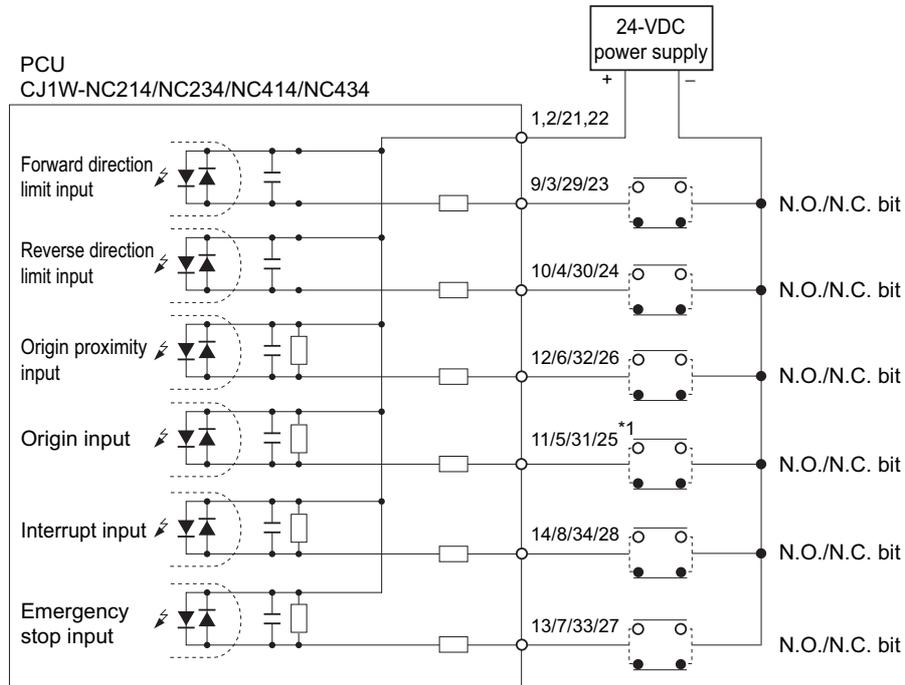
*1. One of the following can be selected as the origin input: Encoder phase Z (+, −) on the Servo Drive connector, origin input (24 V) on the Servo Drive connector, or the origin input (24 V) on the external signal connector. If the origin signal is input from an external device, use the origin input (24 V). Also, set the Origin Input Signal Selection axis parameter to 1 (use external origin input).

MPG and External Encoder Input
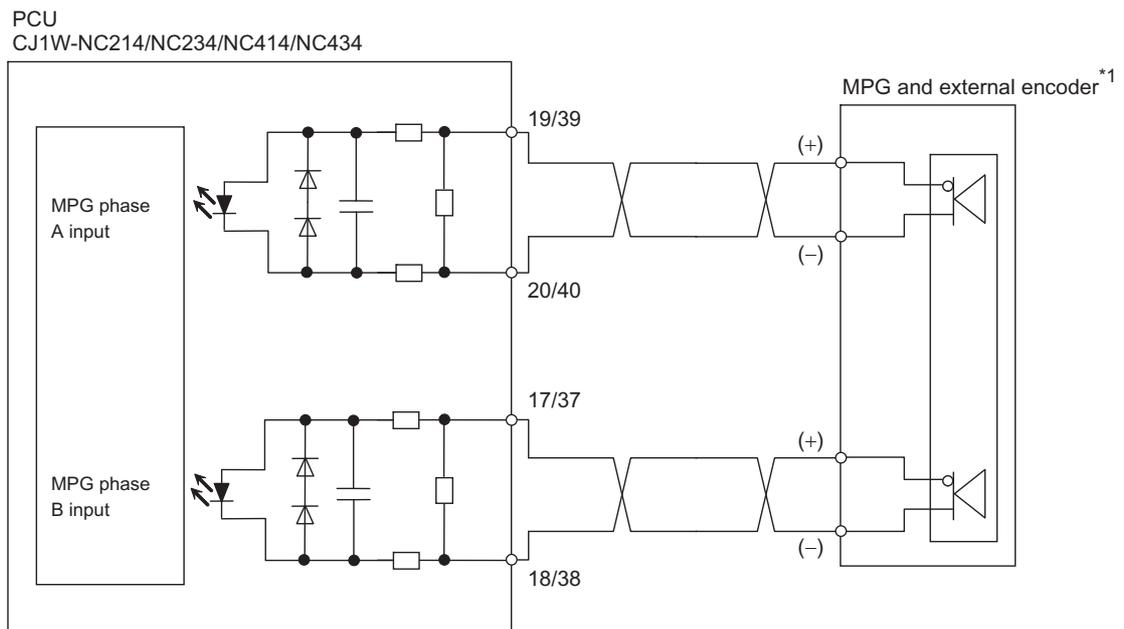
*1. Provide an external power supply for MPG and external encoder.

2

Wiring of Connectors

• This PCU does not come with any connector.
• A dedicated cable is available as an option. For details, refer to "Connection with Dedicated Cable" on page 2-48.
• MIL connectors are used.

Servo Drive Connector

Connector type		Model
Flat-cable connector		XG4M-5030-T[*1]
IDC connector for discrete wires	Socket	XG5M-5032-N[*2]
		XG5M-5035-N[*3]
	Hood cover	XG5S-5022 (horizontal)

*1. This connector comes with a strain relief. To connect to the PCU, use a connector with strain relief.
*2. The applicable wire is AWG24 (UL-1061).
*3. The applicable wire is AWG28 to 26 (UL-1007).

Configuration Diagram for IDC Connector for Discrete Wires

| Socket | Wires | Connection complete | Hood cover | Usage type |

Discrete wires

For Servo Drive connector

Double rows

Horizontal type

Double rows with polarity guide (locking possible)

IDC tool

Simple IDC tool
XY2B-7006
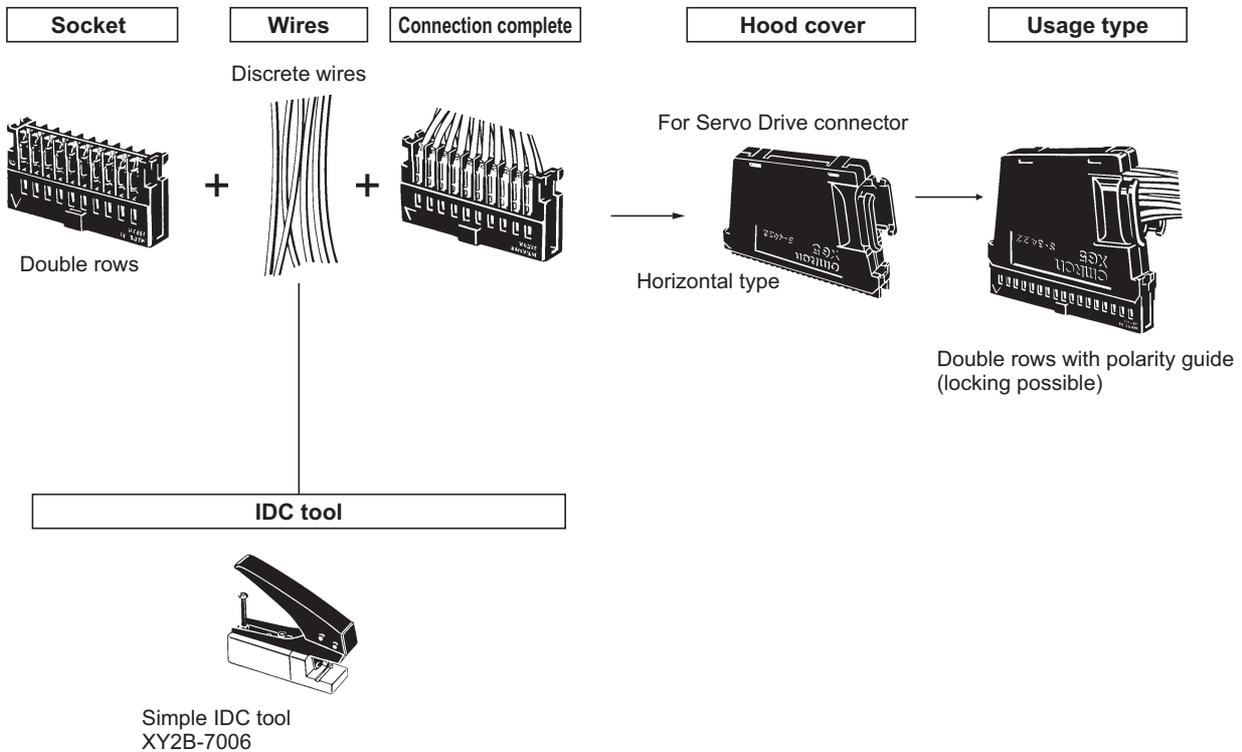
Hood Cover Installation Method for IDC Connector for Discrete Wires
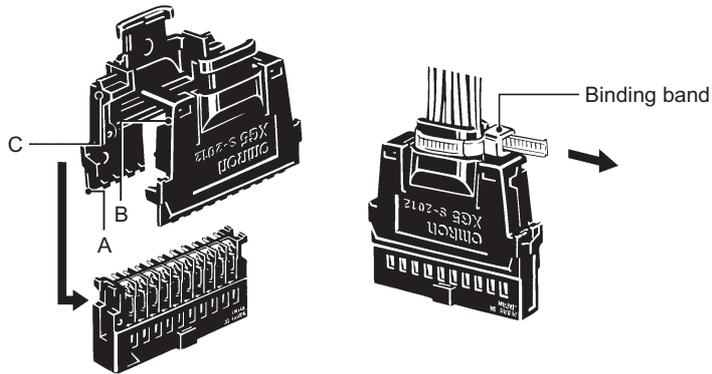
1. **Insert tab A on one hood cover into the socket.**
2. **Insert tab B on the hood cover into C of the other hood cover.**
3. **Tighten with a binding band.**

The above drawing shows a vertical hood cover. The Servo Drive connector only accepts a horizontal hood cover, but the installation method is the same.

Configuration Diagram for IDC Connector for Discrete Wires

Horizontal Hood Cover
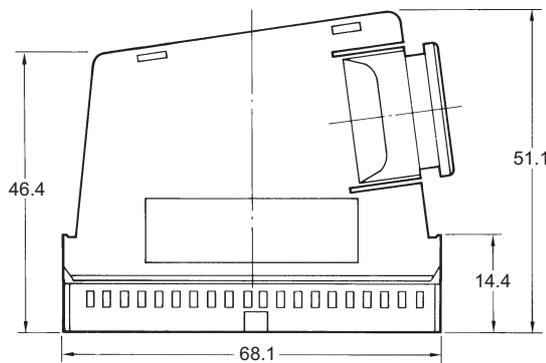
Assembly dimensions drawing
MIL plug+horizontal-type hood cover

2
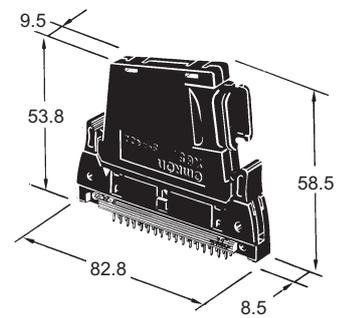
External Signal Connector

Connector type	Model
Flat cable connector	XG4M-2030-T[*1]

*1. This connector comes with a strain relief. To connect to the PCU, use a connector with strain relief.

To connect discrete wires to an external signal connector, use a cable with crimped terminals for discrete wires.

XW2Z-xxxF
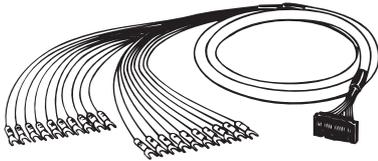
Wiring diagram
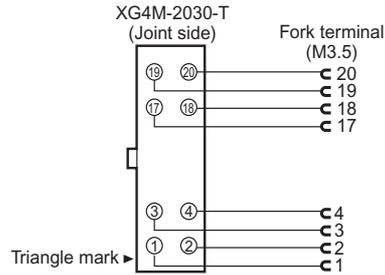
Connector Pin Number Correspondence Table

Fork terminal	Wire core number	Insulator color	Dot mark	Dot color	Connector number
1	1	Blue	□	Red	1 ◁
2		Blue	□	Black	2
3	2	Peach	□	Red	3
4		Peach	□	Black	4
5	3	Green	□	Red	5
6		Green	□	Black	6
7	4	Orange	□	Red	7
8		Orange	□	Black	8
9	5	Gray	□	Red	9
10		Gray	□	Black	10
11	6	Blue	□□	Red	11
12		Blue	□□	Black	12
13	7	Peach	□□	Red	13
14		Peach	□□	Black	14
15	8	Green	□□	Red	15
16		Green	□□	Black	16
17	9	Orange	□□	Red	17
18		Orange	□□	Black	18
19	10	Gray	□□	Red	19
20		Gray	□□	Black	20

2

Wiring Precautions

Electronic control devices may cause position deviation or other malfunctions due to noise from surrounding power supply lines, external loads, etc.

In many cases it is difficult to simulate malfunctions caused by noise, which means that it takes time to identify their cause.

Implement the measures below to prevent malfunctions by noise and thereby enhance the system reliability.

- For the sizes and materials for wiring, use wires or cables of the diameter which is specified in the operation manual of your motor driver.

  Wire the power lines (AC power supply, motor power line) separately from the control lines (pulse output line, external I/O signal line). Do not place them in the same duct or bundle them together.
- Do not share the 24-VDC power supply for pulse output with any other I/O power supply.
- For the control line, use a sheathed, shielded cable.
- Be sure to install a surge absorber for any inductive load (such as a relay or solenoid).

(Example: Okaya Electric Industries Co., Ltd. CR-50500, etc.)
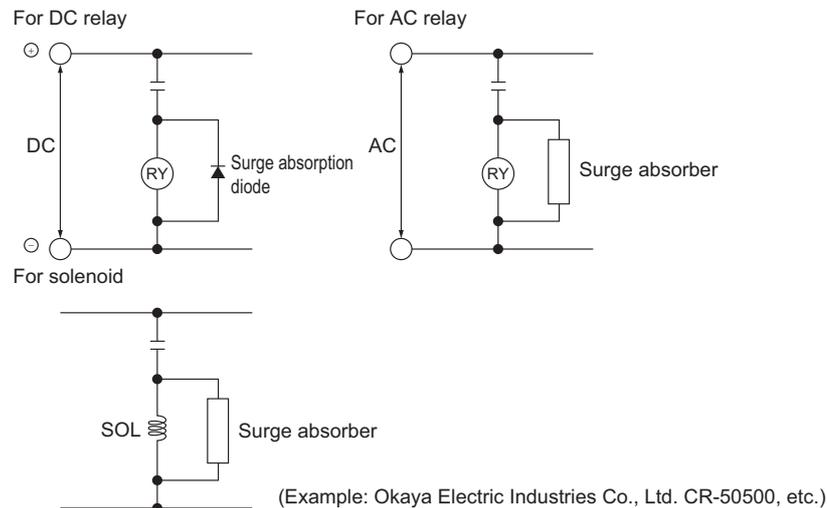
Reference

- Install a surge absorption diode or surge absorber as close as possible to the relay. Also, use a surge absorption diode whose dielectric strength is at least 5 times the circuit voltage.
- When you share the power supply with an electrical welder or electrical discharge machine, or when a source of high-frequency noise is located nearby, noise may enter the power supply line. In this case, insert a noise filter in the input part of the power supply.
- Ground to 100Ω or less, and use as thick a wire as possible which has a wire size of 1.25 mm^2 or greater.
- For the power line, we recommend using a twisted-pair cable.

2-5 Connection Examples for Different Types of Motor Drive

This section shows examples of wiring axis 1 and axis 3. When you use axis 2 and axis 4, check the connector pin numbers and wire in the same manner.
For details, refer to "External I/O Circuit" on page 2-8.

✓ Precautions for Correct Use

⬩ Use a shielded cable to connect a stepping motor driver or Servo Drive. Connect the shield to the FG on the driver side.

Connection Examples for Stepping Motor

This is an example when you use a stepping motor and connect an external sensor to the origin input.
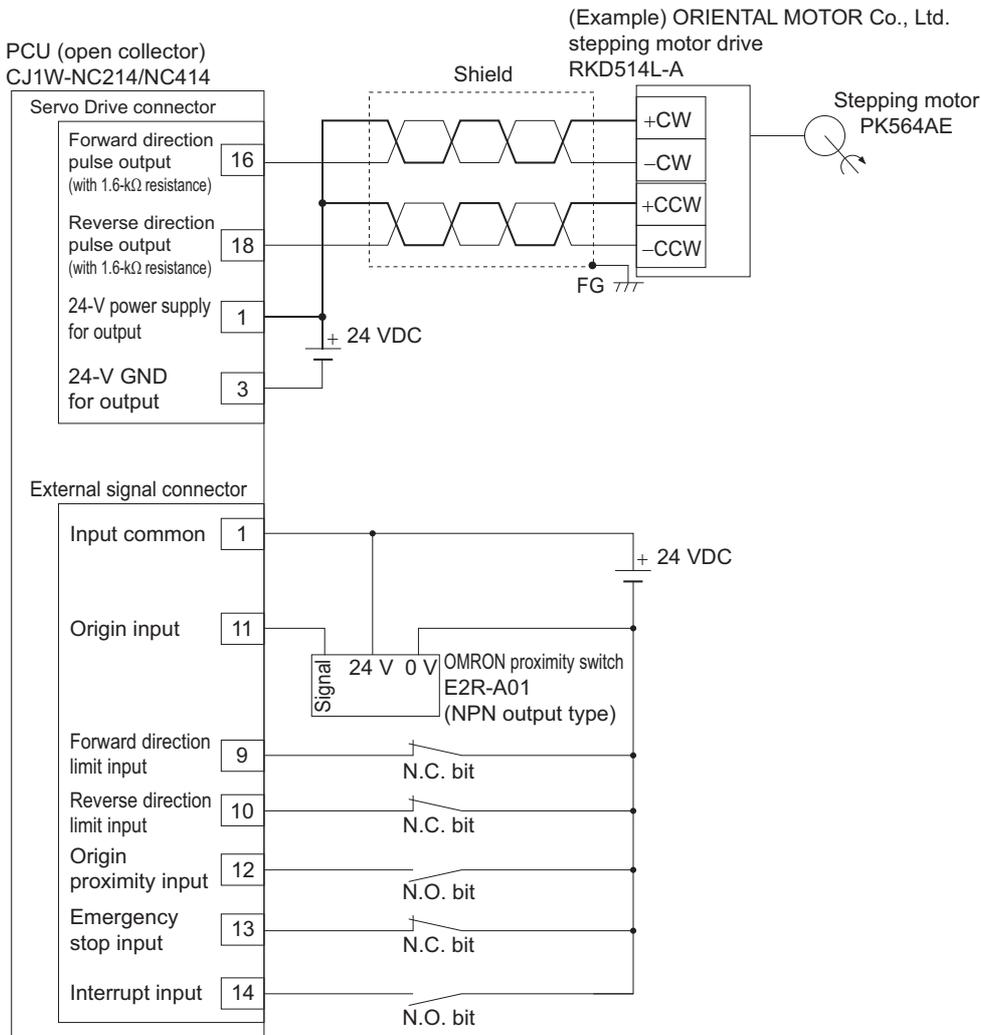
Connection Examples for Servo Drive

Use a Servo Drive, and use the encoder phase Z as the origin input.

In this example, we use OMRON Servo Drive.

Use the positioning completed (INP) of the Servo Drive as the Origin Search Completed and positioning completed.

Set the Servo Drive so that the position completed remains OFF while the motor is operating and turns ON when it stops.

If you do not connect or set the positioning completed signal of the Servo Drive properly, Origin Search may not complete or the positioning completed flag may not turn ON.

Connection Examples for OMNUC G5/G-series Servo Drive

Example of Connection with Line Driver (CJ1W-NC234/NC434)
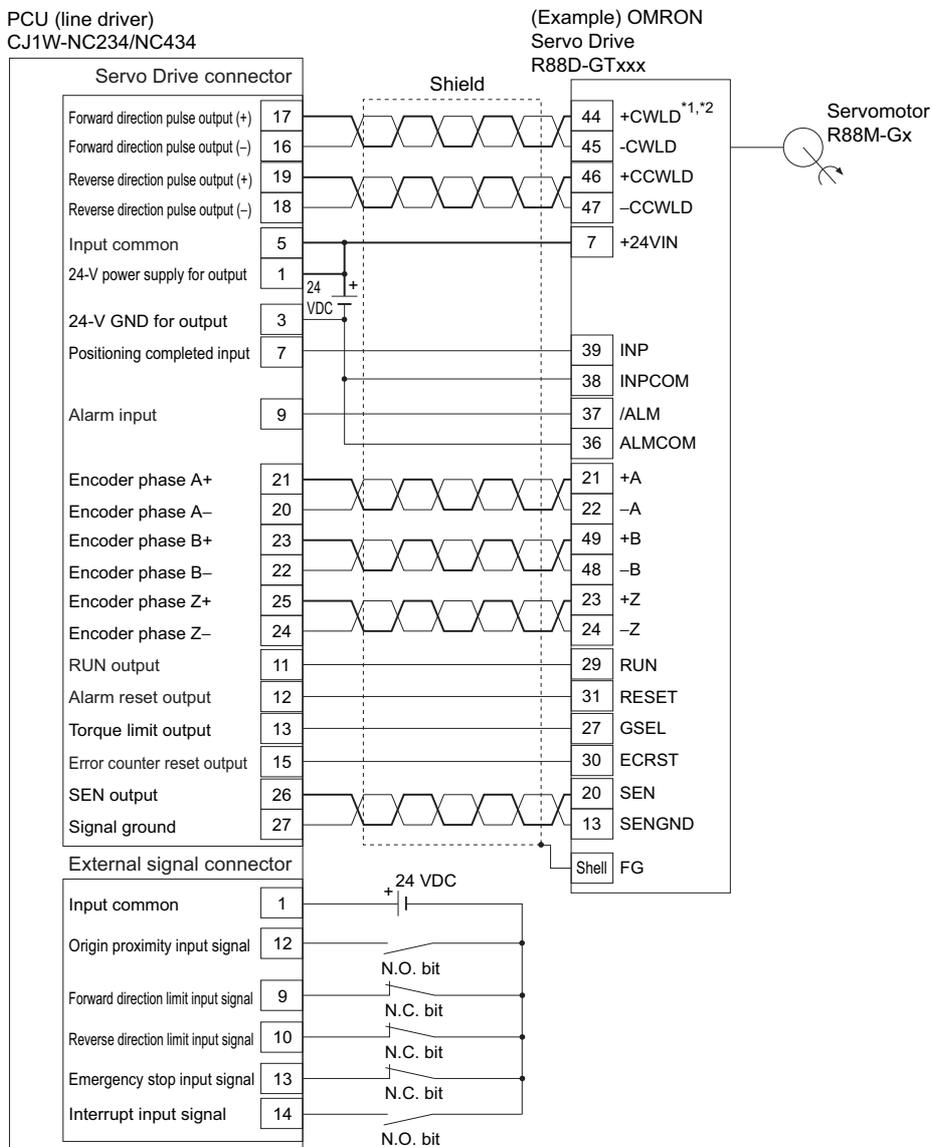
Note 1. This is a line driver input for G5/G-series Servo Drive. To use this input, set Pn005 (Command Pulse Input Selection) of the G5-series Servo Drive or Pn40 (Command Pulse Input Selection) of the G-series Servo Drive to 1 (line driver input).

Note 2. Connect as shown here because the PCU handles forward direction commands as CW direction

and phase A advance pulses (selectable by the pulse output direction selection parameter).

Note 3. For a G5-series Servo Drive, the default settings are used for the control I/O signals.

Example of Connection with Open Collector (CJ1W-NC214/NC414)

PCU (open collector)
CJ1W-NC214/NC414

(Example) OMRON
Servo Drive
R88D-GTxxx

Servomotor
R88M-Gx

Servo Drive connector

Signal	Pin		Pin	Signal
Forward direction pulse output (with 1.6-kΩ resistance)	16	Shield	3	+CW[*1,*2]
			4	−CW
Reverse direction pulse output (with 1.6-kΩ resistance)	18		5	+CCW
			6	−CCW
Input common	5		7	+24VIN
24-V power supply for output	1			
24-V GND for output	3			
Positioning completed input	7		39	INP
			38	INPCOM
Alarm input	9		37	/ALM
			36	ALMCOM
Encoder phase A+	21		21	+A
Encoder phase A−	20		22	−A
Encoder phase B+	23		49	+B
Encoder phase B−	22		48	−B
Encoder phase Z+	25		23	+Z
Encoder phase Z−	24		24	−Z
RUN output	11		29	RUN
Alarm reset output	12		31	RESET
Torque limit output	13		27	GSEL
Error counter reset output	15		30	ECRST
SEN output	26		20	SEN
Signal ground	27		13	SENGND
			Shell	FG

24 VDC (+)

External signal connector

Signal	Pin	
Input common	1	24 VDC +
Origin proximity input signal	12	N.O. bit
Forward direction limit input signal	9	N.C. bit
Reverse direction limit input signal	10	N.C. bit
Emergency stop input signal	13	N.C. bit
Interrupt input signal	14	N.O. bit

Note 1. Use the photocoupler input of the G5/G-series Servo Drive. To use this input, set Pn005 (Command Pulse Input Selection) of the G5-series Servo Drive or Pn40 (Command Pulse Input Selection) of the G-series Servo Drive to 0 (photocoupler input).

Note 2. Connect as shown here because the PCU handles forward direction commands as CW direction and phase A advance pulses (selectable by the pulse output direction selection parameter).

Note 3. For a G5-series Servo Drive, the default settings are used for the control I/O signals.

2

Installation and Wiring

Connection Examples for SMARTSTEP2 Series Servo Drive

Example of Connection with Line Driver (CJ1W-NC234/NC434)

PCU (line driver)
CJ1W-NC234/NC434

(Example) OMRON
Servo Drive
R7D-BPxxx

Servo Drive connector

Shield

Forward direction pulse output (+)	17	22 +CW [1]
Forward direction pulse output (−)	16	23 −CW
Reverse direction pulse output (+)	19	24 +CCW
Reverse direction pulse output (−)	18	25 −CCW
Input common	5	1 +24VIN
24-V power supply for output	1	
24-V GND for output	3	
Positioning completed input	7	10 INP
		13 0GND
Alarm input	9	9 /ALM
Encoder phase A+	21	15 +A
Encoder phase A−	20	16 −A
Encoder phase B+	23	18 +B
Encoder phase B−	22	17 −B
Encoder phase Z+	25	19 +Z
Encoder phase Z−	24	20 −Z
RUN output	11	2 RUN
Alarm reset output	12	3 RESET
Torque limit output	13	5 TLSEL
Error counter reset output	15	4 ECRST
SEN output	26	
Signal ground	27	

24 VDC

Servomotor
R88M-Gx

26 FG

External signal connector

Input common	1	24 VDC +
Origin proximity input signal	12	N.O. bit
Forward direction limit input signal	9	N.C. bit
Reverse direction limit input signal	10	N.C. bit
Emergency stop input signal	13	N.C. bit
Interrupt input signal	14	N.O. bit

Note 1. Connect as shown here because the PCU handles forward direction commands as CW direction and phase A advance pulses (selectable by the pulse output direction selection parameter).

Example of Connection with Open Collector (CJ1W-NC214/NC414)

PCU (open collector)
CJ1W-NC214/NC414

(Example) OMRON
Servo Drive
R7D-BPxxx

Servo Drive connector

Shield

Servomotor
R88M-Gx

Forward direction pulse output (with 1.6-kΩ resistance)	16	22	+CW[*1]
		23	−CW
Reverse direction pulse output (with 1.6-kΩ resistance)	18	24	+CCW
		25	−CCW
Input common	5	1	+24VIN
24-V power supply for output	1		
24-V GND for output	3		
Positioning completed input	7	10	INP
		13	0GND
Alarm input	9	9	/ALM
Encoder phase A+	21	15	+A
Encoder phase A−	20	16	−A
Encoder phase B+	23	18	+B
Encoder phase B−	22	17	−B
Encoder phase Z+	25	19	+Z
Encoder phase Z−	24	20	−Z
RUN output	11	2	RUN
Alarm reset output	12	3	RESET
Torque limit output	13	5	TLSEL
Error counter reset output	15	4	ECRST
SEN output	26		
Signal ground	27	26	FG

24 VDC

External signal connector

Input common	1	24 VDC
Origin proximity input signal	12	N.O. bit
Forward direction limit input signal	9	N.C. bit
Reverse direction limit input signal	10	N.C. bit
Emergency stop input signal	13	N.C. bit
Interrupt input signal	14	N.O. bit

Note 1. Connect as shown here because the PCU handles forward direction commands as CW direction and phase A advance pulses (selectable by the pulse output direction selection parameter).

2

2-6 Wiring of Unused Axis

This section explains what to do when this PCU does not use some axes.

Use the axis parameter [Axis Type] to select whether or not to use a given axis.

Parameter name	Function	Setting range	Unit	Default setting
Axis Type	Set the axis type. 0: Physical axis, 1: Virtual axis, 2: Unused axis	0 to 2	–	0[*1]

*1.With a 2-axis PCU, the default setting is [2] for axis 3 and axis 4.

When virtual axis or unused axis is selected, I/O wiring is not necessary.

📖 **Reference**

- Select [Physical Axis] for those axes that are actually wired to operate, and set [Unused Axis] for unused axes.

2-7 Connection with Dedicated Cable

You can use a dedicated cable to save wiring between the Servo Drive and PCU.
Dedicated cables for the 1-axis type and 2-axis type are available. Also, the cable model varies depending on the type of the connected Servo Drive.
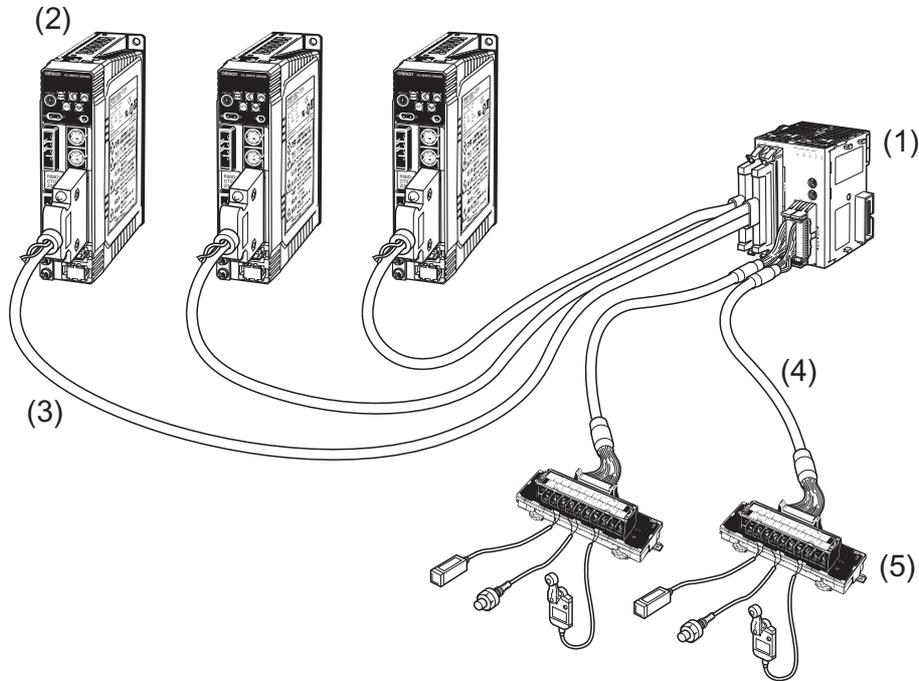
Number	Name	Model
(1)	PCU	CJ1W-NC214 CJ1W-NC234 CJ1W-NC414 CJ1W-NC434
(2)	Servo Drive	R88D-GTxxx R88D-WTxxx R7D-BPxxx R7D-APxxx
(3)	Servo Drive connecting cable	XW2Z-xxxJ-Gx
(4)	External signal connecting cable	XW2Z-xxxX
(5)	Terminal block	XW2B-20G4 XW2B-20G5 XW2D-20G6

2

CJ1W-NC234/NC434 Cable

The table below shows the CJ1W-NC234/NC434 cable.
2 types of cable are available: One for Servo Drive connection and the other for external signal connection.

Servo Drive Connecting Cable

The Servo Drive connecting cables for the 1-axis type and 2-axis type are available, and there's also a combination of cables to be used depending on the type of the Servo Drive.

Cable Type

Servo Drive		Length	Cable model
OMNUC G5 Series R88D-KTxxx	1-axis type	1 m	XW2Z-100J-G9
		5 m	XW2Z-500J-G9
		10 m	XW2Z-10MJ-G9
OMNUC G Series R88D-GTxxx[*1]	2-axis type	1 m	XW2Z-100J-G1
		5 m	XW2Z-500J-G1
		10 m	XW2Z-10MJ-G1
OMNUC W Series R88D-WTxxx	1-axis type	1 m	XW2Z-100J-G10
		5 m	XW2Z-500J-G10
		10 m	XW2Z-10MJ-G10
	2-axis type	1 m	XW2Z-100J-G2
		5 m	XW2Z-500J-G2
		10 m	XW2Z-10MJ-G2
SMARTSTEP2 Series R7D-BPxxx	1-axis type	1 m	XW2Z-100J-G12
		5 m	XW2Z-500J-G12
		10 m	XW2Z-10MJ-G12
	2-axis type	1 m	XW2Z-100J-G4
		5 m	XW2Z-500J-G4
		10 m	XW2Z-10MJ-G4
SMARTSTEP A Series R7D-APxxx	1-axis type	1 m	XW2Z-100J-G11
		5 m	XW2Z-500J-G11
		10 m	XW2Z-10MJ-G11
	2-axis type	1 m	XW2Z-100J-G3
		5 m	XW2Z-500J-G3
		10 m	XW2Z-10MJ-G3

*1. Use the line driver input for command pulses to the G5/G-series Servo Drive. When you use this cable, set Pn005 (Command Pulse Input Selection) of the G5-series Servo Drive or Pn40 (Command Pulse Input Selection) of the G-series Servo Drive to 1 (line driver input).

2

Connection Configuration and Dimensions

Cable for the 1-axis type
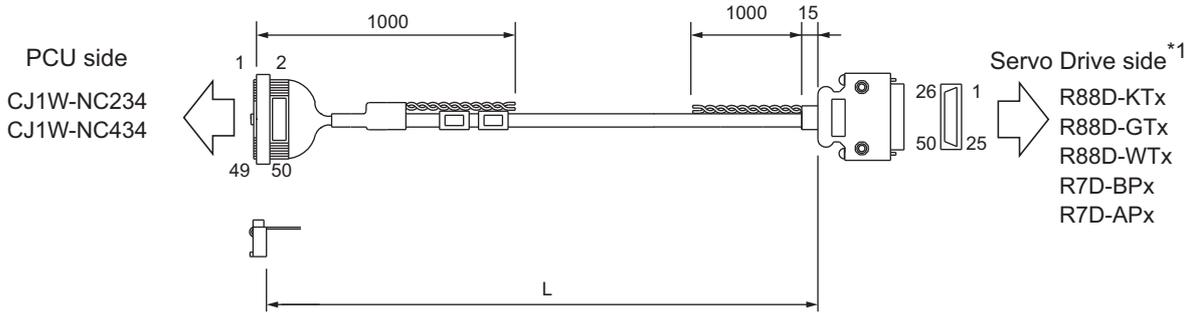
Cable for the 2-axis type

*1. The SMARTSTEP2 Series (R7D-BPx) uses a 26-pin connector, while the SMARTSTEP Series (R7D-APx) uses a 36-pin connector.

For the cable wiring diagram, refer to "Appendix-3 Servo Drive Connecting Cable".

External Signal Connecting Cable and Terminal Block

This cable connects external signals such as the forward direction limit input, reverse direction limit input, origin proximity input, origin input, interrupt input and emergency stop input.

Cable Type

Cable model	Length
XW2Z-C50X	0.5 m
XW2Z-100X	1 m
XW2Z-200X	2 m
XW2Z-300X	3 m
XW2Z-500X	5 m
XW2Z-010X	10 m

Terminal Block Type

XW2B-20G5

XW2B-20G4

XW2D-20G6

2

CJ1W-NC214/NC414 Cable

The table below shows the CJ1W-NC214/NC414 cable.
2 types of cable are available: One for Servo Drive connection and the other for external signal connection.

Servo Drive Connecting Cable

The Servo Drive connecting cables for the 1-axis type and 2-axis type are available, and there's also a combination of cables to be used depending on the type of the Servo Drive.

Cable Type

Servo Drive		Length	Cable model
OMNUC G5 Series R88D-KTxxx	1-axis type	1 m	XW2Z-100J-G13
		3 m	XW2Z-300J-G13
OMNUC G Series R88D-GTxxx[1]	2-axis type	1 m	XW2Z-100J-G5
		3 m	XW2Z-300J-G5
OMNUC W Series R88D-WTxxx	1-axis type	1 m	XW2Z-100J-G14
		3 m	XW2Z-300J-G14
	2-axis type	1 m	XW2Z-100J-G6
		3 m	XW2Z-300J-G6
SMARTSTEP2 Series R7D-BPxxx	1-axis type	1 m	XW2Z-100J-G16
		3 m	XW2Z-300J-G16
	2-axis type	1 m	XW2Z-100J-G8
		3 m	XW2Z-300J-G8
SMARTSTEP A Series R7D-APxxx	1-axis type	1 m	XW2Z-100J-G15
		3 m	XW2Z-300J-G15
	2-axis type	1 m	XW2Z-100J-G7
		3 m	XW2Z-300J-G7

[1]. Use the photocoupler input for command pulses to the G5/G-series Servo Drive. When you use this cable, set Pn005 (Command Pulse Input Selection) of the G5-series Servo Drive or Pn40 (Command Pulse Input Selection) of the G-series Servo Drive to 0 (photocoupler input).
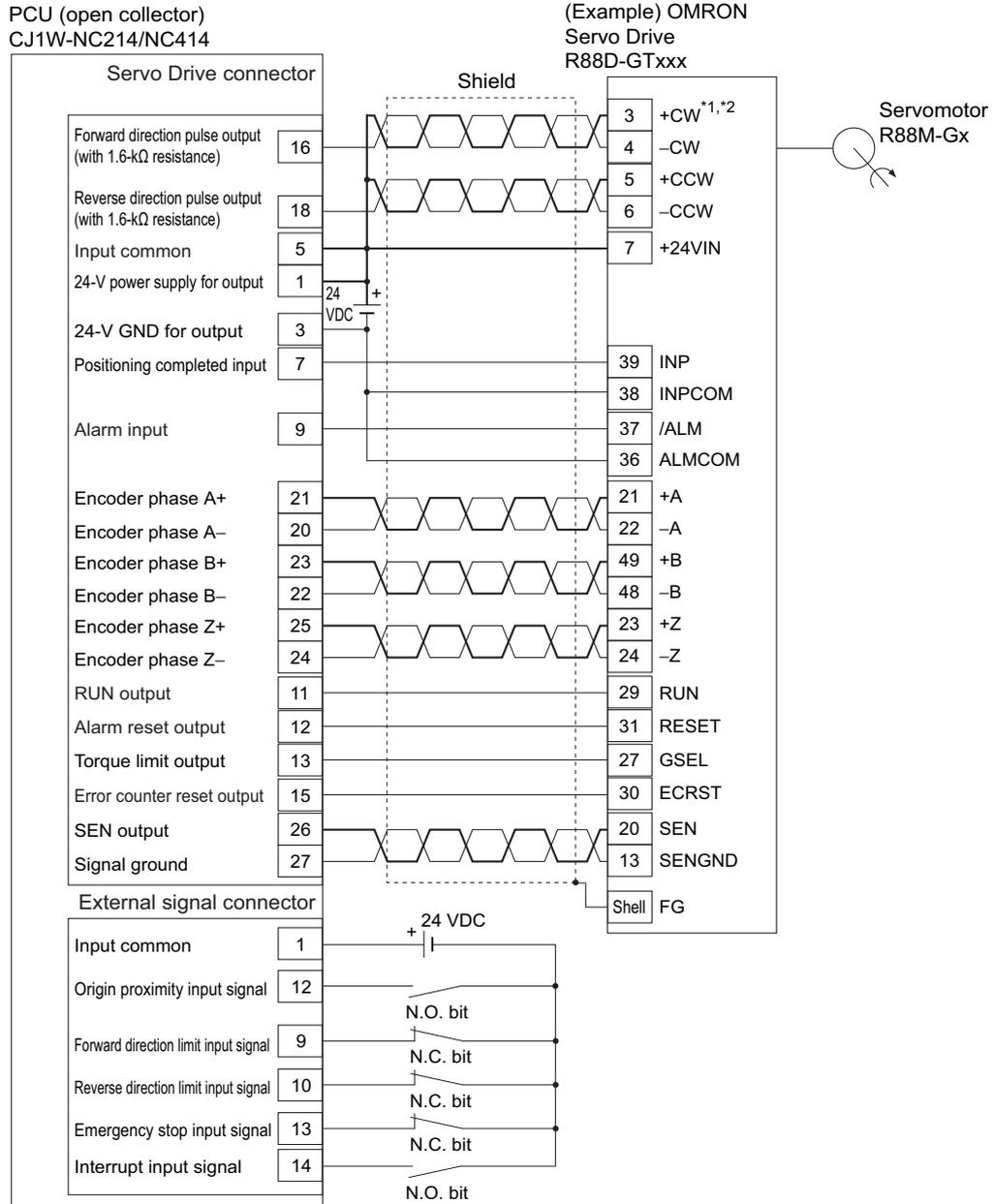
Connection Configuration and Dimensions

Cable for the 1-axis type

Cable for the 2-axis type

PCU side

CJ1W-NC214
CJ1W-NC414

Servo Drive side[1]

R88D-KTx
R88D-GTx
R88D-WTx
R7D-BPx
R7D-APx

*1. The SMARTSTEP2 Series (R7D-BPx) uses a 26-pin connector, while the SMARTSTEP Series (R7D-APx) uses a 36-pin connector.

For the cable wiring diagram, refer to "Appendix-3 Servo Drive Connecting Cable".

External Signal Connecting Cable and Terminal Block

This cable connects external signals such as the forward direction limit input, reverse direction limit input, origin proximity input, origin input, interrupt input and emergency stop input.

Cable Type

Cable model	Length
XW2Z-C50X	0.5 m
XW2Z-100X	1 m
XW2Z-200X	2 m
XW2Z-300X	3 m
XW2Z-500X	5 m
XW2Z-010X	10 m

Terminal Block Type

XW2B-20G5

XW2B-20G4

XW2D-20G6

2-8 Wiring Check with CX-Programmer

You can use CX-Programmer to check the wiring.
Manually operate the I/O signals of the Servo Drive connector and external signal connector, except for the pulse I/O signals. Check the wiring of pulse I/O signals by manual operation such as JOG operation.
For manual operation, refer to "Outline of Manual Operation" on page 3-1.

Operating Procedure

1. **Connect online to the PLC via CX-Programmer.**
2. **Open the data setting window of the PCU.**
3. **Click the [PCU] on the menu and select [Test Run].**
    When the caution dialog box below appears, read the message carefully. After you confirm a safe condition, click [OK].

> **Test Run**
>
> **CAUTION**
> This function actually operates the motor and can be dangerous.
> Make sure to refer to the Operation Manual before execution.
> The following items require special attention.
>
> Confirm safety around the operating section.
> Press the JOG Buttons to operate the motor at the designated speed. Execute only after confirming the safety.
> Provide an emergency stop device externally.
> There is a possibility that the operation on the personal computer may not stop the motor operation. To be able to stop the motor immediately, provide an emergency stop device externally.
> Cautions during Operation
> All commands from CPU are invalid during operation because of software occupied mode.
>
> Starts operation. Proceed?
>
> [OK]   [Cancel]

📝 **Precautions for Correct Use**

♦ When you click [OK], the PCU enters the SOFTWARE EXCLUSIVE mode (Test Run).
   For the SOFTWARE EXCLUSIVE mode (Test Run), refer to "Outline of Manual Operation" on page 3-1.

4. When the Test Run Window appears, click the [Wiring Check] tab.
   The window below appears.
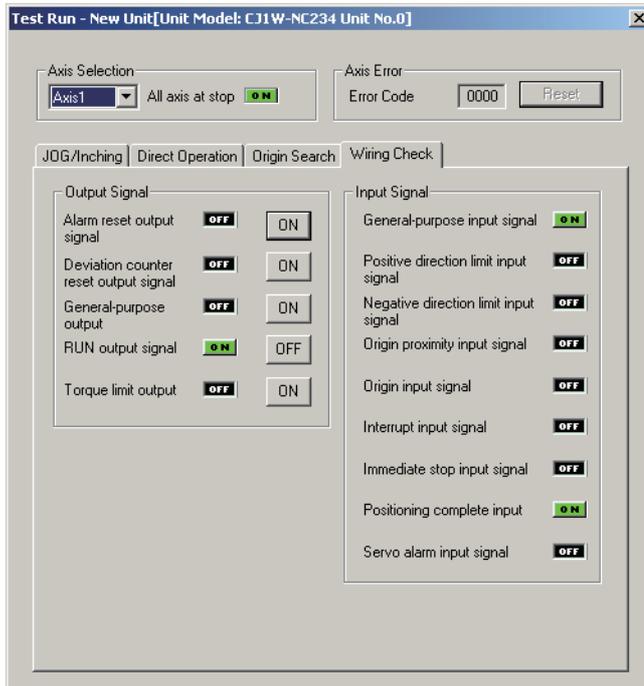
5. Select the axis whose wiring you want to check.

6. Under [Output Signal] and [Input Signal], [ON] and [OFF] indicate the current status.

7. Under [Output Signal], click [ON] of the output you want to turn ON.

8. Under [Output Signal], click [OFF] of the output you want to turn OFF.

3

3

Manual Operation

This chapter explains the manual operation for JOG operation, inching operation and MPG operation.

3-1 Outline of Manual Operation

Manual operation is necessary to confirm that the motor rotates according to the command. If you can confirm the motor operation is performed as commanded in manual operation, it also means that you confirmed the wiring.

Manual operation requires some parameter settings.
This section explains JOG operation, inching operation and MPG operation along with the minimum required parameters.

Operating Status of PCU

The PCU has these operating status. Operation you can perform with the PLC varies depending on the operating status.

Operating status	Explanation of operating status	PCU status			Operation from PLC
		PCU ready	External input	External output	
Initializing	From the status in which you turn ON the power supply or execute a restart until the unit starts. In this status, the PCU ready (n+11 word, bit 15)[1] is OFF.	OFF	Disabled	Output cutoff	Not possible
PCU setup in progress	The PCU Setup memory area (n word, bit 15) [1] is ON and the PCU ready is OFF.	OFF	Disabled	Output cutoff	Only the PCU Control memory area can operate.
SOFTWARE EXCLUSIVE Mode (Data Transfer)	A mode by a CX-Programmer command. In this mode, data transfer by CX-Programmer is possible. Ladder program output is disabled.	OFF	Disabled	Output cutoff	Not possible
SOFTWARE EXCLUSIVE Mode (Test Run)	A mode by a CX-Programmer command. In this mode, operation by CX-Programmer is possible. Ladder program output is disabled.	OFF	Enable	Retain the status before the SOFTWARE EXCLUSIVE mode (Test Run) transition.	Not possible
Normal operation	The PCU ready is ON.	ON	Normal operation	Normal operation	Possible

*1. n word indicates a Special I/O Unit Memory area. You can determine the Special I/O Unit Memory area by the formula below:
   First word in Special I/O Unit Memory area (n) $n = 2{,}000 + 10 \times$ unit number

📝 **Reference**

• Manual operation has two methods in which you perform from CX-Programmer in the SOFTWARE EXCLUSIVE mode (Test Run), and from the PLC ladder program in normal operation.

3-2 JOG Operation

While the JOG is ON, the axis operates in the specified direction at the specified JOG speed for the specified JOG acceleration time. When you turn OFF the JOG, the axis decelerates over the specified JOG deceleration time and stops.
JOG operation is possible even when the origin has not been fixed yet.

Operation Procedure

1. **Common parameter settings**
   To perform JOG operation, set [Manual Operation Command Memory Area].

2. **Axis parameter settings**
   Set the axis parameters for pulse output, JOG speed data, etc.

3. **Data transfer**
   Transfer to the PCU the common parameter and axis parameters you set.

4. **Restart of the PCU**
   The transferred data becomes valid when you restart the PCU.

5. **Put the Servo Drive in operating status and lock the servo.**

6. **Select the JOG speed.**

7. **Turn ON the JOG bit and perform JOG operation.**

Common Parameter Settings

Use CX-Programmer to set the common parameters which you use on the PCU.

1. **Start CX-Programmer.**

2. **Connect CX-Programmer to the PLC.**
   Select [PROGRAM Mode] when it is connected to the PLC.

3. **Double-click [IO Table] in the project tree of CX-Programmer.**
   The I/O Table Window opens on the PLC.

4. **In the I/O Table Window, select and double-click the PCU.**
   The PCU Setting Window opens.

5. **Click [Common Parameter] in the project tree in the PCU Setting Window.**
   The window for setting [Common Parameter] appears.

6. **Select [Operation Memory Area Allocation Setting] under [Parameter Type].**

7. **Click [Manual Operation Command Memory Area Selection].**
   Select one of five areas: [CIO Area], [WR Area], [HR Area], [DM Area] and [EM Area].

8. **Enter the first word number under [First Word of Manual Operation Command Memory Area].**

📇 **Reference**

⬧ If you want to perform JOG operation only, you can operate the axis only with the above common parameters settings.

Manual Operation

3

Manual Operation

Setting Example

Try setting the PCU as follows.

⬥ Select 3 as the PCU unit number.

⬥ Use [WR Area] for [Manual Operation Command Memory Area] and set 100 words as the first word of the WR area.

To set the PCU this way:

1) Select WR Area] under [Manual Operation Command Memory Area Selection] for 7 on the previous page.

2) Enter [100] in [First Word of Manual Operation Command Memory Area] for 8 on the previous page.

The above steps will set W100 to W107 words for [Manual Operation Command Memory Area].

Manual Operation Command Memory Area

Words	Name	Bit	Bit name	Function
W100	Axis 1 Manual Operation Command Memory area	0	Servo lock	The RUN output turns ON the moment the bit turns ON. If you set the RUN output function to general-purpose output, ON/OFF of this output becomes ON/OFF of the RUN output.
		5	Override valid	Specify whether to enable/disable override.
		6	JOG/Inching speed selection	Select the JOG speed/inching speed. Speed 1 is selected when this bit is OFF, while speed 2 is selected when it is ON.
		7	Forward direction JOG/Inching	Perform JOG operation or inching operation in the forward direction when this bit is ON.
		8	Reverse direction JOG/Inching	Perform JOG operation or inching operation in the reverse direction when this bit is ON.
		9	MPG valid	MPG operation is enabled when this bit is ON.
		14	Deceleration stop	Deceleration stop starts the moment the bit turns ON.
		15	Servo unlock	The RUN output turns OFF the moment the bit turns ON If you set the RUN output function to general-purpose output, this bit becomes disabled.
W101	Axis 1 override	0 to 15	–	Set the override value in hexadecimal. You can set a desired value from 1 to 50,000 (0001 to C350 hex), which corresponds to 0.01% to 500.00%.
W102	Axis 2 Manual Operation Command Memory area	0 to 15	Refer to the explanation for axis 1.	
W103	Axis 2 override	0 to 15	Refer to the explanation for axis 1.	
W104	Axis 3 Manual Operation Command Memory area	0 to 15	Refer to the explanation for axis 1.	
W105	Axis 3 override	0 to 15	Refer to the explanation for axis 1.	
W106	Axis 4 Manual Operation Command Memory area	0 to 15	Refer to the explanation for axis 1.	

3

Words	Name	Bit	Bit name	Function
W107	Axis 4 override	0 to 15	Refer to the explanation for axis 1.	

Axis Parameter Settings

1. **Click [Axis Parameter] in the project tree in the PCU Setting Window.**
   The window for setting [Axis Parameter] appears.

2. **Select [IO Function Selection] under [Parameter Type].**
   Select the input type for the various connected sensors.
   When you want to try JOG operation only with no sensor connected, set [N.O. Bit] for all logic settings of each input.

3. **Select [Acceleration/Deceleration Setting] under [Parameter Type].**
   Set [Maximum Speed] and [Starting Speed].

4. **Select [Pulse Output Setting] under [Parameter Type].**
   Select [Pulse Output Method].

5. **Select [Command Position Unit Setting] under [Parameter Type].**
   Set [Command Pulse Count Per Motor Rotation] and [Work Travel Distance Per Motor Rotation].

6. **Select [JOG/ Inching Setting] under [Parameter Type].**
   Set [JOG/ Inching Speed 1] and [JOG/ Inching Speed 2].

Reference

- If you want to perform JOG operation only, other axis parameters need not be changed from their default values.

Setting Example

Try setting the PCU as follows.

- Here, because it is a test operation, no sensors are connected.
- Connect a Servomotor, and set the maximum speed to 3,000 r/min.
- In accordance with the driver, forward/reverse direction pulse outputs are used for the Servo Drive.
- The encoder resolution is 2,000 pulses, and the movement per motor rotation is also 2,000 pulses.
- The JOG speed is 300 r/min for speed 1, and 600 r/min for speed 2.

To set the PCU this way:

1) For logics of each input of [IO Function Selection] in 2 above, select [N.O. Bit] for all.

2) Set 100 kpps for [Maximum Speed] in 3 above, because the motor speed is 3,000 r/min and encoder resolution is 2,000 pulses. Accordingly, enter [100000] as the set value.
   Also set [0] for [Starting Speed] because you do not set this item for a Servomotor.

3) For [Pulse Output Method] in 4 above, select [Forward/Reverse Direction Pulse Output] according to the Servo Drive.

4) [Command Pulse Count Per Motor Rotation] and [Work Travel Distance Per Motor Rotation] in 5 above are both 2,000 pulses, so enter [2000] for both.

5) [JOG/ Inching Speed 1] in 6 above is 10 kpps, so enter [10000]. [JOG/ Inching Speed 2] is 20 kpps, so enter [20000].

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Manual Operation

JOG/Inching Setting

In the setting example, you set only the minimum required data. This section explains [JOG/Inching Setting] under [Axis Parameter] in details.

Parameter name	Function	Setting range	Unit	Default value
Inching Width	Set the amount of movement during inching. If you set this parameter to [0], the axis operates as JOG.	0 to 4000[*1]	Command unit[*2]	0
JOG/ Inching Speed 1	Set JOG/inching speed 1.	1 to 4000000[*1]	Command unit[*2] /s	1000
JOG/ Inching Speed 2	Set JOG/inching speed 2.	1 to 4000000[*1]	Command unit[*2] /s	10000
JOG Acceleration Time	Set the acceleration time of JOG operation.	0 to 250000	ms	1000
JOG Deceleration Time	Set the deceleration time of JOG operation.	0 to 250000	ms	1000

*1. This setting range is based on the pulse unit.

*2. For the command unit, refer to "Command Position Unit Setting" on page 5-30.

Inching Width

Set the amount of movement per one inching operation. If you set the amount of movement to [0], the axis functions as JOG operation.

JOG/Inching Speed

Use this parameter as a speed command for JOG operation/inching operation. You can set two speeds, speed 1 and speed 2, and change the speed during operation.

JOG Acceleration Time and JOG Deceleration Time

Set the acceleration time and deceleration time of JOG operation and inching operation.
For the JOG acceleration time and JOG deceleration time, [Acceleration/ Deceleration Time Selection] determines their changing patterns.
For details, refer to "Acceleration/Deceleration Setting" on page 5-23 and "Acceleration/ Deceleration Time Selection" on page 5-25.

📄 **Reference**

⬦ The previous setting example did not mention the command unit. However, most axis parameters use default values, so the command unit is set to one pulse.

⬦ All setting ranges are based on the pulse unit.

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Manual Operation

Data Transfer and Restart

Transfer to the PCU the common parameter and axis parameter data you set, and then restart the PCU.

1. **In the PCU Setting Window, click the [PCU] menu and select [Transfer Selection [PC to NC]].**

2. **Select [Specified Data] on the transfer window, tick only [Parameter], and click [Changed Data].**
   Also tick [Save to the flash memory after downloading] and click the [OK] button.
   Transfer starts and the progress of transfer appears.

3. **After you save all data to the flash memory, a restart confirmation message appears. Click [OK].**

This completes the transfer and restart.

Reference

• In previous version, you needed to reconnect the PLC power supply or turn ON the unit restart signal to restart the unit. As a result, the CPU cyclic stopped every time you restarted the unit.
  This PCU has a unit setup memory area (n word, bit 15) that can restart the unit alone without stopping the CPU.

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Manual Operation

Timing Chart

The following shows the JOG operation timing chart of axis 1.
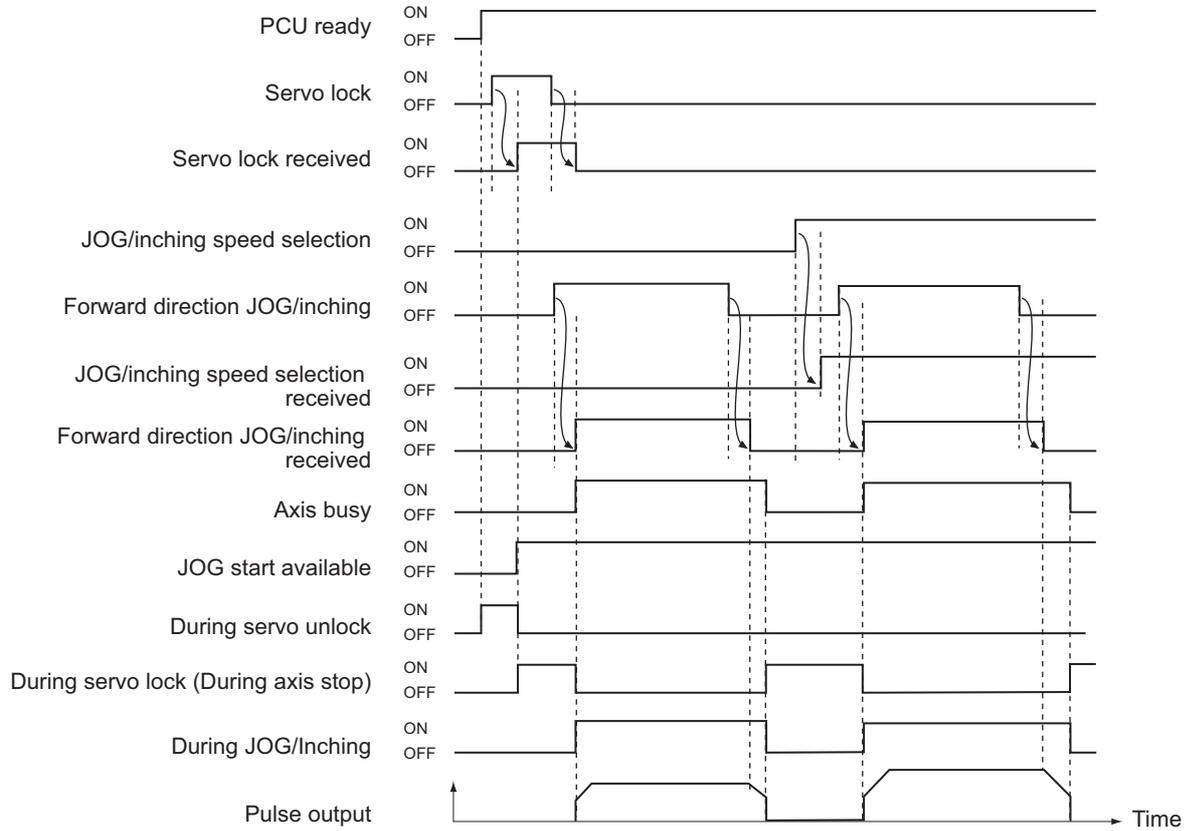
The positioning operation completed signal turns OFF when the JOG operation starts.

Program Example

The following shows an example of JOG operation program of axis 1.
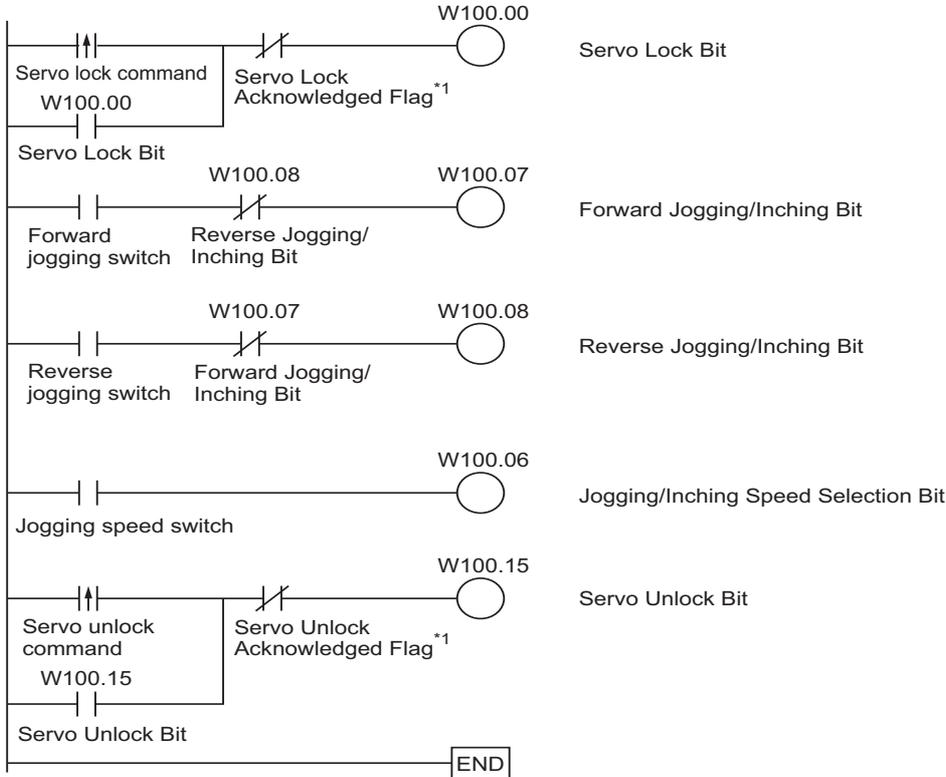
W100.00
Servo lock command   Servo Lock Acknowledged Flag[1]   Servo Lock Bit
W100.00
Servo Lock Bit

W100.08   W100.07
Forward jogging switch   Reverse Jogging/Inching Bit   Forward Jogging/Inching Bit

W100.07   W100.08
Reverse jogging switch   Forward Jogging/Inching Bit   Reverse Jogging/Inching Bit

W100.06
Jogging speed switch   Jogging/Inching Speed Selection Bit

W100.15
Servo unlock command   Servo Unlock Acknowledged Flag[1]   Servo Unlock Bit
W100.15
Servo Unlock Bit

END

[1] When locking and unlocking the servo from the ladder program, keep the command bit ON until the Servo Lock Acknowledged Flag or Servo Unlock Acknowledged Flag turns ON in the Axis Status Memory Area.

Reference

⬩ Other operations cannot be started while jogging is being performed.

Manual Operation

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3

Manual Operation

3-3 Inching Operation

Inching operation refers to an operation that moves the axis by a specified distance and then stops it.

Inching operation uses the same parameters for aforementioned JOG operation. Set the amount of movement in [Inching Width] under [JOG/Inching Setting], and the unit performs inching operation. If you set the amount of movement to [0], the unit performs JOG operation.

Operation Procedure

The procedure is almost the same as the aforementioned JOG operation procedure.

1. **Common parameter settings**
    To perform inching operation, set [Manual Operation Command Memory Area].
2. **Axis parameter settings**
    Set the axis parameters for pulse output method, inching speed data, etc.
3. **Data transfer**
    Transfer to the PCU the common parameter and axis parameters you set.
4. **Restart of the PCU**
    The transferred data becomes valid when you restart the PCU.
5. **Put the Servo Drive in operating status and lock the servo.**
6. **Select the inching speed.**
7. **Turn ON the inching bit to perform inching operation.**

Settings of the common parameters are the same as those for JOG operation, so refer to "Common Parameter Settings" on page 3-2.

Axis Parameter Settings

The axis parameters are also roughly the same as those for JOG operation. Accordingly, this section explains only the additional parameters that require setting.

1. **Click [Axis Parameter] in the project tree in the PCU Setting Window.**
    The window for setting [Axis Parameter] appears.
2. **Select [JOG/ Inching Setting] under [Parameter Type].**
    Set the amount of movement per one inching operation in [Inching Width].

Setting Example

Try setting the PCU as follows.

• Assume that one input turns the motor by 0.5 rotation.

To set the PCU this way:
For [Inching Width] in 2 above, set 1,000 pulses to turn the motor by 0.5 rotation, because the encoder resolution is 2,000 pulses. Enter [1000] as the set value.

Since you have changed the parameter, transfer the parameter data to the PCU and restart the PCU. For details, refer to "Data Transfer and Restart" on page 3-6.

3

Timing Chart

The following shows the inching operation timing chart of axis 1.
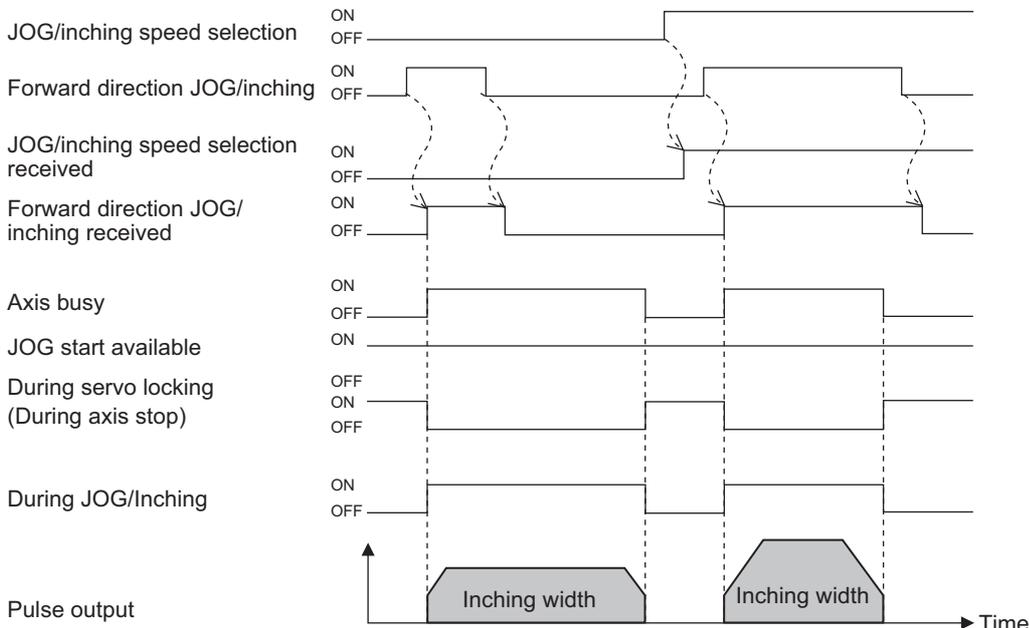
The positioning operation completed signal turns OFF when inching operation starts.

Manual Operation

3

Manual Operation

Program Example

The following shows an example of inching operation program of axis 1.
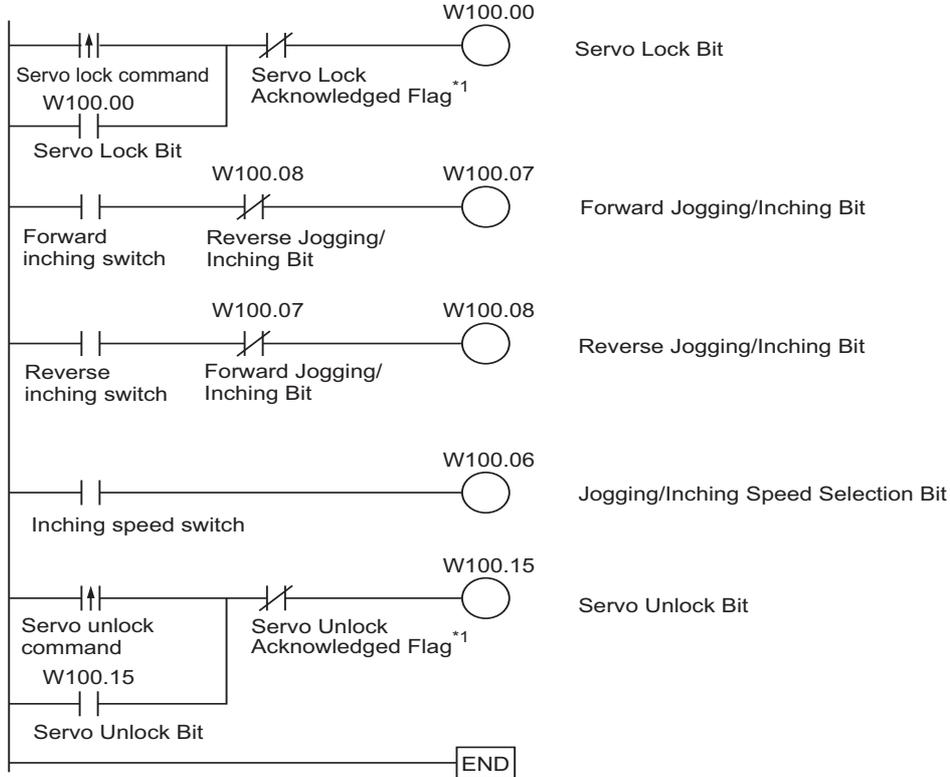
W100.00 Servo Lock Bit

Servo lock command / W100.00
Servo Lock Acknowledged Flag [*1]
W100.00 Servo Lock Bit

Forward inching switch / W100.08 Reverse Jogging/Inching Bit / W100.07 Forward Jogging/Inching Bit

Reverse inching switch / W100.07 Forward Jogging/Inching Bit / W100.08 Reverse Jogging/Inching Bit

Inching speed switch / W100.06 Jogging/Inching Speed Selection Bit

Servo unlock command / W100.15 Servo Unlock Acknowledged Flag [*1] / W100.15 Servo Unlock Bit

END

*1 When locking and unlocking the servo from the ladder program, keep the command bit ON until the Servo Lock Acknowledged Flag or Servo Unlock Acknowledged Flag turns ON in the Axis Status Memory Area.

📖 **Reference**

♦ Other operations cannot be started while inching is being performed.

3-4 MPG Operation

You can use a manual pulse generator (MPG) to handle-feed axes.

Operation Procedure

1. **Wire the MPG**
   Wire the MPG to the external signal connector.

2. **Common parameter settings**
   To perform MPG operation, set [Manual Operation Command Memory Area].

3. **Data transfer**
   Transfer to the PCU the common parameter and axis parameters you set.

4. **Restart of the PCU**
   The transferred data becomes valid when you restart the PCU.

5. **Put the Servo Drive in operating status and lock the servo.**

6. **Select the MPG.**

7. **Turn the MPG handle to perform MPG operation.**

Common Parameter Settings

1. **Click [Common Parameter] in the project tree in the PCU Setting Window.**
   The window for setting [Common Parameter] appears.

2. **Select [Operation Memory Area Allocation Setting] under [Parameter Type].**

3. **Click [Manual Operation Command Memory Area Selection].**
   Select one of five areas: [CIO Area], [WR Area], [HR Area], [DM Area] and [EM Area].

4. **Enter the beginning word number under [First Word of Manual Operation Command Memory Area].**

5. **Select [MPG Magnification Setting] under [Parameter Type].**
   To change the MPG magnification setting, set a desired magnification (numerator and denominator) under [MPG Magnification Setting].
   You can select from four default settings of 1 time, 10 times, 100 times and 1,000 times.

Settings of the common parameters are the same as those for JOG operation, so refer to "Common Parameter Settings" on page 3-2. Refer to the next page if you want to change [MPG Magnification Setting].

📝 **Reference**

♦ The axis parameters for the MPG input are the same as those for the external encoder axis.
During MPG operation, however, input pulses are not converted into the command unit, but they are reflected in the output in units of pulses. (Count values which you read with the IORD instruction are command units.)

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Manual Operation

MPG Magnification Setting

You can change the MPG setting magnification.

Parameter name	Function	Setting range	Unit	Default value
MPG Magnification 1 (Numerator)	Set the magnification 1 for MPG pulses. (Numerator)	−10000 to 10000	–	1
MPG Magnification 1 (Denominator)	Set the magnification 1 for MPG pulses. (Denominator)	1 to 10000	–	1
MPG Magnification 2 (Numerator)	Set the magnification 2 for MPG pulses. (Numerator)	−10000 to 10000	–	10
MPG Magnification 2 (Denominator)	Set the magnification 2 for MPG pulses. (Denominator)	1 to 10000	–	1
MPG Magnification 3 (Numerator)	Set the magnification 3 for MPG pulses. (Numerator)	−10000 to 10000	–	100
MPG Magnification 3 (Denominator)	Set the magnification 3 for MPG pulses. (Denominator)	1 to 10000	–	1
MPG Magnification 4 (Numerator)	Set the magnification 4 for MPG pulses. (Numerator)	−10000 to 10000	–	1000
MPG Magnification 4 (Denominator)	Set the magnification 4 for MPG pulses. (Denominator)	1 to 10000	–	1

Switching of MPG Magnification

Use a Special I/O Unit Memory area to switch the MPG magnification. You can determine the Special I/O Unit Memory area by the formula below:

First word in Special I/O Unit Memory area (n) $n = 2,000 + 10 \times$ unit number

Allocation of MPG Magnification Switching

Name	Memory area	Bit	Description
MPG magnification selection	n + 7	00 to 01	Select the MPG magnification commonly used by all units. 00: Magnification 1 selection 01: Magnification 2 selection 10: Magnification 3 selection 11: Magnification 4 selection

Setting Example

Select 3 as the PCU unit number.

The MPG magnification becomes bits 00 to 01 of 2037 words.

3

Manual Operation

Timing Chart 3-4

The following shows the MPG operation timing chart of axis 1.

MPG valid	ON / OFF	
MPG valid received	ON / OFF	
Axis busy	ON / OFF	
During servo lock (During axis stop)	ON / OFF	
During MPG operation	ON / OFF	
MPG pulse input		
Pulse output		Time
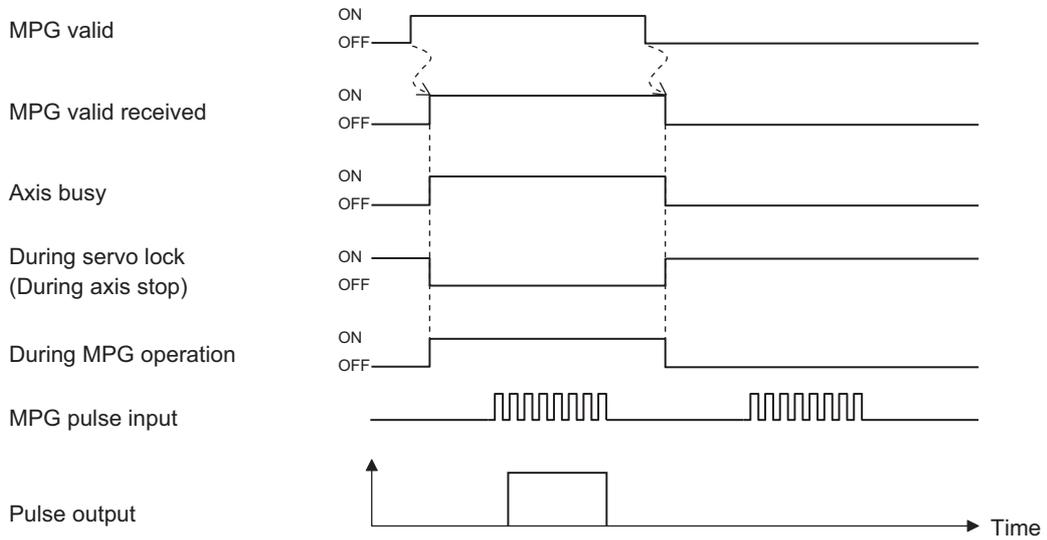
* The positioning operation completed signal turns OFF upon reception of a MPG enable signal.

Program Example

The following shows an example of MPG operation program of axis 1. The PCU unit number is 3.
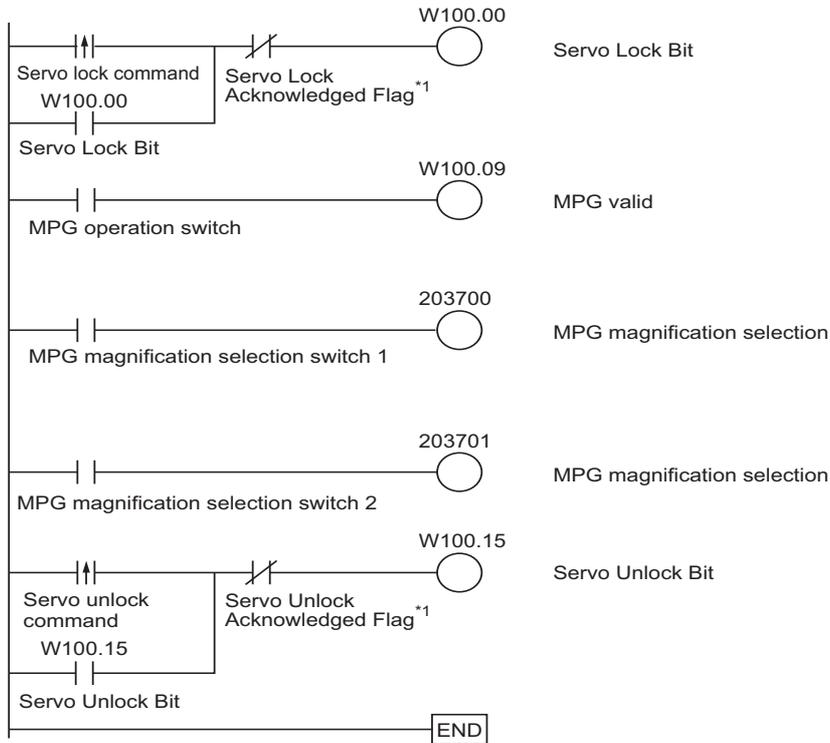
*1 When locking and unlocking the servo from the ladder program, keep the command bit ON until the Servo Lock Acknowledged Flag or Servo Unlock Acknowledged Flag turns ON in the Axis Status Memory Area.

Reference

• Other operations cannot be started while MPG is being performed.

3-5 Manual Operation with CX-Programmer

Manual operation with CX-Programmer makes it possible to perform 5 operations below.

- ◆ JOG operation
- ◆ Inching operation
- ◆ Direct operation
- ◆ Origin Search
- ◆ Wiring check

This section explains JOG operation and inching operation.

▣ Precautions for Correct Use

- ◆ When you execute JOG operation, direct operation or Origin Search from CX-Programmer command, the motor actually operates at the specified speed.
  Before you execute operation, thoroughly confirm absence of danger which may be caused by motor operation.
- ◆ When you operate with CX-Programmer, install an external emergency stop circuit or take other appropriate measures to safely stop the motor. CX-Programmer may not be able to issue commands if a computer error, etc. occurs.
- ◆ Click the [Save] button, and the settings are reflected in the axis parameters.
  To perform Origin Search from a ladder by using the parameters which you set on the test RUN window, be sure to click the [Save] button.

Procedure to Open Manual Operation Window

1. **On the data setting window of the PCU, click the [PCU] menu and select [Test Run].**
   When the caution dialog box below appears, read the message carefully. After you confirm a safe condition, click [OK].

   Test Run

   CAUTION
   This function actually operates the motor and can be dangerous.
   Make sure to refer to the Operation Manual before execution.
   The following items require special attention.

   Confirm safety around the operating section.
   Press the JOG Buttons to operate the motor at the designated speed. Execute only after confirming the safety.
   Provide an emergency stop device externally.
   There is a possibility that the operation on the personal computer may not stop the motor operation. To be able to stop the motor immediately, provide an emergency stop device externally.
   Cautions during Operation
   All commands from CPU are invalid during operation because of software occupied mode.

   Starts operation. Proceed?

   [OK]   [Cancel]

▣ Precautions for Correct Use

- ◆ When you click [OK], the PCU enters the SOFTWARE EXCLUSIVE mode (Test Run).
  For the SOFTWARE EXCLUSIVE mode (Test Run), refer to "Outline of Manual Operation" on page 3-1.

2. **The manual operation window appears.**
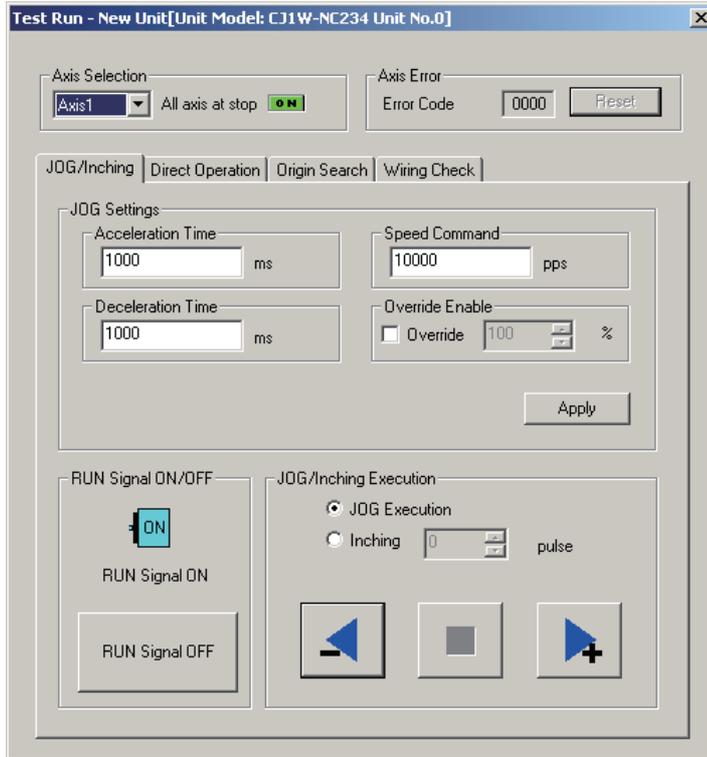
JOG Operation/Inching Operation Procedure

1. **Select the [JOG/Inching] tab on the aforementioned manual operation window.**
   The window below appears.
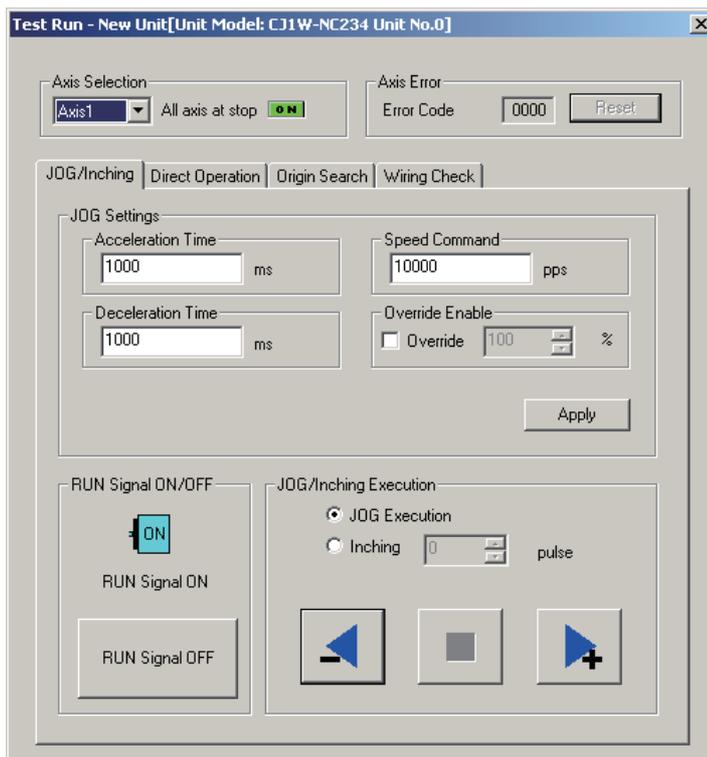
2. **Select the axis you want to perform JOG operation/inching operation.**

3. **Enter the values of acceleration time, deceleration time, speed command and override for JOG operation/inching operation, and click the [Apply] button.**
   Be sure to click the [Apply] button before you execute JOG operation/inching operation.

4. **If you are using the RUN output of the PCU, click the [RUN Signal ON] button to turn ON the RUN output.**

5. **Select [JOG Execution] or [Inching].**
   If you select [Inching], enter the amount of movement.

6. **Execute the operation.**
   In the case of JOG operation, the axis operates while you press the button.

4

Defining the Origin

This chapter explains how to determine the origin, such as the origin search procedure as well as origin return, present position preset and absolute encoder settings.

4-1 Outline of Defining the Origin

To perform positioning of the absolute position for the system that requires positioning, you must define the origin first.

For example, If you want to perform positioning to the position (axis 1, axis 2) = (100 mm, 200 mm) in the XY plane as shown below, you must determine the mechanical origin (0,0).

This process of determining the mechanical origin is called defining the origin.
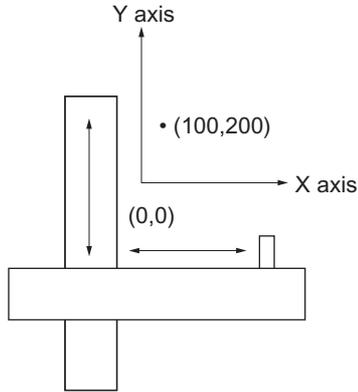
This PCU has two functions below to determine the mechanical origin:

Name	Description
Origin Search	Actually move the motor and use the limit sensor, origin proximity sensor, and input signal that indicates the origin, to determine the origin. Use the proximity sensor, encoder phase Z, etc. for the input signal that indicates the origin.
Present position preset	Forcibly set an arbitrary value for the position where the motor currently stops to determine the origin. This PCU has 3 types of present position preset functions. For details, refer to "Present Position Preset" on page 4-37.

Also, the Origin Return function below is available to return to the origin which you determined by the above methods.

Name	Description
Origin Return	Positioning is performed to the origin which you determined by Origin Search or present position preset, from the position where the motor currently stops.

Note that with this PCU, you can run the motor even when the origin is not yet determined (except for Origin Return).

However, the operation is as follows in this case.

Function		Operation
JOG operation, Inching operation, MPG operation, Speed control		If the origin is not confirmed, the position at power ON is defined as "0" to control movements.
Origin Return		Do not use. When you use this function, a present position unknown error (error code: 6006) occurs.
Direct operation	Absolute movement	If the origin is not confirmed, the position at power ON is defined as "0" to control movements.
	Relative movement	
	Interrupt feeding	
Memory operation		Although you can combine the above speed control, absolute movement, relative movement and interrupt feeding to operate the machine, the position at power ON is defined as "0" to control movements if the origin is not confirmed.

Reference

- If an origin search is performed for an axis that is being used as a virtual axis, revolution for the axis will continue once the origin search is started. This is because the origin cannot be defined because there is no origin input, origin proximity sensor input, or other external input signals. A present position preset can be used to define the origin for virtual axes.

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Defining the Origin

4-2 Origin Search Procedure

This section explains how to set data for Origin Search with an example of axis 1.

1. **Common parameter settings**
   To perform Origin Search, set [Manual Operation Command Memory Area] and [Axis Status Memory Area].

2. **Axis parameter settings**
   Set the axis parameters for maximum speed, Origin Search Speed, Origin Search Approach Speed, Origin Search Acceleration Time, Origin Search Deceleration Time, etc.

3. **Data transfer**
   Transfer to the PCU the common parameter and axis parameters you set.

4. **Restart of the PCU**
   The transferred data becomes valid when you restart the PCU.

5. **Put the driver in operating status.**

6. **Execution of Origin Search**
   Turn ON the Origin Search signal and perform origin Search.

Common Parameter Settings

Among the common parameters, you must set [Manual Operation Command Memory Area] and [Axis Status Memory Area].

1. **Start CX-Programmer.**

2. **Connect CX-Programmer to the PLC.**
   Select [PROGRAM Mode] while it is connected to the PLC.

3. **Double-click [IO Table] in the project tree of CX-Programmer.**
   The I/O Table Window opens.

4. **In the I/O Table Window, select and double-click the PCU.**
   The PCU Setting Window opens.

5. **Click [Common Parameter] in the project tree in the PCU Setting Window.**
   The window for setting [Common Parameter] appears.

6. **Select [Operation Memory Area Allocation Setting] under [Parameter Type].**

7. **Click [Manual Operation Command Memory Area Selection].**
   Select one of five areas: [CIO Area], [WR Area], [HR Area], [DM Area] and [EM Area (5## = EM bank No.)].

8. **Enter the beginning word number under [First Word of Manual Operation Command Memory Area].**

9. **Click [Axis Status Memory Area Selection].**
   Select one of five areas: [CIO Area], [WR Area], [HR Area], [DM Area] and [EM Area (5## = EM bank No.)].

10. **Enter the beginning word number under [First Word of Axis Status Memory Area].**

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Manual Operation Command Memory Area

The table below shows the allocation when you select [A] as the beginning word in the Manual Operation Command Memory area.

Words	Name	Bit	Bit name	Function
A	Axis 1 manual operation command memory area	0	Servo lock	The RUN output turns ON the moment this bit turns ON. If you set the RUN output function to general-purpose output, ON/OFF of this output becomes ON/OFF of the RUN output.
		5	Override enable	Specify whether to enable/disable override.
		6	JOG/Inching speed selection	Select the JOG speed/inching speed. Speed 1 is selected when this bit is OFF, while speed 2 is selected when it is ON.
		7	Forward direction JOG/Inching	Perform JOG operation or inching operation in the forward direction when this bit is ON.
		8	Reverse direction JOG/Inching	Perform JOG operation or inching operation in the reverse direction when this bit is ON.
		9	MPG enable	MPG operation is enabled when this bit is ON.
		10	Origin Search	Origin Search starts the moment this bit turns ON.
		11	Origin Return	Origin Return starts the moment this bit turns ON.
		14	Deceleration stop	Deceleration stop starts the moment this bit turns ON.
		15	Servo unlock	The RUN output turns OFF the moment this bit turns ON. If you set the RUN output function to general-purpose output, this bit becomes disabled.
A+1	Axis 1 override	0 to 15	–	Set the override value in hexadecimal. You can set a desired value from 1 to 50,000 (0001 to C350 hex), which corresponds to 0.01% to 500.00%.
A+2	Axis 2 manual operation command memory area	0 to 15		Refer to the explanation for axis 1.
A+3	Axis 2 override	0 to 15		Refer to the explanation for axis 1.
A+4	Axis 3 manual operation command memory area	0 to 15		Refer to the explanation for axis 1.
A+5	Axis 3 override	0 to 15		Refer to the explanation for axis 1.
A+6	Axis 4 manual operation command memory area	0 to 15		Refer to the explanation for axis 1.
A+7	Axis 4 override	0 to 15		Refer to the explanation for axis 1.

Axis Status Memory Area

Select [C] as the beginning word in the Axis Status Memory area.
The table below lists the minimum Axis Status Memory areas for each word that are necessary for defining the origin.
For details on Axis Status Memory areas, refer to "Axis Status Memory Area" on page 5-72.

Words	Name	Bit	Bit name	Function
C	Axis 1 manual operation command received	0	Servo lock received	This turns ON when the PCU receives a servo lock output.
		1	Drive alarm reset output received	This turns ON when the PCU receives a driver alarm reset output.
		2	Error counter reset output received	This turns ON when the PCU receives an Error Counter Reset output.
		3	Torque limit output received	This turns ON when the PCU receives a torque limit output.
		4	General-purpose output received	This turns ON when the PCU receives a general-purpose output.
		5	Override enable received	This turns ON when the PCU receives an override enable.
		6	JOG/Inching speed selection received	This turns ON when the PCU receives a JOG/ Inching speed selection.
		7	Forward direction JOG/Inching received	This turns ON when the PCU receives a forward direction JOG/inching.
		8	Reverse direction JOG/Inching received	This turns ON when the PCU receives a reverse direction JOG/inching.
		9	MPG enable received	This turns ON when the PCU receives a MPG.
		10	Origin Search received	This turns ON when the PCU receives an Origin Search.
		11	Origin Return received	This turns ON when the PCU receives an Origin Return.
		12 to 13	Not used	Do not use.
		14	Deceleration stop received	This turns ON when the PCU receives a deceleration stop.
		15	Servo unlock received	This turns ON when the PCU receives a servo unlock.
C+2	Axis 1 command status	0	Axis busy	This remains ON while a PCU command is in progress. During memory operation, the busy signal turns ON for all axes which are allocated to the axis configuration, even when they are not in operation.
		1	JOG start available	This turns ON when the PCU can receive a JOG start command.
		2	Direct operation start available	This turns ON when the PCU receives a duplicate start command which becomes enabled by starting direct operation.

Words	Name	Bit	Bit name	Function
C+2 (Continued)	Axis 1 command status	3	Not used	Do not use.
		4	During deceleration stop input	This remains ON while the PCU decelerates due to reception of a deceleration stop command or while the deceleration stop command is input.
		5	During synchronous group stop input	This remains ON while the PCU stops due to reception of a synchronous group stop output during data synchronization or the synchronous group stop output is ON.
		6	During All Synchronous Unit stop input	This remains ON while the PCU stops due to reception of all Synchronous Unit stop output during data synchronization or the all Synchronous Unit stop output is ON.
		7	High-speed PTP Start Acknowledged Flag	This flag turns ON to acknowledge a high-speed PTP start. (Unit version 1.1 or later. This bit is not supported by unit version 1.0.)
		8	Start invalid	The Start Invalid Flag turns ON when command execution fails because the conditions that are required to start the command function were not met. The Start Invalid Flag turns ON when the command cannot be started because an error occurred when starting the command or because of the priority of the command.
		9	Error counter reset invalid	The Error Counter Reset Invalid Flag turns ON when an error counter reset output is performed during an origin search operation but the error counter reset output for the axis is not received.
		10 to 11	Not used	Do not use.
		12	Stop executed	This turns ON when axis operation has stopped for one of the following causes during axis operation in manual operation or direct operation. • Execution of deceleration stop, error counter reset, or servo unlock • Stop for error occurrence • Stop for stop function of Synchronous Unit
		13	Positioning operation completed	This turns ON when operation stops for positioning operation in direct operation, Origin Search completion, Origin Return completion, JOG, MPG, or synchronous feed operation stop.
		14 to 15	Not used	Do not use.

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Words	Name	Bit	Bit name	Function
C+3	Axis 1 axis operation status	0	During servo unlock	This remains ON while the PCU servo is unlocked.
		1	During servo lock	This remains ON while the PCU stops with its servo locked.
		2	During backlash compensation	This remains ON while backlash compensation of the axis is effective.
		3	During acceleration	This remains ON while the PCU accelerates to the target speed.
		4	During constant speed movement	This remains ON while the PCU operates at a constant speed after it reached the target speed.
		5	During deceleration	This remains ON while the PCU decelerates to the target position or target speed.
		6	During pass	This remains ON while the axis movement in continuous 1 and continuous 3 is accelerating or decelerating toward the target speed of the next sequence.
		7	Positioning completed input waiting	This remains ON while the PCU waits for completion of positioning.
		8	During deceleration stop	This turns ON when the PCU decelerates to stop while in operation, and remains ON until the axis stops.
C+3 (Continued)	Axis 1 axis operation status	9	During immediate stop	This turns ON when the PCU makes an immediate stop while in operation, and remains ON until the axis stops.
		10 to 15	Not used	Do not use.

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Defining the Origin

Words	Name	Bit	Bit name	Function
C+5	Axis 1 control status	0	Origin fix	This turns ON once the origin is confirmed. 0: Origin not yet confirmed 1: Origin confirmation
		1	Origin Stop	This remains ON while the PCU stops inside the in-position width around the origin position. It does not turn ON if the origin is not confirmed.
		2	Latch completed	This turns ON when the present position latch is executed.
		3	Not used	Do not use.
		4	Command present position overflow	This turns ON when the command present position overflows in the LINEAR mode.
		5	Command present position underflow	This turns ON when the command present position underflows in the LINEAR mode.
		6	Feedback present position overflow	This turns ON when the feedback present position overflows in the LINEAR mode.
		7	Feedback present position underflow	This turns ON when the feedback present position underflows in the LINEAR mode.
		8	Sensor error	This turns ON when an external sensor for the emergency stop input or limit input generate an error.
		9	Servo error	This turns ON when the outside the system notifies a drive alarm input or other error.
		10	Execution error	The Execution Error Flag turns ON when an error occurs, such as a duplicate start error, due to a problem in the execution conditions or command values when a command for axis operation is executed.
		11	Axis warning	This turns ON when a warning occurs.
		12	Axis error	This turns ON when an PCU error occurs.
		13	Zone 0	This remains ON while the present position is inside zone 0.
		14	Zone 1	This remains ON while the present position is inside zone 1.
		15	Zone 2	This remains ON while the present position is inside zone 2.
C+7	Axis 1 error code	0 to 15	–	This returns a PCU error code.
C+15	Axis 2 command status	0 to 15	Refer to the explanation for axis 1.	
C+16	Axis 2 operation status	0 to 15	Refer to the explanation for axis 1.	
C+18	Axis 2 control status	0 to 15	Refer to the explanation for axis 1.	
C+20	Axis 2 error code	0 to 15	Refer to the explanation for axis 1.	
C+28	Axis 3 command status	0 to 15	Refer to the explanation for axis 1.	
C+29	Axis 3 operation status	0 to 15	Refer to the explanation for axis 1.	

Words	Name	Bit	Bit name	Function
C+31	Axis 3 control status	0 to 15		Refer to the explanation for axis 1.
C+33	Axis 3 error code	0 to 15		Refer to the explanation for axis 1.
C+41	Axis 4 command status	0 to 15		Refer to the explanation for axis 1.
C+42	Axis 4 operation status	0 to 15		Refer to the explanation for axis 1.
C+44	Axis 4 control status	0 to 15		Refer to the explanation for axis 1.
C+46	Axis 4 error code	0 to 15		Refer to the explanation for axis 1.

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Axis Parameter Settings

This section explains the minimum axis parameters that are necessary for Origin Search.

1. **Click [Axis Parameter] in the project tree in the PCU Setting Window.**
   The window for setting [Axis Parameter] appears.

2. **Select [Axis Type Setting] under [Parameter Type].**
   Select [Physical Axis] for the axis connected to the motor.
   Select [Unused Axis] for any unused axes. An error will not be displayed even if you do not wire the axis.

3. **Select [Command Position Unit Setting] under [Parameter Type].**
   Set [Axis Feeding Mode], [Rotation Axis Upper Limit], [Display Unit], [Command Pulse Count Per Motor Rotation], [Work Travel Distance Per Motor Rotation], [Unit Multiplier], [Compensation Ratio Numerator] and [Compensation Ratio Denominator].

4. **Select [IO Function Setting] under [Parameter Type].**
   Select the input type for the various connected sensors.
   Select [Origin Proximity Input Signal Selection] and [Origin Input Signal Selection].

5. **Select [Acceleration/Deceleration Setting] under [Parameter Type].**
   Set [Maximum Speed], [Starting Speed], [Acceleration/Deceleration Curve Selection] and [Acceleration/Deceleration Time Selection].

6. **Select [Pulse Output Setting] under [Parameter Type].**
   Select [Pulse Output Method] and [Pulse Output Direction].

7. **Select [Software Limit Setting] under [Parameter Type].**
   Set [Software Limit Function Selection], [Reverse Direction Software Limit] and [Forward Direction Software Limit].

8. **Select [Origin Search Setting] under [Parameter Type].**
   Set [ORIGIN SEARCH OPERATION Mode], [Operation at Forward Direction Limit Input], [Operation at Reverse Direction Limit Input], [Origin Search Start Direction], [Origin Input Detecting Direction], [Origin Search Holding Time], [Origin Input Mask Amount], [Origin Compensation Value], [Origin Position Offset], [Origin Search Speed], [Origin Search Approach Speed], [Origin Search Compensation Speed], [Origin Search Acceleration Time], and [Origin Search Deceleration Time].

Reference

- Set other settings such as [JOG/Inching Setting], [Feedback Pulse Input Setting], [Expanded Monitor Type] and [Monitor Function Setting] if necessary.
- For details on axis parameters, refer to "Axis Parameters" on page 5-13.

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Axis Type Setting

Parameter name	Function	Setting range	Unit	Default value
Axis Type[*1]	Select the axis type. 0: Physical Axis 1: Virtual Axis 2: Unused Axis	0 to 2	–	0[*2]

*1. If you select a Virtual Axis or unused axis, I/O wiring is not necessary.

*2. The default value is [2] for dedicated Virtual Axes and axes 3 and 4 of a 2-axis PCU.

📖 **Reference**

♦ Select [Physical Axis] for axes that are actually wired to operate, and set [Unused Axis] for unused axes.

Command Position Unit Setting

Parameter name	Function	Setting range	Unit	Default value
Axis Feeding Mode	Select the count mode of the command position. 0: Linear axis (Finite length), 1: Rotation axis (Infinite length)	0 to 1	–	0
Rotation Axis Upper Limit	Set the rotation axis upper limit when you set the AXIS FEEDING mode to rotation axis.	1 to 1073741823[*1]	Command unit	1073741823
Display Selection	Select the unit of command values. 0: pulse, 1: mm, 2: degree, 3: inch	1 to 3	–	0
Command Pulse Count Per Motor Rotation	Set the number of pulses per 1 motor rotation.	1 to 1048576	Pulse	10000
Work Travel Distance Per Motor Rotation	Set the amount of the workpiece movement per 1 motor rotation.	1 to 1048576	Display unit	10000
Unit Multiplier	Set the magnification relative to the amount of the workpiece movement per 1 motor rotation. 0: 1 time, 1: 10 times, 2: 100 times, 3: 1000 times, 4: 10000 times	0 to 4	–	0
Compensation Ratio Numerator[*2]	Compensation ratio for position command (numerator)	1 to 4294967295	–	1
Compensation Ratio Denominator[*2]	Compensation ratio for position command (denominator)	1 to 4294967295	–	1

*1. This setting range is based on the pulse unit.

*2. For details, refer to "Command Position Unit Setting" on page 5-30.

4

AXIS FEEDING Mode

Linear axis:

* It uses a linear counter that counts from -2,147,483,648 to 2,147,483,647 centering around 0.
* In position control, commands whose counter value overflows/underflows generate an error and you cannot execute those commands.
* An error is generated upon interrupt input during positioning based on interrupt feeding input.
* In speed control, a warning (overflow/underflow) is generated when the present position overflows/underflows the counter value, but operation continues. However, the counter value is locked at the maximum value.
* While the counter value is locked, only JOG operation commands are acceptable in the reverse direction. A command to start any other operation generates an error at start.
* The counter value remains locked until you clear the overflow/underflow status.
* To clear the overflow/underflow status, you must perform Origin Search or present position preset.

-2147483648   0   2147483647
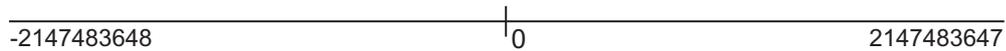
Rotation axis:

* It uses a ring counter whose maximum value is 1,073,741,823. (Unlimited axis)
* If 0 (shortest route), 1 (forward), or 2 (reverse) is specified as the Rotation Axis Direction for an absolute movement command, an error will occur if a command value exceeding the rotation axis upper limit is set. If 3 (not specified) is specified as the Rotation Axis Direction for an absolute movement command or if a relative movement command is used, multiple rotations will be supported if a command value that exceeds the rotation axis upper limit is set.

Rotation Axis Upper Limit

This set value becomes valid when you set the AXIS FEEDING mode to rotation axis.

Display Selection

Select the unit system for commands.
Even if you change the unit system, position data, etc. will not be reconverted.

Command Pulse Count Per Motor Rotation

Set the number of encoder pulses per 1 motor rotation.

Work Travel Distance Per Motor Rotation

Set the amount of the workpiece movement when the motor makes 1 rotation. Since the setting is an integer, also set [Unit Multiplier] below if you want to set decimal places.

Unit Multiplier

Set the ratio relative to the amount of the workpiece movement when the motor makes 1 rotation.

Setting a Command Unit of 1 mm

If the movement per motor rotation is 6 mm and you want to rotate the motor once with a command unit of 1 mm, set the Work Travel Distance Per Motor Rotation parameter to 6 and the Unit Multiplier parameter to 0 (x1).

With these settings, the motor will rotate once for a position command of 6.

Setting a Command Unit of 0.01mm

If the movement per motor rotation is 6 mm and you want to rotate the motor once with a command unit of 0.01mm, set the Work Travel Distance Per Motor Rotation parameter to 6 and the Unit Multiplier parameter to 2 (x100).

With these settings, the motor will rotate once for a position command of 600.

Precautions for Correct Use

If the Axis Feeding Mode parameter is set to Rotation Axis, set the pulse unit so that the number of pulses in one rotation can be divided evenly by the pulse unit.
Specifically, if the setting of the Rotation Axis Upper Limit parameter plus one (command units) is converted to pulses, the number of pulse must be an integer. If the number of pulses in one rotation is not an integer, the decimal portion will be truncated, causing a position offset. If there is a decimal portion, the command present value will not be displayed correctly.

I/O Function Setting

I/O Logic Selection

Parameter name	Function	Setting range	Unit	Default value
Forward Direction Limit Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	0
Reverse Direction Limit Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	0
Origin Proximity Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	1
Origin Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	1
Interrupt Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	1
Immediate Stop Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	0
Positioning Completion Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	1
Drive Alarm Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	0

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Defining the Origin

I/O Function Selection

Parameter name	Function	Setting range	Unit	Default value
RUN Output Function[1],[2]	Select the function of the RUN output. 0: Use as general-purpose input 1: Use as RUN output	0 to 1	–	1
Drive Alarm Reset Output Function[1]	Select the function of the drive alarm reset output. 0: Use as general-purpose output 1: Use as drive alarm reset output	0 to 1	–	1
Error Counter Reset Output Function[1]	Select the function of the Error Counter Reset output. 0: Use as general-purpose output 1: Use as error counter reset output	0 to 1	–	1
Origin Proximity Input Signal Selection[3]	Select the input destination of the origin proximity input. 0: Use origin proximity input internal memory area as the origin proximity input 1: Use external origin proximity input	0 to 1	–	1
Origin Input Signal Selection	Select the input destination of the origin input. 0: Use Z-phase input as the origin 1: Use external origin input	0 to 1	–	0
Interrupt Input Function[4]	Select the function of the interrupt input. 0: Use as interrupt feeding trigger 1: Use as present position latch	0 to 1	–	0
Positioning Completion Input Function[5]	Select the function of the positioning completed input. 0: Use as general-purpose input 1: Detect drive alarm input as an error	0 to 1	–	1
Drive Alarm Input Function[5]	Select the function of the driver alarm input. 0: Use as general-purpose input 1: Detect drive alarm input as an error	0 to 1	–	1
Immediate Stop Input Stop Method [5],[6],[7]	Select the function to be implemented when an emergency stop input is input. 0: Immediate stop of pulse output (Deviation pulse stop) 2: Immediate stop of pulse output, and output the error counter reset signal[8] 3: Immediate stop of pulse output, output the error counter reset signal[8], and RUN signal[9] OFF. 4: Immediate stop of pulse output, and RUN signal[9] OFF.	0 to 4	–	0
Limit Input Stop Method[5]	Select the function to be implemented when a forward/reverse direction limit signal is input. 0: Immediate stop of pulse output 1: Deceleration stop of pulse output 2: Immediate stop of pulse output, and output the error counter reset signal[7],[8] 3: Immediate stop of pulse output, output the error counter reset signal[8], and RUN signal[9] OFF.[7] 4: Immediate stop of pulse output, and RUN signal[9] OFF.[7]	0 to 4	–	0

Parameter name	Function	Setting range	Unit	Default value
Drive Alarm Input Stop Method[*5]	Select the function to be implemented when a driver alarm input is input while a driver alarm is set. 0: Immediate stop of pulse output 1: Deceleration stop of pulse output 2: Immediate stop of pulse output, and output the error counter reset signal[*7],[*8] 3: Immediate stop of pulse output, output the error counter reset signal[*8], and RUN signal[*9] OFF.[*7] 4: Immediate stop of pulse output, and RUN signal[*9] OFF.[*7]	0 to 4	–	4
Error Counter Reset Output Time[*1]	Set the automatic output time for Error Counter Reset output.	1 to 1000	ms	20
Drive Alarm Reset Output Time[*1]	Set the automatic output time when the driver alarm reset output is enabled. (upon an error reset)	1 to 1000	ms	200
Positioning Monitoring Time[*5]	Set the monitor time when the positioning completed signal is enabled. If you set [0], it does not monitor the positioning completed signal. During Origin Search, it continues to wait for a positioning completed input when the origin input is detected. As for origin compensation operation, it does not monitor the positioning completed input. If you set any value other than [0], an error is generated if the specified time is exceeded.	1 to 10000	ms	0

*1. In the case of a Virtual Axis, this setting becomes disabled and the signal is treated as a general-purpose output.

*2. If you use an absolute encoder system, be sure to use this signal as a RUN output. If you use an absolute encoder system, read the present position when the RUN output turns ON, upon which the origin is confirmed.

*3. If you select [0] for origin proximity input signal selection, bits 0 to 3 of the origin proximity input internal bit correspond to the origin proximity inputs of axes 1 to 4, respectively. Also, you can use the external origin proximity input signals as general purpose inputs.
In the case of a Virtual Axis, this setting becomes disabled. You can use the external origin proximity input signals as general purpose inputs.

*4. If you select [1] for interrupt input function selection, the target axis of latch depends on [Latch Signal Setting] under [Common Parameter].

*5. In the case of a Virtual Axis, this setting becomes disabled and the signals are treated as general-purpose input.

*6. [1] is not available among the options for emergency stop input stop method.

*7. If you do not select for RUN output function nor Error Counter Reset output function, these parameters operate the same as when you set them to [0].

*8. The signal is output only when you set Error Counter Reset output function as Error Counter Reset output.

*9. Turn OFF the signal only when you set RUN output function to RUN output.

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Defining the Origin

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Defining the Origin

Acceleration/Deceleration Setting

Parameter name	Function	Setting range	Unit	Default value
Maximum Speed	Specify the maximum speed of the axis.	0 to 4,000,000[*1],[*2]	Command unit/s	4,000,000[*1]
Starting Speed	Specify the starting speed of the axis.	0 to 4,000,000[*2]	Command unit/s	0
Operation at Reverse Rotation Command[*3]	Select the reverse operation at duplicate starts. 0: Deceleration stop at reverse rotation, 1: Immediate stop at reverse rotation	0 to 1	–	0
Acceleration/ Deceleration Curve Selection	Select the acceleration/deceleration curve. 0: Trapezoid, 1: S-curve (Cubic curve)	0 to 1	–	0
Acceleration/ Deceleration Time Selection	Select how to specify the acceleration/deceleration time. 0: Time from starting speed to maximum speed of each axis (Acceleration/deceleration specified) 1: Time from present speed to target speed of each axis (Time specified)	0 to 1	–	0
Single Axis Deceleration Time at Interpolation [*3]	Set the axis deceleration stop time for interpolation during memory operation.	0 to 250,000	ms	1,000

*1. The maximum speed is 500,000 for the open collector output type. The default setting is also 500,000.

*2. This setting range is based on the pulse unit.

*3. This parameter need not be set for Origin Search. For details, refer to "Acceleration/Deceleration Setting" on page 5-23.

Maximum Speed

Register the fastest speed which you actually use. This prevents you from inadvertently using speeds exceeding the maximum speed.

With the line driver output type and Virtual Axes, the maximum speed is 4,000,000 (pps). With the open collector output type, however, the maximum speed is 500,000 (pps).

Starting Speed

If you use a Servomotor, set [0].

If you use a stepping motor, normally you should set a value which is one-tenth to one-half the maximum self-start frequency to prevent step-out at start. The suitable value depends on the load condition. Check the manual for your stepping motor for details.

Acceleration/Deceleration Curve Selection

Select the acceleration/deceleration curve.

Trapezoid   **S-curve**

4

Defining the Origin
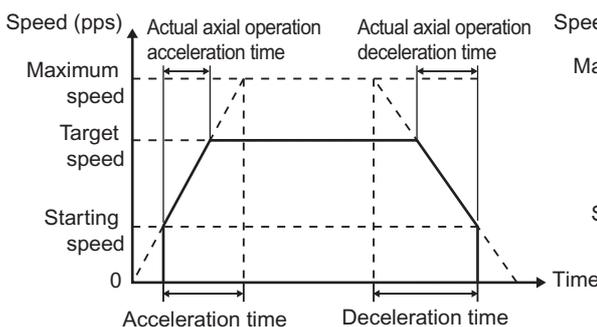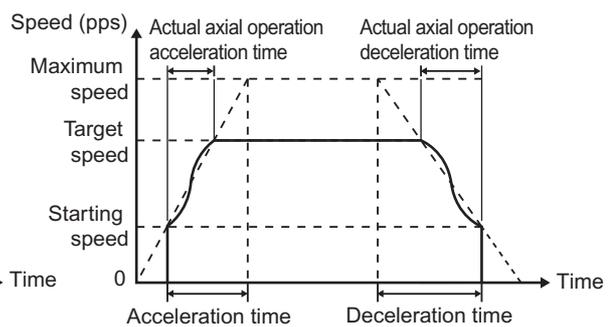
Acceleration/Deceleration Time Selection

For the acceleration/deceleration time designation method, select the method using on fixed acceleration or fixed acceleration/deceleration time.

Under the fixed acceleration method, you determine the time from the starting speed to maximum speed, so that the acceleration/deceleration time changes according to the target speed.

Under the fixed acceleration/deceleration time, you set the time from the present speed to target speed, and the acceleration/deceleration time does not change. In the case of triangle control, however, you determine the acceleration/deceleration time according to the acceleration which you calculated from the present speed, target speed and acceleration/deceleration time.

Acceleration/deceleration specified

[During starting]
  TA: Acceleration time
  Ta1: Actual acceleration time
  A: Degree of acceleration

[During speed change]
  TA: Acceleration time
  Ta2: Actual acceleration time
  A: Degree of acceleration

[During deceleration]
  TD: Deceleration time
  Td: Actual deceleration time
  D: Degree of deceleration

Time specified

[During starting]
  TA: Acceleration time
  A1: Degree of acceleration

[During speed change]
  TA: Acceleration time
  A2: Degree of acceleration

[During deceleration]
  TD: Deceleration time
  D: Degree of deceleration

Reference

♦ The axis always rotates at [Acceleration/deceleration specified] during Origin Search, regardless of the setting of acceleration/deceleration time selection.

Pulse Output Setting

Parameter name	Function	Setting range	Unit	Default value
Pulse Output Method	Select the method of output pulses. 0: Phase difference pulse output (1 multiplier) 1: Phase difference pulse output (Doubler) 2: Phase difference pulse output (Quadruple) 3: Forward/Reverse direction pulse output 4: Pulse plus direction output	0 to 4	–	3
Pulse Output Direction[*1]	Select the rotation direction of the motor. 0: Output forward direction pulse/ phase A advance pulse when the command is issued for the forward direction. 1: Output reverse direction pulse/ phase B advance pulse when the command is issued for the forward direction.	0 to 1	–	0

*1. You can switch the rotation direction of the motor without changing the wiring.

Pulse Output Method

Phase difference pulse output

Forward/reverse direction pulse output

Pulse plus direction output

Pulse Output Direction

You can change the rotation direction of the motor without changing the wiring.

4

Defining the Origin
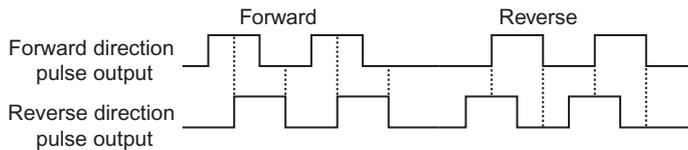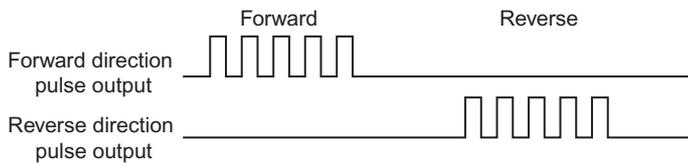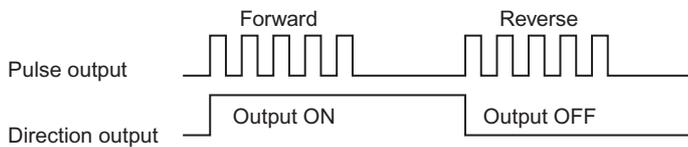
Software Limit Setting

Parameter name	Function	Setting range	Unit	Default value
Software Limit Function Selection	Select the software limit function. 0: Invalid 1: Valid to command position. Invalid on adjustment operation*1 2: Valid to feedback position. Invalid on adjustment operation*1 3: Valid to command position and on adjustment operation*1 4: Valid to feedback position and on adjustment operation*1	0 to 4	–	0
Reverse Direction Software Limit	Set the software limit value in the reverse direction.	−2147483647 to 2147483646*2	Command unit	−2147483647
Forward Direction Software Limit	Set the software limit value in the forward direction.	−2147483647 to 2147483646*2	Command unit	2147483646

*1. Adjustment operations include JOG operation, inching operation and MPG operation.

*2. This setting range is based on the pulse unit.

Origin Search Settings

Parameter name	Function	Setting range	Unit	Default value
Origin Search Operation Mode	Select the method to confirm the origin. 0: Proximity reverse turn/ origin proximity input OFF specified 1: Proximity reverse turn/ origin proximity input ON specified 2: Proximity reverse turn/ origin proximity Input OFF specified (Approach speed after reverse turn) 3: Proximity reverse turn/ origin proximity input ON specified (Approach speed after reverse turn) 4: Origin proximity input OFF specified 5: Origin proximity input ON specified 6: No origin rev turn/origin proximity input 7: No origin proximity input 8: Limit input OFF 9: Proximity rev turn/ origin input mask amount 10: Origin proximity input only 11: Proximity rev turn/ holding time 12: Proximity rev turn/ holding origin input 13: No origin proximity input/ holding origin input 14: Origin preset	0 to 14	–	0

Parameter name	Function	Setting range	Unit	Default value
Operation at Forward Direction Limit Input	Select the operation to be performed when the limit input in the operating direction turns ON during Origin Search. 0: Without reverse turn, Error stop[*1] 1: Reverse turn, Deviation pulse stop 2: Reverse turn, Deceleration stop	0 to 2	–	1
Operation at Reverse Direction Limit Input	Select the operation to be performed when the limit input in the operating direction turns ON during Origin Search. 0: Without reverse turn, Error stop[*1] 1: Reverse turn, Deviation pulse stop 2: Reverse turn, Deceleration stop	0 to 2	–	1
Origin Search Start Direction	Select the starting direction of Origin Search. 0: Forward direction, 2: Reverse direction	0 to 1	–	0
Origin Input Detecting Direction	Select the origin input detecting direction during Origin Search. 0: Forward direction, 2: Reverse direction	0 to 1	–	0
Origin Search Holding Time	Set the holding time when you set the ORIGIN SEARCH OPERATION mode to [Proximity Rev Turn/Holding Time].	0 to 10000	ms	100
Origin Input Mask Amount	Set the constant amount when you set the ORIGIN SEARCH OPERATION mode to [Proximity Rev Turn/ Origin Input Mask Amount].	0 to 2147483647[*2]	Command unit	10000
Origin Compensation Value	Set the Origin Search compensation amount which is applied after the origin confirmation.	−2147483647 to 2147483647[*2]	Command unit	0
Origin Position Offset	Preset the present position to the specified value when Origin Search starts. With an absolute encoder system, also execute the absolute encoder origin setting.	−2147483647 to 2147483647[*2]	Command unit	0
Origin Search Speed	Set the high speed during Origin Search.	1 to 4000000[*2]	Command unit/s	10000
Origin Search Approach Speed	Set the proximity speed during Origin Search.	1 to 4000000[*2]	Command unit/s	1000
Origin Search Compensation Speed	Set the compensation speed during Origin Search.	1 to 4000000[*2]	Command unit/s	1000
Origin Search Acceleration Time	Set the acceleration time during Origin Search.	0 to 250000	ms	1000
Origin Search Deceleration Time	Set the deceleration time during Origin Search.	0 to 250000	ms	1000

*1. The error stopping method depends on the limit input stopping method.

*2. This setting range is based on the pulse unit.

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Defining the Origin

ORIGIN SEARCH OPERATION Mode

Select one of 15 operations to determine the mechanical origin. For operation details, refer to "Origin Confirmation Operation" on page 4-24.

Operation at Forward Direction Limit Input and Operation at Reverse Direction Limit Input

Select whether to reverse the axis and continue with the Origin Search, or not reverse the axis but generate an error and stop the axis, when the axis reaches the limit input in the operating direction during Origin Search. To reverse the axis, also select the stopping method.

When you set [Reverse] for limit input operation in both directions, the axis generates an error and stops if the axis could not detect the origin after moving from the limit input position opposite to the origin input detection direction to the other limit input position.

Origin Search Start Direction

Select the direction in which the axis starts moving when Origin Search starts. Refer to the figure below.

Origin Input Detecting Direction

Select the direction of confirming the origin. Refer to the figure below.

When the origin search start direction is the same as the origin input detecting direction

When the origin search start direction is different from the origin input detecting direction

When proximity is ON at start, the start direction is determined only by the origin input detecting direction setting.

4

Defining the Origin
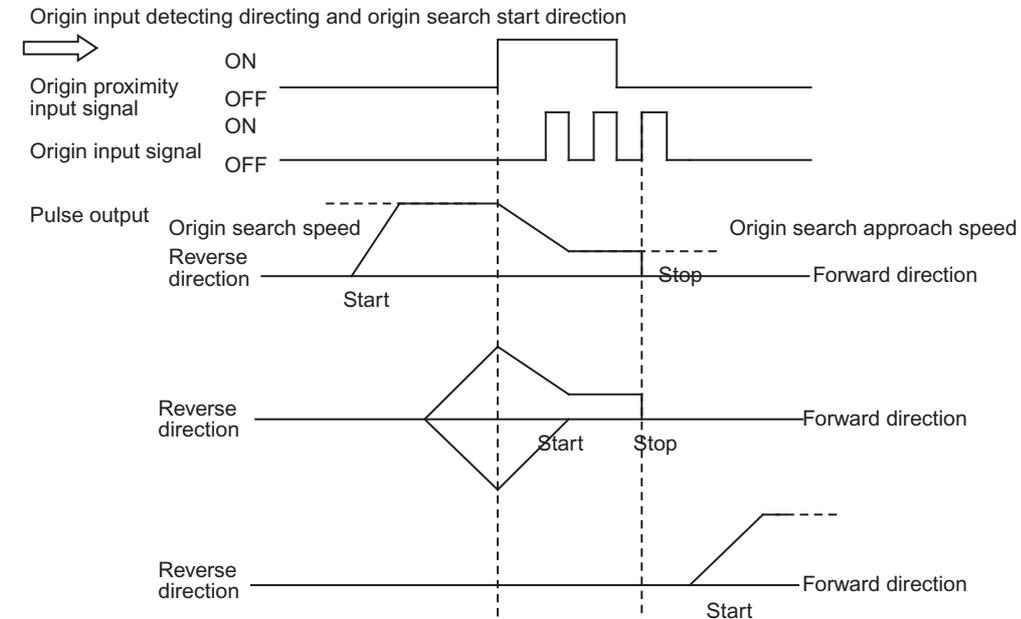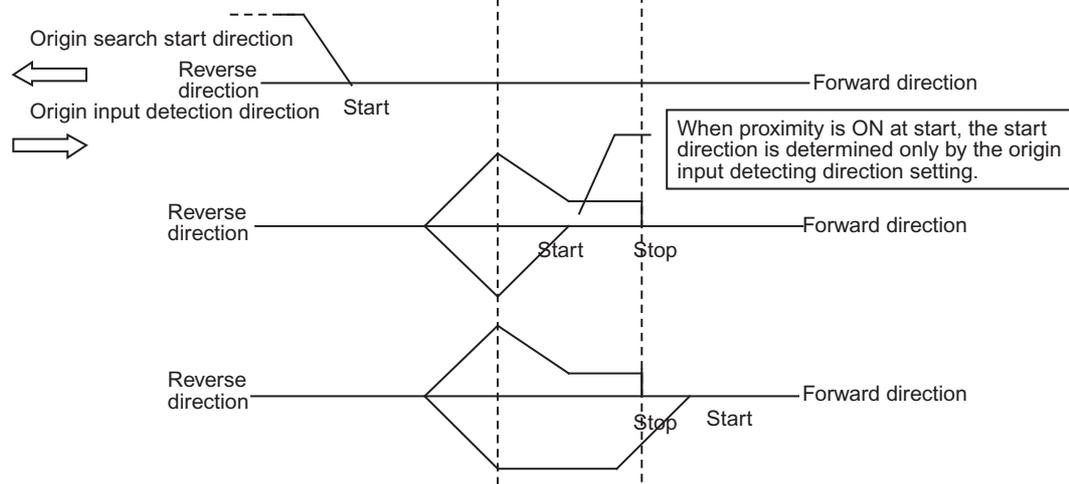
Origin Search Holding Time

Set the holding time when you set the ORIGIN SEARCH OPERATION mode to [Proximity Rev Turn/Holding Time].

For operation details, refer to "Operation by 11: Proximity Reverse Turn and Holding Time Specified" on page 4-31.

Origin Input Mask Amount

Set the constant amount when you set the ORIGIN SEARCH OPERATION mode to [Proximity Rev Turn/Origin Input Mask Amount].

For operation details, refer to "Operation by 9: Proximity Reverse Turn and Origin Input Mask Amount Specified" on page 4-29.

Origin Compensation Value

Set the Origin Search compensation amount which is applied after the origin detection.

Set the applicable movement speed under [Origin Search Compensation Speed].

For operation details, refer to "Origin Compensation" on page 4-33.

Origin Position Offset

This is the present position preset when the Origin Search operation is completed.

The value set under [Origin Position Offset] is the present position.

Origin Search Speed

The high speed during Origin Search.

Origin Search Approach Speed

The proximity speed during Origin Search.

Origin Search Compensation Speed

This is the movement speed when you set [Origin Compensation Value].

For operation details, refer to "Origin Compensation" on page 4-33.

Origin Search Acceleration Time and Origin Search Deceleration Time

Set the acceleration time and deceleration time during Origin Search.

For details, refer to "Acceleration/Deceleration Setting" on page 4-17.

4-3 Origin Search Operation

This PCU has 15 ORIGIN SEARCH OPERATION modes. You can also fine-tune the confirmed origin with an origin compensation value.

Origin Confirmation Operation

This section explains 15 types of origin confirmation operations.

Operation by 0: Proximity Reverse Turn and Origin Proximity Input OFF Specified

1. **The axis starts at the Origin Search Speed, and when the origin proximity sensor turns from OFF to ON, it starts decelerating to the Origin Search Approach Speed.**

2. **After it reaches the Origin Search Approach Speed, the axis stops at the first origin input after the origin proximity sensor turns from ON to OFF, then the mechanical origin is confirmed.**

📄 **Reference**

- If you perform Origin Search when the origin proximity input is ON, operation starts at the Origin Search Speed in the direction opposite to the origin input detecting direction. After a reverse turn from the origin proximity input ON status, Origin Search operation starts at the Origin Search Speed in the origin input detecting direction.

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Defining the Origin

Operation by 1: Proximity Reverse Turn and Origin Proximity Input ON Specified

1. **The axis starts at the Origin Search Speed, and when the origin proximity sensor turns from OFF to ON, it starts decelerating to the Origin Search Approach Speed.**

2. **After it reaches the Origin Search Approach Speed, the axis stops at the first origin input, then the mechanical origin is confirmed.**

Origin input detecting direction

Origin proximity
input signal ON / OFF

Origin input signal ON / OFF

Pulse output

Stop Origin search approach speed

Reverse direction Forward direction

Start

Origin search speed

📖 Reference

• If you perform Origin Search when the origin proximity input is ON, operation starts at the Origin Search Speed in the direction opposite to the origin input detecting direction. After a reverse turn from the origin proximity input ON status, Origin Search operation starts at the Origin Search Speed in the origin input detecting direction.

Operation by 2: Proximity Reverse Turn and Origin Proximity Input OFF Specified (Approach Speed After Reverse Turn)

1. **The axis starts at the Origin Search Speed, and when the origin proximity sensor turns from OFF to ON, it starts decelerating to the Origin Search Approach Speed.**

2. **After it reaches the Origin Search Approach Speed, the axis stops at the first origin input after the origin proximity sensor turns from ON to OFF, then the mechanical origin is confirmed.**

Origin input detecting direction

ON / OFF

ON / OFF

Origin search approach speed

Pulse output

Start Stop

Origin search speed

📖 Reference

• If you perform Origin Search when the origin proximity input is ON, operation starts at the Origin Search Speed in the direction opposite to the origin input detecting direction. After a reverse turn from the origin proximity input ON status, Origin Search operation starts at the Origin Search Approach Speed in the origin input detecting direction.

4

Defining the Origin

Operation by 3: Proximity Reverse Turn and Origin Proximity Input ON Specified (Approach Speed After Reverse Turn)

1. **The axis starts at the Origin Search Speed, and when the origin proximity sensor turns from OFF to ON, it starts decelerating to the Origin Search Approach Speed.**

2. **After it reaches the Origin Search Approach Speed, the axis stops at the first origin input, then the mechanical origin is confirmed.**

Origin input detecting direction

Origin proximity input signal   ON / OFF

Origin input signal   ON / OFF

Pulse output

Stop   Origin search approach speed

Reverse direction   Forward direction

Start

Origin search speed

Reference

* If you perform Origin Search when the origin proximity input is ON, operation starts at the Origin Search Speed in the direction opposite to the origin input detecting direction. After a reverse turn from the origin proximity input ON status, Origin Search operation starts at the Origin Search Approach Speed in the origin input detecting direction.

Operation by 4: Origin Proximity Input OFF Specified

1. **The axis starts at the Origin Search Speed, and when the origin proximity sensor turns from OFF to ON, it starts decelerating to the Origin Search Approach Speed.**

2. **After it reaches the Origin Search Approach Speed, the axis stops at the first origin input after the origin proximity sensor turns from ON to OFF, then the mechanical origin is confirmed.**

Origin input detecting direction

Origin proximity input signal   ON / OFF

Origin input signal   ON / OFF

Origin search speed

Pulse output

Reverse direction   Origin search approach speed

Forward direction

Start   Stop

📑 **Reference**

 • If you perform Origin Search while the origin proximity sensor is ON, the axis performs the operation below depending on how you set the Origin Search start direction.
   When the Origin Search start direction is the same as the origin input detecting direction:

   The axis does not perform reverse turn operation and Origin Search starts in the origin input detecting direction at the Origin Search Approach Speed.

   When the Origin Search start direction is different from the origin input detecting direction:

   Operation starts in the Origin Search start direction at the Origin Search Speed, regardless of the status of the origin proximity input. If you set the operation at the limit input in the Origin Search start direction to "Reverse," the axis reverses upon detection of the limit input and performs Origin Search operation in the origin input detecting direction.

Operation by 5: Origin Proximity Input ON Specified

1. **The axis starts at the Origin Search Speed, and when the origin proximity sensor turns from OFF to ON, it starts decelerating to the Origin Search Approach Speed.**

2. **After it reaches the Origin Search Approach Speed, the axis stops at the first origin input, then the mechanical origin is confirmed.**
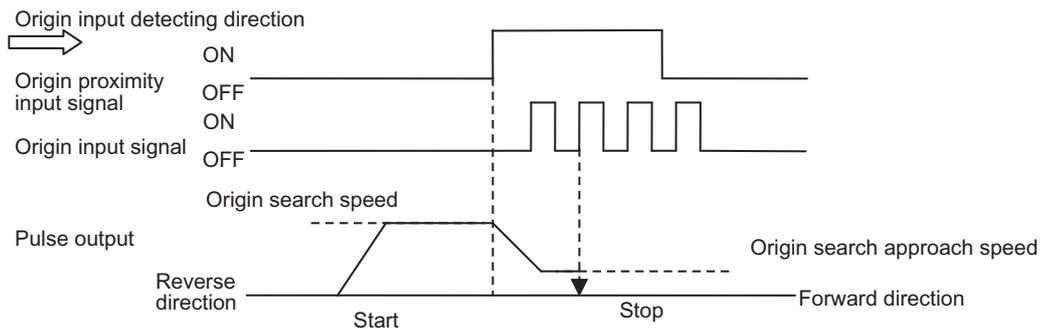
📑 **Reference**

 • If you perform Origin Search while the origin proximity sensor is ON, the axis perform the operation below depending on how you set the Origin Search direction.

   When the Origin Search start direction is the same as the origin input detection direction:

   The axis does not perform retreat operation and Origin Search starts in the origin input detecting direction at the Origin Search Speed.

   When the Origin Search start direction is different from the origin input detecting direction:

   Operation starts in the Origin Search start direction at the Origin Search Speed, regardless of the status of the origin proximity input. If you set the operation at the limit input in the Origin Search start direction to "Reverse," the axis reverses upon detection of the limit input and performs Origin Search operation in the origin input detecting direction.

4

Operation by 6: Origin Reverse Turn and No Origin Proximity Input

1. **Origin Search starts at the Origin Search Approach Speed.**
2. **The axis stops at the first origin input, then the mechanical origin is confirmed.**
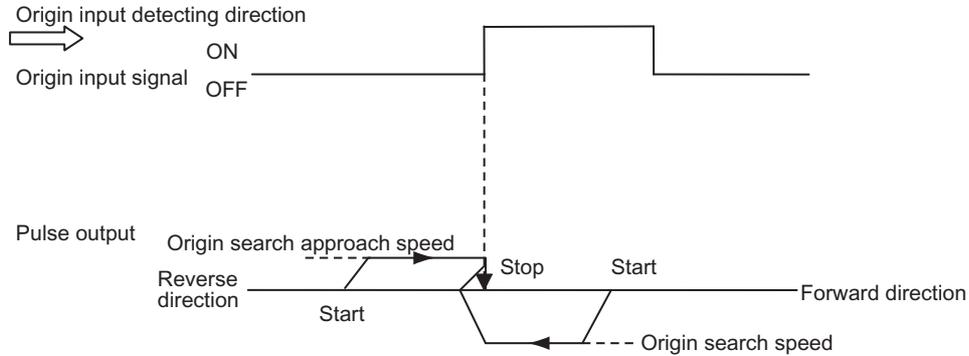
📖 Reference

- If you perform Origin Search when the origin proximity input is ON, operation starts at the Origin Search Speed in the direction opposite to the origin input detecting direction. After a reverse turn from the origin proximity input ON status, Origin Search operation starts at the Origin Search Approach Speed in the origin input detecting direction.

Operation by 7: No Origin Proximity Input

1. **Origin Search starts at the Origin Search Approach Speed.**
2. **The axis stops at the first origin input, then the mechanical origin is confirmed.**
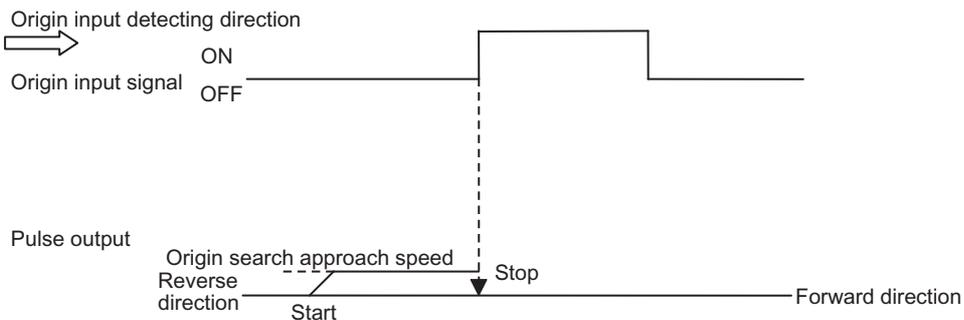
📖 Reference

- If you perform Origin Search while the origin proximity is ON, the axis performs the operation below depending on how you set the Origin Search start direction.

  When the Origin Search start direction is the same as the origin input detecting direction:

    The axis does not perform reverse turn operation and Origin Search starts in the origin input detecting direction at the Origin Search Approach Speed.

  When the Origin Search start direction is different from the origin input detecting direction:

    Operation starts in the Origin Search start direction at the Origin Search Speed, regardless of the status of the origin proximity input. If you set the operation at the limit input in the Origin Search start direction to "Reverse," the axis reverses upon detection of the limit input and performs Origin Search operation in the origin input detecting direction.

Operation by 8: Limit Input OFF Specified

1. **The axis starts at the Origin Search Speed, and when the limit sensor in the direction opposite to the origin input detection direction turns from OFF to ON, it starts decelerating to the Origin Search Approach Speed.**

2. **After it reaches the Origin Search Approach Speed, the axis stops at the first origin input after the limit sensor turns from ON to OFF, then the mechanical origin is confirmed.**
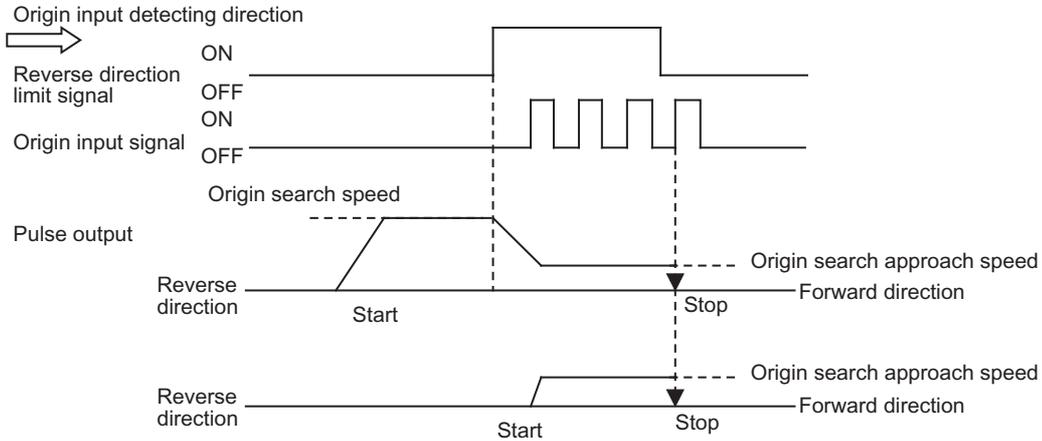
📑 Reference

♦ If you perform Origin Search when the limit input on the opposite side of the origin input detecting direction is ON, Origin Search operation starts at the Origin Search Approach Speed in the origin input detecting direction.

Operation by 9: Proximity Reverse Turn and Origin Input Mask Amount Specified

1. **The axis starts at the Origin Search Speed, and when the origin proximity sensor turns from OFF to ON, it starts decelerating to the Origin Search Approach Speed.**

2. **After the origin proximity sensor turns from OFF to ON, the axis moves by the specified amount of movement ([Origin Input Mask Amount]), stops at the first origin input, and the mechanical origin is confirmed.**
   If the specified movement is short and the movement would be completed before the speed decelerates to the Origin Search Approach Speed, an invalid origin input mask amount error (error code: 6407) occurs when you start Origin Search.
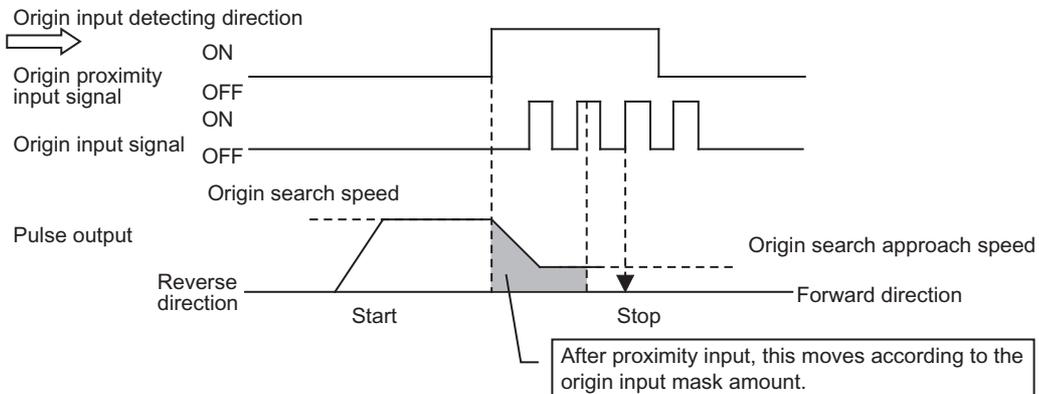
After proximity input, this moves according to the origin input mask amount.

📑 **Reference**

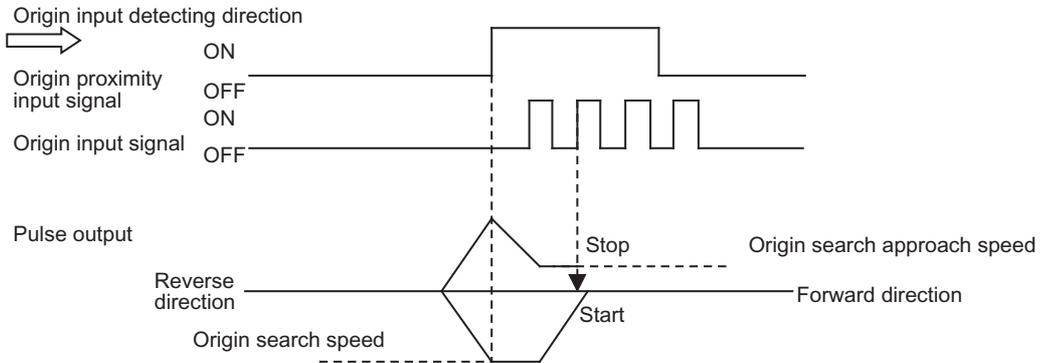• If you perform Origin Search when the origin proximity input is ON, operation starts at the Origin Search Speed in the direction opposite to the origin input detecting direction. After a reverse turn from the origin proximity input ON status, Origin Search operation starts at the Origin Search Approach Speed in the origin input detecting direction.

Operation by 10: Origin Proximity Input Only

1. **The axis starts at the Origin Search Speed, and when the origin proximity sensor turns from OFF to ON, it decelerates to a stop.**

2. **After it stops, the axis reverses at the Origin Search Approach Speed and then stops when the origin proximity sensor turns from ON to OFF, then the mechanical origin is confirmed.**
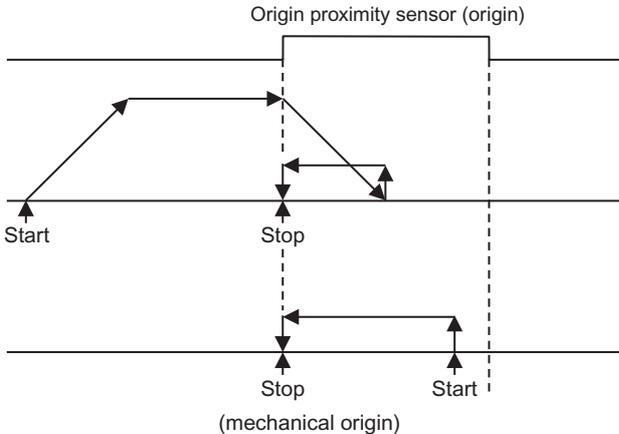
📑 **Reference**

• If you only use the origin proximity input to perform Origin Search, the point at which the origin proximity signal turns from ON to OFF during operation in the direction opposite to the origin input detecting direction is set as the origin detection position.

• If you perform Origin Search when the origin proximity input is ON, operation starts at the Origin Search Approach Speed in the direction opposite to the origin input detecting direction, and the origin position detection ends when the origin proximity signal turns from ON to OFF.

4

Defining the Origin

▌ Operation by 11: Proximity Reverse Turn and Holding Time Specified

1. The axis starts at the Origin Search Speed, and when the origin proximity sensor turns from OFF to ON, it starts decelerating to the Origin Search Approach Speed. The moment the axis starts decelerating, the torque limit output turns ON and time monitoring starts.

2. The mechanical origin is confirmed after the specified time elapses.

Origin input detecting direction

⇨

Origin proximity input signal — ON / OFF

The origin is confirmed upon elapse of the specified time.

Origin search speed

Pulse output

Reverse direction

Origin search approach speed

Start — Stop
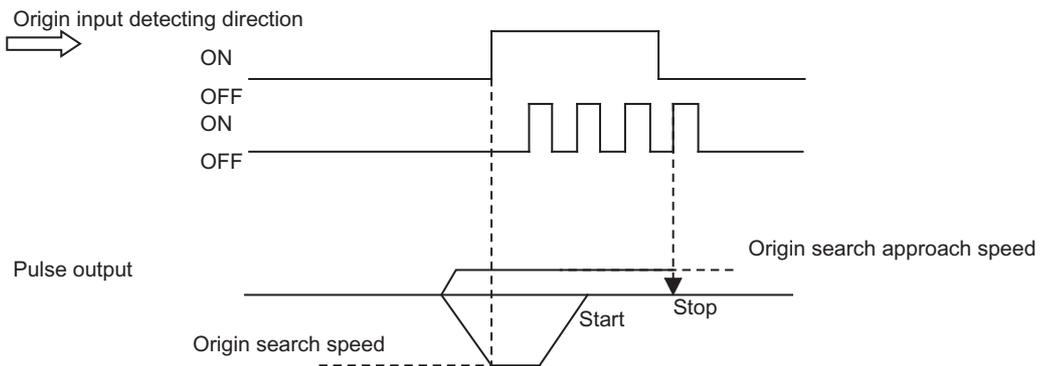
Forward direction

Torque limit output signal

📑 Reference

• If you perform Origin Search when the origin proximity input is ON, operation starts at the Origin Search Speed in the direction opposite to the origin input detecting direction. After a reverse turn from the origin proximity input ON status, Origin Search operation starts at the Origin Search Approach Speed in the origin input detecting direction.
• For the torque limit output, refer to "Automatic Control during Origin Search" on page 9-19.
• To perform this Origin Search, you must set the torque limit on the Servo Drive side.

▌ Operation by 12: Proximity Reverse Turn and Holding Origin Input Specified

1. The axis starts at the Origin Search Speed, and when the origin proximity sensor turns from OFF to ON, it starts decelerating to the Origin Search Approach Speed. The moment the axis starts decelerating, the torque limit output turns ON.

2. The mechanical origin is confirmed when the origin input turns from OFF to ON.

Origin input detecting direction

⇨

Origin proximity input signal — ON / OFF

Origin input signal — ON / OFF

Origin search high speed

Pulse output

Reverse direction

Origin search approach speed

Start — Stop

Forward direction

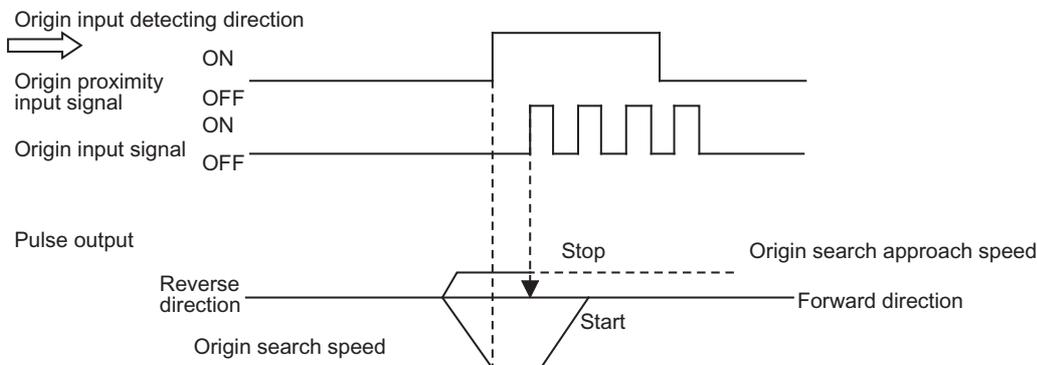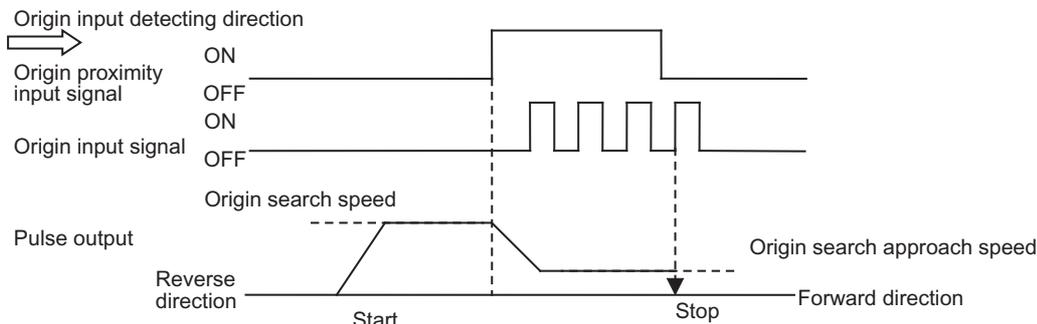Torque limit output signal

📖 **Reference**

- If you perform Origin Search when the origin proximity input is ON, operation starts at the Origin Search Speed in the direction opposite to the origin input detecting direction. After a reverse turn from the origin proximity input ON status, Origin Search operation starts at the Origin Search Approach Speed in the origin input detecting direction.
- For the torque limit output, refer to "Automatic Control during Origin Search" on page 9-19.
- To perform this Origin Search, you must set the torque limit on the Servo Drive side.

Operation by 13: No Origin Proximity Input and Holding Origin Input Specified

1. **The axis starts at the Origin Search Approach Speed and the torque limit output turns ON.**

2. **The mechanical origin is confirmed when the origin input turns from OFF to ON.**
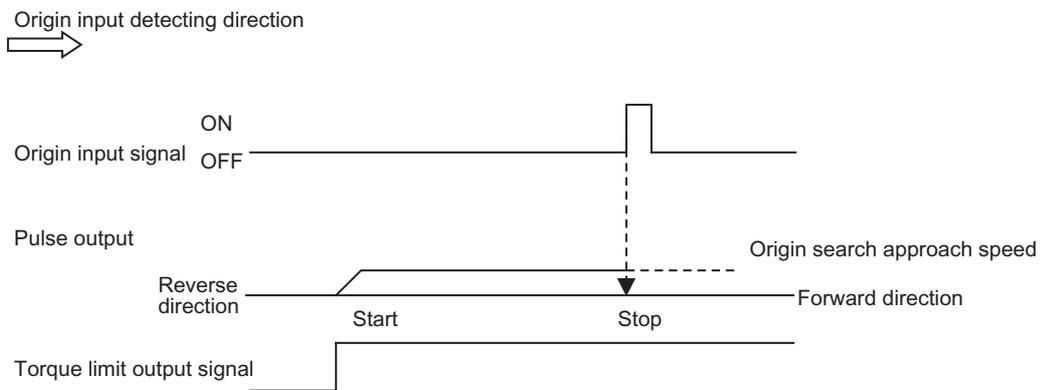
📖 **Reference**

- For the torque limit output, refer to "Automatic Control during Origin Search" on page 9-19.
- To perform this Origin Search, you must set the torque limit on the Servo Drive side.

Operation by 14: Origin Preset

1. **The axis forcibly changes the current stopping position to the origin position offset to confirm the mechanical origin.**

If you set the origin position offset to 0, the origin stop signal also turns ON the moment the origin confirmation signal turns ON.

Origin Compensation

When you set an origin compensation value, the axis will move by the origin compensation value after detection of the origin input, to confirm the origin.

Since adjusting the origin for the workpiece is difficult after the mechanical origin confirmation in the mechanical system, deviation from the mechanical origin confirmed at the beginning is set as the compensation data, if fine-tuning is necessary.

The applicable movement speed conforms to the Origin Search Compensation Speed.
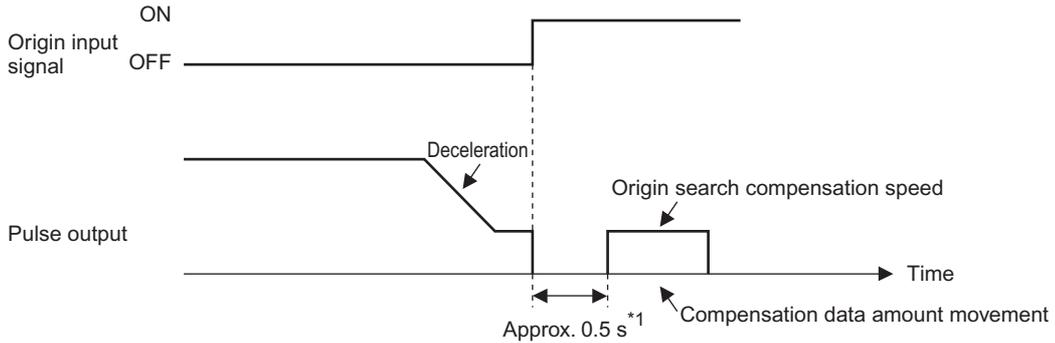
*1 Origin compensation operation starts approx. 0.5 seconds after the Error Counter Reset output turns OFF if you use the Error Counter Reset output.

Timing Chart

4

The chart below shows an Origin Search timing chart of axis 1.

Without Origin Compensation

Defining the Origin
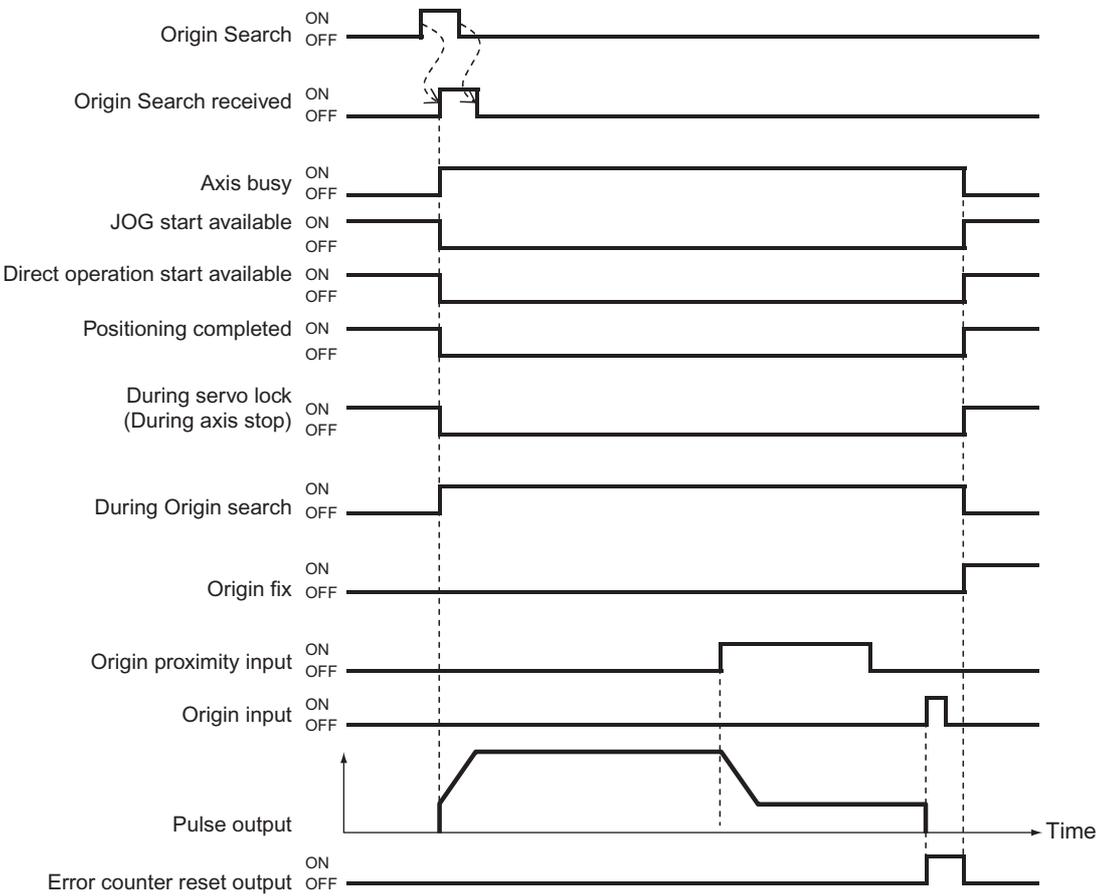
With Origin Compensation
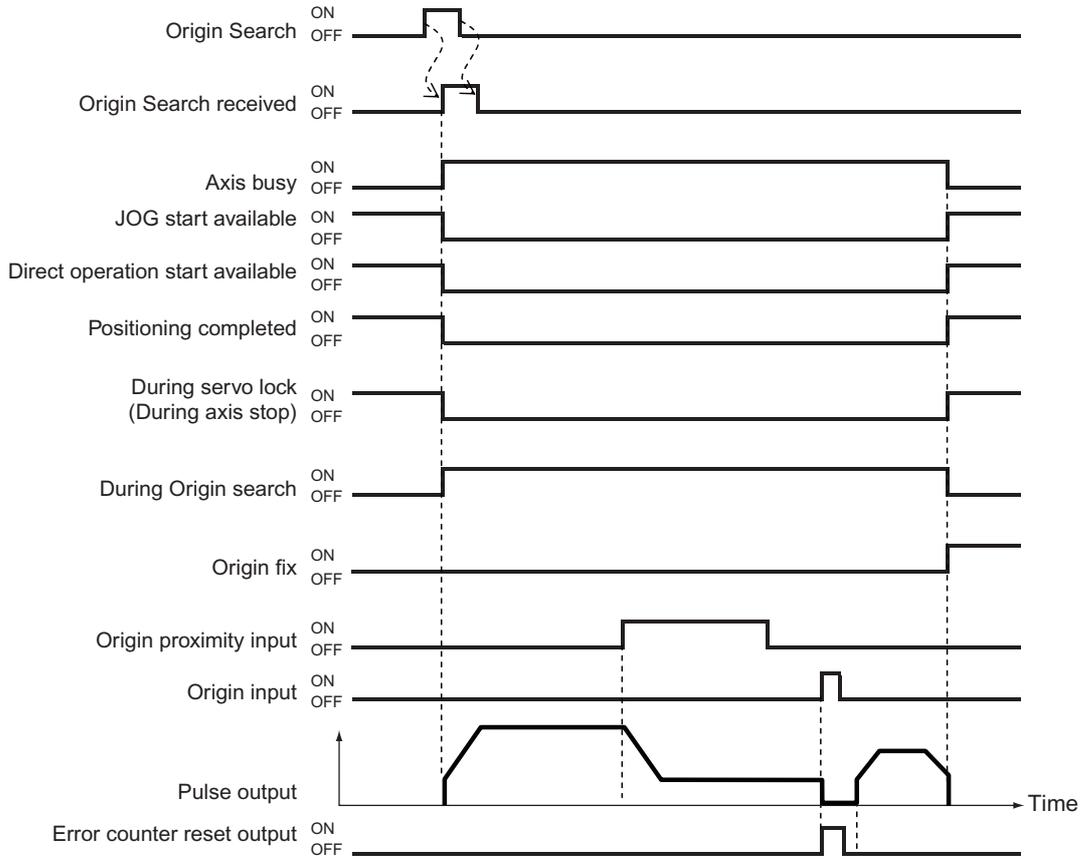
Deceleration Stop During Origin Search
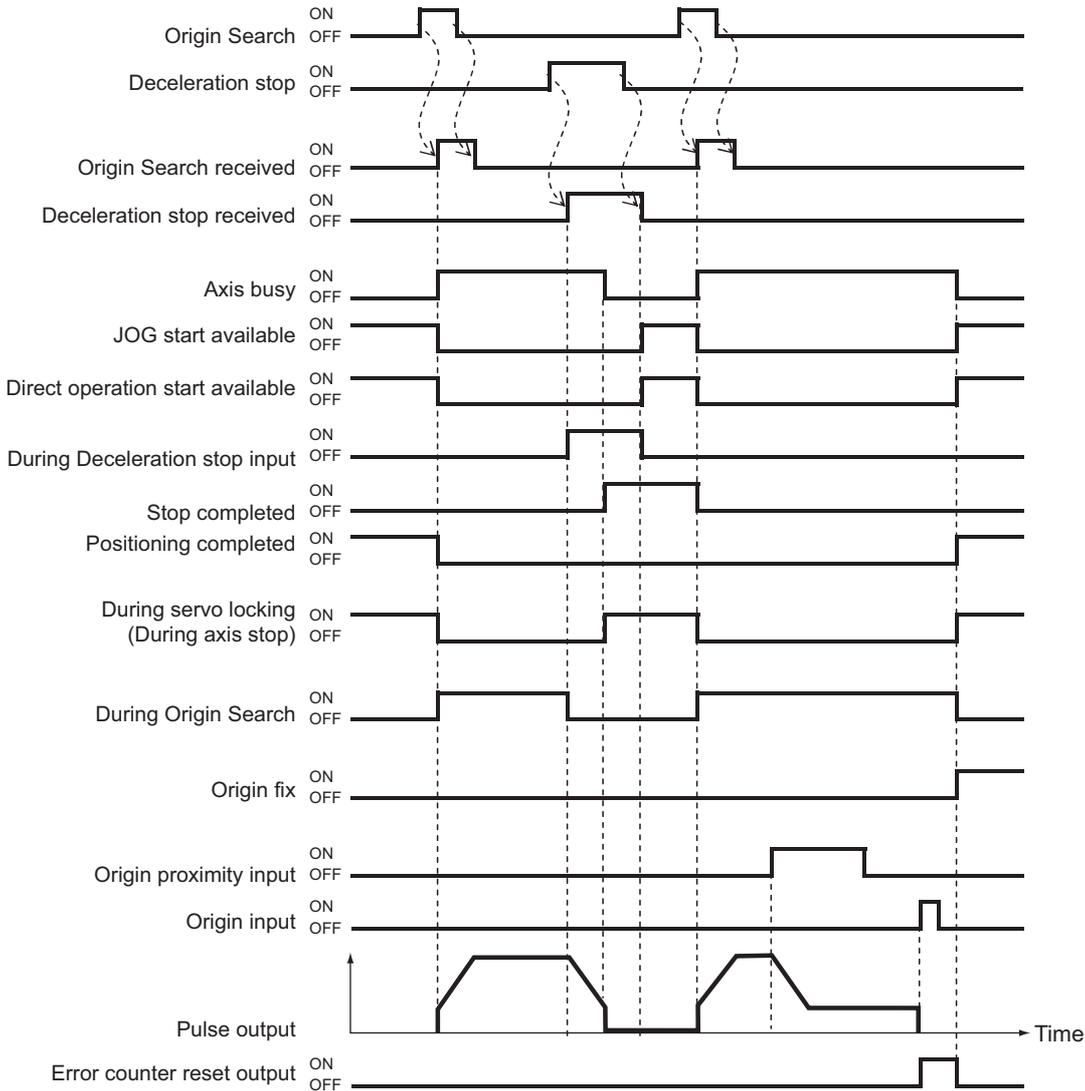
4-4 Present Position Preset

The present position preset function changes the present position to a desired value.

Outline of Operation

This PCU has 3 types of present position preset functions as follows.

Origin Preset

This is one of the Origin Search functions which determines the mechanical origin by forcibly changing the present stop position to the origin position offset. The axis is preset when Origin Search starts.
For details, refer to "Operation by 14: Origin Preset" on page 4-32.

Starting Present Position Clear Enable

This function presets the present position to 0 when the positioning function starts. It is useful for feeding control, such as feeder control.
However, the axis loses the mechanical origin and the operating condition changes to the origin unconfirmed status when you execute the starting present position clear enable.

Present Position Preset

This function changes the present position to a desired value.
When you execute preset position preset, the mechanical origin is confirmed and the operating condition changes to the origin confirmed status.

Starting Present Position Clear Enable

You can set this function for each axis with the axis parameter [Starting Present Position Clear Enable].
The axis which you set starts after you set the command position to 0.
The timings at which you execute the starting present position clear enable are as follows:

Direct operation: When the positioning function that includes duplicate starts, and the interrupt input for interrupt feeding turns ON.

Memory operation: When the Memory Operation Start Bit or Memory Operation Independent Start Bit is turned ON and the interrupt input for interrupt feeding turns ON.

Precautions for Correct Use

• The axis loses the mechanical origin and the operating condition changes to the origin unconfirmed status when you execute starting present position clear enable.

4

> **Reference**
>
> • With Starting Present Position Clear Enable, 0 preset occurs not only when the positioning function starts, but also at duplicate starts and the input of the interrupt signal for interrupt feeding.
> • Even if the axis is still waiting for the condition to be met and is not operating when it receives a start command from the bit, 0 preset occurs once the sequence starts.
> • For a synchronous operation function that includes MPG, Origin Search function, and JOG/inching function, the setting of starting present position clear enable is disabled and 0 preset does not occur.
> • 0 preset does not occur when the axis stops and then starts during memory operation (according to an automatic pattern, etc.).

Present Position Preset

The present position changes to the desired value which you set under [Direct Operation Command Memory Area] the moment the present position preset signal in [Direct Operation Command Memory Area] turns ON.

Thereafter, the operating condition changes to the origin confirmed status.

For the bit allocations, refer to "Direct Operation Command Memory Area" on page 5-68.

Timing Chart

The following shows a timing chart.

When you change the present position to 0, it becomes the origin and thus the origin stop flag turns ON.
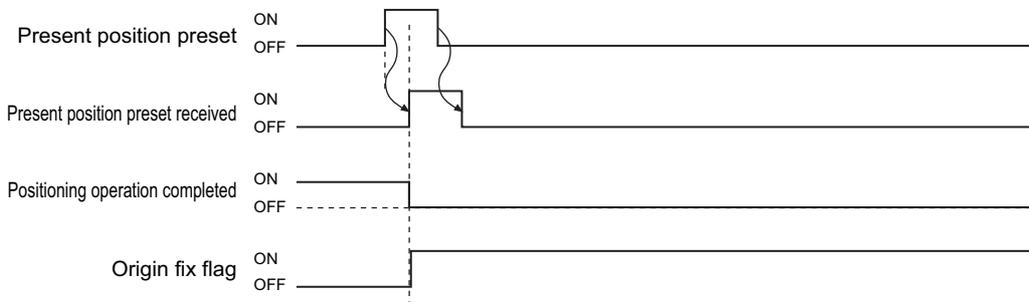
> **Precautions for Correct Use**
>
> • An error will occur if the present position is preset outside of the ring range in Ring Mode or when the Axis Busy Flag is ON. The present position will also not be preset while there is an error.

4-5 Origin Search with CX-Programmer

Manual operation with CX-Programmer makes it possible to perform the 5 operations below.

- ◆ JOG operation
- ◆ Inching operation
- ◆ Direct operation
- ◆ Origin Search
- ◆ Wiring check

This section explains Origin Search.

Precautions for Correct Use

- ◆ When you execute JOG operation, direct operation or Origin Search from CX-Programmer command, the motor actually operates at the specified speed.
  Before you execute operation, thoroughly confirm absence of danger which may be caused by motor operation.
- ◆ For operations from CX-Programmer, install an external emergency stop circuit or take other appropriate measures to safely stop the motor. CX-Programmer may not be able to give commands if a computer error, etc., occurs.
- ◆ Click the [Save] button, and the axis parameters reflects the settings.
  To perform Origin Search from a ladder based on the parameters that you set on the test RUN window, be sure to click the [Save] button.

Origin Search Procedure

1. On the data setting window of the PCU, click the [PCU] menu and select [Test Run].
When the caution dialog box below appears, read the message carefully. After you confirm a safe condition, click [OK].
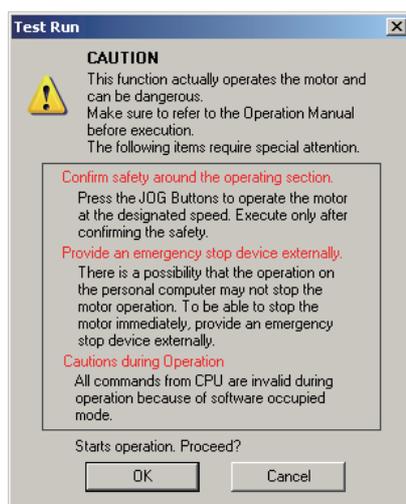
Precautions for Correct Use

• When you click [OK], the PCU enters the SOFTWARE EXCLUSIVE mode (Test Run).
  For the SOFTWARE EXCLUSIVE mode (Test Run), refer to "Outline of Manual Operation" on page 3-1.

2. When the manual operation window appears, select the [Origin Search] tab.
   The window below appears.
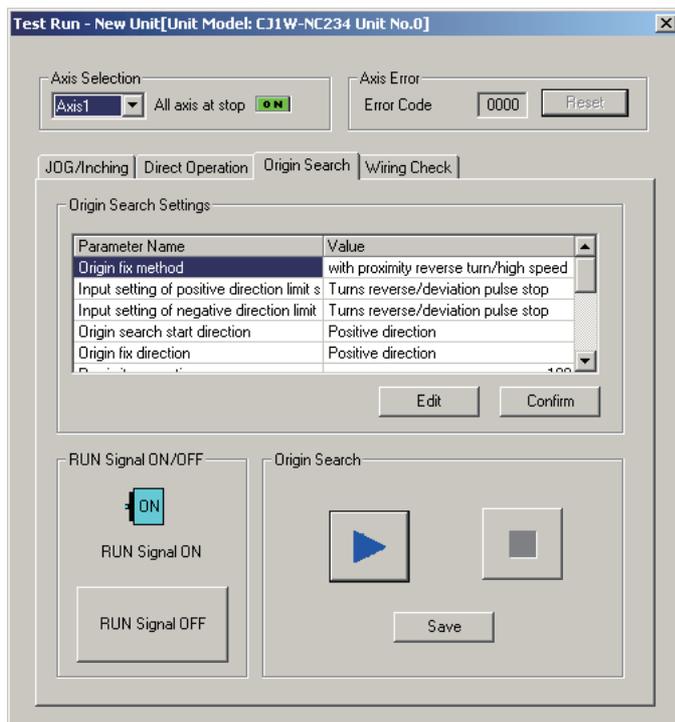
3. Select the axis whose origin you want to search.

4

Defining the Origin

4. Confirm the Origin Search settings.

To change the settings, click the [Edit] button. If there's no problem with the settings, click the [Confirm] button.
When editing the Origin Search settings, the window below appears.
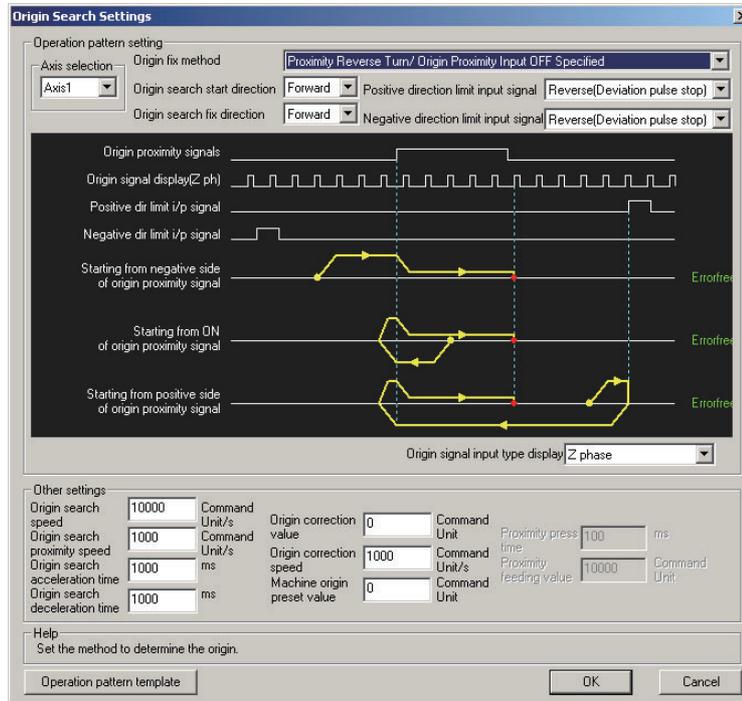
After you edit all necessary items, click the [OK] button to close the window.
When you edit the Origin Search settings, be sure to click the [Confirm] button before you execute Origin Search.

5. If you are using the RUN output of the PCU, click the [RUN Signal ON] button to turn ON the RUN output.

6. Execute Origin Search operation.

 Precautions for Correct Use

In Support Software-controlled Operation Mode, operation commands can be given only for one axis.
Operation commands cannot be given simultaneously for more than one axis.
Even if the axis selection in the Test Run Dialog Box is changed, the new axis cannot be operated while operation is in progress for another axis.

4

4-6 Absolute Encoder Origin Setting

For the PCU of pulse-output type, the position control loop is at the driver side regardless of whether the application is of semi-closed loop or full-closed loop method.
However, this PCU can input encoder feedback.
You can use either an incremental encoder or absolute encoder.

If you use an absolute encoder, the absolute data can be retained by the battery backup even when the power supply to the CPU Unit (PCU) is shut OFF. You can determine the present position by reading this absolute data from the absolute encoder when the power supply to the CPU Unit (PCU) turns ON.
Unlike the case of using an incremental encoder, if the origin has been determined once, you need not perform Origin Search after the power supply turns ON.
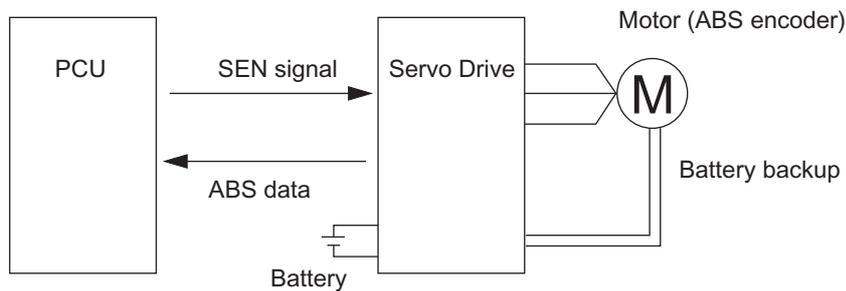
Outline of Operation

You can determine the origin of an absolute encoder system by Origin Search in the same manner as when you use an incremental encoder.
Load the command position after the origin determination, and the offset of the mechanical origin that was read from the absolute encoder, into the axis parameter [ABS Encoder Origin Position Offset].
Accordingly, [ABS Encoder Origin Position Offset] is a read-only parameter.

Applicable Servomotors

The Servomotors which are equipped with an absolute encoder and connectable to the PCU are listed below.

Manufacturer	Series	Servo Drive model	Servomotor model
OMRON	OMNUC G5 Series	R88D-KTxxx	R88M-KxxxxxS R88M-KxxxxxT R88M-KxxxxxC
	OMNUC G series	R88D-GTxxx	R88M-GxxxxxS R88M-GxxxxxT
	OMNUC W series	R88D-WTxxx	R88M-WxxxxxS R88M-WxxxxxT

4

Defining the Origin

Connection with Servo Drive

To use an absolute encoder, you must connect the encoder phase A and B inputs from the Servo Drive to the RUN output and SEN output for the Servo Drive. Also note that, in relation to the pulse output, you cannot acquire proper absolute data if the forward/reverse direction connections are wrong.

Connect correctly according to "Connection Examples for OMNUC G5/G-series Servo Drive" on page 2-42. (To connect to any OMNUC W Series Servo Drive, refer to the wiring diagram in "Appendix-3 Servo Drive Connecting Cable".)

Setting Procedure

This section explains the procedure to set the origin of an absolute encoder system.

1. **Setup of absolute encoder (OMNUC G5/W Series only)**

   For the OMNUC G Series, setup of the absolute encoder is not necessary.

   For the setup method of the OMNUC G5 Series, refer to User's Manual for OMNUC G5-series AC Servomotor/Servo Drive (I571). For the setup method of the OMNUC W Series, refer to User's Manual for OMNUC W-series AC Servomotor/Servo Drive (I531).

2. **Setting of PCU axis parameter**

   Select [Encoder Type] under [Feedback Pulse Input Setting] among the PCU axis parameters. For details, refer to "Feedback Pulse Input Setting" on page 5-46.

   In addition, set [RUN Output Function] under [I/O Function Selection] among the axis parameters to [1: Use as RUN output].

3. **Execution of servo lock**

   Put the Servo Drive in operating status and lock the servo.

4. **Execution of Origin Search**

   Execute Origin Search.

   After the origin determination, load the command position after the origin determination, and the offset of the mechanical origin that was read from the absolute encoder, into the axis parameter [ABS Encoder Origin Position Offset].

Reference

- After you set the absolute encoder origin, save the parameters. For information on how to save data, refer to "Saving Data" on page 8-42.

Precautions for Correct Use

- A motor with absolute encoder cannot be installed to the system where both the rotation axes and decelerators are used.

- If you use a reducer or for some other reason the Command Pulse Count Per Motor Rotation parameter and the actual number of pulses per motor rotation do not match, you cannot use a motor with an absolute encoder.

Setting of PCU and Servo Drive

To use an absolute encoder, you must use a specified combination of PCU and Servo Drive parameter settings. Set according to the combination of the table below.

PCU each axis parameter			Servo Drive parameter				
Pulse output setting	Feedback pulse input setting		G5 Series		G-series		W-series
Pulse Output Direction	Feedback Pulse Input Method	Feedback Pulse Input Direction	Command Pulse Rotation Direction Switch (Pn006)	Encoder Output Direction Switch (Pn012)	Command Pulse Rotation Direction Switch (Pn41)	Encoder Output Direction Switch (Pn41)	Reverse Rotation Mode (Pn000.0)
0: Output forward direction pulse/ phase A advance pulse when the command is issued for the forward direction.	2: Phase difference pulse input (Quadruple) (*)	1: Count as the forward direction when reverse direction pulse/ phase B advance pulse are input.	0: Motor rotation in the direction according to command pulse (*)	0: Phase B logic: No reverse turn (*)	0: Motor rotation in the direction according to command pulse (*)	0: Phase B output: No reverse turn (*)	0: Rotation in reverse direction upon + command (*)
1: Output reverse direction pulse/ phase B advance pulse when the command is issued for the forward direction.		0: Count as the forward direction when forward direction pulse/ phase A advance pulse are input.					

Note. Set values above are default settings for each equipment. Do not change the settings.

Also, set the encoder input divider as follows.

PCU each axis parameter	Servo Drive parameter				
Feedback pulse input setting	G5 Series		G-series		W-series
Number of feedback pulses per motor rotation	Encoder Divider Numerator Setting (Pn011)	Encoder Divider Denominator Setting (Pn503)	Encoder Divider Numerator Setting (Pn44)	Encoder Divider Denominator Setting (Pn45)	Encoder Divider Setting (Pn201)
A × 4	A	0	A	0	A

For A, set the same value within the range of Servomotor/Servo Drive resolutions.

[Example] Default setting for G-series Servo: Pn44 = 2,500 (Pn45 = 0)
Number of PCU feedback pulses per motor rotation = 2,500 × 4 = 10,000. Accordingly, set 10,000.

4-7 Origin Return

Use Origin Return to return the axis from a desired position to the origin. This is executed the moment the Origin Return turns ON.
For the input of Origin Return, refer to "Manual Operation Command Memory Area" on page 4-4.

📝 **Precautions for Correct Use**

♦ Execute Origin Return after the origin determination. If the origin is not determined, a present position unknown error (error code: 6006) is generated.

Axis Parameter Settings

Origin Return is a function which you use after the origin determination by Origin Search or present position preset. Accordingly, you need to set the same common parameters and axis parameters which you set for Origin Search.
This section explains the axis parameters that are used exclusively for Origin Return, in addition to the parameters set for Origin Search.

1. **Click [Axis Parameter] in the project tree in the PCU Setting Window.**
   The window for setting [Axis Parameter] appears.
2. **Select [Origin Return Setting] under [Parameter Type].**
   Set [Origin Return Speed], [Origin Return Acceleration Time] and [Origin Return Deceleration Time].

Origin Return Setting

Parameter name	Function	Setting range	Unit	Default value
Origin Return Speed	Set the speed of Origin Return.	1 to 4,000,000[*1]	Command unit/s	10,000
Origin Return Acceleration Time	Set the acceleration time of Origin Return.	0 to 250,000	ms	1,000
Origin Return Deceleration Time	Set the deceleration time of Origin Return.	0 to 250,000	ms	1,000

*1. This setting range is based on the pulse unit.

Origin Return Speed
Set the speed of Origin Return.

Origin Return Acceleration Time and Origin Return Deceleration Time
Set the acceleration time and deceleration time of Origin Return.
For Origin Return Acceleration Time and Origin Return Deceleration Time, their operation depends on [Acceleration Time Specification].
For details, refer to "Acceleration/Deceleration Setting" on page 4-17 and "Acceleration/Deceleration Time Selection" on page 4-18.

Timing Chart   4-46

The chart below shows the Origin Return timing chart of axis 1.
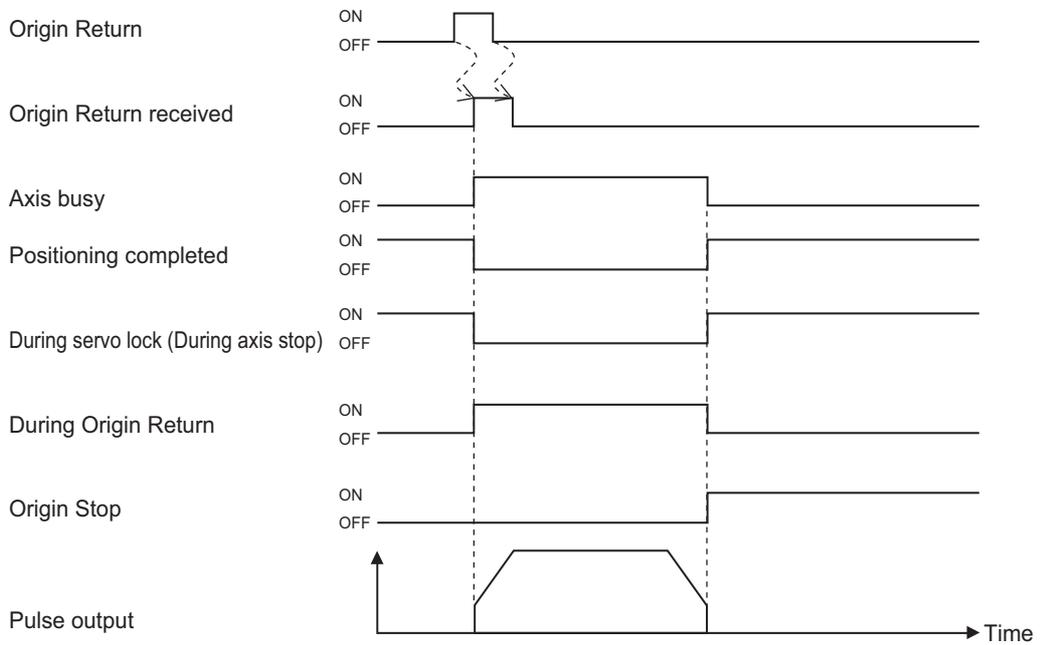
5

Setting Data

This chapter explains the overall data configuration, common parameters, each axis parameter and other data which you use on this PCU.

5

Setting Data

5-1 Overall Structure

This section explains an outline of data exchange between the PLC and PCU.

The PLC and PCU exchange data as shown below.

5
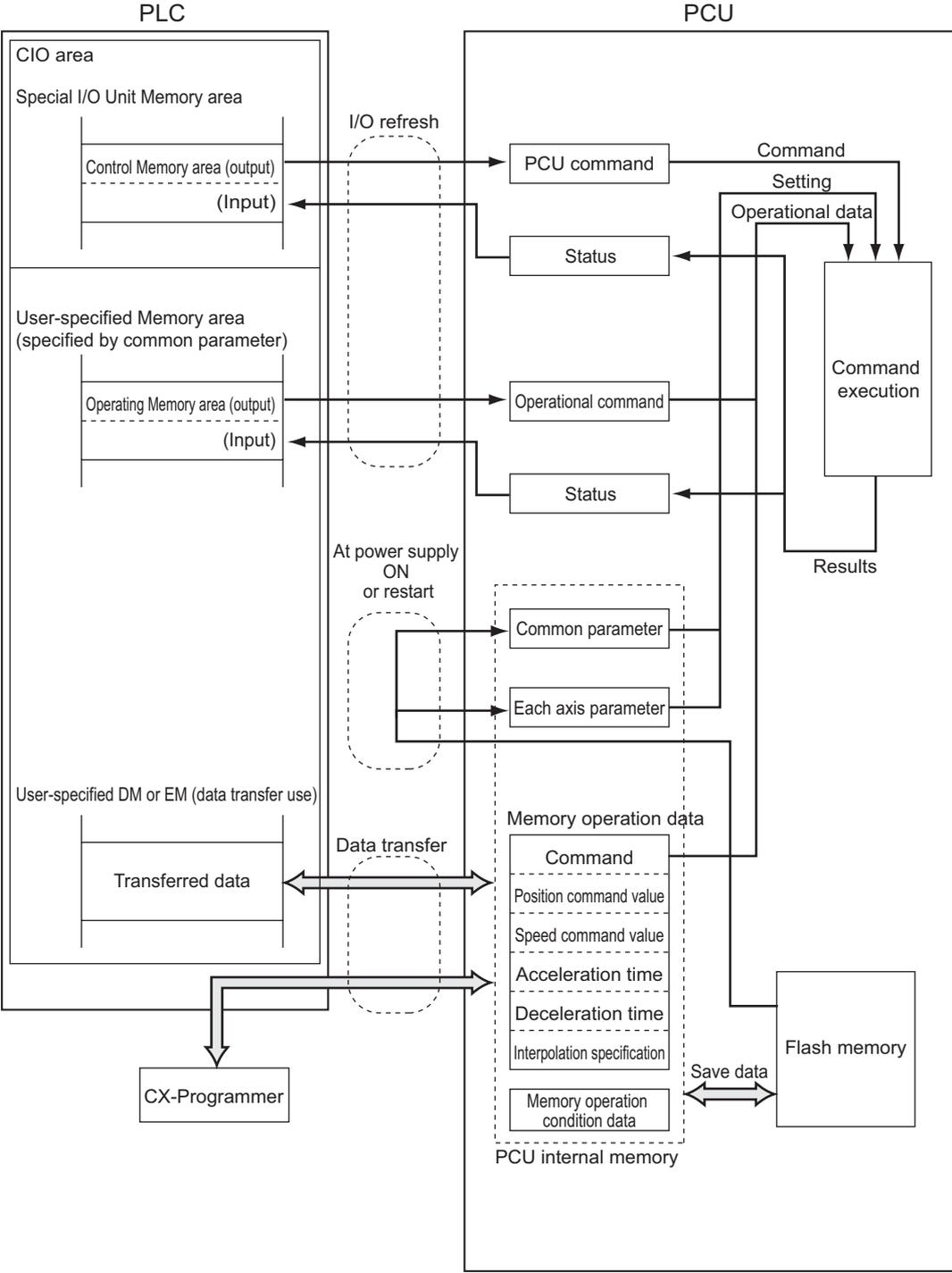
Setting Data

Parameters and Memory Areas List

The table below shows 11 types of data and memory areas which the PCU handles.

Parameter Data

Data name	Description	Setting location
Common parameters	These parameters set the basic allocations in the Direct Operation Command Memory area which are necessary to operate the PCU. You must set common parameters when you use the PCU.	Internal flash memory of the PCU
Axis parameters	These parameters set the pulse output method, input signal logic, command position unit, maximum speed of each axis, and other items that relate to axis operation.	
Memory operation parameters	These parameters set the configuration axes, interpolation operation and other items that relate to memory operation.	

Memory Area

Data name	Description	Setting location
PCU Control Memory areas	Data read/write, error reset, error flags, error codes and other items that relate to the PCU status are allocated in these areas.	PLC special I/O Unit area
Manual Operation Command Memory areas	Servo lock, Origin Search, JOG, inching, Origin Return and other items that relate to manual operation are allocated in these areas.	Use the CIO area, WR area, HR area, DM area and EM area in the PLC. Use common parameters to set these areas.
Direct Operation Command Memory areas	Position data, speed data, acceleration/deceleration time and other items that relate to direct operation, as well as starting bits for relative movement, absolute movement, etc. are allocated in these areas.	
Axis Status Memory areas	Busy flag for input status, servo locking, positioning completed, zones, axis error codes, present position monitor and other items that relate to axes are allocated in these areas.	
Memory Operation Command Memory areas	Sequence numbers for output status, M code reset, teaching address and other items that relate to memory operation are allocated in these areas.	
Memory Operation Status Memory areas	Memory operation errors for input status, memory operation error codes, M strobes, M codes and other items that relate to memory operation are allocated in these areas.	

Memory Operation Data

Data name	Description	Setting location
Memory operation data	These data set operation sequences, positions, speeds, acceleration/deceleration times and other items that relate to memory operation.	Internal flash memory of the PCU
Memory operation condition data	These data set conditional expressions for condition data, comparison area, timers, counters and other items that relate to memory operation.	

5

Setting Data

Data Setting with CX-Programmer

CX-Programmer supports the data editing below.

- Common parameters
- Axis parameters
- Memory operation parameters
- Memory operation data
- Memory operation condition data

This section explains procedures to edit data on the data setting window of CX-Programmer.

Editing Procedures for Common Parameters/Axis Parameters/Memory Operation Parameters

1. **In the IO Table Window of CX-Programmer, select and double-click the PCU.**
   The PCU Setting Window opens.

2. **In the project tree in the PCU Setting Window, select the parameter you want to edit.**

3. **Edit the parameter on the edit window that appears on the right side.**

Editing Procedures for Memory Operation Data

1. **In the IO Table Window of CX-Programmer, select and double-click the PCU.**
   The PCU Setting Window opens.

2. **In the project tree in the PCU Setting Window, select the [Sequence Data] you want to edit.**

3. **The edit window appears on the right side. Select the number of [Sequence Data] you want to edit.**

4. **Select [Command].**

5. **When the necessary parameter appears on the right side of [Command], select or enter a desired setting.**
   To disable [Command], tick [Invalid].

Editing Procedures for Memory Operation Condition Data

1. **In the IO Table Window of CX-Programmer, select and double-click the PCU.**
   The PCU Setting Window opens.

2. **In the project tree in the PCU Setting Window, select [Condition Data] under [Memory Operation Data].**

3. **The edit window appears on the right side. Click the row that shows the number of [Condition Data] you want to edit.**

4. **Select [Type].**

5. **Select or enter a desired condition in the displayed dialog box for editing detailed conditions.**

6. **Select [Edge Selection].**

5-2 Common Parameters

For common parameters, specify the axis parameters and Operation Data Setting areas that are necessary in axis operation. You must set common parameters when you use the PCU, but you only need to set the necessary parameters for operation.

Common Parameter areas are allocated to the internal flash memory of the PCU.

Accordingly, use CX-Programmer to set these parameters.

Common Parameters List

General name	Parameter name	Reference page	Valid timing
Operation memory area allocation setting	Manual Operation Command Memory Area Selection	5-7	At power supply ON, restart or setup
	First Word of Manual Operation Command Memory Area		
	Direct Operation Command Memory Area Selection	5-8	
	First Word of Direct Operation Command Memory Area		
	Memory Operation Command Memory Area Selection	5-9	
	First Word of Memory Operation Command Memory Area		
	Axis Status Memory Area Selection	5-9	
	First Word of Axis Status Memory Area		
	Memory Operation Status Memory Area Selection	5-10	
	First Word of Memory Operation Status Memory Area		
Synchronous data send selection	Synchronous Data Send Selection 1	5-11	
	Synchronous Data Send Selection 2		
	Synchronous Data Send Selection 3		
	Synchronous Data Send Selection 4		
	Synchronous Data Send Selection 5		
	Synchronous Data Send Selection 6		
	Synchronous Data Send Selection 7		
	Synchronous Data Send Selection 8		

5

Setting Data

General name	Parameter name	Reference page	Valid timing
MPG magnification setting	MPG Magnification 1 (Numerator)	5-12	Always
	MPG Magnification 1 (Denominator)		
	MPG Magnification 2 (Numerator)		
	MPG Magnification 2 (Denominator)		
	MPG Magnification 3 (Numerator)		
	MPG Magnification 3 (Denominator)		
	MPG Magnification 4 (Numerator)		
	MPG Magnification 4 (Denominator)		
Latch function setting	Latch 1 Object Axis Selection	5-12	At power supply ON, restart or setup
	Latch 2 Object Axis Selection		
	Latch 3 Object Axis Selection		
	Latch 4 Object Axis Selection		

Operation Memory Area Allocation Setting

Allocate the Operation I/O Memory areas. To operate the axes, you only need to allocate the Operation I/O Memory areas which you use.

The Operation Memory area allocation setting parameters become enabled at power supply ON, restart, or setup.

Manual Operation Command Memory Area Selection

You can select one of these 5 areas.

Area	Area name	Setting word range
No setting	–	–
CIO Area	Core I/O Area	0000 to 6143 words
WR Area	Work Area	W000 to W511 words
HR Area	Holding Area	H000 to H511 words
DM Area	Data Memory Area	D00000 to D32767 words
EM Area	Extended Data Memory Area	E00_00000 to E1C_32767 words[1]

*1. The number of available banks varies depending on the CPU.

First Word of Manual Operation Command Memory Area

Specify the first word of the memory area which you specified under Manual Operation Command Memory area selection.

5

Precautions for Correct Use

⬩ A Manual Operation Command Memory area uses 2 words per axis. Set the first word so that the memory areas that correspond to the number of axes which you use do not exceed the setting word range of each area.

⬩ Axis numbers, up to the highest number you use for each axis are allocated in the memory area. Unused axis numbers between used axis numbers are also occupied.

Reference

⬩ For details on the Manual Operation Command areas, refer to "Manual Operation Command Memory Area" on page 5-67.

Direct Operation Command Memory Area Selection

You can select one of these 5 areas.

Area	Area name	Setting word range
No setting	–	–
CIO Area	Core I/O Area	0000 to 6143words
WR Area	Work Area	W000 to W511 words
HR Area	Holding Area	H000 to H511 words
DM Area	Data Memory Area	D00000 to D32767 words
EM Area	Extended Data Memory Area	E00_00000 to E1C_32767 words[1]

*1. The number of available banks varies depending on the CPU.

First Word of Direct Operation Command Area

Specify the first word of the memory area which you specified under Direct Operation Command Memory area selection.

Precautions for Correct Use

⬩ A Direct Operation Command Memory area uses 12 words per axis. Set the first word so that the memory areas that correspond to the number of axes which you use do not exceed the setting word range of each area.

⬩ Axis numbers, up to the highest number you use for each axis are allocated in the memory area. Unused axis numbers between used axis numbers are also occupied.

Reference

⬩ For details on the Direct Operation Command memory areas, refer to "Direct Operation Command Memory Area" on page 5-68.

Memory Operation Command Memory Area Selection

You can select one of these 5 areas.

Area	Area name	Setting word range
No setting	–	–
CIO Area	Core I/O Area	0000 to 6143 words
WR Area	Work Area	W000 to W511 words
HR Area	Holding Area	H000 to H511 words
DM Area	Data Memory Area	D00000 to D32767 words
EM Area	Extended Data Memory Area	E00_00000 to E1C_32767 words[1]

*1. The number of available banks varies depending on the CPU.

First Word in Memory Operation Command Memory Area

Specify the first word in the memory area you specified under Memory Operation Command Memory area selection.

Precautions for Correct Use

- A Memory Operation Command Memory area uses 3 words per task. Set the first word so that the areas that correspond to the number of tasks which you use do not exceed the setting word range of each area.
- Task numbers, up to the highest number you use for each task are allocated in the memory area. Unused task numbers between used task numbers are also occupied.

Reference

Axis Status Memory Area Selection

You can select one of these 5 areas.

Area	Area name	Setting word range
No setting	–	–
CIO Area	Core I/O Area	0000 to 6143words
WR Area	Work Area	W000 to W511 words
HR Area	Holding Area	H000 to H511 words
DM Area	Data Memory Area	D00000 to D32767 words
EM Area	Extended Data Memory Area	E00_00000 to E1C_32767 words[1]

*1. The number of available banks varies depending on the CPU.

First Word in Axis Status Memory Area

Specify the first word in the memory area which you specified under Axis Status Memory area selection.

Precautions for Correct Use

• An Axis Status Memory area uses 13 words per axis. Set the first word so that the memory areas that correspond to the number of axes which you use do not exceed the setting word range of each area.

• Axis numbers, up to the highest number you use for each axis are allocated in the memory area. Unused axis numbers between used axis numbers are also occupied.

Reference

• For details on the Axis Status Memory areas, refer to "Axis Status Memory Area" on page 5-72.

Memory Operation Status Memory Area Selection

You can select one of these 5 areas.

Area	Area name	Setting word range
No setting	–	–
CIO Area	Core I/O Area	0000 to 6143 words
WR Area	Work Area	W000 to W511 words
HR Area	Holding Area	H000 to H511 words
DM Area	Data Memory Area	D00000 to D32767 words
EM Area	Extended Data Memory Area	E00_00000 to E1C_32767 words[1]

*1. The number of available banks varies depending on the CPU.

First Word in Memory Operation Status Memory Area

Specify the first word in the memory area which you specified under Memory Operation Status Memory area selection.

Precautions for Correct Use

• A Memory Operation Status Memory area uses 6 words per task. Set the first word so that the memory areas that correspond to the number of tasks which you use do not exceed the setting word range of each area.

• Task numbers, up to the highest number you use for each task are allocated in the memory area. Unused task numbers between used task numbers are also occupied.

Reference

• For details on the Memory Operation Status Memory areas, refer to "Memory Operation Status Memory Area" on page 5-83.

Synchronous Data Send Selection

Valid when synchronous unit operation is performed.

Parameter name	Function	Setting range	Default values
Synchronous Data Send Selection 1	Select the axis number and data type for each selected data.	0100 hex to FF04 hex	Axis 1, feedback present position
Synchronous Data Send Selection 2	The first 2 digits of the word indicate the axis number, while the last 2 digits indicate the data type.	0100 hex to FF04 hex	Axis 2, feedback present position
Synchronous Data Send Selection 3		0100 hex to FF04 hex	Axis 3, feedback present position
Synchronous Data Send Selection 4	Axis number 01 to 04: Physical axis number	0100 hex to FF04 hex	Axis 4, feedback present position
Synchronous Data Send Selection 5	F1: External encoder axis	0100 hex to FF04 hex	Axis 1, feedback present position
Synchronous Data Send Selection 6	Data type 00: Feedback present position 01: Command present position	0100 hex to FF04 hex	Axis 2, feedback present position
Synchronous Data Send Selection 7	02: Position error 03: Present speed (calculation from the feedback position)	0100 hex to FF04 hex	Axis 3, feedback present position
Synchronous Data Send Selection 8	04: Present command speed	0100 hex to FF04 hex	Axis 4, feedback present position

MPG Magnification Setting

You can change the magnification of MPG setting.
The MPG magnification setting is always enabled.

Parameter name	Function	Setting range	Unit	Default values
MPG Magnification 1 (Numerator)	Set the magnification 1 for MPG pulses. (Numerator)	−10,000 to 10,000	–	1
MPG Magnification 1 (Denominator)	Set the magnification 1 for MPG pulses. (Denominator)	1 to 10,000	–	1
MPG Magnification 2 (Numerator)	Set the magnification 2 for MPG pulses. (Numerator)	−10,000 to 10,000	–	10
MPG Magnification 2 (Denominator)	Set the magnification 2 for MPG pulses. (Denominator)	1 to 10,000	–	1
MPG Magnification 3 (Numerator)	Set the magnification 3 for MPG pulses. (Numerator)	−10,000 to 10,000	–	100
MPG Magnification 3 (Denominator)	Set the magnification 3 for MPG pulses. (Denominator)	1 to 10,000	–	1
MPG Magnification 4 (Numerator)	Set the magnification 4 for MPG pulses. (Numerator)	−10,000 to 10,000	–	1,000
MPG Magnification 4 (Denominator)	Set the magnification 4 for MPG pulses. (Denominator)	1 to 10,000	–	1

Latch Function Setting

Select the object axis of each present position latch when you set the interrupt input to present position latch.
Latch function setting becomes enabled at power supply ON, restart, or setup.

Parameter name	Function	Setting range	Default values
Latch 1 Object Axis Selection	Select the object axis for latch 1. 1: Axis 1, 2: Axis 2, 3: Axis 3, 4: Axis 4 F1: External encoder axis	1 to 4, F1	1
Latch 2 Object Axis Selection	Select the object axis for latch 2. 1: Axis 1, 2: Axis 2, 3: Axis 3, 4: Axis 4 F1: External encoder axis	1 to 4, F1	2
Latch 3 Object Axis Selection	Select the object axis for latch 3. 1: Axis 1, 2: Axis 2, 3: Axis 3, 4: Axis 4 F1: External encoder axis	1 to 4, F1	3
Latch 4 Object Axis Selection	Select the object axis for latch 4. 1: Axis 1, 2: Axis 2, 3: Axis 3, 4: Axis 4 F1: External encoder axis	1 to 4, F1	4

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5-3 Axis Parameters

Axis parameters set the pulse output method, input signal logic, Origin Search and other items that relate to axis operation, for each axis which you control on the PCU.

5 sets of axis parameters are available, which include parameters for 4 axes and 1 external encoder axis. However, for external encoder axis parameters, there are a limited number of parameters that you can set. Therefore, only the external encoder axis parameters you can set are denoted by the External icon. Unused external encoder parameters are fixed to 0.

Note, however, that the parameter settings are the same among all axes, and therefore this section explains only the parameters for 1 axis.

Axis Parameters List

Axis parameters are available for each axis, and you must set them for each axis.

General name	Parameter name	Reference page	Valid timing
Axis type setting	Axis Type	5-17	At power supply ON, restart or setup
IO function setting	I/O Logic Selection	5-18	
	I/O Function Selection	5-19	
	Emergency Stop Input Stop Method	5-20	
	Limit Input Stop Method	5-20	
	Drive Alarm Input Stop Method	5-21	
	Error Counter Reset Output Time	5-21	
	Drive Alarm Reset Output Time	5-21	
	Positioning Monitoring Time	5-22	
Acceleration/ Deceleration setting	Maximum Speed (Rightmost Word)	5-23	
	Maximum Speed (Leftmost Word)		
	Starting Speed (Rightmost Word)		
	Starting Speed (Leftmost Word)		
	Operation at Reverse Rotation Command		
	Acceleration/Deceleration Curve Selection		
	Acceleration/ Deceleration Time Selection		
	Single Axis Deceleration Time at Interpolation (Rightmost Word)		Always
	Single Axis Deceleration Time at Interpolation (Leftmost Word)		
Backlash compensation function setting	Backlash Output Method	5-28	At power supply ON, restart or setup
	Backlash Compensation Amount		
	Backlash Compensation Speed (Rightmost Word)		
	Backlash Compensation Speed (Leftmost Word)		
Pulse output setting	Pulse Output Method	5-28	
	Pulse Output Direction		

General name	Parameter name	Reference page	Valid timing
Command position unit setting	Axis Feeding Mode `External`		At power supply ON, restart or setup
	Rotation Axis Upper Limit (Rightmost Word) `External`		
	Rotation Axis Upper Limit (Leftmost Word) `External`		
	Display Unit `External`	5-30	At power supply ON, restart or setup
	Command Pulse Count per Motor Rotation (Rightmost Word)		
	Command Pulse Count per Motor Rotation (Leftmost Word)		
	Work Travel Distance per Motor Rotation (Rightmost Word) `External`		
	Work Travel Distance per Motor Rotation (Leftmost Word) `External`		
	Unit Multiplier `External`		
	Compensation Ratio Numerator (Rightmost Word)		
	Compensation Ratio Numerator (Leftmost Word)		
	Compensation Ratio Denominator (Rightmost Word)		
	Compensation Ratio Denominator (Leftmost Word)		
	Starting Present Position Clear Enable Selection	5-35	
Software limit setting	Software Limit Function Selection		
	Reverse Direction Software Limit (Rightmost Word)		
	Reverse Direction Software Limit (Leftmost Word)	5-36	
	Forward Direction Software Limit (Rightmost Word)		
	Forward Direction Software Limit (Leftmost Word)		
Zone setting	Zone 0 Function Selection		Always
	Zone 0 Lower Limit (Rightmost Word)		
	Zone 0 Lower Limit (Leftmost Word)		
	Zone 0 Upper Limit (Rightmost Word)		
	Zone 0 Upper Limit (Leftmost Word)		
	Zone 1 Function Selection	5-38	
	Zone 1 Lower Limit (Rightmost Word)		
	Zone 1 Lower Limit (Leftmost Word)		
	Zone 1 Upper Limit (Rightmost Word)		
	Zone 1 Upper Limit (Leftmost Word)		
	Zone 2 Function Selection		

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General name	Parameter name	Reference page	Valid timing
Zone setting (Continued)	Zone 2 Lower Limit (Rightmost Word)	5-38	
	Zone 2 Lower Limit (Leftmost Word)		
	Zone 2 Upper Limit (Rightmost Word)		
	Zone 2 Upper Limit (Leftmost Word)		
Interrupt feeding setting	Interrupt Feeding Setting	5-40	
	Interrupt Feeding Amount (Rightmost Word)		
	Interrupt Feeding Amount (Leftmost Word)		
Origin Search setting	Origin Search Operation Mode	5-41	Always
	Operation at Forward Direction Limit Input		
	Operation at Reverse Direction Limit Input		
	Origin Search Direction		
	Origin Search Holding Time		
	Origin Input Mask Amount (Rightmost Word)		
	Origin Input Mask Amount (Leftmost Word)		
	Origin Compensation Value (Rightmost Word)		
	Origin Compensation Value (Leftmost Word)		
	Origin Position Offset (Rightmost Word)		
	Origin Position Offset (Leftmost Word)		
	Origin Search Speed (Rightmost Word)		
	Origin Search Speed (Leftmost Word)		
	Origin Search Approach Speed (Rightmost Word)		
	Origin Search Approach Speed (Leftmost Word)		
	Origin Search Compensation Speed (Rightmost Word)		
	Origin Search Compensation Speed (Leftmost Word)		
	Origin Search Acceleration Time (Rightmost Word)		
	Origin Search Acceleration Time (Leftmost Word)		
	Origin Search Deceleration Time (Rightmost Word)		
	Origin Search Deceleration Time (Leftmost Word)		

General name	Parameter name	Reference page	Valid timing
Origin Return setting	Origin Return Speed (Rightmost Word)	5-44	Always
	Origin Return Speed (Leftmost Word)		
	Origin Return Acceleration Time (Rightmost Word)		
	Origin Return Acceleration Time (Leftmost Word)		
	Origin Return Deceleration Time (Rightmost Word)		
	Origin Return Deceleration Time (Leftmost Word)		
JOG/ Inching setting	Inching Width	5-45	
	JOG/ Inching Speed 1 (Rightmost Word)		
	JOG/ Inching Speed 1 (Leftmost Word)		
	JOG/ Inching Speed 2 (Rightmost Word)		
	JOG/ Inching Speed 2 (Leftmost Word)		
	JOG Acceleration Time (Rightmost Word)		
	JOG Acceleration Time (Leftmost Word)		
	JOG Deceleration Time (Rightmost Word)		
	JOG Deceleration Time (Leftmost Word)		
Feedback pulse input setting	Feedback Pulse Input Method `External`	5-46	At power supply ON, restart or setup
	Feedback Pulse Input Direction `External`		
	Feedback Pulse Input Backlash Enable		
	Feedback Pulse Input Position Monitoring Enable		
	Feedback Pulse Input Position Reflection Method Selection		
	Feedback Pulse Count per Motor Rotation (Rightmost Word) `External`	5-49	
	Feedback Pulse Count per Motor Rotation (Leftmost Word) `External`		
	Encoder Type	5-49	At origin confirmation
	ABS Encoder Origin Position Offset (Rightmost Word)		
	ABS Encoder Origin Position Offset (Leftmost Word)		
Expanded monitor setting	Expanded Monitor Type	5-49	Always
Error monitor function setting	Error Monitor Setting	5-51	Always
	Feedback Speed Sampling Period		
	Speed Error Monitor Wait Time		
	Speed Error Limit Value		
	Position Error Limit Value		

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General name	Parameter name	Reference page	Valid timing
Synchronous Unit operation function setting	Synchronous Group Stop Selection	5-53	At power supply ON, restart or setup
	Synchronous Feeding Command Position Data		Always

Axis Type Setting

Set the axis type. When Virtual Axis or unused axis is selected, I/O wiring is not necessary. Axis type becomes enabled at power supply ON, restart, or setup.

Parameter name	Function	Setting range	Unit	Default values
Axis Type	Set the axis type. 0: Physical axis, 1: Virtual axis, 2: Unused axis	0 to 2	–	0[*1]

*1. For a 2-axis PCU, the default value is [2] for axis 3 and axis 4.

📝 **Reference**

⬧ Select [Physical Axis] for axes that are actually wired to operate, and set [Unused Axis] for unused axes.

Virtual Axis

If you select [1: Virtual Axis] under axis type setting, you can use the axis as a Virtual Axis. A Virtual Axis does not have any actual input/output and is used only for calculation purposes. In a similar manner as a Physical Axis that actually outputs pulses, a Virtual Axis changes its present position or status only on the PCU based on the command for each axis operation.
A Virtual Axis is different from a Physical Axis in the points below:

⬧ The command present position is the only present position. The feedback present position value is always the same as the command present position. An attempt to execute present position preset to the feedback present position generates an error and fails.
⬧ All external inputs/outputs function as general-purpose inputs/outputs. However, only the interrupt input is an exception because you can use it as a latch input.
⬧ There is no servo unlock status. It is handled as servo lock status at all times.
⬧ With the open collector output type, the setting range of the maximum speed for each axis parameter is up to 500 kpps in the case of a Physical Axis. However, the upper limit becomes 4 Mpps for a Virtual Axis.
⬧ The backlash compensation function is disabled, regardless of the settings.

📒 **Precautions for Correct Use**

⬧ When an origin search or interrupt feeding is started for a virtual axis, the axis will continue moving because there are no external input signals, such as an origin input or an interrupt input.
To set the machine origin for a virtual axis, use the Present Position Preset Bit.
⬧ The present position latch function cannot be used for a virtual axis.

I/O Function Setting

I/O Logic Selection

Select the input type for various sensors.
I/O logic selection becomes enabled at power supply ON, restart, or setup.

Parameter name	Function	Setting range	Unit	Default values
Forward Direction Limit Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	0
Reverse Direction Limit Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	0
Origin Proximity Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	1
Origin Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	1
Interrupt Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	1
Emergency Stop Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	0
Positioning Completed Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	1
Drive Alarm Input Logic	Select the contact for input signals. 0: N.C. bit, 1: N.O. bit	0 to 1	–	0

I/O Function Selection

Select the functions of various I/O signals.
I/O function selection becomes enabled at power supply ON, restart, or setup.

Parameter name	Function	Setting range	Unit	Default values
RUN Output Function[1],[2]	Select the function of the RUN output. 0: Use as general-purpose output 1: Use as RUN output	0 to 1	–	1
Drive Alarm Reset Output Function [2]	Select the function of the drive alarm reset output. 0: Use as general-purpose output 1: Use as drive alarm reset output	0 to 1	–	1
Error Counter Reset Output Function[2]	Select the function of the error counter reset output. 0: Use as general-purpose output 1: Use as error counter reset output	0 to 1	–	1
Origin Proximity Input Signal Selection[3]	Select the input destination of the origin proximity input. 0: Use Origin Proximity Input Internal Memory area as the origin proximity input 1: Use external origin proximity input	0 to 1	–	1
Origin Input Signal Selection	Select the input destination of the origin input. 0: Use Z-phase input as the origin 1: Use external origin input	0 to 1	–	0
Interrupt Input Function[4]	Select the function of the interrupt input. 0: Use as interrupt feeding trigger 1: Use as present position latch signal	0 to 1	–	0
Positioning Completed Input Function[5],[6]	Select the function of the positioning completed input. 0: Use as general-purpose input 1: Use as positioning completed input	0 to 1	–	1
Drive Alarm Input Selection[5]	Select the function of the drive alarm input. 0: Use as general-purpose input 1: Detect drive alarm input as an error	0 to 1	–	1

[1]. If you use an absolute encoder system, be sure to use this signal as a RUN output. If you use an absolute encoder system, read the present position when the RUN output turns ON, upon which the origin is confirmed.

[2]. In the case of a Virtual Axis, this setting becomes disabled and the signal is treated as a general-purpose output.

[3]. If you select [0] for origin proximity input signal selection, bits 0 to 3 of the origin proximity input internal bit correspond to the origin proximity inputs of axes 1 to 4, respectively. Also, you can use the external origin proximity input signals as general purpose inputs.
In the case of a Virtual Axis, this setting becomes disabled. You can use the external origin proximity input signals as general purpose inputs.

[4]. If you select [1] for interrupt input function selection, the target axis of latch depends on [Latch Signal Setting] under [Common Parameter].

[5]. In the case of a Virtual Axis, this setting becomes disabled and the signals are treated as general purpose inputs.

[6]. If you set [0] for the Position Monitoring Time axis parameter, the positioning completed input will not be monitored regardless of the Positioning Completed Input Function parameter set. For details, refer to "In-position Check" on page 9-24.

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Emergency Stop Input Stop Method

Parameter name	Function	Setting range	Unit	Default values
Emergency Stop Input Stop Method[1],[2]	Select the function to be implemented when an emergency stop input is input. 0: Immediate stop of pulse output (Deviation pulse stop) 2: Immediate stop of pulse output, and output the error counter reset signal[3] 3: Immediate stop of pulse output, output the error counter reset signal[3], and RUN signal[4] OFF. 4: Immediate stop of pulse output, and RUN signal[4] OFF.	0, 2 to 4	–	0

*1. [1] is not available for emergency stop input stopping method.
In the case of a Virtual Axis, this setting becomes disabled and the emergency stop inputs are treated as general-purpose inputs.

*2. If you do not select for RUN output selection nor error counter reset output function, these parameters operate the same as when you set them to [0].

*3. The signal is output only when you set error counter reset output function as error counter reset output.

*4. Turn OFF the signal only when you set RUN output function to RUN output.

Limit Input Stop Method

Parameter name	Function	Setting range	Unit	Default values
Limit Input Stop Method[1]	Select the function to be implemented when a forward/reverse direction limit signal is input. 0: Immediate stop of pulse output (Deviation pulse stop) 1: Deceleration stop of pulse output 2: Immediate stop of pulse output, and output the error counter reset signal[2] 3: Immediate stop of pulse output, output the error counter reset signal[2], and RUN signal[3] OFF.[4] 4: Immediate stop of pulse output, and RUN signal[3] OFF.	0 to 4	–	0

*1. In the case of a Virtual Axis, this setting becomes disabled and the limit input signals are treated as general-purpose inputs.

*2. The signal is output only when you set error counter reset output function as error counter reset output.

*3. Turn OFF the signal only when you set RUN output function to RUN output.

*4. If you do not select for RUN output selection nor error counter reset output function, these parameters operate the same as when you set them to [0].

Drive Alarm Input Stop Method

Parameter name	Function	Setting range	Unit	Default values
Drive Alarm Input Stop Method[1]	Select the function to be implemented when a drive alarm input is input while a drive alarm is set. 0: Immediate stop of pulse output (Deviation pulse stop) 1: Deceleration stop of pulse output 2: Immediate stop of pulse output, and output the error counter reset signal[2] 3: Immediate stop of pulse output, output the error counter reset signal[2], and RUN signal[3] OFF.[4] 4: Immediate stop of pulse output, and RUN signal[3] OFF.	0 to 4	–	4

[1]. In the case of a Virtual Axis, this setting becomes disabled and the drive alarm input signal is treated as general-purpose input.

[2]. The signal is output only when you set error counter reset output function as error counter reset output.

[3]. Turn OFF the signal only when you set RUN output function to RUN output.

[4]. If you do not select for RUN output selection nor error counter reset output function, these parameters operate the same as when you set them to [0].

Error Counter Reset Output Time

Parameter name	Function	Setting range	Unit	Default values
Error Counter Reset Output Time[1]	Set the automatic output time for error counter reset output.[2]	1 to 1,000	ms	20

[1]. In the case of a Virtual Axis, this setting becomes disabled and the error counter reset output is treated as a general-purpose output.

[2]. Depending on the operating pattern of Origin Search, the output time becomes longer than the set value by 2 control cycles of the PCU.

Drive Alarm Reset Output Time

Parameter name	Function	Setting range	Unit	Default values
Drive Alarm Reset Output Time[1]	Set the automatic output time when the drive alarm reset output is enabled. (upon an error reset)	1 to 1,000	ms	200

[1]. In the case of a Virtual Axis, this setting becomes disabled and the drive alarm reset output is treated as a general-purpose output.

Positioning Monitoring Time

Parameter name	Function	Setting range	Unit	Default values
Positioning Monitoring Time[1]	Set the monitoring time to be applied when the positioning completed input is enabled. If you set [0], it does not monitor the positioning completed signal. During Origin Search, it continues to wait for a positioning completed input when the origin input is detected. As for origin compensation operation, it does not monitor the positioning completed input. If you set any value other than [0], an error is generated when the setting exceeds the specified time.	1 to 10,000	ms	0

*1. In the case of a Virtual Axis, this setting becomes disabled and the positioning completed input is treated as general-purpose input.

Precautions for Correct Use

Even if you set [1] (use as positioning completed input) for the Positioning Completed Input Function axis parameter, setting [0] for the Position Monitoring Time disables the monitoring the positioning completed signal from the Servo Drive. If you wish to use the positioning completed signal from the Servo Drive to check the completion of the positioning operation, set any value other than [0] for the Position Monitoring Time parameter. For details, refer to "In-position Check" on page 9-24.

Reference

The operations below do not monitor the positioning completed signal.

- Synchronous feeding
- JOG operation
- MPG operation
- Deceleration stop
- Error stop
- Origin Search, duplicate starts or reversing at interrupt feeding

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Setting Data

Acceleration/Deceleration Setting

Set the maximum speed, starting speed, acceleration/deceleration time, etc.
The speed and acceleration/deceleration setting parameters become valid at power supply ON, restart or setup, except for deceleration time designation. Deceleration time designation is always enabled.

Parameter name	Function	Setting range	Unit	Default values
Maximum Speed	Specify the maximum speed of the axis.	1 to 4000000[*1],[*2]	Command unit/s	4000000[*1]
Starting Speed	Specify the starting speed of the axis.	0 to 4000000[*2]	Command unit/s	0
Operation at Reverse Rotation Command	Select the operation at reverse rotation command. 0: Deceleration stop at reverse rotation, 1: Immediate stop at reverse rotation	0 to 1	–	0
Acceleration/ Deceleration Curve Selection	Select the acceleration/deceleration curve. 0: Trapezoid, 1: S-curve (Cubic curve)	0 to 1	–	0
Acceleration/ Deceleration Time Selection	Select how to specify the acceleration/deceleration time. 0: Time from starting speed to maximum speed of each axis (Acceleration/ deceleration specified) 1: Time from present speed to target speed of each axis (Time specified)	0 to 1	–	0
Single Axis Deceleration Time at Interpolation	Set the deceleration stop time to be applied when an error occurs in any of the interpolated axes or an individual deceleration stop is executed during interpolation operation in memory operation.	0 to 250,000	ms	1,000

*1. For an axis of open-collector output type, the maximum value is 500,000 and the default value is also 500,000. In the case of a Virtual Axis, however, the above setting is applied for the open-collector output type.

*2. This setting range is based on the pulse unit.

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Maximum Speed

Register the fastest speed which you actually use. This prevents you from inadvertently using speeds exceeding the maximum speed.

For the line driver output type and Virtual Axes, the maximum speed is 4,000,000 (pps). For the open collector output type, however, the maximum speed is 500,000 (pps).

In the case of a Virtual Axis, however, the maximum value is 4,000,000 (pps) even for the open collector output type.

Also when the pulse output method is the one that uses phase difference pulses, the upper limit of the setting range of the maximum speed changes as follows according to the selected multiplication:

	Quadruple	Doubler	1 multiplier
Line driver output type	4,000,000	2,000,000	1,000,000
Open collector output type	500,000	250,000	125,000

Starting Speed

If you use a Servomotor, set [0].

If you use a stepping motor, normally you should set a value which is one-tenth to one-half the maximum self-start frequency to prevent step out at start. Also note that stepping motors generally resonate at pulse speeds of 100 to 300 Hz. Therefore, set a value higher than this range. The suitable value depends on the load condition. Check the manual for your stepping motor for details.

Operation at Reverse Rotation

Select the method to stop the axis that reverses due to duplicate starts.

[Setting patterns for deceleration stop at reverse rotation]

When there is no reverse command   When there is a reverse command
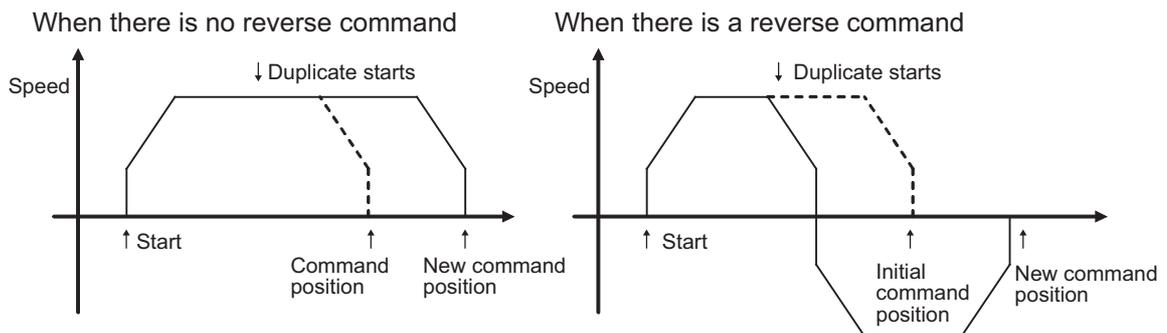
[Setting patterns for immediate stop at reverse rotation]

When there is no reverse command   When there is a reverse command

Setting Data

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Acceleration/Deceleration Curve Selection

Select the acceleration/deceleration curve.

Trapezoid

S-curve

Acceleration/Deceleration Time Selection

For the acceleration/deceleration time designation method, select the method using fixed acceleration or fixed acceleration/deceleration time.

Under the fixed acceleration method, you determine the time from the starting speed to maximum speed, so that the acceleration/deceleration time changes according to the target speed.

Under the fixed acceleration/deceleration time, you set the time from the present speed to target speed, and the acceleration/deceleration time does not change. In the case of triangle control, however, you determine the acceleration/deceleration time according to the acceleration which you calculated from the present speed, target speed and acceleration/ deceleration time. However, even for triangle control, when triggered by the Deceleration Stop Bit or error occurrence, an axis is decelerated to a stop based on the deceleration time specified for the ongoing operation.

Acceleration/deceleration specified
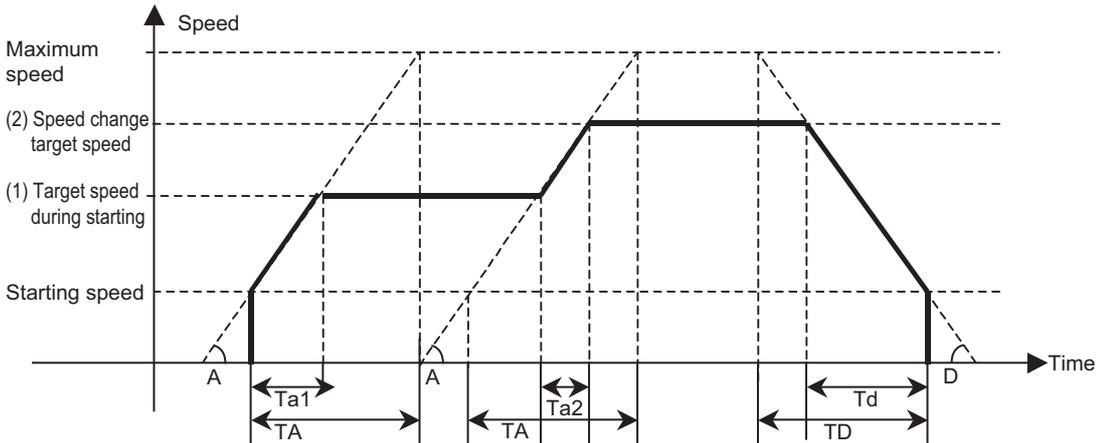
[During starting]
TA: Acceleration time
Ta1: Actual acceleration time
A: Degree of acceleration

[During speed change]
TA: Acceleration time
Ta2: Actual acceleration time
A: Degree of acceleration

[During deceleration]
TD: Deceleration time
Td: Actual deceleration time
D: Degree of deceleration

Time specified

[During starting]
TA: Acceleration time
A1: Degree of acceleration

[During speed change]
TA: Acceleration time
A2: Degree of acceleration

[During deceleration]
TD: Deceleration time
D: Degree of deceleration
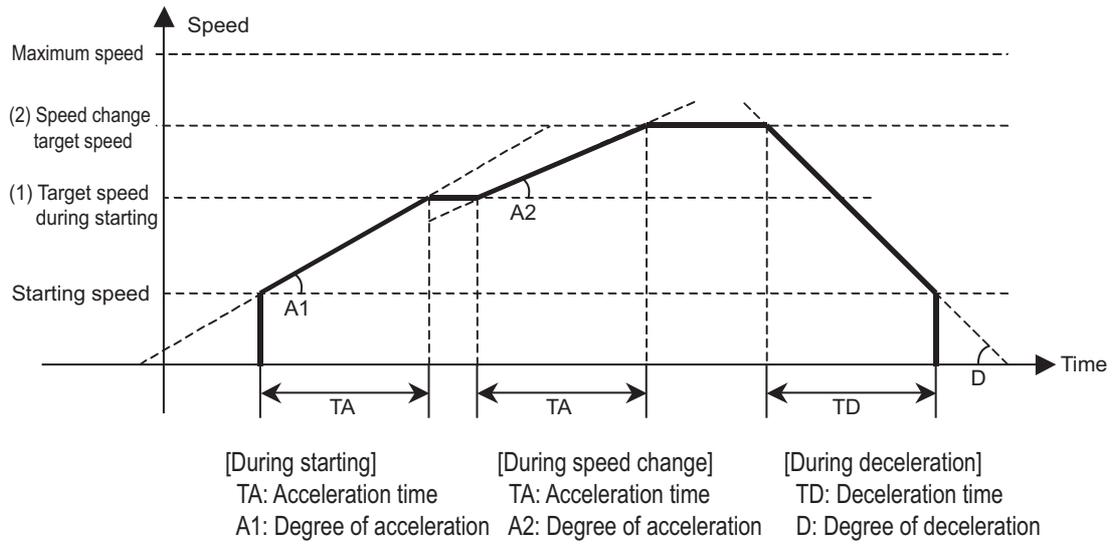
Constant acceleration/deceleration time (for triangle control)

At Startup
TA: Acceleration time
Ta: Actual acceleration time
A: Acceleration rate

TD: Deceleration time
Td: Actual deceleration time
D: Rate of deceleration

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Setting Data
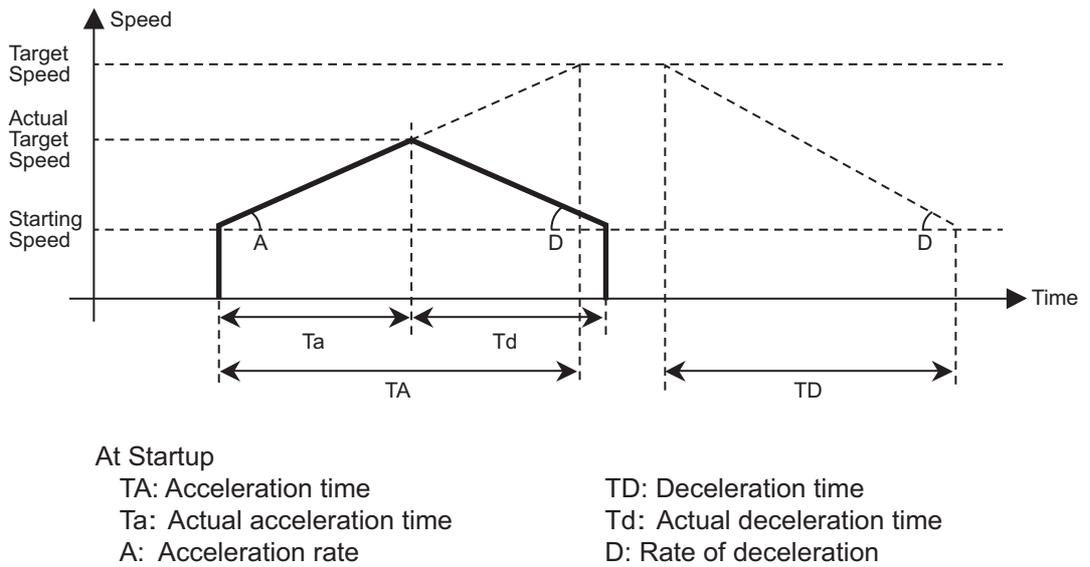
> **Precautions for Correct Use**
>
> ◆ Even with Constant Acceleration/Deceleration Time selected and triangle control enabled, when triggered by the Deceleration Stop Bit or error occurrence, an axis is decelerated to a stop based on the acceleration time specified for the ongoing operation.
> For that reason, depending on the timing in which a deceleration stop starts, an axis may go beyond the target position for the ongoing operation.
> To select Constant Acceleration/Deceleration Time, calculate the maximum value for the stopping distance and ensure safety before using this method.

Constant acceleration/deceleration time (for a deceleration stop)
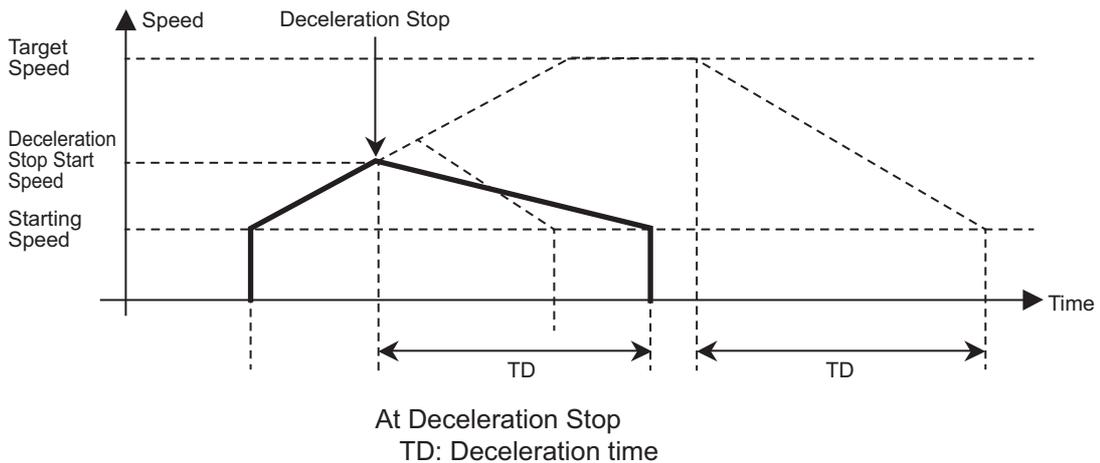
At Deceleration Stop
TD: Deceleration time

> **Reference**
>
> ◆ The axis always rotates at [Acceleration/deceleration specified] during Origin Search regardless of the setting of acceleration/deceleration time selection.
> ◆ If it exceeds a software limit in the operation below, or an overflow occurs at the command present position, the deceleration time becomes shorter.
>   ◆ Deceleration stop due to JOG OFF
>   ◆ Deceleration stop due to reversing during JOG operation
>   ◆ Deceleration stop due to reversing upon command change during direct operation

Single-axis Deceleration Time at Interpolation

This is the deceleration time to be applied when you select [Deceleration Stop] under the memory operation parameter [Interpolation Axis Stop Method]. For the setting, refer to "Interpolation Axis Stop Method" on page 5-58.
This is the time which you use for deceleration stop if any of the interpolated axes generates an error or an individual deceleration stop command is executed during interpolation of memory operation.

5

Backlash Compensation Function Setting

Set the mechanical backlash compensation.

In the case of a Virtual Axis, ignore this setting.

For backlash compensation, refer to "Backlash Compensation" on page 9-28.

Backlash compensation function setting becomes valid at power supply ON, restart, or setup.

Parameter name	Function	Setting range	Unit	Default values
Backlash Output Method	Select the backlash output method. 0: Compensation amount is superimposed at the start of positioning[1] 1: Compensation operation is performed before the start of positioning[2]	0 to 1	–	0
Backlash Compensation Amount[3]	Set the backlash compensation value.	0 to 50000[4]	Command unit	0
Backlash Compensation Speed	Set the speed at the time of backlash compensation. If you set [0], use the initial speed when the axis starts (initial acceleration speed).	0 to 4000000[4]	Command unit/s	0

[1]. Add compensation pulses to the first command value of positioning operation, to execute positioning.

[2]. Output a compensation value before positioning operation, based on the calculation of compensation pulses + compensation speed designation. Thereafter, execute positioning. However, you cannot use circular interpolation or end pattern [Continuous 3]. If you set circular interpolation or end pattern [Continuous 3], an error will occur at start.

[3]. Although you can set a desired value in the command unit, it must not exceed 50,000 pulses after electronic gear conversion.

[4]. This setting range is based on the pulse unit.

Pulse Output Setting

Select the pulse output method from the PCU.

Pulse output setting becomes valid at power supply ON, restart, or setup.

Parameter name	Function	Setting range	Unit	Default values
Pulse Output Method	Select the method of output pulses. 0: Phase difference pulse output (1 multiplier) 1: Phase difference pulse output (Doubler) 2: Phase difference pulse output (Quadruple) 3: Forward/Reverse direction pulse output 4: Pulse plus direction output	0 to 4	–	3
Pulse Output Direction[1]	Select the rotation direction of the motor. 0: Output forward direction pulse/ phase A advance pulse when the command is issued for the forward direction. 1: Output reverse direction pulse/ phase B advance pulse when the command is issued for the forward direction.	0 to 1	–	0

[1]. You can switch the rotating direction of the motor without changing the wiring.

Pulse Output Method

Phase Difference Pulse Output

Forward direction pulse output

Reverse direction pulse output

Forward/Reverse Direction Pulse Output

Forward direction pulse output

Reverse direction pulse output
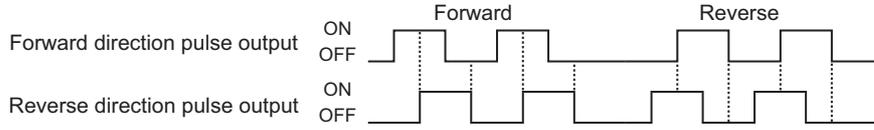
Pulse Plus Direction Output
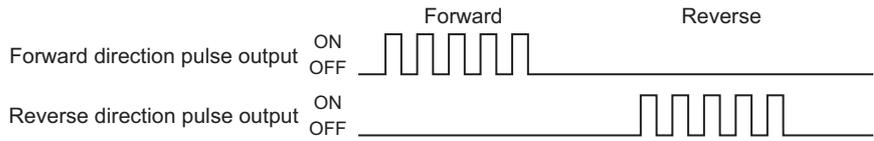
Pulse output
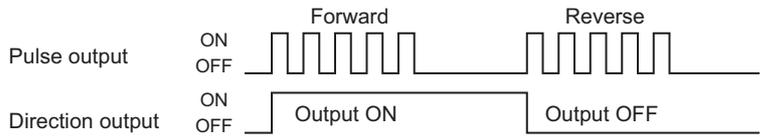
Direction output

Pulse Output Direction

You can change the rotation direction of the motor without changing the wiring.

Command Position Unit Setting

Select the coordinate system or unit system at the command position.
Command position unit setting becomes valid at power supply ON, restart, or setup.

Parameter name	Function	Setting range	Unit	Default values
Axis Feeding Mode External	Select the count mode of the command position. 0: Linear axis (Finite length) 1: Rotation axis (Infinite length)	0 to 1	–	0[*1]
Rotation Axis Upper Limit External	Set the rotation axis upper limit when you set the AXIS FEEDING mode to rotation axis.	1 to 1073741823[*2]	Command unit	1073741823
Display Unit	Select the unit of command values. 0: pulse, 1: mm, 2: degree, 3: inch	1 to 3	–	0
Command Pulse Count Per Motor Rotation	Set the number of pulses per 1 motor rotation.	1 to 1048576	Pulse	10000
Work Travel Distance Per Motor Rotation External	Set the amount of the workpiece movement per 1 motor rotation.	1 to 1048576	Display unit	10000
Unit Multiplier	Set the magnification relative to the amount of the workpiece movement per 1 motor rotation. 0: 1 time, 1: 10 times, 2: 100 times, 3: 1000 times, 4: 10000 times	0 to 4	–	0
Compensation Ratio Numerator	Compensation ratio for position command (numerator)	1 to 4294967295	–	1
Compensation Ratio Denominator	Compensation ratio for position command (denominator)	1 to 4294967295	–	1
Starting Present Position Clear Enable	Select whether to enable or disable the preset function. 0: Disable, 1: Enable	0 to 1	–	0

*1. The default setting for an external encoder axis is [1].

*2. This setting range is based on the pulse unit.

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Setting Data

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Setting Data

AXIS FEEDING Mode

Linear Axis (Finite Length)

- It uses a linear counter whose range is from −2147483648 to 2147483647, centering around 0.
- In position control, commands whose counter value overflows/underflows generate an error and you cannot execute those commands.
- An error is also generated upon interrupt input during positioning based on interrupt constant-pitch input.
- In speed control, a warning (overflow/underflow) is generated when the present position overflows/underflows the counter value, but the operation continues. However, the counter value is locked at the maximum value.
- While the counter value is locked, only JOG operation commands are acceptable in the reverse direction. A command to start any other operation generates an error at start.
- The counter value remains locked until you clear the overflow/underflow status.
- To clear the overflow/underflow status, you must perform Origin Search or present position preset.
- The overflow/underflow values vary depending on the electronic gear setting.
- If you perform backlash compensation, the range in which you can issue commands decreases by the backlash compensation amount.
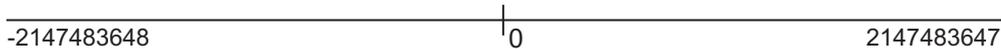
```
|                                    |                                    |
-2147483648                          0                          2147483647
```

Precautions for Correct Use

- Depending on [Command Position Unit Setting], an overflow or underflow may occur even if the command value is within the above range of −2147483648 to 2147483647.
  Take note that the number of pulses must not exceed the setting range.

Rotation Axis (Infinite Length)

- It uses a ring counter whose maximum value is 1073741823. (Infinite axis)
- If 0 (shortest route), 1 (forward), or 2 (reverse) is specified as the Rotation Axis Direction for an absolute movement command, an error will occur if a command value exceeding the rotation axis upper limit is set. If 3 (not specified) is specified as the Rotation Axis Direction for an absolute movement command or if a relative movement command is used, multiple rotations will be supported if a command value that exceeds the rotation axis upper limit is set.

Count value

1073741823

Rotation axis upper limit

0
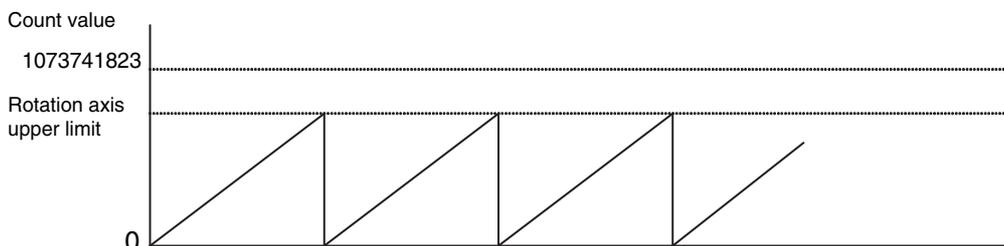
Precautions for Correct Use

- Due to the Command Position Unit Settings, an error may occur even if the command value is within the range given above (0 to 1073741823) depending on the command unit.
  The setting range cannot be exceeded when the value is converted to pulses.

Rotation Axis Upper Limit

This set value becomes valid when you set the AXIS FEEDING mode to rotation axis.
Set the upper limit for rotation axes.

Display Unit

Select the unit for commands.
Even if you change the unit system, position data, etc. will not be reconverted.

Command Pulse Count Per Motor Rotation

Set the number of pulses per 1 motor rotation.

Work Travel Distance Per Motor Rotation

Set the amount of the workpiece movement when the motor makes 1 rotation.

Using a Reducer

If a reducer is being used, consider the gear ratio of the reducer in the number of motor rotations when setting command pulses and travel distances.

For example, calculations would be as follows when using a gear ratio of 1/9 for a motor with a resolution of 10,000 pulses per rotation and a machine operating pitch of 6 mm:

> Number of command pulses per machine rotation (9 motor rotations) = 10,000 × 9 = 90,000 pulses per rotation

> Travel distances per machine rotation (9 motor rotations) = 6 mm

Set the Command Pulse Count Per Motor Rotation and Work Travel Distance Per Motor Rotation parameters to these values.

Precautions for Correct Use

- A motor with absolute encoder cannot be installed to the system where both the rotation axes and decelerators are used.

- If you use a reducer or for some other reason the Command Pulse Count Per Motor Rotation parameter and the actual number of pulses per motor rotation do not match, you cannot use a motor with an absolute encoder.

When the Work Travel Distance Per Motor Rotation Is Not an Integer

The Work Travel Distance Per Motor Rotation parameter is set as an integer. If the work travel distance per motor rotation is not an integer, adjust the command pulses and travel distance so that the travel distance will become an integer.

For example, if the work travel distance per motor rotation is 10.1 mm for a motor with a resolution of 10,000 pulses per rotation, the command pulses and travel distance are each multiplied by 10 so that the travel distance becomes an integer.

> Number of command pulses per 10 motor rotations = 10,000 × 10 = 100,000 pulses per rotation

> Work travel distance per 10 motor rotations = 10.1 × 10 = 101 mm

Set the Command Pulse Count Per Motor Rotation and Work Travel Distance Per Motor Rotation parameters to these values.

When the Number of Command Pulses Per Motor Rotation Exceeds the Setting Range

If the setting range of the Command Pulse Count Per Motor Rotation parameter is exceeded because a reducer is used or because the travel distance per motor rotation is not an integer, reduce the settings of the Command Pulse Count Per Motor Rotation and Work Travel Distance Per Motor Rotation parameters by the same factor so that the setting range is not exceeded.

For example, calculations would be as follows when using a gear ratio of 1/5 for a motor with a resolution of 1,048,576 pulses per rotation and a machine operating pitch of 10 mm:

Number of command pulses per machine rotation (5 motor rotations) = $1,048,576 \times 5 = 5,242,880$ pulses per rotation

Travel distances per machine rotation (5 motor rotations) = 10 mm

The setting range of the Command Pulse Count Per Motor Rotation parameter (1 to 1,048,576) is thus exceeded.

Here, convert the values by a factor (e.g., 1/5) that would bring the setting into range.

Number of command pulses per 1/5 motor rotation = $5,242,880 \div 5 = 1,048,576$ pulses per rotation

Work travel distance per 1/5 motor rotation = $10 \div 5 = 2$ mm

Set the Command Pulse Count Per Motor Rotation and Work Travel Distance Per Motor Rotation parameters to these values.

Unit Multiplier

Set the ratio relative to the amount of the workpiece movement when the motor makes 1 rotation. By setting the unit multiplier, the minimum command unit (the number of digits below the decimal point in the command value) can be changed.

Setting a Command Unit of 1 mm

If the movement per motor rotation is 6 mm and you want to rotate the motor once with a command unit of 1 mm, set the Work Travel Distance Per Motor Rotation parameter to 6 and the Unit Multiplier parameter to 0 (x1).

With these settings, the motor will rotate once for a position command of 6.

Setting a Command Unit of 0.01mm

If the movement per motor rotation is 6 mm and you want to rotate the motor once with a command unit of 0.01mm, set the Work Travel Distance Per Motor Rotation parameter to 6 and the Unit Multiplier parameter to 2 (x100).

With these settings, the motor will rotate once for a position command of 600.

Precautions for Correct Use

If the Axis Feeding Mode parameter is set to *Rotation Axis*, set the pulse unit so that the number of pulses in one rotation can be divided evenly by the specified pulse unit. Specifically, if the setting of the Rotation Axis Upper Limit parameter plus one (command units) is converted to pulses, the number of pulses must be an integer. If the number of pulses in one rotation is not an integer, the decimal portion will be truncated, causing a position offset. If there is a decimal portion, the command present value will not be displayed correctly.

📝 **Reference**

The relationship between the command position unit setting of the Position Control Unit, the number of output pulses, the output pulse speed, the feedback present position, and the number of input pulses is shown below.
This unit conversion is performed for all command values and parameters that are in command units or command units/s.

Position Control Unit
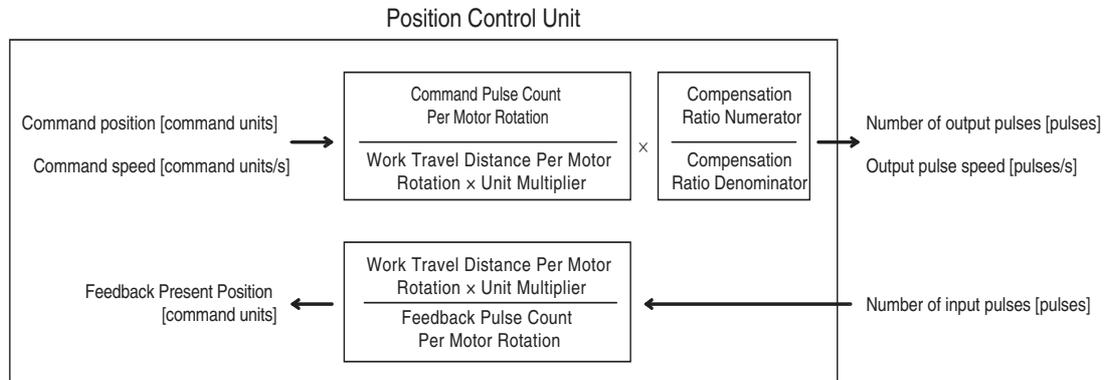
After the command position is converted to pulses, the control range is 32-bits signed ($-2,147,483,648$ to $2,147,483,647$). After the command speed is converted to pulses per second, the maximum speed of the control range is 4 Mpps for models with line-driver outputs and 500 kpps for models with open-collector outputs. The compensation ratio is applied only to output pulses.

5

Setting Data

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Setting Data

Compensation Ratio Numerator and Compensation Ratio Denominator

Set the compensation ratio (numerator/denominator) to compensate for fluctuation in the amount of workpiece movement. For example, use this ratio to compensate for fluctuation in the amount of movement that occurs due to wear of mechanical parts.

$$\text{Compensation ratio} = \frac{\text{Position command}}{\text{Compensation position for position command}}$$

Example of Use

Assume that a 510 command is necessary to move the axis to a 500 position.

$$\text{Compensation ratio} = \frac{\text{Position command}}{\text{Compensation position for position command}} = \frac{510}{500}$$

If you set as above, the axis moves to a 500 position with a 500 command.

⃞ Precautions for Correct Use

* The setting ranges of the parameters below change depending on the command position unit setting:

  For each parameter, pulses cannot exceed the setting range for the parameter.

• Backlash compensation amount	• Origin input mask amount
• Maximum speed	• Rotation axis upper limit
• Origin compensation value	• Starting speed
• Software limit	• Origin position offset
• Backlash compensation speed	• Zone
• Inching width	• Origin Search speed
• Interrupt feeding amount	• Origin Search approach speed
• Origin Search compensation speed	• Origin Return speed
• JOG/inching speed	

* Depending on [Command Position Unit Setting], an overflow or underflow may occur even if the command value is within the above range of −2147483648 to 2147483647. Take note that the number of pulses must not exceed 32 bits.

Starting Present Position Clear Enable Setting

Select the function that presets the present position to 0 at the start of the positioning function. For details on the starting preset setting, refer to "Present Position Preset" on page 4-37.

Software Limit Setting

Select the software limit function.

This function is enabled only in the LINEAR mode.

Software limit setting is always enabled.

If the memory operation pattern is set to continuous 1 to 3, the settings at the start of axis operation are retained.

Parameter name	Function	Setting range	Unit	Default values
Software Limit Function Selection	Select the software limit function. 0: Invalid 1: Valid to command position. Invalid on adjustment operation.[1] 2: Valid to feedback position. Invalid on adjustment operation.[1] 3: Valid to command position. Valid on adjustment operation.[1] 4: Valid to feedback position. Valid on adjustment operation.[1]	0 to 4	–	0
Reverse Direction Software Limit	Set the software limit value in the reverse direction.	–2147483647 to 2147483646[2]	Command unit	–2147483647
Forward Direction Software Limit	Set the software limit value in the forward direction.	–2147483647 to 2147483646[2]	Command unit	2147483646

*1. Adjustment operations include JOG operation, inching operation and MPG operation.

*2. This setting range is based on the pulse unit.

Software Limit Function

This function monitors positioning points via software, separately from hardware limit signals, in order to prevent damage to external devices that may result from an unexpected positioning operation due to erroneous operation.

Set the range to be monitored by software limits using 2 values, or namely the reverse direction limit and the forward direction limit.
Under the normal positioning function, perform positioning within the range of these software limits.
If the present position goes outside the range because of the command which does not cause movement, such as present position preset, the software limit is not detected.
If the present position is outside the range of software limits, you can perform positioning only into the range of software limits.

Also the software limit function does not operate unless the origin is confirmed. Accordingly, software limits are not detected while Origin Search operation is in progress.
The software limit function is enabled in the LINEAR mode.
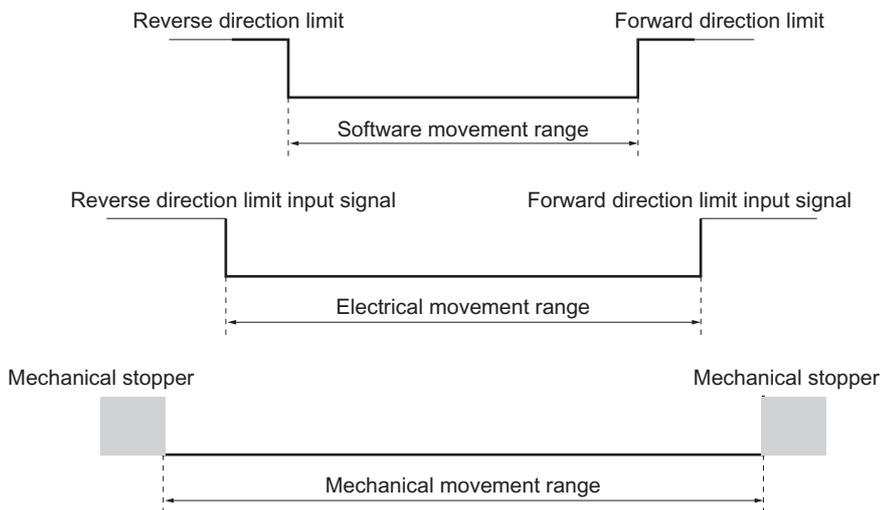
Precautions for Correct Use

- The software limit settings (enable/disable, limit values) are always rewritable. If you change the settings during axis operation, however, the new settings are reflected only when the next axis operation starts.
  Take note, however, that you cannot load changes to the software limit settings during duplicate starts in direct operation or when the interpolation operation pattern switches from Continuous 1, Continuous 2 or Continuous 3.

- Depending on [Command Position Unit Setting], an overflow or underflow may occur even if the command value is within the above range of −2147483647 to 2147483646.
  Take note that the number of pulses must not exceed the setting range.

Zone Setting

The zone setting function notifies the PLC of whether or not the present position of the machine is inside a specified zone. You can set 3 zones for each axis.
Zone setting is always enabled.

Parameter name	Function	Setting range	Unit	Default values
Zone 0 Function Selection	Select the function for zone 0. 0: Invalid 1: Valid to command position 2: Valid to feedback position	0 to 2	–	0
Zone 0 Lower Limit	Set the set value on the reverse direction side of zone 0.	−2147483648 to 2147483647[1]	Command unit	0
Zone 0 Upper Limit	Set the set value on the forward direction side of zone 0.	−2147483648 to 2147483647[1]	Command unit	0
Zone 1 Function Selection	Select the function for zone 1. 0: Invalid 1: Valid to command position 2: Valid to feedback position	0 to 2	–	0
Zone 1 Lower Limit	Set the set value on the reverse direction side of zone 1.	−2147483648 to 2147483647[1]	Command unit	0
Zone 1 Upper Limit	Set the set value on the forward direction side of zone 1.	−2147483648 to 2147483647[1]	Command unit	0
Zone 2 Function Selection	Select the function for zone 2. 0: Invalid 1: Valid to command position 2: Valid to feedback position	0 to 2	–	0
Zone 2 Lower Limit	Set the set value on the reverse direction side of zone 2.	−2147483648 to 2147483647[1]	Command unit	0
Zone 2 Upper Limit	Set the set value on the forward direction side of zone 2.	−2147483648 to 2147483647[1]	Command unit	0

*1.This setting range is based on the pulse unit.

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Zone Function

The zone function notifies the PLC of whether or not the present position of the machine is inside a specified zone. Use Zone Memory area to notify the PLC.
This is a function which you generally use to provide an interlock with a surrounding device, perform synchronous operation, etc., depending on the present position of the machine.
The zone function operates regardless of whether or not the origin is confirmed or an error is occurring.

Take note that 3 Zone Memory area are available for each axis, and you can set each zone individually.

Reference

• For the Zone Memory area, refer to "Axis Status Memory Area" on page 5-72.

If you use the zone function, you must set the lower limit and upper limit, as shown below.

Linear Axis
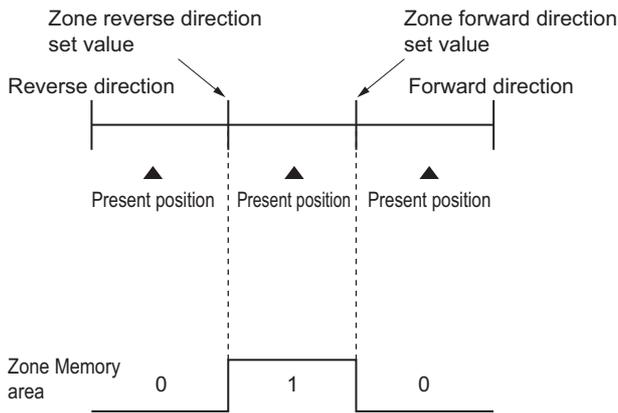
Precautions for Correct Use

• In the LINEAR mode, an error occurs if you set the lower limit value greater than the upper limit.

Rotation Axis
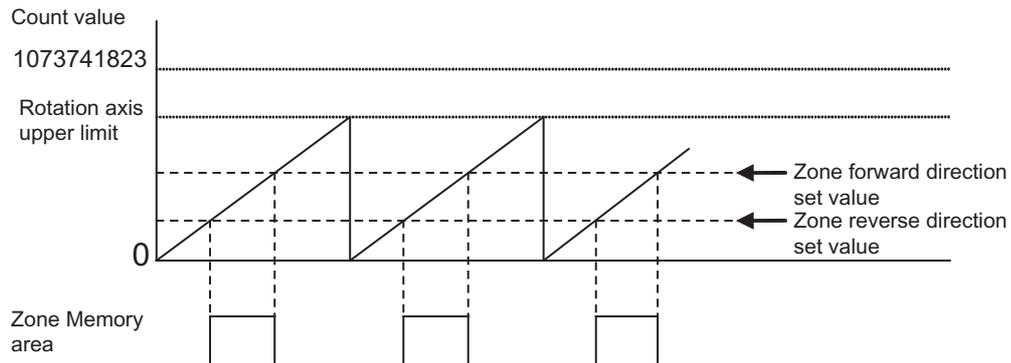
🗒 **Reference**

- With a rotation axis, you can set the lower limit value greater than the upper limit, in order to set a zone that crosses 0.
- Depending on [Command Position Unit Setting], an overflow or underflow may occur even if the command value is within the above range of −2147483648 to 2147483647. Take note that the number of pulses must not exceed the setting range.

Interrupt Feeding Setting

Set the data for interrupt feeding during direct operation.
For details on interrupt feeding, refer to "Interrupt Feeding" on page 9-7.
For the setting of data for interrupt feeding during memory operation, refer to "Interrupt Feeding (Positioning Operation)" on page 7-25.
Interrupt feeding setting is always enabled.

Parameter name	Function	Setting range	Unit	Default values
Interrupt Feeding Reference Position/ Latch Target Position Selection	Select whether to use a command position or feedback position for the reference position or latched position in constant-pitch positioning at the time of interrupt input. 0: Command position 1: Feedback position	0 to 1	–	0
Interrupt Input Undetected Error Enable	Select whether to output an error when an interrupt input is not input before positioning is completed during interrupt feeding by position control. 0: Without error detection 1: With error detection	0 to 1	–	0
Interrupt Feeding Amount	Set the amount of movement in interrupt feeding.	−2147483648 to 2147483647[1]	Command unit	0

*1.This setting range is based on the pulse unit.

> **Precautions for Correct Use**
>
> ⬥ Depending on [Command Position Unit Setting], an overflow or underflow may occur even if the command value is within the above range of −2147483648 to 2147483647. Take note that the number of pulses must not exceed the setting range.

Origin Search Setting

Set the motor operation data which you use to determine the mechanical origin.
Origin Search setting is always enabled.

Parameter name	Function	Setting range	Unit	Default values
Origin Search Operation Mode	Select the method to confirm the origin. 0: Proximity reverse turn and origin proximity input OFF specified 0: Proximity reverse turn/ origin proximity input OFF specified 1: Proximity reverse turn/ origin proximity input ON specified 2: Proximity reverse turn/ origin proximity input OFF specified (Approach speed after reverse turn) 3: Proximity reverse turn/ origin proximity input ON specified (Approach speed after reverse turn) 4: Origin proximity input OFF specified 5: Origin proximity input ON specified 6: No origin rev turn/ origin proximity input 7: No origin proximity input 8: Limit input OFF 9: Proximity rev turn/ origin input mask amount 10: Origin proximity input only 11: Proximity rev turn/ holding time 12: Proximity rev turn/ holding origin input 13: No origin proximity input/ holding origin input 14: Origin preset	0 to E	–	0
Operation at Forward Direction Limit Input	Select the operation to be performed when the limit input in the operating direction turns ON during Origin Search. 0: Without reverse turn, Error stop[1] 1: Reverse turn, Deviation pulse stop 2: Reverse turn, Deceleration stop	0 to 2	–	1
Operation at Reverse Direction Limit Input	Select the operation to be performed when the limit input in the operating direction turns ON during Origin Search. 0: Without reverse turn, Error stop[1] 1: Reverse turn, Deviation pulse stop 2: Reverse turn, Deceleration stop	0 to 2	–	1
Origin Search Start Direction	Select the starting direction of Origin Search. 0: Forward direction, 1: Reverse direction	0 to 1	–	0
Origin Input Detecting Direction	Select the origin input detecting direction during Origin Search. 0: Forward direction, 1: Reverse direction	0 to 1	–	0

Parameter name	Function	Setting range	Unit	Default values
Origin Search Holding Time	Set the holding time when you set the ORIGIN SEARCH OPERATION mode to [Proximity Rev Turn/ Holding Time].	0 to 10,000	ms	100
Origin Input Mask Amount	Set the constant amount when you set the ORIGIN SEARCH OPERATION mode to [Proximity Rev Turn/ Origin Input Mask Amount].	0 to 2147483647[*2]	Command unit	10000
Origin Compensation Value	Set the Origin Search compensation amount which is applied after the origin confirmation.	−2147483648 to 2147483647[*2]	Command unit	0
Origin Position Offset	Preset the present position to the specified value when Origin Search starts.	−2147483648 to 2147483647[*2]	Command unit	0
Origin Search Speed	Set the high speed during Origin Search.	1 to 4000000[*2]	Command unit/s	10000
Origin Search Approach Speed	Set the proximity speed during Origin Search.	1 to 4000000[*2]	Command unit/s	1000
Origin Search Compensation Speed	Set the compensation speed during Origin Search.	1 to 4000000[*2]	Command unit/s	1000
Origin Search Acceleration Time	Set the acceleration time during Origin Search.	0 to 250,000	ms	1,000
Origin Search Deceleration Time	Set the deceleration time during Origin Search.	0 to 250,000	ms	1,000

*1. The error stopping method depends on the limit input stopping method.

*2. This setting range is based on the pulse unit.

ORIGIN SEARCH OPERATION Mode

Select one of 15 operations to determine the mechanical origin. For operation details, refer to "Origin Confirmation Operation" on page 4-24.

Operation at Forward Direction Limit Input and Operation at Reverse Direction Limit Input

Select whether to reverse the axis and continue with the Origin Search, or not reverse the axis but generate an error and stop the axis, when the axis reaches the limit input in the operating direction during Origin Search. To reverse the axis, also select the stopping method.
When you set [Reverse] for limit signal input setting in both directions, the axis generates an error and stops if the axis could not detect the origin after moving from the limit input position opposite to the origin input detection direction to the other limit input position.

Origin Search Start Direction

Select the direction in which the axis starts moving when Origin Search starts. For details, refer to "Origin Search Start Direction" on page 4-22.

5

Setting Data

Origin Input Detecting Direction

Select the direction of confirming the origin. For details, refer to "Origin Input Detecting Direction" on page 4-22.

Origin Search Holding Time

Set the holding time when you set the ORIGIN SEARCH OPERATION mode to [Proximity Reverse Turn and Holding Time Specified].
For operation details, refer to "Operation by 11: Proximity Reverse Turn and Holding Time Specified" on page 4-31.

Origin Input Mask Amount

Set the constant amount when you set the ORIGIN SEARCH OPERATION mode to [Proximity Reverse Turn and Origin Input Mask Amount Specified].
For operation details, refer to "Operation by 9: Proximity Reverse Turn and Origin Input Mask Amount Specified" on page 4-29.

Precautions for Correct Use

- Depending on [Command Position Unit Setting], an overflow or underflow may occur even if the command value is within the above range of 0 to 2147483647. Take note that the number of pulses must not exceed the setting range.

Origin Compensation Value

Set the Origin Search compensation amount which is applied after the origin confirmation.
For operation details, refer to "Origin Compensation" on page 4-33.

Precautions for Correct Use

- Depending on [Command Position Unit Setting], an overflow or underflow may occur even if the command value is within the above range of −2147483648 to 2147483647. Take note that the number of pulses must not exceed the setting range.

Origin Position Offset

Use as the present position preset at the start of Origin Search.

Precautions for Correct Use

- Depending on [Command Position Unit Setting], an overflow or underflow may occur even if the command value is within the above range of −2147483648 to 2147483647. Take note that the number of pulses must not exceed the setting range.

5

Origin Search Speed

The high speed during Origin Search.

Origin Search Approach Speed

The proximity speed during Origin Search.

Origin Search Compensation Speed

The movement speed when you set [Origin Compensation Value].
For operation details, refer to "Origin Compensation" on page 4-33.

Origin Search Acceleration Time and Origin Search Deceleration Time

Set the acceleration time and deceleration time during Origin Search.
For the Origin Search Acceleration Time and Origin Search Deceleration Time, [Acceleration/
Deceleration Time Selection] determines the operation.
For details, refer to "Acceleration/Deceleration Setting" on page 5-23 and "Acceleration/
Deceleration Time Selection" on page 5-25.

Origin Return Setting

Set the speed and acceleration/deceleration times to use when you return the axis from a given position to the origin after origin confirmation.
Origin Return setting is always enabled.

Parameter name	Function	Setting range	Unit	Default values
Origin Return Speed	Set the speed of Origin Return.	1 to 4000000[*1]	Command unit/s	10000
Origin Return Acceleration Time	Set the acceleration time of Origin Return.	0 to 250,000	ms	1,000
Origin Return Deceleration Time	Set the deceleration time of Origin Return.	0 to 250,000	ms	1,000

*1.This setting range is based on the pulse unit.

Origin Return Speed

Set the speed of Origin Return.

Origin Return Acceleration Time and Origin Return Deceleration Time

Set the acceleration time and deceleration time of Origin Return.
For the Origin Return Acceleration Time and Origin Return Deceleration Time, [Acceleration/
Deceleration Time Selection] determines the operation.
For details, refer to "Acceleration/Deceleration Setting" on page 5-23 and "Acceleration/
Deceleration Time Selection" on page 5-25.

JOG/Inching Setting

Set the items that are necessary to perform JOG operation and inching operation.
JOG/inching setting is always valid.

Parameter name	Function	Setting range	Unit	Default values
Inching Width	Set the amount of movement during inching. If you set this parameter to [0], the axis operates as JOG.	0 to 4000[*1]	Command unit	0
JOG/ Inching Speed 1	Set JOG/inching operation speed 1.	1 to 4000000[*1]	Command unit/s	1000
JOG/ Inching Speed 2	Set JOG/inching operation speed 2.	1 to 4000000[*1]	Command unit/s	10000
JOG Acceleration Time	Set the acceleration time of JOG operation.	0 to 250,000	ms	1,000
JOG Deceleration Time	Set the deceleration time of JOG operation.	0 to 250,000	ms	1,000

*1.This setting range is based on the pulse unit.

Inching Width

Set the amount of movement per 1 inching operation. If you set the amount of movement to [0], the axis functions as JOG operation.

⚓ **Precautions for Correct Use**

♦ Depending on [Command Position Unit Setting], an overflow or underflow may occur even if the command value is within the above range of 0 to 4,000. Take note that the number of pulses must not exceed the setting range.

JOG/Inching Speed

You use this parameter as a speed command for JOG operation/inching operation. You can set one of two speeds, speed 1 and speed 2, and change the speed during operation.

JOG Acceleration Time and JOG Deceleration Time

Set the acceleration time and deceleration time of JOG operation and inching operation.
For the JOG acceleration time and JOG deceleration time, [Acceleration/Deceleration Time Selection] determines the operation.
For details, refer to "Acceleration/Deceleration Setting" on page 5-23 and "Acceleration/ Deceleration Time Selection" on page 5-25.

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Feedback Pulse Input Setting

Set this parameter to input feedback pulses to the PCU.
In the case of a Virtual Axis, this setting becomes disabled.
For the feedback function, also refer to "Feedback Position Monitoring Function" on page 9-1.
Feedback pulse input setting becomes enabled at power supply ON, restart, or setup.

Parameter name	Function	Setting range	Unit	Default values
Feedback Pulse Input Method **External**	Select the feedback pulse method to be input. 0: Phase difference pulse input (1 multiplier) 1: Phase difference pulse input (Doubler) 2: Phase difference pulse input (Quadruple) 3: Forward/Reverse direction pulse input 4: Pulse plus direction input	0 to 4	–	2
Feedback Pulse Input Direction **External**	Select the direction of input according to the input pulse. 0: Count as the forward direction when forward direction pulse/ phase A advance pulse are input. 1: Count as the forward direction when reverse direction pulse/ phase B advance pulse are input.	0 to 1	–	1
Feedback Pulse Input Backlash Enable	Set whether to enable or disable the backlash compensation function for input feedback pulses. 0: Valid, 1: Invalid	0 to 1	–	0
Feedback Pulse Input Position Monitoring Enable	Select whether to reflect input pulse positions in position monitoring. 0: Not reflect, 1: Reflect	0 to 1	–	0
Feedback Pulse Input Position Reflection Method Selection	Select how to reflect the input pulse position upon output of an Error Counter Reset signal when you select [Reflect] for feedback pulse input position monitoring enable.[1] 0: Reflect once when the error counter reset output is ON 1: Reflect always when the error counter reset output is ON	0 to 1	–	0
Feedback Pulse Count per Motor Rotation **External**	Set the number of pulses per 1 motor rotation for feedback position.	1 to 1,048,576	Number of pulses	1,000
Encoder Type	0: Incremental encoder 1: ABS encoder[2] (OMNUC G5/W series) 2: ABS encoder (OMNUC G Series)	0 to 2	–	0
ABS Encoder Origin Position Offset	This stores the absolute encoder compensation value which is taken in when you execute absolute origin setting.	–	Command unit	0

*1. Select an appropriate option based on whether the driver-side Error Counter Reset input conforms to ON rising edge detection or ON level detection.

*2. An OMNUC G5-series absolute encoder is applicable to the PCU Unit version 1.1 or later.

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Setting Data

Feedback Pulse Input Method

Select the feedback pulse method.

Phase Difference Pulse Input
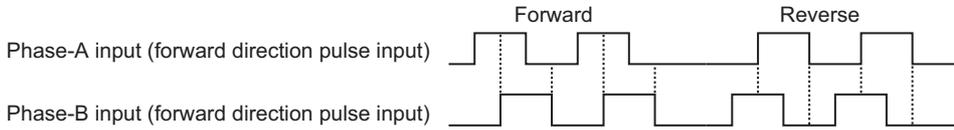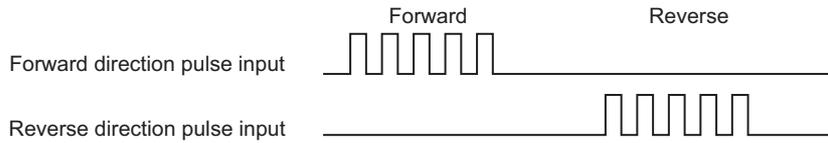
Phase-A input (forward direction pulse input)

Phase-B input (forward direction pulse input)
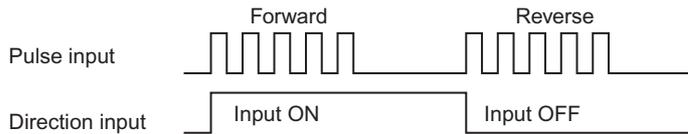
Forward   Reverse

Forward/Reverse Direction Pulse Input

Forward direction pulse input

Reverse direction pulse input

Forward   Reverse

Pulse Plus Direction Input

Pulse input

Direction input

Forward   Reverse

Input ON   Input OFF

Feedback Pulse Input Direction

Select the direction of input according to the input pulse.
You can switch the direction of input pulses without changing the wiring.

Feedback Pulse Input Backlash Enable

Select whether to enable or disable the backlash function for input pulses.

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Feedback Pulse Input Position Monitoring Enable

Select whether or not to reflect feedback pulses in position monitoring.
The table below summarizes position monitoring when feedback pulses are reflected and when they are not.

Item	Do not use feedback positions in position monitoring		Use feedback positions in position monitoring	
	Present position counter	Feedback position counter	Present position counter	Feedback position counter
Power supply ON	"0"	"0"	"0"	"0"
During servo unlock	No change Hold the current command position.	Feedback position count value	Always updated by the feedback position count value.[*1]	Feedback position count value
Servo lock in progress	Command count value. Read value of absolute data in the case of a motor with absolute encoder.[*2]	Feedback position count value. Read value of absolute data in the case of a motor with absolute encoder.[*2]	Command count value. Read value of absolute data in the case of a motor with absolute encoder.[*2]	Feedback position count value. Read value of absolute data in the case of a motor with absolute encoder.[*2]
During servo lock (During axis stop/ operation)	Command count value	Feedback position count value	Command count value	Feedback position count value
Present position preset	Preset command value	Feedback position count value	Preset command value	Preset command value
Origin Search completed	0 or preset value at Origin Search	Feedback position count value	0 or preset value at Origin Search	0 or preset value at Origin Search
Starting present position clear enable	Preset to 0.	Feedback position count value	Preset to 0.	Preset to 0.
Error counter reset in progress	No change Hold the current command position.	No change Hold the current feedback position.	The feedback position count value is preset.[*3]	No change Hold the current feedback position.

*1. Even if you execute the servo unlock after the origin is confirmed by Origin Search, etc., the confirmed origin is held.

*2. When a motor with an absolute encoder is connected, the absolute data is preset to both the present position counter and feedback position counter at servo lock execution.

*3. After this operation, the origin confirmed status immediately before is held.

Feedback Pulse Input Position Reflection Method Selection

Select whether to reflect only once when the error counter reset output turns ON, or reflect always.
This setting is made in case position deviation should occur when the Servo Drive detects the error counter reset output either at level or edge.

5

Feedback Pulse Count Per Motor Rotation

Set the number of feedback pulses per 1 motor rotation.
For display unit, movement per 1 motor rotation and unit ratio, the same settings as [Command Position Unit Setting] for pulse outputs are used.
For [Command Position Unit Setting], refer to "Command Position Unit Setting" on page 5-30.

Encoder Type

Set the encoder type for feedback input.

Absolute Encoder Origin Position Offset

This stores the absolute encoder compensation value which is taken in when you execute absolute encoder origin setting. This stores the compensation value for mechanical origin.
This set value is read-only and you cannot write it.
However, you can write the data via a data transfer bit during the PCU setup.
In addition, the value is overwritten by restore of PLC Backup Tool in CX-Programmer and restore of simple backup.

Precautions for Correct Use

⬧ Before you select the overwrite setting, check for negative impact because changing this parameter changes the origin position which is determined by the absolute encoder.

Expanded Monitor Setting

Select the type of expanded monitor.
Expanded monitor setting is always enabled.

Parameter name	Function	Setting range	Unit	Default values
Expanded Monitor Type	Select the type of expanded monitor. 0: Feedback present position 1: Command present position 2: Position error 3: Present speed[1] 4: Present command speed[1]	0 to 4	–	0

*1.The monitored speeds are calculated (i.e., updated) at every control period. If the PCU is operated in the control cycle of 1 ms, the monitored speeds are output in units of 1,000 command unit/s. When using the Synchronous Unit Operation function, the output speeds will be calculated at every synchronous control cycle.

Expanded Monitor Type

Select the type of expanded monitor.
If you select Virtual Axis for the axis type, the command present position becomes enabled even when you select [0: Feedback Present Position]. Similarly, the position error becomes [0] when you select [2: Position Error], and the present command speed is used for [3: Present Speed].

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Error Monitor Function Setting

Set the items that are necessary to monitor the position error between the command position and feedback position, and speed error between the command speed and feedback speed. Error monitor function setting is always enabled.

Parameter name	Function	Setting range	Unit	Default values
Speed Error Monitor Enable	Select whether to enable or disable the speed error monitor function. 0: Invalid, 1: Valid	0 to 1	–	0
Position Error Monitor Enable	Select whether to enable or disable the position error monitor function. 0: Invalid, 1: Valid	0 to 1	–	0
Feedback Speed Sampling Period	Set the sampling cycle at which to measure the feedback speed.	1 to 20	ms	10
Speed Error Monitor Wait Time	Set the time from the start of the command speed output, until the speed error monitor start.	10 to 10,000	ms	1,000
Speed Error Limit Value	Set the speed error you want to monitor.	1 to 65000	–	100
Position Error Limit Value	Set the position error you want to monitor.	1 to 65000	Command unit	100

Positioning monitoring time[1]
Upon completion of a command (after the command has been issued), if there is no positioning completed signal input within the set time, a positioning monitoring time over error will occur.

| Position Error |

Position error limit value
The position error (absolute value) is monitored from the start of the command, until the completion of positioning operations.
A position error over error will occur if the position error reaches or exceeds the set value.

Time

Position error monitor period

Speed

Command speed

Feedback speed

Speed error limit value
Monitors the error (absolute value) with the command speed and feedback speed during the speed error monitor period.
A speed error over error will occur if the speed error reaches or exceeds the set value.

Time

Speed error monitor period

Speed error monitor dwell time
The time from the start of command speed output, until the speed error monitor start.

Feedback speed sampling cycle
The sampling cycle when feedback speed is measured.
The time interval is set in integral multiples of 1 ms.

*1. For the positioning monitor time, refer to "Positioning Monitoring Time" on page 5-22.

> **Reference**
>
> ⬧ Under the error monitor function, monitoring starts at the start of operation of the axis whose monitoring is currently valid (axis busy flag ON), and ends upon completion of operation (axis busy flag OFF).
> ⬧ In the case of linear interpolation or circular interpolation by memory operation, the error monitor function remains active on all configuration axes whose monitoring is valid in the same task, until the series of operations are completed (until the memory operation busy flag turns OFF).
> ⬧ If you have selected [Automatic] under [End Pattern] for memory operation during speed error monitoring, error monitoring continues to the next sequence if the [Positioning Completed Input Monitor Valid] setting is disabled. If the [Positioning Completed Input Monitor Valid] setting is enabled, speed error monitoring will start when the next sequence commences after an elapse of the speed error monitor wait time.

Speed Error Monitor Enable

Set whether or not to monitor the speed error between the command speed and feedback speed.
If the speed error exceeds [Speed Error Limit Value], a speed error over error occurs.

Position Error Monitor Enable

Set whether or not to monitor the position error between the command position and feedback position.
Monitor position error based on the absolute coordinates of command position and feedback position.
Monitor position error after a command starts until positioning is completed.
If the position error exceeds [Position Error Limit Value], a position error over error occurs.
With this monitoring, the PCU is equipped with double check functions including the positioning completed signal via the positioning monitor time when using the positioning completed signal from the Servo Drive .

Feedback Speed Sampling Period

Set the sampling cycle at which to measure the feedback speed.

Speed Error Monitor Wait Time

Set the time from the start of the command speed output, until the speed error monitor start.

Speed Error Limit Value

Set the speed error you want to monitor as an amount of movement per speed sampling time.

[Example]

To monitor the error of 10,000 command unit/s at the feedback speed sampling cycle [5 ms], [Speed Error Limit Value] is calculated as follows:

Speed error limit value = Monitor speed (command unit/s) × Feedback speed sampling cycle (s)

Accordingly, set [50] for the speed error limit value.

Position Error Limit Value

Set the position error amount you want to monitor.

Synchronous Unit Operation Function Setting

Synchronous Data Refresh areas are allocated to the I/O areas 1,200 to 1,295 words in the CPU.
You can set the CPU and PCUs, respectively, to exchange data between the CPU and the allocated areas of each PCU.
For details on synchronous unit operation, refer to Chapter 10, Synchronous Unit Operation Function.

Synchronous Group Stop Selection

Synchronous group stop selection supports bits 00 to 14 in the Synchronous Data Refresh area 1,200 words. Select whether or not to stop axis movement when each bit turns ON.
The synchronous group stop selection become valid at power supply ON, restart, or setup.

Parameter name	Bit	Function	Setting range	Default values
Synchronous Group Stop Selection	00	Select the operation that takes place when bit 00 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 00. 1: Stop when bit 00 turns ON.	0 to 1	0
	01	Select the operation that takes place when bit 01 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 01. 1: Stop when bit 01 turns ON.	0 to 1	0
	02	Select the operation that takes place when bit 02 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 02. 1: Stop when bit 02 turns ON.	0 to 1	0
	03	Select the operation that takes place when bit 03 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 03. 1: Stop when bit 03 turns ON.	0 to 1	0
	04	Select the operation that takes place when bit 04 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 04. 1: Stop when bit 04 turns ON.	0 to 1	0
	05	Select the operation that takes place when bit 05 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 05. 1: Stop when bit 05 turns ON.	0 to 1	0

Parameter name	Bit	Function	Setting range	Default values
Synchronous Group Stop Selection (Continued)	06	Select the operation that takes place when bit 06 turns ON in the Synchronous Data Refresh area 1,200 words. 0: Ignore ON of bit 06 1: Stop when bit 06 turns ON	0 to 1	0
	07	Select the operation that takes place when bit 07 turns ON in the Synchronous Data Refresh area 1,200 words. 0: Ignore ON of bit 07 1: Stop when bit 07 turns ON	0 to 1	0
	08	Select the operation that takes place when bit 08 turns ON in the Synchronous Data Refresh area 1,200 words. 0: Ignore ON of bit 08 1: Stop when bit 08 turns ON	0 to 1	0
	09	Select the operation that takes place when bit 09 turns ON in the Synchronous Data Refresh area 1,200 words. 0: Ignore ON of bit 09 1: Stop when bit 09 turns ON	0 to 1	0
	10	Select the operation that takes place when bit 10 turns ON in the Synchronous Data Refresh area 1,200 words. 0: Ignore ON of bit 10 1: Stop when bit 10 turns ON	0 to 1	0
	11	Select the operation that takes place when bit 11 turns ON in the Synchronous Data Refresh area 1,200 words. 0: Ignore ON of bit 11 1: Stop when bit 11 turns ON	0 to 1	0
	12	Select the operation that takes place when bit 12 turns ON in the Synchronous Data Refresh area 1,200 words. 0: Ignore ON of bit 12 1: Stop when bit 12 turns ON	0 to 1	0
	13	Select the operation that takes place when bit 13 turns ON in the Synchronous Data Refresh area 1,200 words. 0: Ignore ON of bit 13 1: Stop when bit 13 turns ON	0 to 1	0
	14	Select the operation that takes place when bit 14 turns ON in the Synchronous Data Refresh area 1,200 words. 0: Ignore ON of bit 14 1: Stop when bit 14 turns ON	0 to 1	0
	15	–	–	–

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Synchronous Feeding Command Position Data

Select the output data for Synchronous Data Refresh areas which you use as command positions under the synchronous feeding function.
Synchronous feeding command position data is always enabled.

Parameter name	Function	Setting range	Default values
Synchronous Feeding Command Position Data	Set relative positions (words) from the beginning word in output data for synchronous data refresh which is allocated to the applicable PCU by the CPU.	0000 hex to maximum output size	Axis 1: 0000 hex Axis 2: 0002 hex Axis 3: 0004 hex Axis 4: 0006 hex

5-4   Memory Operation Parameter

If you execute memory operation with the PCU, you must determine the applicable tasks first. Use memory operation parameters to set tasks.

Tasks

With this PCU, you can set up to 4 tasks. A task refers to an axis configuration based on which to execute memory operation.
If you allocate 1 axis to 1 task to set 4 tasks, the 4 axes operate independently. If you allocate 4 axes to 1 task, you can perform linear interpolation of 4 axes.
You can use axes 1, 2, 3 and 4.
Note, however, that you cannot set the same axis to different tasks.

Example 1: 4 tasks, 4 axes used

Task 1 X axis	Task 2 Y axis	Task 3 Z axis	Task 4 U axis

Example 2: 2 tasks, 3 axes used

Task 1 X,Y axis	Task 2 Z axis

Task 1 Y,Z axis	Task 2 Y,U axis

Example 3: 2 tasks, 4 axes used

Task 1 X,Y,Z axis	Task 2 U axis

Task 1 X,Y,Z axis	Task 2 X,Y,U axis

Memory Operation Parameters List

4 sets of memory operation parameters are available for tasks 1 to 4. Set the parameters according to the number of tasks which you use.
The explanation below is based on 1 task.

General name	Parameter name	Reference page	Valid timing
Configuration axis	Configuration Axis	5-57	At power supply ON, restart or setup
Teaching setting	Teaching Object	5-58	Always
Interpolation axis stop method	Interpolation Axis Stop Method	5-58	At power supply ON, restart or setup
Error between axes monitor setting	Error Between Axes Monitor Enable	5-59	Always
	Error Between Axes Limit Value		
	Error Between Axes Monitor Target Axis		

Configuration Axis

Select the configuration axis or axes of the task.
Configuration axis setting becomes valid at power supply ON, restart, or setup.

Parameter name	Function	Setting range	Unit	Default values
Configuration Axis	Select the configuration axis or axes of the task. Bits 00 to 03 correspond to axes 1 to 4, respectively. 　0: Not use as configuration axis 　1: Use as configuration axis 000 hex: Not use this task　　0002 hex: Use axis 2 only 0001 hex: Use axis 1 only　　0004 hex: Use axis 3 only 0003 hex: Use axes 1 and 2　0006 hex: Use axes 2 and 3 0005 hex: Use axes 1 and 3　0008 hex: Use axis 4 only 0007 hex: Use axes 1 to 3　　000A hex: Use axes 2 and 4 0009 hex: Use axes 1 and 4　000C hex: Use axes 3 and 4 000B hex: Use axes 1, 2 and 4　000E hex: Use axes 2 to 4 000D hex: Use axes 1, 3 and 4 000F hex: Use axes 1 to 4	0000 to 000F hex	–	0

☑ **Precautions for Correct Use**

◆ You cannot set an axis which is already in use for other task.

Teaching Setting

Select the target position data for task teaching.
Teaching setting is always enabled.

Parameter name	Function	Setting range	Unit	Default values
Teaching Object	Select the target position data for teaching. 0: Command position, 1: Feedback Position	0 to 1	–	0

Interpolation Axis Stop Method

Set the stop method which will apply to other axes upon issuance of a servo unlock, Error Counter Reset or deceleration stop command to each individual interpolation axis during memory operation.
Interpolation axis stop method becomes enabled at power supply ON, restart, or setup.

Parameter name	Function	Setting range	Unit	Default values
Interpolation Axis Stop Method	0: Immediate stop (Deviation pulse stop) 1: Deceleration stop 4: RUN OFF of pulse output (Free run stop) 5: Interpolation path deceleration stop	0 to 5	–	0

📝 **Precautions for Correct Use**

♦ If you set [4: RUN Output OFF] when you are not using the RUN output, immediate stop is applied.

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Error between Axes Monitor Setting

Set the function to monitor feedback positions between axes in linear interpolation.
For details, refer to "Feedback Position Monitoring Function" on page 9-1.
Error between axes monitor setting is always enabled.

Parameter name	Function	Setting range	Unit	Default values
Error between Axes Monitor Enable	Select whether or not to monitor the feedback counter between axes. 0: Not monitor, 1: Monitor	0 to 1	–	0
Error between Axes Limit Value	Set the allowable error amount for the feedback counter between axes.	0 to 65535	Command unit	0

Error between Axes Monitor Target Axis	Select the axes to monitor. Bits 00 to 03 correspond to axes 1 to 4, respectively. Select 2 or more axes.
	    0: Not monitor,
	    1: Monitor
	
	0000 hex: Not monitor 0003 hex: Axes 1 and 2
	0005 hex: Axes 1 and 3 0006 hex: Axes 2 and 3
	0007 hex: Axes 1 to 3 0009 hex: Axes 1 and 4
	000A hex: Axes 2 and 4 000B hex: Axes 1, 2 and 4
	000C hex: Axes 3 and 4 000D hex: Axes 1, 3 and 4
	000E hex: Axes 2 to 4 000F hex: Axes 1 to 4
		0000 hex, 0003 hex, 0005 to 0007 hex, 0009 to 000F hex	–	0

Error between Axes Monitor Enable

Select whether or not to use the position error between axes function in linear interpolation.

Error between Axes Limit Value

Set the position error between axes amount in linear interpolation.

Error between Axes Monitor Target Axis

Set the axes to monitor in linear interpolation. Select from the axes that are already allocated under [Configuration Axis]. Also note that if you do not set axes as physical axes, an error occurs.
Selecting [Not Monitor] for this setting has the same effect as selecting [0: Not Monitor] under [Error between Axes Monitor Enable].

5-5 Operating Memory Area

The Operating Memory area is where the output bits that issue operation commands to the PCU and the input bits used for indicating the PCU status are allocated.

The Operating area contains PCU control bits, Manual Operation Command Memory areas, Direct Operation Command Memory areas, Axis Status Memory areas, Memory Operation Command Memory areas and Memory Operation Status Memory areas.

The table below lists the memory areas which you use in each operation.

√: Yes, −: No

	PCU Control Output area	PCU Control Input area	Manual Operation Command Memory area	Direct Operation Command Memory area	Axis Status Memory areas	Memory Operation Command Memory areas	Memory Operation Memory Status areas
Manual operation	√	√	√	−	√	−	−
Origin Search	√	√	√	−	√	−	−
Direct operation	√	√	√	√	√	−	−
Memory operation	√	√	√	−	√	√	√

Outline of Operating Memory Area

2 types of Operating Memory areas are available: one which is allocated as the PLC Special I/O Unit area and the other set by common parameters.

The Operating Memory area is divided into outputs and inputs.

Commands that relate to operation are allocated to the Output Memory area, where you send a command to the PCU while each bit is ON or the moment the bit turns ON for each bit. Command data is also set.

Allocated in the Input area are internal PCU status and external I/O status, where applicable data is input from the PCU.

If you use a CJ1W-NC414/NC434 4-axis PCU and set axes 1 and 2 as Physical Axes with the remaining 2 axes set as unused axes, for example, each memory area occupies 2 axes only. If you set different 2 axes, namely axes 1 and 3 as Physical Axes with the remaining 2 axes set as unused axes, each area occupies 3 axes.

Axis 1	Physical axis	Area occupied
Axis 2	Physical axis	by 2 axes
Axis 3	Unused axis	
Axis 4	Unused axis	

Axis 1	Physical axis	Area occupied
Axis 2	Unused axis	by 3 axes
Axis 3	Physical axis	
Axis 4	Unused axis	

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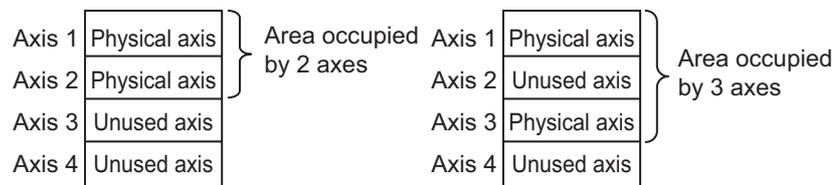
Basic Usage of Operating Memory Areas

Operating Memory areas of the PCU consist of Output Memory areas that issue commands to start functions, and Input Memory areas that correspond to respective Output Memory areas. The applicable Input Memory areas indicate 5 statuses that include command reception, executing, command disable, completed successfully and error.
Note, however, that not all 5 statuses are available depending on the function.
The table below shows basic function memory areas.

Type	Memory Area type	Explanation of function	Memory Area that relates to data transfer	Memory Areas that relate to manual operation and direct operation	Memory Area that relates to memory operation
Output	Command Memory areas	This memory area turns ON when an operation or function starts.	Write data Read data Save data, etc.	Servo lock JOG/inching MPG enable Origin Search Origin Return Absolute movement Relative movement, etc.	Memory operation start Memory operation independent start Teaching, etc.
Input	Command received	Response status to the ON/OFF switching of a Command Memory area according to the ladder program. For a function which you execute the moment the Command Memory area turns on, use this command reception to hold the status.	Data write received Data read received Saved data received, etc.	Servo lock received MPG enable received Origin search received Origin return received, etc.	Memory operation received M code reset received Teaching received, etc.
Input	Executing	This status indicates that the command function is currently executing. It is used as an interlock if executing a different function during processing generates an error.	Data transferring, etc.	Axis busy, etc.	Memory operation busy, etc.
Input	Command invalid	This status indicates that the executed command failed because it did not meet the condition for starting the applicable function. This status turns ON when you could not start operation due to an error at the start of the command or because of the priority of the command.	Data transfer invalid, etc.	Start invalid, etc.	Memory operation invalid Teaching invalid, etc.
Input	Completed successfully	This status indicates that a process completed successfully.	Data transfer completed, etc.	Positioning operation completed, etc.	Memory operation positioning completed, etc.
Input	Error	This status indicates that an error occurred when you start or execute the command-specified function.	PCU error PCU warning, etc.	Axis error Axis warning, etc.	Memory operation error Memory operation warning, etc.

In addition to the above, these Command Memory areas also use the executing, command invalid and completed successfully statuses.

Name of Command Memory area	Memory Area type	Name of Status Memory area
Error reset	Executing	Resetting error
Axis deceleration stop	Completed successfully	Stop execution
Memory operation stop	Completed successfully	Memory operation stop executed
Error counter reset output	Command invalid	Error counter reset invalid

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Operation Flow of Operating Memory Areas

The chart below shows the basic operation flow.
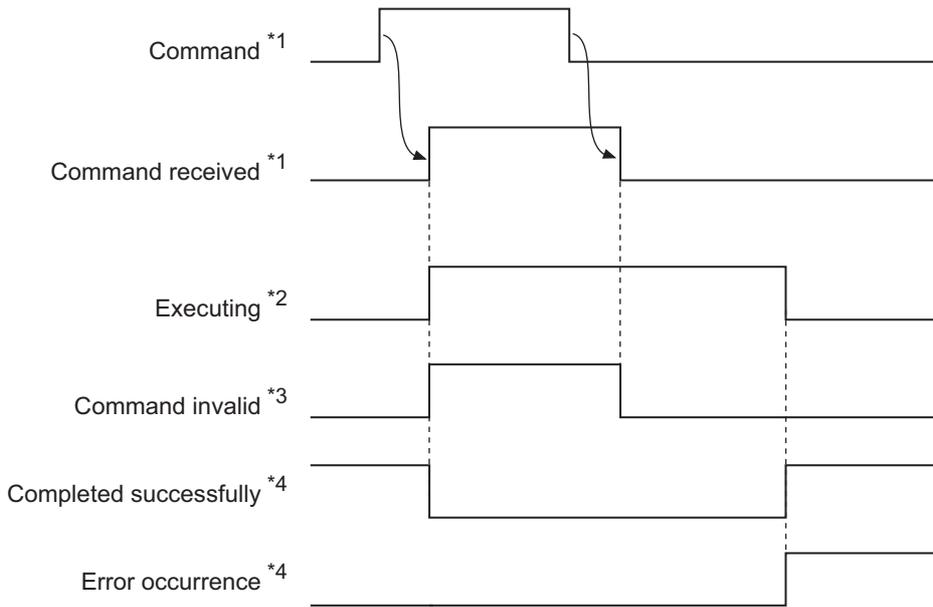
*1 In the case of a command which starts the moment the bit turns ON, you can turn OFF the Command Memory area if the command received turns ON.

*2. In the case of a function that takes some time to process, the executing status remains ON while the processing is in progress.

*3. If the execution condition is not satisfied, the command invalid status also remains ON while the command received status is ON.

*4. One of the areas turns ON depending on whether the command was successful or an error occurred.

PCU Control Memory Area

Data read/write, error reset, error flags, error codes and other items that relate to the PCU status are allocated in this memory area.

The PCU Control Memory area is allocated as a Special I/O Unit Memory area.

The first word of the memory area which is allocated as a Special I/O Unit Memory area is determined by the calculation formula below according to the unit number of the PCU.

First word of Special I/O Unit memory area (n) $n = 2{,}000 + 10 \times$ unit number

■ PCU Control Output Memory Area

Words	Name	Bit	Bit name	Function
n	PCU Control Command area	0	Error reset	Reset common errors within the PCU the moment the bit turns ON.
		1	Warning reset	Reset common warnings within the PCU the moment the bit turns ON.
		2 to 11	Not used	Do not use.
		12	Write data	Writing data starts the moment the bit turns ON.
		13	Read data	Reading data starts the moment the bit turns ON.
		14	Save data	Saving data starts the moment the bit turns ON.
		15	PCU setup	Reset the PCU the moment the bit turns ON. Hold the reset status while this bit is ON.
n+1	Number of data transfer words	0 to 15	–	Set the number of words which you use for writing/reading data.
n+2	CPU data transfer area type	0 to 15	–	Set the area type on the CPU side. 00B0 (hex): I/O Memory area (CIO) 00B1 (hex): Internal Auxiliary Memory area (WR) 00B2 (hex): Holding Memory area (HR) 0082 (hex): DM area (DM) 0050 to 0068 (hex): EM Area (EM) in CJ2 CPU Units*1 0050 (hex): EM bank No. 0 0051 (hex): EM bank No. 1 : 0068 (hex): EM bank No. 18 00A0 to 00AF (hex): EM Area (EM) in CJ1 CPU Units*1 00A0 (hex): EM bank No. 0 (hex) 00A1 (hex): EM bank No. 1 (hex) : 00AF (hex): EM bank No. F (hex) *1. The number of available banks varies depending on the CPU.

Words	Name	Bit	Bit name	Function
n+3	CPU data transfer beginning word	0 to 15	–	Set the beginning word on the CPU side. Specify the location to store the transferred data of the CPU I/O memory, together with the area type setting. Example: When you specify D00100 CPU area type (n+2): 0082 (hex) CPU starting word (n+3): 0064 (hex)
n+4	PCU data transfer area type[*1]	0 to 15	–	Set the area type on the PCU side. Set in hexadecimal.
n+5	PCU data transfer beginning word[*1]	0 to 15	–	Set the beginning word on the PCU side. Set in hexadecimal.
n+6	Origin proximity input internal memory area	0 to 15	–	Output Memory area which you can specify in the PCU (bits 0 to 15). If you select the origin proximity input internal bit for [IO Function Selection] under the axis parameter [Origin Proximity Input Signal Selection], bits 0 to 3 correspond to the origin proximity inputs for axes 1 to 4, respectively.[*2]
n+7	MPG magnification selection[*3]	0 to 1	–	Select the MPG magnification. 00: Magnification 1 selection 01: Magnification 2 selection 10: Magnification 3 selection 11: Magnification 4 selection

*1. For the area type and address, refer to "Data Address" on page 8-4.

*2. For the axis parameters, refer to "I/O Function Setting" on page 5-18.

*3. Use a common parameter to set the MPG magnification. For details, refer to "MPG Magnification Setting" on page 3-13.

PCU Control Input Memory Area

Words	Name	Bit	Bit name	Function
n+11	PCU control command received	0	Error reset received	This turns ON at the error reset output reception.
		1	Warning reset received	This turns ON at the warning reset output reception.
		2 to 11	Not used	Do not use.
		12	Write data received	This turns ON at the data write output reception.
		13	Read data received	This turns ON at the data read output reception.
		14	Save data received	This turns ON at the data save output reception.
		15	PCU ready	This turns ON when the PCU becomes ready to operate.

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Words	Name	Bit	Bit name	Function
n+12	PCU control status	0	Data transferring	This remains ON while data transfer is in progress.
		1	Data transfer invalid	This turns ON when data transfer failed.
		2	Data transfer completed	This turns ON when data write, read, or save is completed successfully.
		3	Save data request	This turns ON at the situation in which information will be lost when you cut off the power supply, unless you save the data.
		4	Error resetting	This remains ON while an error reset is in progress.
		5 to 7	Not used	Do not use.
		8	Synchronous operating	This remains ON while the PCU is operating in the SYNCHRONOUS mode.
		9	Not used	Do not use.
n+12 (Continued)	PCU control status	10	SOFTWARE EXCLUSIVE Mode (Data Transfer)	This remains ON during the SOFTWARE EXCLUSIVE mode (data transfer) by software.
		11	SOFTWARE EXCLUSIVE Mode (Test Run)	This remains ON during the SOFTWARE EXCLUSIVE mode (test run) by software.
		12 to 15	Not used	Do not use.

Words	Name	Bit	Bit name	Function
n+13	PCU error status	0	Restore error	This turns ON upon occurrence of inconsistency between an internal PCU setting and the system environment.
		1	Synchronous data receive error	This turns ON when missing data occurred at least twice when you send synchronous data from the CPU, or a synchronous time monitor timeout error occurred.
		2	Synchronous data receive warning	This turns ON (warning) if missing data occurred at least once when you send synchronous data from the CPU.
		3	Synchronous processing time over	This turns ON when the PCU detects a new synchronous interrupt in the synchronous cycle process. The bit turns OFF the next time a synchronous interrupt is received normally.
		4 to 7	Not used	Do not use.
		8	Saved data error	This turns ON when data in the nonvolatile memory becomes corrupted or data corruption occurs because the power is cut off while saving.
		9	PLC system error	This remains ON while an error is input from outside the system.
		10	Not used	Do not use.
		11	PCU warning	This turns ON upon detection of a common warning-level error within the PCU.
		12	PCU error	This turns ON upon detection of a common error within in the PCU.
		13	Overall axis error	This turns ON when an axis error occurs.
		14	Overall memory operation error	This turns ON upon occurrence of a memory operation error.
		15	Overall error	This turns ON upon occurrence of an error in the PCU.
n+14	PCU error code	0 to 15	–	This returns an PCU error code.
n+15	Memory Operation Auxiliary Memory area	0 to 15	–	An input area which you can specify in the PCU (bits 0 to 15).

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Manual Operation Command Memory Area

For information on the setting method for Manual Operation Command Memory area, refer to "Manual Operation Command Memory Area Selection" on page 5-7.

The table below shows the allocation when you select [A] as the first word in the Manual Operation Command Memory area.

Words	Name	Bit	Bit name	Function
A	Axis 1 Manual Operation Command Memory area	0	Servo lock	The RUN output turns ON the moment the bit turns ON. If you set the RUN output function to general-purpose output, ON/OFF of this output becomes ON/OFF of the RUN output.
		1	Drive alarm reset output	Turn ON/OFF the drive alarm reset.
		2	Error counter reset output	Turn ON/OFF the error counter reset.[1] If this bit turns ON during Origin Return, however, a error counter reset error (error code: 6007) occurs. As a result, after a deceleration stop, output the error counter reset output according to this bit.
		3	Torque limit output	Turn ON/OFF the torque limit output.
		4	General-purpose output	Turn ON/OFF the built-in general-purpose output.
		5	Override enable	Specify whether to enable/disable override. ON: enable, OFF: disable
		6	JOG/Inching speed selection	Select the JOG speed/inching speed. Speed 1 is selected when this bit is OFF, while speed 2 is selected when it is ON.
		7	Forward direction JOG/Inching	Perform JOG operation or inching operation in the forward direction when this bit is ON.
		8	Reverse direction JOG/Inching	Perform JOG operation or inching operation in the reverse direction when this bit is ON.
		9	MPG enable	MPG operation is enabled when this bit is ON.
		10	Origin Search	Origin Search starts the moment the bit turns ON.
		11	Origin Return	Origin Return starts the moment the bit turns ON.
		12	Not used	Do not use.
		13	Not used	Do not use.
		14	Deceleration stop	Deceleration stop starts the moment the bit turns ON.[2]
		15	Servo unlock	The RUN output turns OFF the moment the bit turns ON.[3] If you set the RUN output function to general-purpose output, this bit becomes disabled.
A+1	Axis 1 override	0 to 15		Set the override value in hexadecimal. You can set a desired value from 1 to 50,000 (0001 to C350 hex), which corresponds to 0.01% to 500.00%.

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Words	Name	Bit	Bit name	Function
A+2	Axis 2 Manual Operation Command Memory area	0 to 15		Refer to the explanation for axis 1.
A+3	Axis 2 override	0 to 15		Refer to the explanation for axis 1.
A+4	Axis 3 Manual Operation Command Memory area	0 to 15		Refer to the explanation for axis 1.
A+5	Axis 3 override	0 to 15		Refer to the explanation for axis 1.
A+6	Axis 4 Manual Operation Command Memory area	0 to 15		Refer to the explanation for axis 1.
A+7	Axis 4 override	0 to 15		Refer to the explanation for axis 1.

*1. Be sure to turn OFF the error counter reset output upon turning ON [Error Counter Reset Output Received] under [Axis Status Memory Area]. If the error counter reset output remains ON, the axis may not receive other commands.

*2. Be sure to turn OFF the deceleration stop upon turning ON [Deceleration Stop Received] under [Axis Status Memory Area]. If the deceleration stop output remains ON, the axis may not receive other commands.

*3. Be sure to turn OFF the servo unlock output upon turning ON [Servo Unlock Received] under [Axis Status Memory Area]. If the servo unlock output remains ON, the axis may not receive other commands.

Direct Operation Command Memory Area

For information on the setting method for Direct Operation Command Memory area, refer to "Direct Operation Command Memory Area Selection" on page 5-8.

The table below shows the allocation when you select [B] as the beginning world in the Direct Operation Command Memory area.

Words	Name	Bit	Bit name	Function
B	Axis 1 Direct Operation Command Memory area	0	Absolute movement	Start absolute positioning operation the moment the bit turns ON.
		1	Relative movement	Start relative positioning operation the moment the bit turns ON.
		2	Speed control	Start speed control the moment the bit turns ON.
		3 to 4	Not used	Do not use.
		5	Interrupt feeding specification	Specify interrupt feeding the moment the bit of the absolute movement, relative movement or speed control turns ON. ON: Enable, OFF: Disable
		6	Interrupt input mask enable/ Present position latch enable	Depending on the parameter setting, you can select the interrupt input mask for interrupt feeding or the present position latch enable when it is used for interrupt input. ON: Enable, OFF: Disable
		7	Present position preset	Perform present position preset the moment the bit turns ON.

Words	Name	Bit	Bit name	Function
B (Continued)	Axis 1 Direct Operation Command Memory area	8	Synchronous feeding	Perform synchronous feeding operation while this bit is ON.
		9 to 14	Not used	Do not use.
		15	Latch completed clear	Clear the latch completed flag the moment the bit turns ON.
B+1	Axis 1 rotation axis direction	0 to 15		Specify the operating direction to be applied when you use an infinite axis or execute absolute movement. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified
B+2	Axis 1 command position (rightmost word)	0 to 15		Specify the position to be used in direct operation or present position preset. The unit corresponds to [Command Unit]. Set in hexadecimal. Setting range: 80000000 to 7FFFFFFF hex (−2147483648 to 2147483647 [Command Unit])
B+3	Axis 1 command position (leftmost word)	0 to 15		
B+4	Axis 1 command speed (rightmost word)	0 to 15		Specify the target speed to be used in direct operation. The unit corresponds to [Command Unit/s]. Set in hexadecimal. Setting range: Position control: 1 to 7FFFFFFF hex (1 to 2147483647 [Command Unit/s]), Speed control: 80000000 to 7FFFFFFF hex (−2147483648 to 2147483647[Command Unit/s])
B+5	Axis 1 command speed (leftmost word)	0 to 15		
B+6	Not used	Do not use.		
B+7	Not used	Do not use.		
B+8	Axis 1 acceleration time (rightmost word)[1]	0 to 15		Specify the acceleration time. The unit corresponds to [ms]. Set in hexadecimal. Setting range: 0 to 3D090 hex (0 to 250000 ms)
B+9	Axis 1 acceleration time (leftmost word)[1]	0 to 15		
B+10	Axis 1 deceleration time (rightmost word)[1]	0 to 15		Specify the deceleration time. The unit corresponds to [ms]. Set in hexadecimal. Setting range: 0 to 3D090 hex (0 to 250000 ms)
B+11	Axis 1 deceleration time (leftmost word)[1]	0 to 15		
B+12	Axis 2 Direct Operation Command Memory area	0 to 15		Refer to the explanation for axis 1.
B+13	Axis 2 rotation axis direction	0 to 15		Refer to the explanation for axis 1.
B+14	Axis 2 command position (rightmost word)	0 to 15		Refer to the explanation for axis 1.
B+15	Axis 2 command position (leftmost word)	0 to 15		Refer to the explanation for axis 1.
B+16	Axis 2 command speed (rightmost word)	0 to 15		Refer to the explanation for axis 1.

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Words	Name	Bit	Bit name	Function
B+17	Axis 2 command speed (leftmost word)	0 to 15		Refer to the explanation for axis 1.
B+18	Not used	Do not use.		
B+19	Not used	Do not use.		
B+20	Axis 2 acceleration time (rightmost word)[1]	0 to 15		Refer to the explanation for axis 1.
B+21	Axis 2 acceleration time (leftmost word)[1]	0 to 15		Refer to the explanation for axis 1.
B+22	Axis 2 deceleration time (rightmost word)[1]	0 to 15		Refer to the explanation for axis 1.
B+23	Axis 2 deceleration time (leftmost word)[1]	0 to 15		Refer to the explanation for axis 1.
B+24	Axis 3 Direct Operation Command Memory area	0 to 15		Refer to the explanation for axis 1.
B+25	Axis 3 rotation axis direction	0 to 15		Refer to the explanation for axis 1.
B+26	Axis 3 command position (rightmost word)	0 to 15		Refer to the explanation for axis 1.
B+27	Axis 3 command position (leftmost word)	0 to 15		Refer to the explanation for axis 1.
B+28	Axis 3 command speed (rightmost word)	0 to 15		Refer to the explanation for axis 1.
B+29	Axis 3 command speed (leftmost word)	0 to 15		Refer to the explanation for axis 1.
B+30	Not used	Do not use.		
B+31	Not used	Do not use.		
B+32	Axis 3 acceleration time (rightmost word)[1]	0 to 15		Refer to the explanation for axis 1.
B+33	Axis 3 acceleration time (leftmost word)[1]	0 to 15		Refer to the explanation for axis 1.
B+34	Axis 3 deceleration time (rightmost word)[1]	0 to 15		Refer to the explanation for axis 1.
B+35	Axis 3 deceleration time (leftmost word)[1]	0 to 15		Refer to the explanation for axis 1.

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Words	Name	Bit	Bit name	Function
B+36	Axis 4 Direct Operation Command Memory area	0 to 15		Refer to the explanation for axis 1.
B+37	Axis 4 rotation axis direction	0 to 15		Refer to the explanation for axis 1.
B+38	Axis 4 command position (rightmost word)	0 to 15		Refer to the explanation for axis 1.
B+39	Axis 4 command position (leftmost word)	0 to 15		Refer to the explanation for axis 1.
B+40	Axis 4 command speed (rightmost word)	0 to 15		Refer to the explanation for axis 1.
B+41	Axis 4 command speed (leftmost word)	0 to 15		Refer to the explanation for axis 1.
B+42	Not used	Do not use.		
B+43	Not used	Do not use.		
B+44	Axis 4 acceleration time (rightmost word)[1]	0 to 15		Refer to the explanation for axis 1.
B+45	Axis 4 acceleration time (leftmost word)[1]	0 to 15		Refer to the explanation for axis 1.
B+46	Axis 4 deceleration time (rightmost word)[1]	0 to 15		Refer to the explanation for axis 1.
B+47	Axis 4 deceleration time (leftmost word)[1]	0 to 15		Refer to the explanation for axis 1.

*1.For the acceleration time and deceleration time, [Acceleration/Deceleration Time Selection] determines the operation. For [Acceleration/Deceleration Time Selection], refer to "Acceleration/Deceleration Setting" on page 5-23 and "Acceleration/Deceleration Time Selection" on page 5-25.

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Axis Status Memory Area

For information on the setting method for Axis Status memory area, refer to "Axis Status Memory Area Selection" on page 5-9.

The table below shows the allocation when you select [c] as the beginning word in the Axis Status area.

Words	Name	Bit	Bit name	Function
C	Axis 1 manual operation command received	0	Servo lock received	This turns ON when the PCU receives a servo lock command.
		1	Drive alarm reset output received	This turns ON when the axis receives a drive alarm reset output.
		2	Error counter reset output received	This turns ON when the PCU receives an error counter reset output.
		3	Torque limit output received	This turns ON when the PCU receives a torque limit output.
		4	General-purpose output received	This turns ON when the PCU receives a general-purpose output.
		5	Override enable received	This turns ON when the PCU receives an override enable.
		6	JOG/Inching speed selection received	This turns ON when the PCU receives a JOG/inching speed selection.
		7	Forward direction JOG/Inching received	This turns ON at a JOG/inching forward direction operation reception.
		8	Reverse direction JOG/Inching received	This turns ON at a JOG/inching reverse direction operation reception.
		9	MPG enable received	This turns ON at a MPG enable reception.
		10	Origin Search received	This turns ON when the PCU receives an Origin Search.
		11	Origin Return received	This turns ON when the PCU receives an Origin Return.
		12 to 13	Not used	Do not use.
		14	Deceleration stop received	This turns ON when the PCU receives a deceleration stop.
		15	Servo unlock received	This turns ON when the PCU receives a servo unlock.

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Words	Name	Bit	Bit name	Function
C+1	Axis 1 direct operation command received	0	Absolute movement received	This turns ON at an absolute movement reception.
		1	Relative movement received	This turns ON at a relative movement reception.
		2	Speed control received	This turns ON at a speed control reception.
		3 to 4	Not used	Do not use.
		5	Interrupt feeding specification received	This turns ON at an interrupt feeding specification reception.
		6	Interrupt input mask enable/ Present position latch enable received	This turns ON at an interrupt input mask enable/ present position latch enable reception.
		7	Present position preset received	This turns ON at a present position preset reception.
		8	Synchronous feeding received	This turns ON at a synchronous feeding reception.
		9 to 14	Not used	Do not use.
		15	Latch completed clear received	This turns ON at a latch completed clear reception.

Words	Name	Bit	Bit name	Function
C+2	Axis 1 command status	0	Axis busy	This remains ON while the axis is operating. During memory operation, the axis busy bit turns ON for any axis which is allocated to the axis configuration even when it is not operating.
		1	JOG start available	This turns ON when the PCU can receive a JOG start up command.
		2	Direct operation start available	This turns ON when the PDC can receive a direct operation start command.
		3	Not used	Do not use.
		4	During deceleration stop input	This remains ON while the axis decelerates due to the reception of a deceleration stop command or while the deceleration stop command is input.
		5	During synchronous group stop input	This remains ON while the axis stops due to reception of a synchronous group stop output during data synchronization or the synchronous group stop output is ON.
		6	During All Synchronous Unit stop input	This remains ON while the axis stops due to reception of all Synchronous Unit stop output during data synchronization or the all Synchronous Unit stop output is ON.
		7	High-speed PTP Start Acknowledged Flag	This flag turns ON to acknowledge a high-speed PTP start. (Unit version 1.1 or later. This bit is not supported by unit version 1.0.)
		8	Start invalid	The Start Invalid Flag turns ON when command execution fails because the conditions that are required to start the command function were not met. The Start Invalid Flag turns ON when the command cannot be started because an error occurred when starting the command or because of the priority of the command.
		9	Error counter reset invalid	The Error Counter Reset Invalid Flag turns ON when an error counter reset output is performed during an origin search operation but the error counter reset output for the axis is not received.
C+2 (Continued)	Axis 1 command status	10 to 11	Not used	Do not use.
		12	Stop executed	This turns ON when axis operation has stopped for one of the following causes during axis operation in manual operation or direct operation. • Execution of deceleration stop, error counter reset, or servo unlock • Stop for error occurrence • Stop for stop function of Synchronous Unit
		13	Positioning completed	This turns ON when operation stops for positioning operation in direct operation, Origin Search completion, Origin Return completion, JOG, MPG, or synchronous feed operation stop.
		14 to 15	Not used	Do not use.

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Words	Name	Bit	Bit name	Function
C+3	Axis 1 axis operation status	0	During servo unlock	This remains ON while the axis is in servo unlock status.
		1	During servo lock	This remains ON while the axis stops with its servo locked.
		2	During backlash compensation	This remains ON while backlash compensation of the axis is effective. You can use this as a path status during interpolation.
		3	During acceleration	This remains ON while the axis accelerates to the target speed. You can use this as a path status during interpolation.
		4	During constant speed movement	This remains ON while the axis operates at a constant speed after it reached the target speed. You can use this as a path status during interpolation.
		5	During deceleration	This remains ON while the axis decelerates to the target position or target speed. You can use this as a path status during interpolation.
		6	During pass	This remains ON while the axis movement in continuous 1 or continuous 3 is accelerating or decelerating toward the target speed of the next sequence. You can use this as a path status during interpolation.
		7	Positioning completed input waiting	This remains ON while the axis waits for completion of positioning. You can use this as a path status during interpolation.
		8	During deceleration stop	This turns ON when the axis decelerates to stop while in operation, and remains ON until the axis stops.
		9	During immediate stop	This turns ON when the axis makes an immediate stop while in operation, and remains ON until the axis stops.
		10 to 15	Not used	Do not use.

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Words	Name	Bit	Bit name	Function
C+4	Axis 1 operation status	0	During Origin Search	This remains ON during Origin Search operation.
		1	During Origin Return	This remains ON during Origin Return operation.
		2	During MPG operation	This remains ON during MPG control operation.
		3	During JOG/Inching	This remains ON during JOG/inching operation.
		4	During absolute movement	This remains ON during absolute movement operation. (Including the time before the interrupt input.)
		5	During relative movement	This remains ON during relative movement operation. (Including the time before the interrupt input.)
		6	During speed control	This remains ON during speed control operation. (Including the time before the interrupt input.)
		7	During interrupt feeding (interrupt input waiting)	This remains ON before an interrupt input of interrupt feeding operation.
		8	During interrupt feeding (positioning)	This remains ON after an interrupt input of interrupt feeding operation.
		9	Not used	Do not use.
		10	Not used	Do not use.
		11	During memory operation	This remains ON during memory operation.
		12 to 14	Not used	Do not use.
		15	During synchronous feeding	This remains ON during synchronous feeding.
C+5	Axis 1 control status	0	Origin fix	This turns ON once the origin is determined. 0: Origin not yet determined 1: Origin determined
		1	Origin Stop	This turns ON when the status of the Origin Fix flag in the Axis Status Memory Area is ON and the Command Present Position in the Axis Status Memory Area is 0.
		2	Latch completed	This turns ON when the present position latch is executed.
		3	Not used	Do not use.
		4	Command present position overflow	This turns ON when the command position overflow occurs in the LINEAR mode.
		5	Command present position underflow	This turns ON when the command position underflow occurs in the LINEAR mode.

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Words	Name	Bit	Bit name	Function
C+5 (Continued)	Axis 1 control status	6	Feedback present position overflow	This turns ON when a feedback position overflows in the LINEAR mode.
		7	Feedback present position underflow	This turns ON when a feedback position underflows in the LINEAR mode.
		8	Sensor error	This turns ON when an external sensor for the emergency stop input or limit input generates an error.
		9	Servo error	This turns ON when an error, such as the drive alarm input, is notified from the outside of the system.
		10	Execution error	The Execution Error Flag turns ON when an error occurs, such as a duplicate start error, due to a problem in the execution conditions or command values when a command for axis operation is executed.
		11	Axis warning	This turns ON when a warning occurs.
		12	Axis error	This turns ON when an axis error occurs.
		13	Zone 0	This remains ON while the present position is inside zone 0.
		14	Zone 1	This remains ON while the present position is inside zone 1.
		15	Zone 2	This remains ON while the present position is inside zone 2.

Words	Name	Bit	Bit name	Function
C+6	Axis 1 external I/O status	0	RUN output	This remains ON while the servo RUN output is ON.
		1	Drive alarm reset output	This remains ON while the drive alarm reset output is ON.
		2	Error counter reset output	This remains ON while the error counter reset output is ON.
		3	Torque limit output	This remains ON while the torque limit output is ON.
		4	General-purpose output	This remains ON while the general-purpose output is ON.
		5 to 6	Not used	Do not use.
		7	General-purpose input	This remains ON while the general-purpose inputs are ON.
		8	Forward direction limit input	This remains ON while the forward direction limit input is activated.
		9	Reverse direction limit input	This remains ON while the reverse direction limit input is activated.
		10	Origin proximity input	This remains ON while the origin proximity input is activated.
		11	Origin input	This remains ON while the origin input is activated.
		12	Interrupt input	This remains ON while the interrupt input is ON.
		13	Emergency stop input	This remains ON while the emergency stop input is ON.
		14	Positioning completed input	This remains ON while the positioning completed input is input.
		15	Drive alarm input	This remains ON while the drive alarm input is input.
C+7	Axis 1 error code	0 to 15		This returns an axis error code.
C+8	Axis 1 command present position (rightmost word)	0 to 15		Returns the commended present position.
C+9	Axis 1 command present position (leftmost word)	0 to 15		
C+10	Axis 1 expanded monitor (rightmost word)	0 to 15		Returns the monitor value which is specified in the axis parameter [Expanded Monitor Type]. For details, refer to "Expanded Monitor Setting" on page 5-49.
C+11	Axis 1 expanded monitor (leftmost word)	0 to 15		
C+12	Not used	0 to 15		Do not use.
C+13	Axis 2 manual operation command received	0 to 15		Refer to the explanation for axis 1.
C+14	Axis 2 direct operation command received	0 to 15		Refer to the explanation for axis 1.

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Words	Name	Bit	Bit name	Function
C+15	Axis 2 command status	0 to 15	Refer to the explanation for axis 1.	
C+16	Axis 2 axis operation status	0 to 15	Refer to the explanation for axis 1.	
C+17	Axis 2 operation status	0 to 15	Refer to the explanation for axis 1.	
C+18	Axis 2 control status	0 to 15	Refer to the explanation for axis 1.	
C+19	Axis 2 external I/O status	0 to 15	Refer to the explanation for axis 1.	
C+20	Axis 2 error code	0 to 15	Refer to the explanation for axis 1.	
C+21	Axis 2 command present position (rightmost word)	0 to 15	Refer to the explanation for axis 1.	
C+22	Axis 2 command present position (leftmost word)	0 to 15		
C+23	Axis 2 expanded monitor (rightmost word)	0 to 15	Refer to the explanation for axis 1.	
C+24	Axis 2 expanded monitor (leftmost word)	0 to 15		
C+25	Not used	0 to 15	Do not use.	
C+26	Axis 3 manual operation command received	0 to 15	Refer to the explanation for axis 1.	
C+27	Axis 3 direct operation command received	0 to 15	Refer to the explanation for axis 1.	
C+28	Axis 3 command status	0 to 15	Refer to the explanation for axis 1.	
C+29	Axis 3 axis operation status	0 to 15	Refer to the explanation for axis 1.	
C+30	Axis 3 operation status	0 to 15	Refer to the explanation for axis 1.	
C+31	Axis 3 control status	0 to 15	Refer to the explanation for axis 1.	
C+32	Axis 3 external I/O status	0 to 15	Refer to the explanation for axis 1.	
C+33	Axis 3 error code	0 to 15	Refer to the explanation for axis 1.	
C+34	Axis 3 command present position (rightmost word)	0 to 15	Refer to the explanation for axis 1.	
C+35	Axis 3 command present position (leftmost word)	0 to 15		

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Words	Name	Bit	Bit name	Function
C+36	Axis 3 expanded monitor (rightmost word)	0 to 15		Refer to the explanation for axis 1.
C+37	Axis 3 expanded monitor (leftmost word)	0 to 15		
C+38	Not used	0 to 15	Do not use.	
C+39	Axis 4 manual operation command received	0 to 15	Refer to the explanation for axis 1.	
C+40	Axis 4 direct operation command received	0 to 15	Refer to the explanation for axis 1.	
C+41	Axis 4 command status	0 to 15	Refer to the explanation for axis 1.	
C+42	Axis 4 axis operation status	0 to 15	Refer to the explanation for axis 1.	
C+43	Axis 4 operation status	0 to 15	Refer to the explanation for axis 1.	
C+44	Axis 4 control status	0 to 15	Refer to the explanation for axis 1.	
C+45	Axis 4 external I/O status	0 to 15	Refer to the explanation for axis 1.	
C+46	Axis 4 error code	0 to 15	Refer to the explanation for axis 1.	
C+47	Axis 4 command present position (rightmost word)	0 to 15		Refer to the explanation for axis 1.
C+48	Axis 4 command present position (leftmost word)	0 to 15		
C+49	Axis 4 expanded monitor (rightmost word)	0 to 15		Refer to the explanation for axis 1.
C+50	Axis 4 expanded monitor (leftmost word)	0 to 15		

5

Setting Data

5

Setting Data

Memory Operation Command Memory Area

For information on the setting method for Memory Operation Command Memory area, refer to "Memory Operation Command Memory Area Selection" on page 5-9.

The table below shows the allocation when you select [D] as the beginning word in the Memory Operation Command area.

Words	Name	Bit	Bit name	Function
D	Task 1 Memory Operation Command Memory area	0	Sequence No. enable	Specify whether to enable/disable the sequence number for Operation Data area at memory operation start. ON: Enable, OFF: Disable
		1	Memory operation start	Memory operation starts the moment the bit turns ON.
		2	Memory operation independent start	Memory operation starts the moment the bit turns ON. Perform independent operation, except when you set END for [Command].
		3	Not used	Do not use.
		4	M code reset	Perform M code reset the moment the bit turns ON.
		5	Teaching	Perform teaching the moment the bit turns ON.
		6 to 14	Not used	Do not use.
		15	Memory operation stop	Memory operation decelerates to a stop the moment the bit turns ON.
D+1	Task 1 sequence No.	0 to 15		Specify the starting sequence number of memory operation. Set a sequence number between 1 and 500 in hexadecimal.
D+2	Task 1 teaching address	0 to 15		Set the position data number (sequence number) to use in position teaching. Set a sequence number between 1 and 500 in hexadecimal.
D+3	Task 2 Memory Operation Command Memory area	0 to 15		Refer to the explanation for task 1.
D+4	Task 2 sequence No.	0 to 15		Refer to the explanation for task 1.
D+5	Task 2 teaching address	0 to 15		Refer to the explanation for task 1.
D+6	Task 3 Memory Operation Command Memory area	0 to 15		Refer to the explanation for task 1.
D+7	Task 3 sequence No.	0 to 15		Refer to the explanation for task 1.
D+8	Task 3 teaching address	0 to 15		Refer to the explanation for task 1.
D+9	Task 4 Memory Operation Command Memory area	0 to 15		Refer to the explanation for task 1.

Words	Name	Bit	Bit name	Function
D+10	Task 4 sequence No.	0 to 15	Refer to the explanation for task 1.
D+11	Task 4 teaching address	0 to 15	Refer to the explanation for task 1.

Memory Operation Start (D Word Bit 1)

For a start via [Memory Operation], after you execute the started sequence, automatically execute the next sequence number.

Execution continues until [END] is found in the sequence data [Command].

For details, refer to "Starting Memory Operation" on page 7-14.

Memory Operation Independent Start (D Word Bit 2)

For a start via [Memory Operation Independent Start], perform all operations as [Individual] for [End Pattern], regardless of sequence data designation.

Use [Memory Operation Independent Start] for debugging by step execution.

Perform operation according to the specified sequence number, after which [Executing Sequence No.] is updated based on the execution result and then the operation ends.

For details, refer to "Starting Memory Operation" on page 7-14.

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Setting Data

Memory Operation Status Memory Area

For information on the setting method for Memory Operation Status Memory area, refer to "Memory Operation Status Memory Area Selection" on page 5-10.

The table below shows the allocation when you select [E] as the beginning word in Memory Operation Status area.

Words	Name	Bit	Bit name	Function
E	Task 1 memory operation command received	0	Sequence No. enable received	This turns ON at a sequence number enable reception.
		1	Memory operation start received	This turns ON at a memory operation start reception.
		2	Memory operation independent start received	This turns ON at a memory operation independent start reception.
		3	Not used	Do not use.
		4	M code reset received	This turns ON at a M code reset reception.
		5	Teaching received	This turns ON at a teaching reception.
		6 to 14	Not used	Do not use.
		15	Memory operation stop received	This turns ON at a memory operation stop reception.

Words	Name	Bit	Bit name	Function
E+1	Task 1 memory operation command status	0	Memory operation busy	This remains ON while a task command is in progress. This remains ON while a task configuration axis is busy or task function is in progress.
		1	Memory operation start available	This turns ON at memory operation start available. This remains OFF while a task configuration axis is busy or task function is in progress.
		2 to 3	Not used	Do not use.
		4	During memory operation stop input	This remains ON while decelerating after receiving a memory operation stop command.
		5 to 7	Not used	Do not use.
		8	Memory operation start invalid	The Memory Operation Start Invalid Flag turns ON when an error occurs, such as a memory operation duplicate start error, due to a problem in the execution conditions or command values when a command for memory operation is executed.
		9	Teaching invalid	This turns ON when the PCU could not receive a teaching command.
		10 to 11	Not used	Do not use.
		12	Memory operation stop executed	This turns ON when memory operation stops for a memory operation stop command, error stop, or a command with an individual axis stop during memory operation.
		13	Memory operation completed	This turns ON when memory operation is completed normally.
		14	Teaching completed	This turns ON when the teaching command is completed.
		15	Not used	Do not use.

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Setting Data

Words	Name	Bit	Bit name	Function
E+2	Task 1 memory operation control status	0	During memory operation stop	This remains ON while you do not execute memory operation.
		1	Memory operation waiting	This remains ON while memory operation is on standby. This remains ON while the memory operation stops without END executed after you start the memory operation.
		2	During memory operation axis operation	This remains ON while the axis is operating during memory operation. The bit turns ON if any of the configuration axes is not stationary.
		3	Condition input waiting	This remains ON while the PCU is waiting for the input of conditions during memory operation.
		4	Dwell timer waiting	This remains ON while the PCU is waiting for the dwell time during memory operation.
		5	M code reset waiting	This remains ON while the PCU is waiting for the M code reset during memory operation.
		6	M strobe	This remains ON while a M code is output during memory operation.
		7 to 9	Not used	Do not use.
		10	Memory operation execution error	This turns ON when the task function generates an operation error.
		11	Memory operation warning	This turns ON when a warning occurs.
		12	Memory operation error	This turns ON when a memory operation error occurs.
		13 to 15	Not used	Do not use.
E+3	Task 1 memory operation error code	0 to 15		Return a task error code.
E+4	Task 1 executing sequence No.	0 to 15		Return the executing sequence number of memory operation.
E+5	Task 1 M code	0 to 15		Return the M code (output code) of memory operation.
E+6	Task 2 memory operation command received	0 to 15		Refer to the explanation for task 1.
E+7	task 2 memory operation command status	0 to 15		Refer to the explanation for task 1.
E+8	Task 2 memory operation control status	0 to 15		Refer to the explanation for task 1.
E+9	Task 2 memory operation error code	0 to 15		Refer to the explanation for task 1.
E+10	Task 2 executing sequence No.	0 to 15		Refer to the explanation for task 1.
E+11	Task 2 M code	0 to 15		Refer to the explanation for task 1.

Words	Name	Bit	Bit name	Function
E+12	Task 3 memory operation command received	0 to 15		Refer to the explanation for task 1.
E+13	Task 3 memory operation command status	0 to 15		Refer to the explanation for task 1.
E+14	Task 3 memory operation control status	0 to 15		Refer to the explanation for task 1.
E+15	Task 3 memory operation error code	0 to 15		Refer to the explanation for task 1.
E+16	Task 3 executing sequence No.	0 to 15		Refer to the explanation for task 1.
E+17	Task 3 M code	0 to 15		Refer to the explanation for task 1.
E+18	Task 4 memory operation command received	0 to 15		Refer to the explanation for task 1.
E+19	Task 4 memory operation command status	0 to 15		Refer to the explanation for task 1.
E+20	Task 4 memory operation control status	0 to 15		Refer to the explanation for task 1.
E+21	Task 4 memory operation error code	0 to 15		Refer to the explanation for task 1.
E+22	Task 4 executing sequence No.	0 to 15		Refer to the explanation for task 1.
E+23	Task 4 M code	0 to 15		Refer to the explanation for task 1.

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Setting Data

5-6 Memory Operation Data

Memory operation data sets the operation sequence, position, speed, acceleration/deceleration time and other items that relate to memory operation.

Memory operation refers to an operation where you set memory operation data and memory operation condition data in the PCU beforehand, and perform positioning control and speed control based on commands from the PLC.

4 tasks are available in the PCU, where you can register up to 500 sets of sequence data per task.

For details on memory operation, refer to Chapter 7, Memory Operation.

Memory Operation Data List

Memory operation data is always enabled.
Also note that once you set data, it is used as valid data at the start of memory operation.

📝 **Precautions for Correct Use**

⬩ As for the PCU address for transfer, the applicable address changes depending on the command. For details, refer to "Commands" on page 7-15 and "Data Address" on page 8-4.

Each sequence data includes the set data below. However, you need not set all data depending on the data attribute. For details, refer to "Details of Memory Operation Data" on page 5-92.

Data name	Function	Setting range	Unit	Default values
Axis 1 command position	Set the command position.	–2147483648 to 2147483647	Command unit	0
Axis 2 command position	Set the command position.	–2147483648 to 2147483647	Command unit	0
Axis 3 command position	Set the command position.	–2147483648 to 2147483647	Command unit	0
Axis 4 command position	Set the command position.	–2147483648 to 2147483647	Command unit	0
Command	0000 hex: No sequence data 8### hex: NOP (Treat it as a comment.) [Sequence commands] 0001 hex: JUMP, 0002 hex: FOR 0003 hex: NEXT, 0004 hex: PSET 0005 hex: PRSET, 004F hex: END			0

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Data name	Function	Setting range	Unit	Default values
Command (Continued)	[Operation commands] 0800 hex: Positioning operation, 0801 hex: Linear interpolation operation 0802 hex: Circular interpolation (clockwise direction), 0803 hex: Circular interpolation (counterclockwise direction), 081E hex: Speed control, 081F hex: Interrupt feeding (positioning operation) 0820 hex: Interrupt feeding (speed control)			0
JUMP/ repeat conditions	Set the memory operation condition data number for JUMP and FOR. 0: Execute unconditionally 1 to 100: Memory operation condition data No.	0 to 100	–	0
JUMP destination sequence No.	Set the sequence number for the JUMP destination.	1 to 500	–	0
Repeat loop No.	Set the correspondence of FOR and NEXT combinations.	0 to 49	–	0

Output signal	Specify the destination of forced output.
	0000 hex: No output
	##00 hex: RUN output[1]
	##01 hex: Drive alarm reset output
	##02 hex: Error counter reset output[1]
	##03 hex: General-purpose output
	##04 hex: Torque limit output
	
	##: 01 to 04
	   (Physical Axis 01: Axis 1, 02: Axis 2, 03: Axis 3, 04: Axis 4)
	8000 to 800F hex: Memory Operation Auxiliary Memory Area
	   (8000 to 800F hex correspond to bits 0 to 15, respectively.)
				0

Sequence start condition	Set the sequence starting condition. 0: No start condition 1 to 100: Memory operation condition data No.	0 to 100	–	0
Sequence skip condition	Set the stopping/skipping condition. 0: No sequence skip condition 1 to 100: Memory operation condition data No.	0 to 100	–	0
End pattern	Set the operation end pattern. 0: Individual 1: Automatic 2: Continuous 1 (Until the next sequence speed) 3: Continuous 2 (Acceleration/deceleration starts at the next sequence) 4: Continuous 3 (Pass: Superimpose deceleration of the present sequence and acceleration at the next sequence)	0 to 4	–	0
Dwell timer	Set a dwell time if the end pattern is individual or automatic. 0: No dwell time 1 to 1000: Dwell time	0 to 1,000	10 ms	0
Positioning completed input monitor valid	Select the in-position check to be applied when the operating axis stops. 0: Not wait for the positioning completed signal 1: Wait for the positioning completed signal	0 to 1	–	0

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Setting Data

Setting Data

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Data name	Function	Setting range	Unit	Default values
M code	Set the M code after positioning completed. 0: Without M code 1 to 499: M code that waits for the M code reset 500 to 999: M code that does not wait for the M code reset	0 to 999	–	0
Axis specification	Set the axis to start. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4 Issue a start command when each bit turns ON.	0 to F	–	0
Circular interpolation method	Select the specification method of circular interpolation. 0: Specify the circular center 1: Specify the radius 2: Specify the passing point	0 to 2	–	0
Position specification	Select whether to use a relative position or absolute position for the command position. When each bit is ON, it indicates relative position specification. When the bit is OFF, it indicates absolute position specification. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4	0 to F	–	0
Interpolation speed	Set the interpolation speed.	1 to 8000000	Command unit/s	0
Interpolation acceleration time	Set the interpolated acceleration time.	0 to 250,000	ms	0
Interpolation deceleration time	Set the interpolated deceleration time.	0 to 250,000	ms	0
Interpolation starting speed	Set the interpolated starting speed.	0 to 8000000	Command unit/s	0
Interpolation acceleration/ deceleration curve selection	Select the curve for interpolated acceleration/ deceleration. 0: Trapezoid, 1: S-curve (Cubic curve)	0 to 1	–	0
Interpolation acceleration/ deceleration time selection	Select the specification method for interpolated acceleration/deceleration time. 0: Time from starting speed to maximum speed of each axis (Acceleration/deceleration specified) 1: Time from present speed to target speed of each axis (Time specified)	0 to 1	–	0
Axis 1 circular center/ Passing point position	If you select center point specification under [Circular Interpolation Method], set the center position of the arc. If you select passing point specification, set the position of a passing point.	-2147483648 to 2147483647	Command unit	0
Axis 2 circular center/ Passing point position	If you select center point specification under [Circular Interpolation Method], set the center position of the arc. If you select passing point specification, set the position of a passing point.	−2147483648 to 2147483647	Command unit	0

Data name	Function	Setting range	Unit	Default values
Axis 3 circular center/ Passing point position	If you select center point specification under [Circular Interpolation Method], set the center position of the arc. If you select passing point specification, set the position of a passing point.	−2147483648 to 2147483647	Command unit	0
Axis 4 circular center/ Passing point position	If you select center point specification under [Circular Interpolation Method], set the center position of the arc. If you select passing point specification, set the position of a passing point.	−2147483648 to 2147483647	Command unit	0
Circular radius	If you select radius specification for [Circular Interpolation Method], set the arc radius.	−2147483648 to 2147483647	Command unit	0
Axis 1 rotation axis direction	If you select rotation axis in the applicable axis parameter, select the operating direction of positioning operation (PTP) by absolute movement designation. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified (Absolute position movement inside the ring range without passing through the zero point)	0 to 3	–	0
Axis 2 rotation axis direction	If you select rotation axis in the applicable axis parameter, select the operating direction of positioning operation (PTP) by absolute movement designation. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified (Absolute position movement inside the ring range without passing through the zero point)	0 to 3	–	0
Axis 3 rotation axis direction	If you select rotation axis in the applicable axis parameter, select the operating direction of positioning operation (PTP) by absolute movement designation. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified (Absolute position movement inside the ring range without passing through the zero point)	0 to 3	–	0
Axis 4 rotation axis direction	If you select rotation axis in the applicable axis parameter, select the operating direction of positioning operation (PTP) by absolute movement designation. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified (Absolute position movement inside the ring range without passing through the zero point)	0 to 3	–	0
Axis 1 command speed	Set the target speed of each axis in positioning operation (PTP) and speed control. The command range is 1 to 2147483647 for positioning, and −2147483648 to 2147483647 for speed control.	−2147483648 to 2147483647	Command unit/s	0
Axis 2 command speed	Set the target speed of each axis in positioning operation (PTP) and speed control. The command range is 1 to 2147483647 for positioning, and −2147483648 to 2147483647 for speed control.	−2147483648 to 2147483647	Command unit/s	0

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Setting Data

Data name	Function	Setting range	Unit	Default values
Axis 3 command speed	Set the target speed of each axis in positioning operation (PTP) and speed control. The command range is 1 to 2147483647 for positioning, and −2147483648 to 2147483647 for speed control.	−2147483648 to 2147483647	Command unit/s	0
Axis 4 command speed	Set the target speed of each axis in positioning operation (PTP) and speed control. The command range is 1 to 2147483647 for positioning, and −2147483648 to 2147483647 for speed control.	−2147483648 to 2147483647	Command unit/s	0
Axis 1 acceleration time	Set the acceleration time in positioning operation (PTP) and speed control.	0 to 250,000	ms	0
Axis 2 acceleration time	Set the acceleration time in positioning operation (PTP) and speed control.	0 to 250,000	ms	0
Axis 3 acceleration time	Set the acceleration time in positioning operation (PTP) and speed control.	0 to 250,000	ms	0
Axis 4 acceleration time	Set the acceleration time in positioning operation (PTP) and speed control.	0 to 250,000	ms	0
Axis 1 deceleration time	Set the deceleration time in positioning operation (PTP) and speed control.	0 to 250,000	ms	0
Axis 2 deceleration time	Set the deceleration time in positioning operation (PTP) and speed control.	0 to 250,000	ms	0
Axis 3 deceleration time	Set the deceleration time in positioning operation (PTP) and speed control.	0 to 250,000	ms	0
Axis 4 deceleration time	Set the deceleration time in positioning operation (PTP) and speed control.	0 to 250,000	ms	0
Interpolation speed specification method	Select the interpolated speed designation method for linear interpolation. 0: Specify the interpolation path speed 1: Specify the maximum speed	0 to 1	–	0
Interrupt feeding reference position selection	Select whether to use the command position or feedback position for the reference position of constant-pitch positioning upon interrupt input. 0: Command position 1: Feedback position	0 to 1	–	0
Interrupt input undetected error enable	Select whether to output an error when an interrupt input is not input before positioning is completed during interrupt constant-pitch feeding by position control. 0: Without error detection 1: With error detection	0 to 1	–	0
Interrupt feeding amount	Set the amount of movement in interrupt constant-pitch feeding.	−2147483648 to 2147483647	Command unit	0

*1.Selection is possible only when you use this signal as a general-purpose output.

Details of Memory Operation Data

This section explains each memory operation data.
For the specific setting method for memory operation, refer to Chapter 7, Memory Operation.

Command Position for Axes 1, 2, 3 and 4

Position data is enabled only for an axis which is already allocated in the memory operation parameter [Configuration Axis].
For [Configuration Axis], refer to "Configuration Axis" on page 5-57.

Commands

[Command] is a data that allocates the attribute each sequence data has.
2 types of [Command] data are available: data with sequence attribute and data with operation attribute.
For details, refer to "Commands" on page 7-15.

Sequence

JUMP : Sequence data for the JUMP instruction
The position data number jumps to the one which you specified unconditionally or conditionally.

FOR : Sequence data for the FOR instruction
Repeat the steps until NEXT unconditionally or conditionally. (Up to 50 nests are possible.)

NEXT : Sequence data for the NEXT instruction
Sequence data that indicates the end of the repetition range of FOR.

PSET : Sequence data that forcibly turns ON the PCU outputs
Select under [Output Signal] the contacts which you forcibly turn ON. Hold this data during memory operation.

PRSET : Sequence data that forcibly turns OFF the PCU outputs
Select under [Output Signal] the contacts which you forcibly turn OFF. Hold this data during memory operation.

END : Sequence data for END of memory operation
When you execute END, [Executing Sequence No.] changes to the sequence number which was effective when [Sequence No. Enable] turned ON.

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Setting Data

Operation

Positioning operation (PTP)	: Sequence data for positioning operation
Linear interpolation operation	: Sequence data for linear interpolation operation
Circular interpolation (clockwise direction)	: Sequence data for circular interpolation (clockwise direction)
Circular interpolation (counterclockwise direction)	: Sequence data for circular interpolation (counterclockwise direction)
Speed control	: Sequence data for speed control
Interrupt constant pitch (positioning operation)	: Sequence data for interrupt constant-pitch feeding (positioning operation)
Interrupt constant pitch (speed control)	: Sequence data for interrupt constant-pitch feeding (speed control)

Jumping/Repeat Condition

Set the memory operation condition data number for JUMP and FOR instructions. If you set [0], these instructions are executed unconditionally.
For the memory operation condition data, refer to "Memory Operation Condition Data" on page 5-102.

JUMP Destination Sequence No.

Specify the sequence data number for the JUMP destination by a JUMP instruction.

Repeat Loop No.

Set the combination of FOR and NEXT instructions based on the same repeat loop number.
A repeat loop is formed between FOR and NEXT of the same repeat loop number.
If you set a duplicate repeat loop number, an error occurs.

Output Signal

Specify the output destination of forced output (PSET, PRSET).
For the RUN output and error counter reset output, selection is possible only when you use the signals as general-purpose outputs.
For the settings of the RUN output and Error Counter Reset, refer to "I/O Function Setting" on page 5-18.

Sequence Starting Condition

A sequence starts when the set [Sequence Starting Condition] is satisfied.
If you set [0: No Starting Condition], the sequence starts immediately.

Sequence Skip Condition

The sequence skip condition is enabled after the start of a sequence until the start of the next sequence.
Stopping or skipping occurs when the specified [Sequence Skipping Condition] is satisfied during sequence execution.
In the case of skipping, the program stops the applicable sequence operation and switches to the next sequence according to the end pattern.
If you do not want sequences to stop or skip, set [0: No Stopping or Skipping].

End Pattern

Set the operation end pattern.

Precautions for Correct Use

 • Specifying continuous 1 to 3 is enabled only when the applicable sequence is an interpolation operation. If the sequence is not an interpolation operation, the operation conforms to the one which takes place when you specify automatic.
 • To implement continuous operation, you must set [Linear Interpolation] or [Circular Interpolation] under [Command], and you must not set [Sequence Start Condition] for the next sequence.

The operation under each end pattern is as follows.

Individual:

When [Memory Operation] under [Memory Operation Command Memory Area] turns ON, execute the specified sequence number, after which [Executing Sequence No.] is updated and then the operation ends.
Since the sequence number is updated to the next number, the next sequence number is executed when [Memory Operation] turns ON again.

Automatic:

When [Memory Operation] under [Memory Operation Command Memory Area] turns ON, execute the specified sequence number. When the condition for the next sequence number is satisfied, also the next sequence number is executed automatically.

Continuous 1 (Until the Next Sequence Speed):

When [Memory Operation] under [Memory Operation Command Memory Area] turns ON, execute the specified sequence number, after which the next sequence number is executed successively.

For continuous 1, the speed of the next sequence is reached at the position of the specified sequence number.

Continuous 2 (Acceleration/Deceleration Starts at the Next Sequence):

When [Memory Operation] under [Memory Operation Command Memory Area] turns ON, execute the specified sequence number, after which the next sequence number is executed successively.

For continuous 2, the acceleration or deceleration of the next sequence starts at the position of the specified sequence number.

Continuous 3 (Superimpose Deceleration in the Applicable Sequence and Acceleration in the Next Sequence):

When [Memory Operation] under [Memory Operation Command Memory Area] turns ON, execute the specified sequence number, after which the next sequence number is executed successively.

For continuous 3, superimposing deceleration in the specified sequence number on acceleration in the next sequence realizes smooth interpolation operation.

Speed

Sequence 1   Sequence 2   Time

Precautions for Correct Use

Notes on continuous operation

- Continuous 1 to 3 can be specified for linear interpolation and circular interpolation operation.
  To implement continuous operation, the next sequence must also be linear interpolation or circular interpolation and must not have any sequence starting condition set.
- For the sequences you want to operate continuously, set the amount of movement that requires a positioning time of 2 control cycles or longer. If the required positioning time is less than 2 control cycles, the operation conforms to the [Automatic] pattern.

Dwell Timer

Apply the dwell time only when the end pattern is independent or automatic.
Waiting starts after a successful completion of positioning. Accordingly, waiting does not occur if the axis stops due to a deceleration stop.

Positioning Completed Input Monitor Valid

Select the in-position check that applies when the axis stops.
You can specify this only when the end pattern is independent or automatic.
If you also set [Dwell Timer] above, waiting starts after positioning completed.
If you set [0: Not Wait for the Positioning Completed Signal], positioning is deemed completed upon completion of pulse output.
If you set the axis parameter [Positioning Completed Input] to [Use as General-purpose Input], the operation conforms to [0: Do Not Wait for the Positioning Completed Signal].
Not waiting for positioning completed is also applied when the axis stops due to a deceleration stop.
For the setting of [Positioning Completed Input], refer to "I/O Function Setting" on page 5-18.
If you set [0] for the Position Monitoring Time axis parameter, the positioning completed input will not be monitored regardless of the Positioning Completed Input Function parameter set.
For details, refer to "In-position Check" on page 9-24.

M Code

2 types of M codes are available: M codes that wait for M code reset, and those that do not wait for M code reset.

M code	Description
000	Do not output M code.
001 to 499	Use this M code to trigger an interlock. Temporarily stop sequence execution until a M code reset signal is input.
500 to 999	Use this M code when interlock is not necessary. Do not wait for input of a M code reset signal and execute the next sequence.

If you specify [000] or turn ON [Sequence No. Enable], the M codes are cleared to [0].
For [Sequence No. Enable], refer to "Memory Operation Command Memory Area" on page 5-81.

Axis Specification

Specify the axis to start. Specify only an axis which is already allocated in the memory operation parameter [Configuration Axis].
For [Configuration Axis], refer to "Configuration Axis" on page 5-57.

Circular Interpolation Method

In circular interpolation control, you must specify all interpolated axes in the LINEAR mode.
For information on the setting method for LINEAR mode, refer to "Command Position Unit Setting" on page 5-30.
You can use the methods below to specify circular interpolation:

Command method	Description
Center point specification	Use the present position as the start point and specify the end point, center point and rotation direction, to perform circular interpolation.
Radius specification	Use the present position as the start point and specify the end point, radius and rotation direction, to perform circular interpolation. If you specify the same position as the start point and end point, an error occurs.
Passing point specification	Use the present position as the start point and specify the end point and passing point, to perform circular interpolation. Specifying 3 points, namely the start point, passing point and end point, determines the rotation direction. Accordingly, the specification of circular direction is ignored. If the start point and end point are the same, however, the rotation direction is not determined and thus follows the circular direction.

> ### 📑 Reference
>
> If the start point and end point are clear and you want to perform avoidance operation along the circular path, center point designation is useful.
> Essentially, center point designation calculates the center point to perform complete circular operation.
> In avoidance operation, however, it is difficult to obtain the center point accurately, although the start point and end point are clear. Accordingly, calculate an average of 2 radii and recalculate the center point from the calculated average radius, to perform normal circular interpolation.

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Setting Data
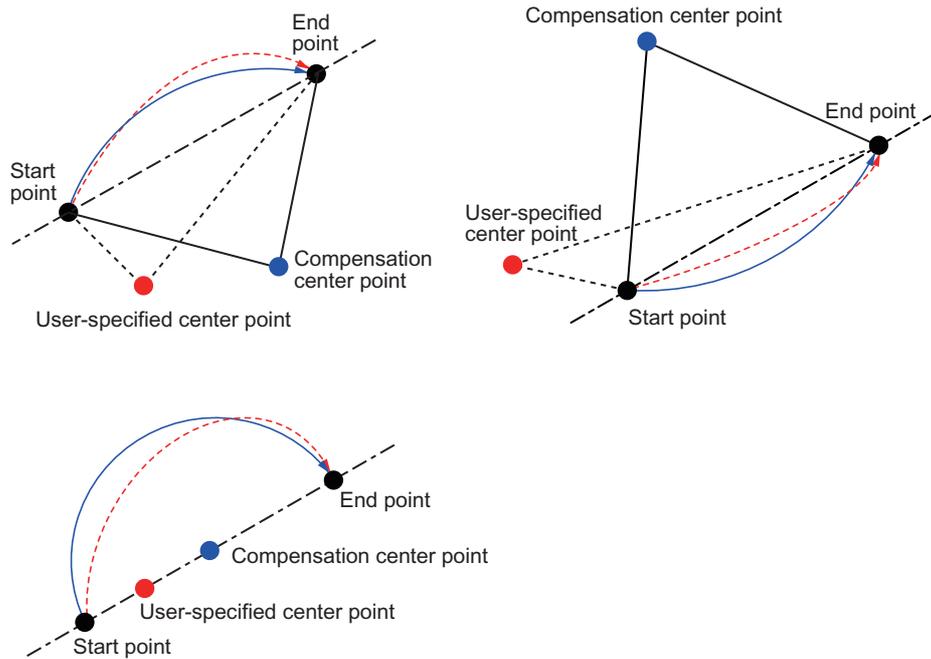
Position Specification

Set absolute position designation or relative position designation for the command position.
Only an axis which is already allocated in the memory operation parameter [Configuration Axis] becomes enabled.
For [Configuration Axis], refer to "Configuration Axis" on page 5-57.

Interpolation Speed

Specify the speed of interpolation control.

Interpolation Acceleration Time/Interpolation Deceleration Time

Set the acceleration time and deceleration time of interpolation control.
For the interpolation acceleration time and interpolation deceleration time, [Interpolation Acceleration/Deceleration Time Selection] determines the operation.

Interpolation Starting Speed

If you use a Servo Motor, set [0].

If you use a stepping motor, normally you should set a value which is one-tenth to one-half the maximum self-start frequency to prevent step-out at start. The suitable value depends on the load condition. Check the manual for your stepping motor for details.

Interpolation Acceleration/Deceleration Curve Selection

Select the curve of interpolation acceleration and interpolation deceleration.

Trapezoid   **S-curve**

Interpolation Acceleration/Deceleration Time Selection

For the acceleration/deceleration time designation method, select the method using fixed acceleration or fixed acceleration/deceleration time.

Under the fixed acceleration method, you determine the time from the starting speed to maximum speed, so that the acceleration/deceleration time changes according to the target speed.

Under the fixed acceleration/deceleration time, you set the time from the present speed to target speed, and the acceleration/deceleration time does not change. In the case of triangle control, however, you determine the acceleration/deceleration time according to the acceleration which you calculated from the present speed, target speed and acceleration/deceleration time.

Fixed acceleration
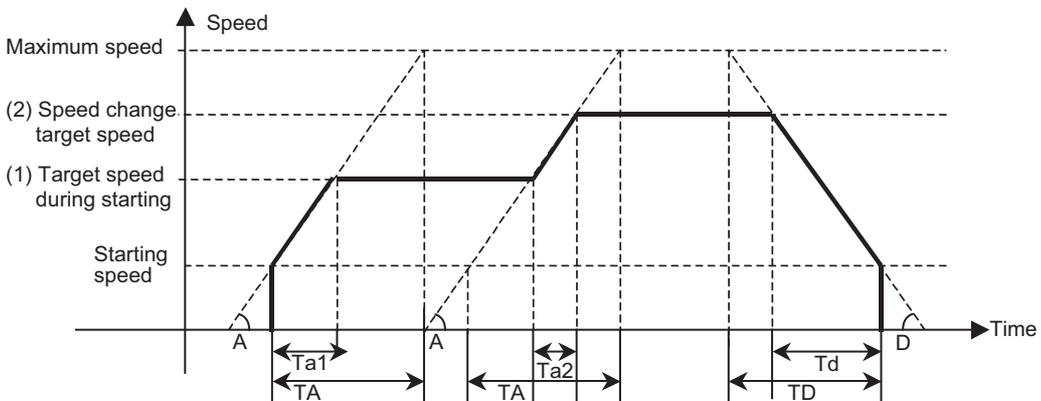
[During starting]   [During speed change]   [During deceleration]
TA: Acceleration time   TA: Acceleration time   TD: Deceleration time
Ta1: Actual acceleration time   Ta2: Actual acceleration time   Td: Actual deceleration time
A: Degree of acceleration   A: Degree of acceleration   D: Degree of deceleration

Fixed acceleration/deceleration time

[During starting]
TA: Acceleration time
A1: Degree of acceleration

[During speed change]
TA: Acceleration time
A2: Degree of acceleration

[During deceleration]
TD: Deceleration time
D: Degree of deceleration

Circular Center and Passing Point Position for Axes 1, 2, 3 and 4

If you select [Specify the Circular Center] for [Circular Interpolation Method], set the center position of the circle.
If you select [Specify the Passing Point] for [Circular Interpolation Method], set the position of a circle passing point.

Circular Radius

If you select [Specify the Radius] for [Circular Interpolation Method], set the circular radius.

Rotation Axis Direction for Axes 1, 2, 3 and 4

If you select rotation axis in the applicable axis parameter, select the operating direction of positioning operation (PTP) by absolute movement designation.

Command Speed for Axes 1, 2, 3 and 4

Set the target speed of each axis in positioning operation (PTP) and speed control.
The specified range is 1 to 2147483647 (command unit/s) for positioning, and −2147483648 to 2147483647 (command unit/s) for speed control.

Acceleration Time/Deceleration Time for Axes 1, 2, 3 and 4

Set the acceleration time and deceleration time of each axis in positioning operation (PTP).
For the acceleration time and deceleration time, [Acceleration/Deceleration Time Selection] under [Axis Parameters] determines the operation.
For acceleration/deceleration time selection, refer to "Acceleration/Deceleration Setting" on page 5-23 and "Acceleration/Deceleration Time Selection" on page 5-25.

Interpolation Speed Specification Method

Select the interpolation speed method for linear interpolation.

Interpolation path speed specification	: This method specifies the speed along the linear interpolation path.
Maximum speed specification	: This method automatically specifies the speed which can realize the fastest operation by combining the maximum speeds of interpolation axes.

Interrupt Feeding Reference Position Selection

This is the interrupt constant-pitch feeding reference position selection in memory operation. Use [Axis Parameter] to set interrupt constant-pitch feeding in direct operation. For the setting of direct operation, refer to "Interrupt Feeding Setting" on page 5-40.

Interrupt Input Undetected Error Enable

This is the interrupt signal error detection setting in memory operation. Use [Axis Parameter] to set interrupt constant-pitch feeding in direct operation. For the setting of direct operation, refer to "Interrupt Feeding Setting" on page 5-40.

Interrupt Feeding Amount

This is the interrupt constant-pitch feeding amount in memory operation. Use [Axis Parameter] to set interrupt constant-pitch feeding in direct operation. For the setting of direct operation, refer to "Interrupt Feeding Setting" on page 5-40.

5-7 Memory Operation Condition Data

For memory operation condition data, you can set up to 100 conditions that apply commonly to all tasks. Condition data is referenced by [JUMP/Repeat Condition], [Sequence Start Condition] and [Sequence Skip Condition] under [Memory Operation Data]. This function judges True or False according to the conditional expression which you set based on the referenced data.
For details on memory operation, refer to Chapter 7, Memory Operation.

Memory Operation Condition Data List

Memory operation condition data is always enabled.

Each condition data includes the set data below. There are some data which you need not set depending on the condition data.

Parameter name	Function	Setting range	Unit	Default values
Condition	Set the comparison condition. 0000 hex: Condition data not yet set 0011 hex: OFF (bit comparison) 0010 hex: ON (bit comparison) 0013 hex: OR (bit comparison) 0012 hex: AND (bit comparison) 0021 hex: ≠ (data comparison: 2 words) 0020 hex: = (data comparison: 2 words) 0023 hex: ≤ (data comparison: 2 words) 0022 hex: ≥ (data comparison: 2 words) 0040 hex: Counter (count specification) 0030 hex: Timer (time specification) [Only the sequence starting condition can be specified.] 0101 hex: Axis 1 external interrupt input 0102 hex: Axis 2 external interrupt input 0103 hex: Axis 3 external interrupt input 0104 hex: Axis 4 external interrupt input\			0
Edge Selection	Select how to evaluate true/false of the conditional expression. 0: Level assessment 1: Edge assessment	0 to 1	–	0
Data 1 Area Selection	Specify the data 1 area for comparison. 0: Unit Control Memory Area (OUT/IN) 1: Manual Operation Command Memory area 2: Direct Operation Command Memory area 3: Memory Operation Command Memory area 4: Axis Status Memory area 5: Memory Operation Status Memory area F: Constant (You can only set either data 1 or data 2 in the data comparison)	0 to 5, 000F hex	–	0
Data 1 Word	Specify the word position as an offset from the beginning word, relative to the target area which you specified by data 1 area selection. Use the beginning word in data comparison.	0 to 255	–	0
Data 1 Bit	Specify the bit position relative to the target word which you specified by data 1 area selection and data 1 word. It is only enabled for the bit comparison.	0 to 15	–	0

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Setting Data

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Setting Data

Parameter name	Function	Setting range	Unit	Default values
Data 2 Area Selection	Specify the data 2 area for comparison. 0: Unit Control Memory area (OUT/IN) 1: Manual Operation Command Memory area 2: Direct Operation Command Memory area 3: Memory Operation Command Memory area 4: Axis Status Memory area 5: Memory Operation Status Memory area F: Constant (You can only set either data 1 or data 2 in the data comparison)	0 to 5, 000F hex	–	0
Data 2 Word	Specify the word position as an offset from the beginning word, relative to the target area which you specified by data 2 area selection. Use the beginning word in data comparison.	0 to 255	–	0
Data 2 Bit	Specify the bit position relative to the target word which you specified by data 2 area selection and data 2 word. It is only enabled for the bit comparison.	0 to 15	–	0
Timer	Set the time to be applied when you specify a timer for the conditional expression.	0 to 1,000	10 ms	0
Counter	Specify the count to be applied when you specify a counter for the conditional expression.	0 to 10,000	times	0
Constant	Set a constant when the condition is data comparison and data 1 or data 2 specifies a constant.	−2147483648 to 2147483647	–	0

Details of Memory Operation Condition Data

This section explains memory operation condition data.

Conditional Expression

Select the conditional expression to use for comparison.

Condition	Judgment method
ON (bit comparison)	If the specified bit is ON, the condition is deemed True. The specified bit is the data 1 bit.
OFF (bit comparison)	If the specified bit is OFF, the condition is deemed True. The specified bit is the data 1 bit.
AND (bit comparison)	If both of the 2 specified bits are ON, the condition is deemed True. Specify the data 1 bit and data 2 bit.
OR (bit comparison)	If either of the 2 specified bits is ON, the condition is deemed True. Specify the data 1 bit and data 2 bit.
Data comparison (2 words)	If the comparison result of the specified 2 data is satisfied, the condition is deemed True. The data in the specified words is compared as 2-word signed data.
Timer (time specification)	The condition is deemed True after a wait time specified in units of 10 ms. Only specifying edge is enabled under [Edge Selection]. An error occurs if you specify level.
Counter (count specification)	Specify the count. Countdown continues every time the condition is referenced. If the countdown result is 0, the condition is deemed False. If the result is other than 0, the condition is deemed True. Once the countdown result becomes "0," the count value is also reset. Only specifying level is enabled under [Edge Selection]. An error occurs if you specify edge. An error also occurs if you set [Count specification] for any other than [FOR and NEXT].
External interrupt input	You can specify this input only for the sequence starting condition. If the external interrupt input is ON, the condition is deemed True. You can specify both edge and level for [Edge Selection]. If you specify edge, an interrupt process starts when the external interrupt input turns from OFF to ON. You can select external interrupt input only for an axis which you specified in the memory operation parameter configuration axis.

Edge Selection

Edge judgment and level judgment are available as the methods to evaluate true/false of a conditional expression for other than a timer (time designation) or counter (count designation). Under level judgment, judge true/false when you judge condition data.

Under edge judgment, the program waits until the condition changes "from True to False to True," if the condition is already True before the judgment of condition data.

For example, assume a sequence for which you specify positioning and set a skipping condition. If the condition is True before you execute the sequence, positioning is not performed and the sequence skips under level judgment.

Under edge judgment, execute positioning, and if the condition changes "from True to False to True," the sequence skips at that point.

Note, however, that condition data for JUMP instructions always conforms to the operation based on level judgment.

Data 1 Area Selection

Specify the area on the left-hand side of the conditional expression for comparison. For the constant, you can only set either data 1 or data 2 in the case of data comparison.

Data 1 Word

Specify the word address of data 1 (left-hand side) for comparison condition. Specify the number of offset words.

For the specification method, specify the word address as an offset in words from the beginning word, relative to the target area which you specified by data 1 area selection.

Data 1 Bit

Specify the bit position of the word of data 1 (left-hand side). This setting is enabled only for bit comparison.

Data 2 Area Selection

Specify the area on the right-hand of the conditional expression for comparison. For the constant, you can only set either data 1 or data 2 in the case of data comparison.

Data 2 Word

Specify the word address of data 2 (right-hand side) for comparison condition. Specify the number of offset words.

For the specification method, specify the word address as an offset in words from the beginning word, relative to the target area which you specified by data 2 area selection.

Data 2 Bit

Specify the bit position of the word of data 2 (right-hand side). This setting is enabled only for bit comparison.

Timer

If you select a timer condition (time designation), set the time for timer condition.

Counter

If you select a counter condition (count designation), set the count for counter condition.

Constant

Set a constant when the condition is data comparison and data 1 or data 2 specifies a constant. You can only set either data 1 or data 2.

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Setting Data

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Direct Operation

This chapter explains the procedure to perform direct operation, setting of operation data, operation method, etc.

6-1 Outline of Direct Operation

With direct operation, you can perform positioning only by writing the position data and speed data to the Direct Operation Command Memory areas which were specified by common parameters.

Position data and speed data which you set in the Direct Operation Command Memory area via MOVL instructions, etc., are automatically output to the PCU at the time of I/O refresh.

Direct Operation Procedure

This section explains the procedure to perform direct operation.

1. **Common parameter settings**
   To perform direct operation, be sure to set the 3 areas: [Manual Operation Command Memory Area], [Direct Operation Command Memory Area] and [Axis Status Memory Area].
   For the setting of memory areas, refer to "Common Parameters" on page 5-6.

2. **Axis parameter settings**
   Set the axis parameters for maximum speed, pulse output method, etc.
   For the axis parameters, refer to "Axis Parameters" on page 5-13.

3. **Data transfer**
   Transfer to the PCU the common parameter and axis parameters you set.

4. **Saving data**
   Save the data to the flash memory in the PCU.

5. **Restart of the PCU**

6. **Put the driver in operating status.**

7. **Execution of origin search**

8. **Setting of Direct Operation Command Memory area**
   Set the position data, speed data, acceleration time, deceleration time and other data in [Direct Operation Command Memory Area].

9. **Starting direct operation**
   Turn ON the absolute movement command bit or relative movement command bit in [Direct Operation Command Memory Area].

6-2 Setting of Direct Operation Data

This section briefly explains [Manual Operation Command Memory Area], [Direct Operation Command Memory Area] and [Axis Status Memory Area] which you use to execute direct operation.

For the setting methods and details, refer to "Operating Memory Area" on page 5-60.
For the setting methods and details of [Common Parameter] and [Axis Parameter], refer to "Common Parameters" on page 5-6 and "Axis Parameters" on page 5-13, respectively.

Memory Areas to Use in Direct Operation

This section explains the data settings and memory areas which you use in direct operation with axis 1 as an example.

Manual Operation Command Memory Area

This is the memory area for servo lock, Origin Search, etc.
The table below shows the allocations when you set [A] as the first word in the Manual Operation Command Memory area.

Words	Name	Bit	Bit name	Function
A	Axis 1 Manual Operation Command Memory area	0	Servo lock	The RUN output turns ON the moment the bit turns ON. If you set the RUN output function to general-purpose output, ON/OFF of this output becomes ON/OFF of the RUN output.
		1	Drive alarm reset output	Turn ON/OFF the drive alarm.
		2	Error counter reset output	Turn ON/OFF the error counter reset.
		3	Torque limit output	Turn ON/OFF the torque limit output.
		4	General-purpose output	Turn ON/OFF the built-in general-purpose output.
		5	Override valid	Specify whether to enable/disable override.
		6	JOG/ Inching speed selection	Select the JOG speed/inching speed. Speed 1 is selected when this bit is OFF, while speed 2 is selected when it is ON.
		7	JOG/ Inching: forward direction	Perform JOG operation or inching operation in the forward direction when this bit is ON.
		8	JOG/ Inching: reverse direction	Perform JOG operation or inching operation in the reverse direction when this bit is ON.
		9	MPG valid	MPG operation is enabled when this bit is ON.
		10	Origin Search	Origin Search starts the moment the bit turns ON.
		11	Origin Return	Origin Return starts the moment the bit turns ON.
		12 to 13	Not used	Do not use.
		14	Deceleration stop	Deceleration stop starts the moment the bit turns ON.

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Direct Operation

Words	Name	Bit	Bit name	Function
A (continued)	Axis 1 Manual Operation Command Memory area	15	Servo unlock	The RUN output turns OFF the moment the bit turns ON. If you set the RUN output function to general-purpose output, this bit becomes disabled.
A+1	Axis 1 override	0 to 15	–	Set the override value in hexadecimal. You can set a desired value from 1 to 50,000 (0001 to C350 hex), which corresponds to 0.01% to 500.00%.

Direct Operation Command Memory Area

This is the area to set the necessary data for direct operation, such as the start command for absolute movement, relative movement or speed control, as well as position data, speed data, acceleration time and deceleration time.

The table below shows the allocations when you set [B] as the first word in the Direct Operation Command Memory area.

Words	Name	Bit	Bit name	Function
B	Axis 1 Direct Operation Command Memory area	0	Absolute movement	Start absolute positioning operation the moment the bit turns ON.
		1	Relative movement	Start relative positioning operation the moment the bit turns ON.
		2	Speed control	Start speed control the moment the bit turns ON.
		3 to 4	Not used	Do not use.
		5	Interrupt feeding specification	Specify interrupt constant-pitch feed the moment the bit of the absolute movement, relative movement or speed control turns ON.
		6	Interrupt input mask valid/ Present position latch valid	Depending on the parameter setting, you can select the interrupt input mask for interrupt feeding or the present position latch valid when it is used for interrupt input.
		7	Present position preset	Perform present position preset the moment the bit turns ON.
		8	Synchronous feeding	Perform synchronous feeding operation while this is ON.
		9 to 14	Not used	Do not use.
		15	Latch completed clear	Clear the latch completed flag the moment the bit turns ON.
B+1	Axis 1 rotation axis direction	0 to 15		Specify the operating direction to be applied when you use an infinite axis or execute absolute movement. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified
B+2	Axis 1 command position (rightmost word)	0 to 15		Specify the position to be used in direct operation or present position preset. The unit corresponds to [Command Unit]. Set in hexadecimal. Setting range: 80000000 to 7FFFFFFF hex (−2147483647 to 2147483647 [Command Unit])
B+3	Axis 1 command position (leftmost word)	0 to 15		

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Direct Operation

Words	Name	Bit	Bit name	Function
B+4	Axis 1 command speed (rightmost word)	0 to 15		Specify the target speed to be used in direct operation. The unit corresponds to [Command Unit/s]. Set in hexadecimal. Setting range: Position control: 1 to 7FFFFFFF hex (1 to 2147483647 [Command Unit/s]) Speed control: 80000000 to 7FFFFFFF hex (−2147483648 to 2147483647 [Command Unit/s])
B+5	Axis 1 command speed (leftmost word)	0 to 15		
B+6	Not used	Do not use.		
B+7	Not used	Do not use.		
B+8	Axis 1 acceleration time (rightmost word)	0 to 15		Specify the acceleration time. The unit corresponds to [ms]. Set in hexadecimal. Setting range: 0 to 3D090 hex (0 to 250,000 ms)
B+9	Axis 1 acceleration time (leftmost word)	0 to 15		
B+10	Axis 1 deceleration time (rightmost word)	0 to 15		Specify the deceleration time. The unit corresponds to [ms]. Set in hexadecimal. Setting range: 0 to 3D090 hex (0 to 250,000 ms)
B+11	Axis 1 deceleration time (leftmost word)	0 to 15		

Precautions for Correct Use

⬥ For the acceleration time and deceleration time, [Acceleration/Deceleration Time Selection] determines their changing patterns. For [Acceleration/Deceleration Time Selection], refer to "Acceleration/Deceleration Setting" on page 5-23 and "Acceleration/Deceleration Time Selection" on page 5-25.

Axis Status Memory Area

This is the area to confirm the axis status, such as axis busy and positioning operation completed.

The table below shows the allocations when you set [C] as the first word in the Axis Status Memory area.

Words	Name	Bit	Bit name	Function
C	Axis 1 manual operation command received	0	Servo lock received	This turns ON when the PCU receives a servo lock command.
		1	Drive alarm reset output received	This turns ON when the PCU receives a drive alarm reset output.
		2	Error counter reset output received	This turns ON when the PCU receives an error counter reset output.
		3	Torque limit output received	This turns ON when the PCU receives a torque limit output.
		4	General-purpose output received	This turns ON when the PCU receives a general-purpose output.

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Direct Operation

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Direct Operation

Words	Name	Bit	Bit name	Function
C (continued)	Axis 1 manual operation command received	5	Override valid received	This turns ON when the PCU receives an override valid.
		6	JOG/Inching speed selection received	This turns ON when the PCU receives a JOG/inching speed selection.
		7	Forward direction JOG/Inching received	This turns ON at a JOG/inching forward direction operation reception.
		8	Reverse direction JOG/Inching received	This turns ON at a JOG/inching reverse direction operation reception.
		9	MPG valid received	This turns ON at a MPG valid reception.
		10	Origin Search received	This turns ON when the PCU receives an Origin Search.
		11	Origin Return received	This turns ON when the PCU receives an Origin Return.
		12 to 13	Not used	Do not use.
		14	Deceleration stop received	This turns ON when the PCU receives a deceleration stop.
		15	Servo unlock received	This turns ON when the PCU receives a servo unlock.
C+1	Axis 1 direct operation command received	0	Absolute movement received	This turns ON at an absolute movement reception.
		1	Relative movement received	This turns ON at a relative movement reception.
		2	Speed control received	This turns ON at a speed control reception.
		3 to 4	Not used	Do not use.
		5	Interrupt feeding specification received	This turns ON at an interrupt constant-pitch feed specification reception.
		6	Interrupt input mask valid/ Present position latch valid received	This turns ON when PCU receives the interrupt input mask/current position latch valid.
		7	Present position preset received	This turns ON at a present position preset reception.
		8	Synchronous feeding received	This turns ON at a synchronous feeding reception.
		9 to 14	Not used	Do not use.
		15	Latch completed clear received	This turns ON at a latch completed clear reception.

Words	Name	Bit	Bit name	Function
C+2	Axis 1 command status	0	Axis busy	This remains ON while the axis is operating. During memory operation, the axis busy bit turns ON for any axis which is allocated to the axis configuration even when it is not operating.
		1	JOG start available	This turns ON when the PCU can receive a JOG start command.
		2	Direct operation start available	This turns ON when the PCU receives a duplicate start command issued via direct operation start.
		3	Not used	Do not use.
		4	During deceleration stop input	This remains ON while the PCU stops due to reception of a synchronous group stop output during data synchronization or the synchronous group stop output is ON.
		5	During synchronous group stop input	This remains ON while the PCU stops due to reception of all Synchronous Unit stop output during data synchronization or the all Synchronous Unit stop output is ON.
		6	During All Synchronous Units stop input	This remains ON when the All Synchronous Units stop output is ON.
		7	High-speed PTP Start Acknowledged Flag	This flag turns ON to acknowledge a high-speed PTP start. (Unit version 1.1 or later. This bit is not supported by unit version 1.0.)
		8	Startup invalid	The Start Invalid Flag turns ON when command execution fails because the conditions that are required to start the command function were not met. The Start Invalid Flag turns ON when the command cannot be started because an error occurred when starting the command or because of the priority of the command.
		9	Error counter reset invalid	The Error Counter Reset Invalid Flag turns ON when an error counter reset output is performed during an origin search operation but the error counter reset output for the axis is not received.
		10 to 11	Not used	Do not use.
		12	Stop executed	This turns ON when axis operation has stopped for one of the following causes during axis operation in manual operation or direct operation. • Execution of deceleration stop, error counter reset, or servo unlock • Stop for error occurrence • Stop for stop function of Synchronous Unit
		13	Positioning operation completed	This turns ON when operation stops for positioning operation in direct operation, Origin Search completion, Origin Return completion, JOG, MPG, or synchronous feed operation stop.
		14 to 15	Not used	Do not use.

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Direct Operation

Words	Name	Bit	Bit name	Function
C+3	Axis 1 axis operation status	0	During servo unlock	This remains ON while the axis is in servo unlock status.
		1	During servo lock	This remains ON while the axis stops with its servo locked.
		2	During backlash compensation	This remains ON during the backlash compensation of the axis.
		3	During acceleration	This remains ON while the axis is accelerating to the target speed.
		4	During constant speed movement	This remains ON while the axis is operating at a constant speed after it reached the target speed.
		5	During deceleration	This remains ON while the axis is decelerating to the target position or target speed.
		6	During pass	This remains ON while the axis movement in continuous 1 and continuous 3 is accelerating or decelerating toward the target speed of the next sequence.
C+3 (continued)	Axis 1 axis operation status	7	Positioning completed input waiting	This remains ON while the axis waits for the completion of positioning.
		8	During deceleration stop	This turns ON when the axis decelerates to stop while in operation, and remains ON until the axis stops.
		9	During immediate stop	This turns ON when the axis makes an immediate stop while in operation, and remains ON until the axis stops.
		10 to 15	Not used	Do not use.

Words	Name	Bit	Bit name	Function
C+4	Axis 1 operation status	0	During Origin Search	This remains ON during Origin Search operation.
		1	During Origin Return	This remains ON during Origin Return operation.
		2	During MPG	This remains ON during MPG control operation.
		3	During JOG/ Inching	This remains ON during JOG/inching operation.
		4	During absolute movement	This remains ON during absolute movement operation. (Including the time before the interrupt input.)
		5	During relative movement	This remains ON during relative movement operation. (Including the time before the interrupt input.)
		6	During speed control	This remains ON during speed control operation. (Including the time before the interrupt input.)
		7	During interrupt feeding (interrupt input waiting)	This remains ON before an interrupt input of interrupt constant-pitch feeding operation.
		8	During interrupt feeding (positioning)	This remains ON after an interrupt input of interrupt constant-pitch feeding operation.
		9	Not used	Do not use.
		10	During deceleration stop	This remains ON while the axis decelerates to a stop.
		11	During memory operation	This remains ON during memory operation.
		12 to 14	Not used	Do not use.
		15	During synchronous feeding	This remains ON during synchronous feeding.
C+5	Axis 1 control status	0	Origin fix	This turns ON once the origin is determined. 0: Origin not yet determined 1: Origin determined
		1	Origin Stop	This remains ON while the axis stops inside the in-position width of the origin position. It does not turn ON if the origin is not determined.
		2	Latch completed	This turns ON when the present position latch is executed.
		3	Not used	Do not use.

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Direct Operation

Words	Name	Bit	Bit name	Function
C+5 (Continued)	Axis 1 control status	4	Command present position overflow	This turns ON when the command present position overflow occurs in the LINEAR mode.
		5	Command present position underflow	This turns ON when the command present position underflow occurs in the LINEAR mode.
		6	Feedback present position overflow	This turns ON when the feedback present position overflow occurs in the LINEAR mode.
		7	Feedback present position underflow	This turns ON when the feedback present position underflow occurs in the LINEAR mode.
		8	Sensor error	This turns ON when an external sensor for the emergency stop input or limit input generate an error.
		9	Servo error	This turns ON when an error, such as the drive alarm input, is notified from the outside of the system.
		10	Execution error	The Execution Error Flag turns ON when an error occurs, such as a duplicate start error, due to a problem in the execution conditions or command values when a command for axis operation is executed.
		11	Axis warning	This turns ON when an axis warning occurs.
		12	Axis error	This turns ON when an axis error occurs.
		13	Zone 0	This remains ON while the present position is inside zone 0.
		14	Zone 1	This remains ON while the present position is inside zone 1.
		15	Zone 2	This remains ON while the present position is inside zone 2.

Words	Name	Bit	Bit name	Function
C+6	Axis 1 external I/O status	0	RUN output	This remains ON while the servo RUN output is ON.
		1	Drive alarm reset output	This remains ON while the drive alarm reset output is ON.
		2	Error counter reset output	This remains ON while the error counter reset output is ON.
		3	Torque limit output	This remains ON while the torque limit output is ON.
		4	General-purpose output	This remains ON while the general-purpose output is ON.
		5 to 6	Not used	Do not use.
		7	General-purpose input	This remains ON while the built-in general purpose inputs are ON.
		8	Forward direction limit input	This remains ON while the forward direction limit input is activated.
		9	Reverse direction limit input	This remains ON while the reverse direction limit input is activated.
		10	Origin proximity input	This remains ON while the origin proximity input is activated.
		11	Origin input	This remains ON while the origin input is activated.
		12	Interrupt input	This remains ON while the interrupt input is ON.
C+6 (continued)	Axis 1 external I/O status	13	Emergency stop input	This remains ON while the emergency stop input is OFF.
		14	Positioning completed input	This remains ON while the positioning completion input is ON.
		15	Drive alarm input	This remains ON while the drive alarm input is OFF.
C+7	Axis 1 error code	0 to 15		This returns an axis error code.
C+8	Axis 1 command present position (rightmost word)	0 to 15		Returns the command present position.
C+9	Axis 1 command present position (leftmost word)	0 to 15		
C+10	Axis 1 expanded monitor (rightmost word)	0 to 15		Returns the monitor value that is specified by the axis parameters [Expanded Monitor Type]. For details, refer to "Expanded Monitor Setting" on page 5-49.
C+11	Axis 1 expanded monitor (leftmost word)	0 to 15		

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Direct Operation

6-3 Operations of Direct Operation

This section explains operations of direct operation and duplicate starts.

Starting Direct Operation

These 4 methods are available to start direct operation.

(1) Turn the absolute movement from OFF to ON.
(2) Turn the relative movement from OFF to ON.
(3) Turn the speed control from OFF to ON.
(4) Turn ON the interrupt feeding specification, and turn either the absolute movement, relative movement or speed control from OFF to ON.

Executed Absolute Movement

Use the position command value in the Direct Operation Command Memory area as absolute data to perform positioning.
Positioning by direct operation uses PTP control.

Executed Relative Movement

Use the position command value in the Direct Operation Command Memory area as increment data to perform positioning.
Positioning by direct operation uses PTP control.

Executed Speed Control

Perform speed control according to the command speed in the Direct Operation Command Memory area.
Specify the rotation direction by the sign of the command speed.
To stop the operation, turn [Deceleration Stop] in [Manual Operation Command Memory Area] of each axis from OFF to ON.

Executed Interrupt Feeding

One of 3 methods is available to start interrupt feeding.
You can now specify not only speed control, but also absolute movement and relative movement as the control which is implemented prior to the interrupt input.
If you specify absolute movement or relative movement, it is also possible to output an error when the interrupt input is not input within the specified movement.
For interrupt feeding, refer to "Interrupt Feeding by Direct Operation" on page 9-8.

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Direct Operation

Operations of Direct Operation

Positioning operation with direct operation is determined by the data which you set in the Direct Operation Command Memory area.
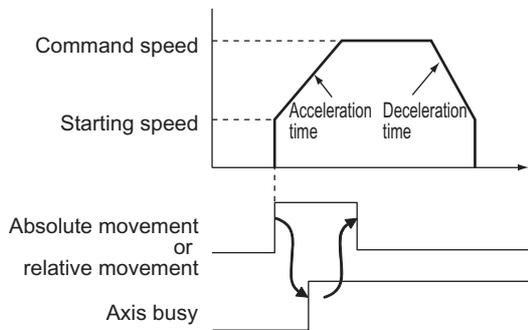
Reference

• For absolute movement, relative movement and speed control, keep the bit ON until [Absolute Movement Received], [Relative Movement Received] or [Speed Control Received] in [Axis Status Memory Area] of each axis turns ON.

Deceleration Stop during Direct Operation

You can decelerate an operating axis to a stop by using the Deceleration Stop Bit. The deceleration time is set as follows according to the Acceleration/Deceleration Time Selection axis parameter.

When a Constant Acceleration/Deceleration Rate is Selected for the Acceleration/Deceleration Time Selection Axis Parameter

An axis is decelerated to a stop while maintaining the deceleration rate for the ongoing operation.

When a Constant Acceleration/Deceleration Time is Selected for the Acceleration/Deceleration Time Selection Axis Parameter

An axis is decelerated to a stop based on the deceleration time specified for the ongoing operation.

Precautions for Correct Use

• When a Constant Acceleration/Deceleration Time is selected for the Acceleration/Deceleration Time Selection axis parameter, an axis may go beyond the target position at the time of a deceleration stop during positioning operation. For details, refer to *5-3 Axis Parameters* on page 5-13.
• When deceleration stop is turned ON while outputting the pulse for the backlash compensation amount, a deceleration stop is not executed immediately but a stop is executed after output of the pulse for the backlash compensation amount is completed. Be careful if a large value will be set for the backlash compensation amount.

Duplicate Starts of Direct Operation

To change the target position during direct operation, you can do so through duplicate starts. Duplicate starts involve setting a new position command value in [Direct Operation Command Memory Area] during operation and then starting an absolute movement or relative movement. In this case, stop the currently executed operation and perform the axis start according to the newly set data.

To perform duplicate starts, confirm the [Direct Operation Start Available] flag for each axis.

Precautions for Correct Use

• You cannot perform duplicate starts during direct operation of memory operation.
• You can only perform duplicate starts during direct operation.

Reference

• To change the target speed, acceleration time and deceleration time, change the speed command, acceleration time and deceleration time in [Direct Operation Command Memory Area]. The changes are reflected immediately.

Combination of Duplicate Starts

Except during interrupt feeding operation, duplicate starts are permitted.
Refer to the combination of duplicate starts table.

Duplicate starts→ / During operation↓	Absolute movement	Relative movement	Speed control	Interrupt feeding
Absolute movement	Permitted	Permitted	Permitted	Permitted
Relative movement	Permitted	Permitted	Permitted	Permitted
Speed control	Permitted	Permitted	Permitted	Permitted
Interrupt feeding	Not Permitted	Not Permitted	Not Permitted	Not Permitted

All duplicate starts during interrupt feeding operation generates a duplicate start error.

Operations of Duplicate Start

If you set [Operation at Reverse Rotation Command] of [Acceleration/Deceleration Setting] under [Axis Parameter], the axis performs the operation below when the axis reverses due to duplicate starts.

Operations of Deceleration Stop upon Reversing

When there is no reverse command

When there is a reverse command
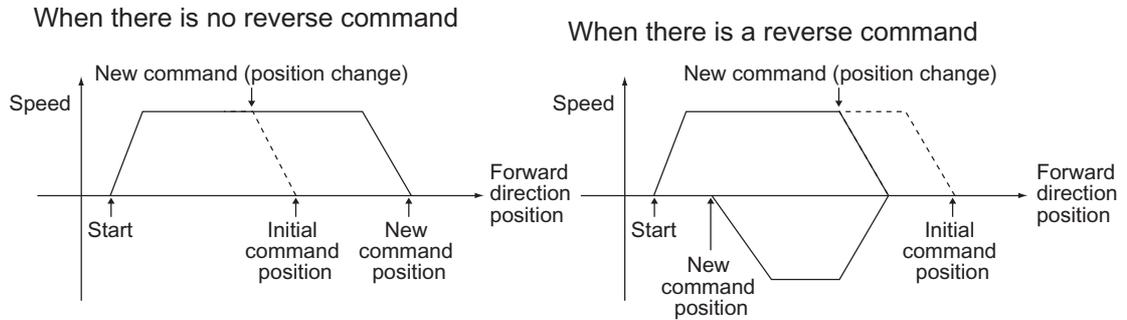
Operation of Immediate Stop upon Reversing

When there is no reverse command

When there is a reverse command

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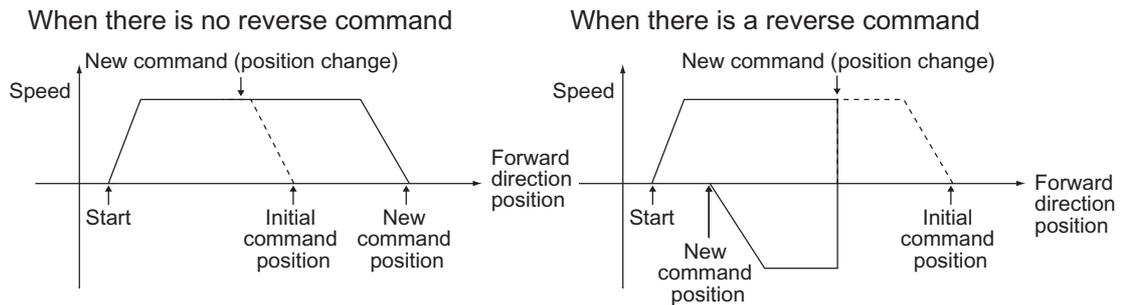
6-4 Timing Chart

This section explains the timing charts of absolute movement, relative movement and speed control with axis 1 as an example.

Example 1 Move to a Relative Position of 10,000 Pulses.

Command position	00002710 hex (10000)
Command speed	000003E8 hex (1000)
Acceleration time	00000064 hex (100)
Deceleration time	00000064 hex (100)

Relative movement

Relative movement received

Axis busy

Direct operation start available

Positioning operation completed

During servo lock stop

During relative movement

Pulse output

Time
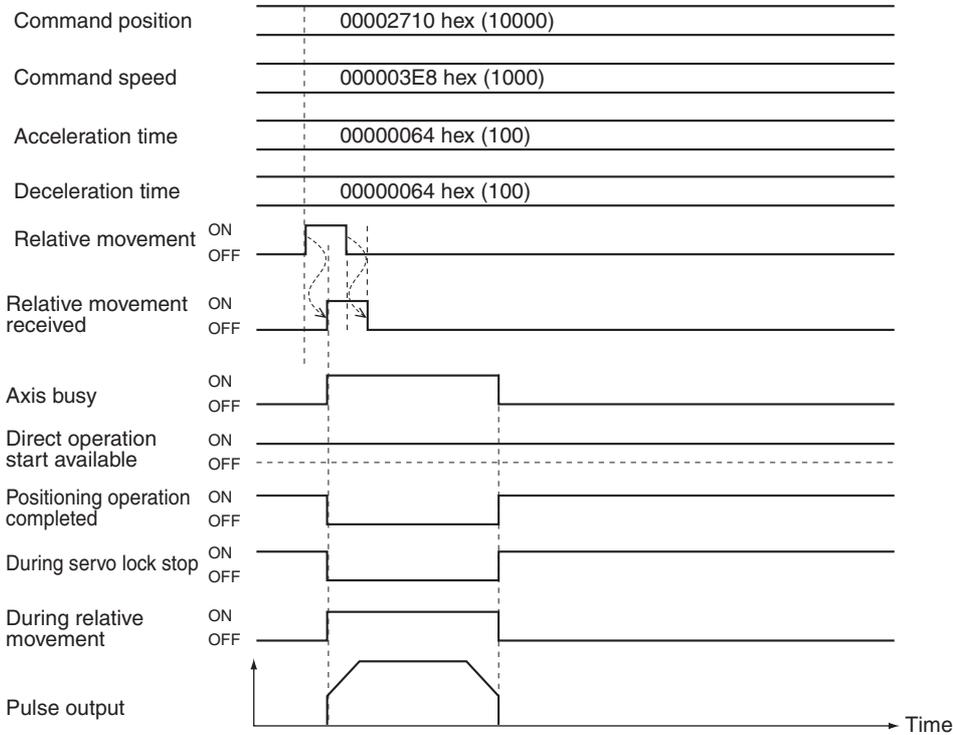
Example 2 Change the Movement Position to an Absolute Position of −10,000 Pulses While the Axis Moves to an Absolute Position of 10,000 Pulses.

Command position	00002710 hex (10000)	FFFFD8F0 hex (-10000)
Command speed	000003E8 hex (1000)	
Acceleration time	00000064 hex (100)	
Deceleration time	00000064 hex (100)	

Absolute movement

Absolute movement received

Axis busy

Direct operation start available

Positioning operation completed

During servo lock stop

During absolute movement

Pulse output

Time
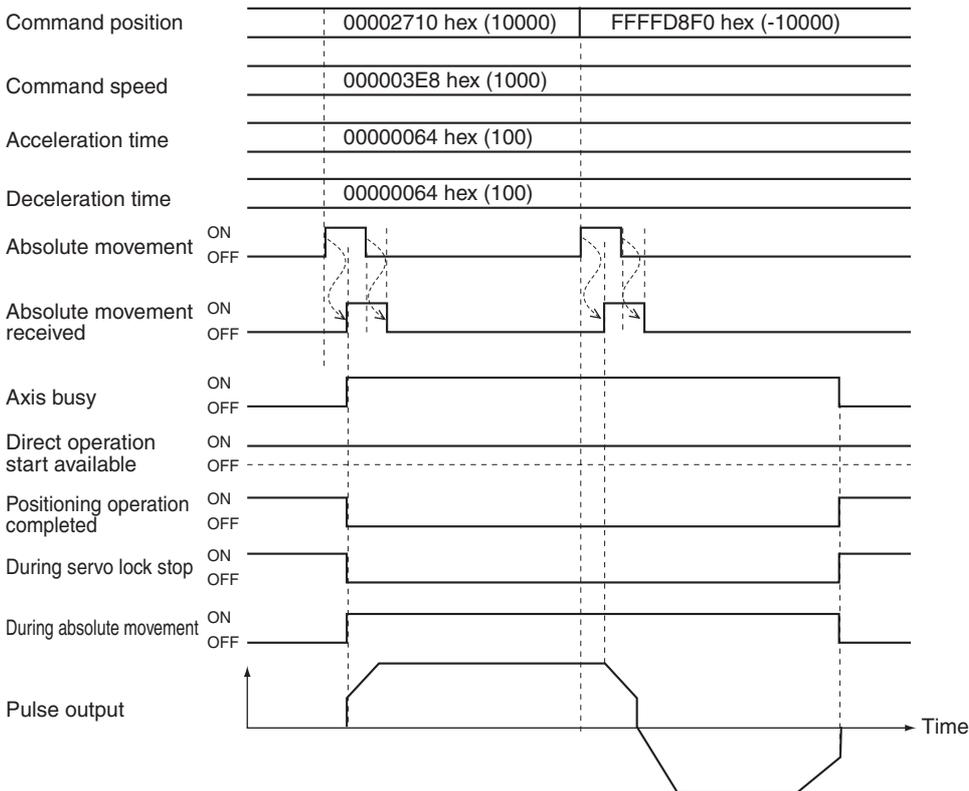
Example 3 Execute Relative Movement to a Relative Position of 10,000 Pulses during Speed Control.

Command position	00002710 hex (10000)
Command speed	000003E8 hex (1000)
Acceleration time	00000064 hex (100)
Deceleration time	00000064 hex (100)

Relative movement ON/OFF

Speed control ON/OFF

Relative movement received ON/OFF

Speed control received ON/OFF

Axis busy ON/OFF

Direct operation start permitted ON/OFF

Positioning operation completed ON/OFF

During servo lock stop ON/OFF

During relative movement ON/OFF

During speed control ON/OFF

Pulse output

10,000 pulses

Time

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6-5 High-speed PTP Start

Direct operation can be started by turning ON the Absolute Movement Bit or Relative Movement Bit in the Direct Operation Command Memory Area. It can also be started by using the NCDMV(218) or IOWR(223) instruction in a ladder program.

NCDMV(218) or IOWR(223) can be used to start positioning as soon as the instruction is executed in a ladder program.

> **Reference**
>
> • NCDMV(218) is a special PCU instruction supported by CJ2M and CJ2H CPU Units with unit version 1.3 or later. Use IOWR(223) with other CPU Units.

Starting Procedure for High-speed PTP Positioning

High-speed PTP positioning is started by executing absolute or relative movements in direction operation using the NCDMV(218) or IOWR(223) instruction. Except for the starting procedure, the procedures and operations are the same as those when you use the Absolute Movement Bit or Relative Movement Bit in the Direct Operation Command Memory Area.

You can start high-speed PTP positioning at the same time as the Absolute Movement Bits and Relative Movement Bits in the Direct Operation Command Memory Area.

This section describes the procedure to start high-speed PTP positioning. Steps 1 to 8 are the same as those in *Direct Operation Procedure* on page 6-1.

1. **Common Parameter Settings**

   To perform direct operation, set these three areas: Manual Operation Command Memory Area, Direct Operation Command Memory Area, and Axis Status Memory Area. For information on setting these areas, refer to *5-2 Common Parameters* on page 5-6.

2. **Axis Parameter Settings**

   Set the maximum speed, output settings, and other axis parameters. For information on the axis parameters, refer to *5-3 Axis Parameters* on page 5-13.

3. **Transferring Data**

   Transfer the common parameters and axis parameters to the PCU.

4. **Saving Data**

   Save the data to the flash memory in the PCU.

5. **Restart the PCU.**

6. **Put the Servo Drive in operating status.**

7. **Execute an origin search.**

8. **Settings in the Direct Operation Command Memory Area**

   Set the command position, command speed, acceleration time, deceleration time, and other data in the Direct Operation Command Memory Area.

9. **Starting High-speed PTP Positioning in Direct Operation**

   High-speed PTP positioning is started with the NCDMV(218) or IOWR(223) instruction.

High-speed PTP Start Instructions

High-speed PTP positioning can be started using the NCDMV(218) or IOWR(223) instruction.

NCDMV(218)

NCDMV(218) is a special PCU instruction supported by CJ2M and CJ2H CPU Units with unit version 1.3 or later. To start high-speed PTP positioning with CPU Units other than CJ2M CPU Units, use IOWR(223).

```
    ┌─────────┐
────┤ NCDMV   │
    │       C │  C: Control data (destination unit number)
    │       S │  S: First source word
    └─────────┘
```

Operands

Operand	Description	Settings
C	Control data (destination unit number)	C: Set the movement method. Absolute movement: 00xx hex Relative movement: 01xx hex (xx = 01 to 04 hex: Axis 1 to 4)
		C+1: Set the unit number of the destination Unit. Specify a unit number between 0 and 94 using 0000 to 005E hex.
S	First source word	Specify the first word (B) of the Direct Operation Command Memory Area.

Precautions for Correct Use

• NCDMV(218) cannot be executed while IOWR(223) or IORD(222) is being executed.

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IOWR(223)

```
─┤ IOWR │        ─┤ @IOWR │
     │ C │             │ C │      C: Control data
     │ S │             │ S │      S: First word of transfer source
     │ D │             │ D │      D: Destination unit number and number of words to transfer
```

Operands

Operand	Description	Settings
C	Control data	Use one of the following values to specify a high-speed PTP command. Absolute movement: 80xx hex Relative movement: 81xx hex (xx = 01 to 04 hex: Axes 1 to 4)
S	First word of transfer source	Specify the first word in the Direct Operation Command Memory Area for the axis for which you want to start high-speed PTP positioning.[1] Axis 1: B Axis 2: B+12 Axis 3: B+24 Axis 4: B+36
D	Destination unit number and number of words to transfer	D: Set the unit number of the destination Unit. Specify a unit number between 0 and 94 using 0000 to 005E hex. D+1: Set the number of words to transfer. Set the number of words that are allocated to the axis in the Direct Operation Command Memory Area. This value is always #000C.

[1] For information on the first word of the Direct Operation Command Memory Area, refer to *Direct Operation Command Memory Area* on page 5-68.

⚠ Precautions for Correct Use

♦ Positioning can be started for only one axis at a time with each IOWR(223) or NCDMV(218) instruction. Also, only absolute movements and relative movements can be used. You cannot specify interrupt feeding.

♦ Another high-speed PTP positioning operation cannot be started while the PCU is starting a previous high-speed PTP positioning operation. Therefore, when using NODMV(218) or IOWR(223) to start high-speed PTP positioning, use a self-holding program structure with the Equals Flag so that NODMV(218) or IOWR(223) is executed every cycle until the positioning operation is started.

```
                        B
    ─┤↑├──────┬──────┤/├─────┬────┤ IOWR │
              │                   │   C  │
      A       │                   │   S  │
    ─┤ ├──────┘                   │   D  │
                         =     B
                    ─────┤ ├─────○
                               A
                    ─────────────○
```
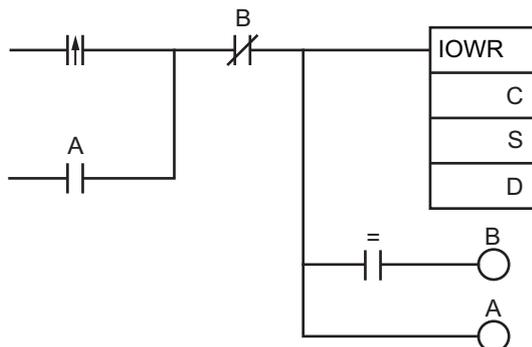
⬥ When you execute the NODMV(218) or IOWR(223) instruction, the execution result is saved in the Condition Flags. Use the Condition Flags, such as the Equals Flag, in input conditions that are branched from the same rung as the NODMV(218) or IOWR(223) instruction.

⬥ If you place a Condition Flag after a different instruction, the Condition Flag may change according to the execution result of the other instruction. Be sure to place any Condition Flags immediately after the NODMV(218) or IOWR(223) instruction.

Instruction Execution for High-speed PTP Starts

When a high-speed PTP start is performed, positioning is started for the axes specified when the instruction is executed. If high-speed PTP positioning is started consecutively, the time that is required to process the NCDMV(218) or IOWR(223) instructions will increase by 0.5 ms. This will increase the cycle time of the PLC.

Example: Consecutively Executing High-speed Start Instructions for Axes 1 to 3
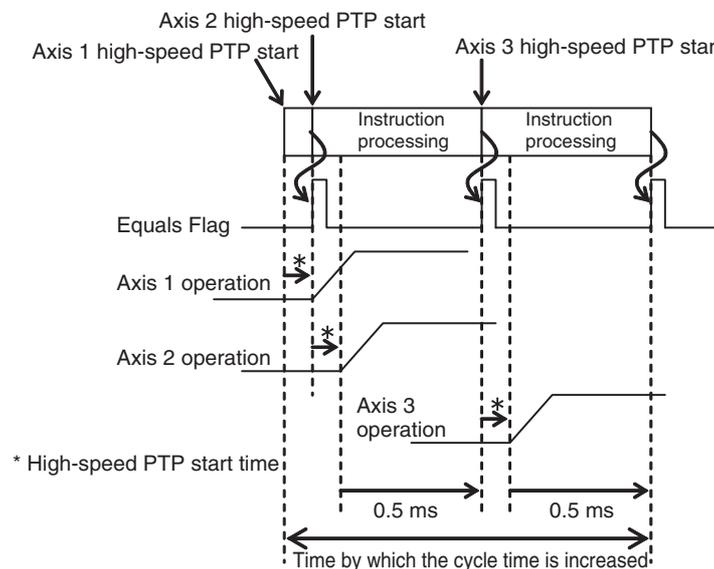
Executing the high-speed PTP start for axis 2 is started after high-speed PTP positioning starts for axis 1, but the instruction execution time is increased by 0.5 ms. Executing the high-speed PTP start for axis 3 is started after processing the high-speed PTP start instruction for axis 2 is completed (i.e., after the instruction execution time elapses).

Axis Status during High-speed PTP Starting

When starting high-speed PTP positioning, reference output will start as soon as the instruction is executed. Updating axis status, such as the High-speed PTP Start Acknowledged Flag, will be performed in the next I/O refresh period.

High-speed PTP start condition

The Absolute Movement/Relative Movement Acknowledged Flag in the Axis Status Memory Area will not turn ON when high-speed PTP positioning is started.

Absolute Movement/Relative Movement Acknowledged Flag

High-speed PTP Start Acknowledged Flag[1]

Positioning Operation Completed Flag

Speed

High-speed PTP start instruction

Time

I/O refresh   I/O refresh

*1. The High-speed PTP Start Acknowledged Flag will turn ON for at least one cycle from the I/O refresh period immediately after the PCU acknowledges the High-speed PTP Start Bit. This flag also shows the response status for a high-speed PTP start command. It can therefore turn ON more than one cycle after the flags that indicate axis operating status, such as the Axis Busy Flag.
(The High-speed PTP Start Acknowledged Flag is supported only by Position Control Units with unit version 1.1 or later.)

6-6 Example of Acceleration/ Deceleration Operation

The operation time based on the acceleration time and deceleration time which you specified in the Direct Operation Command memory area, is determined by the axis parameter [Acceleration/ Deceleration Time Selection].

If you specify [0: Acceleration/Deceleration Specified] under [Acceleration/ Deceleration Time Selection], the time to reach [Maximum Speed] from [Starting Speed] specified by the axis parameters conforms to the acceleration time. Similarly, the time to reach [Starting Speed] from [Maximum Speed] conforms to the deceleration time.

If you specify [1: Time Specified], the acceleration time and deceleration time represent the times needed to reach the target speed from the present speed.

This section explains the acceleration time and deceleration time when you specify [0: Acceleration/Deceleration Specified] under [Acceleration/ Deceleration Time Selection].

Calculation of Basic Acceleration/Deceleration Time

Acceleration time T1 and deceleration time T2 are determined by the formulas below:

Acceleration time $T1 = (V1 - V0) / (Vmax - V0) \times Ta$
Deceleration time $T2 = (V1 - V0) / (Vmax - V0) \times Td$

♦ Parameters to use: 2 parameters below which you specified by axis parameters:
- ♦ Maximum speed Vmax (pps)
- ♦ Starting speed V0 (pps)

♦ Data to use: 4 data below which you specified in the Direct Operation Command Memory area:
- ♦ Command position value
- ♦ Command speed value V1 (pps)
- ♦ Acceleration time Ta (ms)
- ♦ Deceleration time Td (ms)

> 📓 **Reference**
>
> ⬩ The command speed value is calculated as follows when override is enabled:
>   Command speed value = Command speed value in [Direct Operation Command Memory Area] × Override in [Manual Operation Command Memory Area] / 100

Calculation of Acceleration/Deceleration Time for Duplicate Starts

If you changed the command position or command speed during direct operation, the acceleration time and deceleration time are calculated as follows.

When the Command Speed is Higher than the Present Speed

Acceleration time $T1 = (V1 - V0) / (Vmax - V0) \times Ta$
Acceleration time $T2 = (V2 - V1) / (Vmax - V0) \times Ta$
Deceleration time $T3 = (V2 - V0) / (Vmax - V0) \times Td$

⬩ Parameters to use: 2 parameters below which you specified by axis parameters:
  ⬩ Maximum speed Vmax (pps)
  ⬩ Starting speed V0 (pps)

⬩ Data to use: 5 data below which you specified in the Operating Data area:
  Initial command   ⬩ Command position value
       ⬩ Command speed value V1 (pps)
       ⬩ Acceleration time Ta (ms)
       ⬩ Deceleration time Td (ms)
  Speed change command   ⬩ Command speed value V2 (pps)
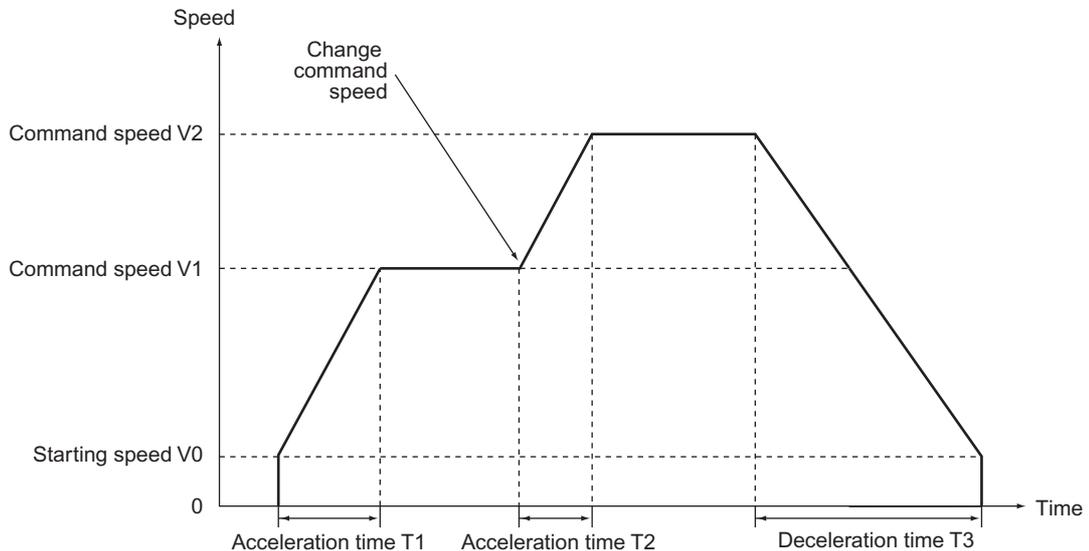
When the Command Speed is Lower than the Present Speed

In this case (V1 > V2), only the calculation of T2 among the formulas above changes in as follows:
  Acceleration time $T2 = (V1 - V2) / (Vmax - V0) \times Td$

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Acceleration/Deceleration Operation with Short Movement

If the movement is short relative to the command speed, acceleration time or deceleration time and you execute the axis start which cannot generate acceleration/deceleration curves according to the command, perform the acceleration/deceleration operation as specified below.

When the Command Speed is Higher than the Present Speed

When positioning operation starts while the axis is stationary or the command speed becomes higher than the present speed, the shorter the movement, the shorter the constant-speed section becomes. In addition, when the movement becomes shorter, the acceleration / deceleration operation is performed with the lowered reached speed while maintaining the initial acceleration and deceleration speed (slopes).
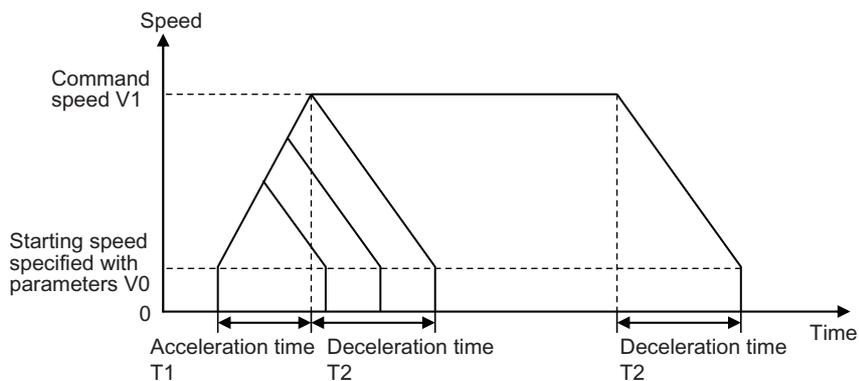
When the Command Speed is Lower than the Present Speed

When you change the command position by duplicate starts during direct operation or the command speed becomes lower than the present speed, the shorter the movement, the shorter the constant-speed section becomes. In addition, when the movement becomes shorter, the deceleration operation is performed with the shorter deceleration time.
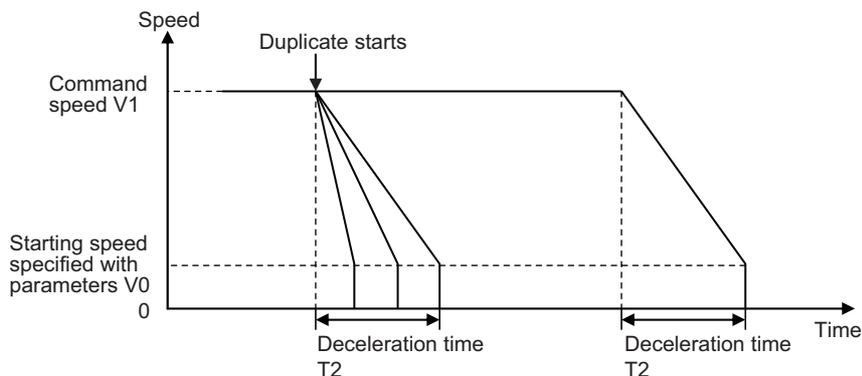
Duplicate Starts at Fixed Acceleration/Deceleration Time

When you implement duplicate starts during direct operation and change the command speed so that it is lower than the present speed, the deceleration curve changes as shown below if the positioning operation with duplicate starts does not have a constant-speed section for the command speed.

When the Changed Speed is One-half the Starting Speed or Lower

The formula below shows the changed speed which is equal to or less than half the difference between the starting speed and the command speed.

$$V2 \leq \frac{V1 - V0}{2}$$

Operation to satisfy the above formula is categorized into two depending on the movement distance.

When Deceleration at Step 1 is Possible:
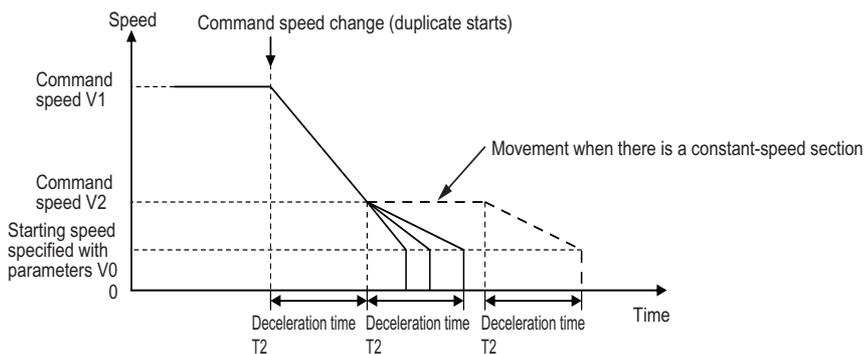
First, the axis decelerates to command speed V2 over deceleration time T2. When the movement distance is short and thus it exceeds the specified distance if the axis decelerates over deceleration time T2, the deceleration time changes depending on the movement distance. In other words, the axis decelerates over a time that is shorter than the specified deceleration time.

When Deceleration at Step 1 is Not Possible:

If the specified movement distance is even shorter than the movement distance shown above, the following is the operation, which exceeds the specified movement distance if deceleration occurs with deceleration time T2.
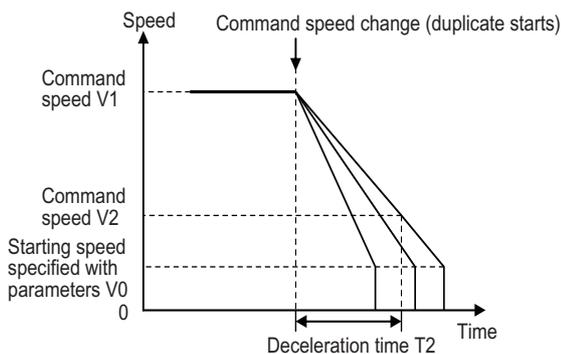
The axis starts decelerating to a stop based on the movement distance specified when duplicate starts are implemented.

📄 **Reference**

If deceleration is not possible at step 1 and the time from duplicate starts to stopping exceeds 250 seconds, this fixes stopping time at 250 seconds.
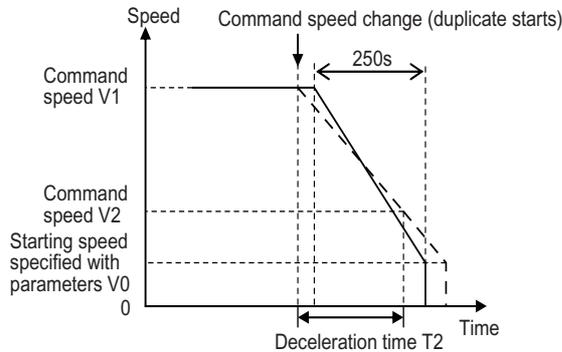
In this case, because there is a fixed deceleration time of 250 seconds, the axis does not decelerate immediately even when you implement multiple starts and the movement distance is adjusted by setting the constant-speed section.

When the Changed Speed Exceeds One-half the Starting Speed

The formula below shows the changed speed which is more than half the difference between the starting speed and command speed:

$$V2 > \frac{V1 - V0}{2}$$

Operation to satisfy the above formula is categorized into two.

When Deceleration at Step 1 is Possible:
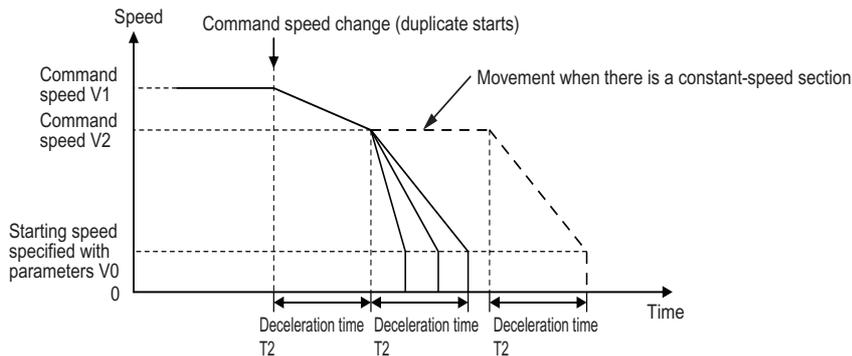
First, the axis decelerates to command speed V2 over deceleration time T2. When the movement distance is short and thus it exceeds the specified distance if the axis decelerates over deceleration time T2, the deceleration time changes depending on the movement distance. In other words, the axis decelerates over a time that is shorter than the specified deceleration time.

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When Deceleration at Step 1 is Not Possible:

If the specified movement distance is even shorter than the movement distance shown on the previous page, the following is the operation, which exceeds the specified movement distance if deceleration occurs with deceleration time T2.
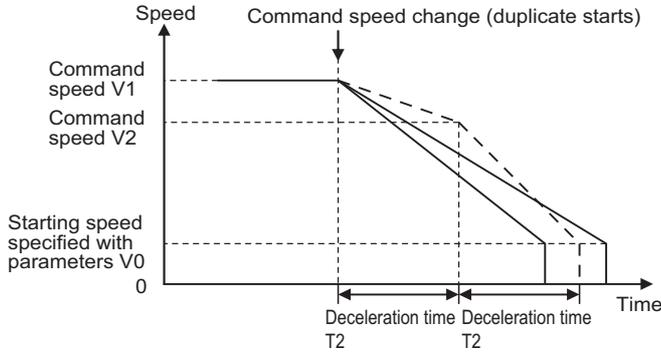
The axis starts decelerating to a stop based on the movement distance specified when duplicate starts are implemented.

In this case, the stopping time may become longer than 2-step deceleration depending on the specified distance.

📑 **Reference**

If deceleration is not possible at step 1 and the time from duplicate starts to stopping exceeds 250 seconds, this fixes stopping time at 250 seconds.
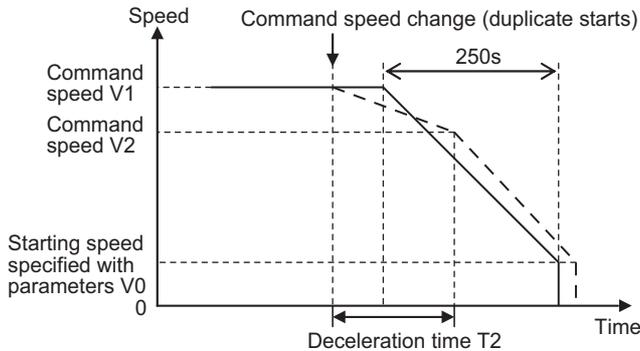
In this case, because there is a fixed deceleration time of 250 seconds, the axis does not decelerate immediately even when you implement duplicate starts and the movement distance is adjusted during the constant-speed section.

6-7   Sample Program

This section shows a sample program for operating the axis as shown below.
In this sample, only axis 1 operates.

Reference

- In this sample program, change only the necessary parameters and use default values for the rest of the parameters. The operation below may not be achieved if you have changed any other parameters.

Description of Operation

Set the mechanical configuration and machine movement as follows.

Mechanical Configuration

- Set the encoder resolution to 2,000 pulses/rotation.
- Use a Servomotor whose rated rpm is 3,000 r/min.
- The workpiece advances by 10 mm per motor rotation.
- Use [mm] as the unit system and issue commands in units of 0.01 mm.

Machine Movement

- Position axis 1 to a 150.00-mm position at a speed of 250 mm/s by relative movement.
- Set the maximum speed to 500mm/s (3,000 r/min).
- Set both the acceleration time and deceleration time to 0.2 s as fixed acceleration.
- To use a Servomotor, set the starting speed to [0].
- Set the Manual Operation Command Memory area to start from W000 word, Direct Operation Command Memory area from W010 word, and Axis Status Memory area from W060 word.
- Do not change the speed by the override.

6
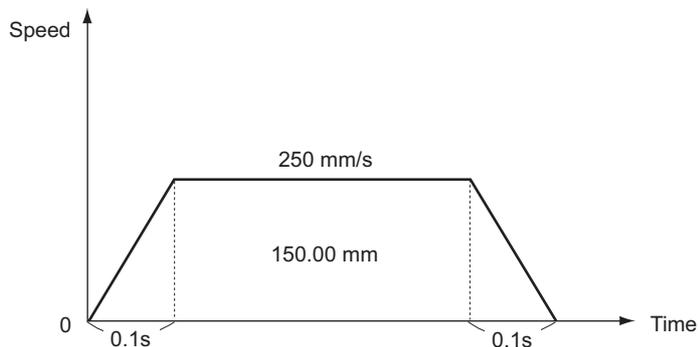
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Parameter Settings

Change the necessary parameters according to the operation.
Parameter changes are made only for axis 1.

Changing of Common Parameters

Here, set 3 parameters: [Manual Operation Command Memory Area], [Direct Operation Command Memory Area] and [Axis Status Memory Area]. For details on common parameters, refer to "Common Parameters" on page 5-6.

Setting of Manual Operation Command Memory Area

Set [W000 word] for the Manual Operation Command memory area.
When you set the common parameters, the Manual Operation Command Memory area is allocated as follows.

Words	Name	Bit	Bit name
W000	Axis 1 Manual Operation Command Memory area	0	Servo lock
		1	Drive alarm reset output
		2	Error counter reset output
		3	Torque limit output
		4	General-purpose output
		5	Override valid
		6	JOG/ Inching speed selection
		7	JOG/ Inching: forward direction
		8	JOG/ Inching: reverse direction
		9	MPG valid
		10	Origin Search
		11	Origin Return
		12 to 13	Not used
		14	Deceleration stop
		15	Servo unlock
W001	Axis 1 override value	0 to 15	–

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Direct Operation Command Memory Area

Set [W010 word] for the Direct Operation Command memory area.
When you set the common parameters, the Direct Operation Command memory area is allocated as follows.

Words	Name	Bit	Bit name
W010	Axis 1 Direct Operation Command Memory area	0	Absolute movement
		1	Relative movement
		2	Speed control
		3 to 4	Not used
		5	Interrupt feeding specification
		6	Interrupt input mask valid/Present position latch valid
		7	Present position preset
		8	Synchronous feeding
		9 to 14	Not used
		15	Latch completed clear
W012	Axis 1 command position (rightmost word)	0 to 15	–
W013	Axis 1 command position (leftmost word)	0 to 15	
W014	Axis 1 command speed (rightmost word)	0 to 15	–
W015	Axis 1 command speed (leftmost word)	0 to 15	
W018	Axis 1 acceleration time (rightmost word)	0 to 15	–
W019	Axis 1 acceleration time (leftmost word)	0 to 15	
W020	Axis 1 deceleration time (rightmost word)	0 to 15	–
W021	Axis 1 deceleration time (leftmost word)	0 to 15	

Axis Status Memory Area

Set [W060 word] for the Axis Status memory area.
When you set the common parameters, the Axis Status Memory area is allocated as follows.

Words	Name	Bit	Bit name
W060	Axis 1 manual operation command received	0	Servo lock received
		1	Drive alarm reset output received
		2	Error counter reset output received
		3	Torque limit output received
		4	General-purpose output received
		5	Override valid received

Words	Name	Bit	Bit name
W060 (continued)	Axis 1 manual operation command received	6	JOG/Inching speed selection received
		7	Forward direction JOG/Inching received
		8	Reverse direction JOG/Inching received
		9	MPG valid received
		10	Origin Search received
		11	Origin Return received
		12 to 13	Not used
		14	Deceleration stop received
		15	Servo unlock received
W061	Axis 1 direct operation command received	0	Absolute movement received
		1	Relative movement received
		2	Speed control received
		3 to 4	Not used
		5	Interrupt feeding specification received
		6	Interrupt input mask valid/Present position latch valid received
		7	Present position preset received
		8	Synchronous feeding received
		9 to 14	Not used
		15	Latch completed clear received
W062	Axis 1 command status	0	Axis busy
		1	JOG start available
		2	Direct operation startup available
		3	Not used
		4	During deceleration stop input
		5	During synchronous group stop input
		6	During All Synchronous Units stop input
		7	High-speed PTP Start Acknowledged Flag (Unit version 1.1 or later. This bit is not supported by unit version 1.0.)
		8	Startup invalid
		9	Error counter reset invalid
		10 to 11	Not used
		12	Stop executed
		13	Positioning operation completed
		14 to 15	Not used

Words	Name	Bit	Bit name
W063	Axis 1 axis operation status	0	During servo unlock
		1	During servo lock
		2	During backlash compensation
		3	During acceleration
		4	During constant speed
		5	During deceleration
		6	During pass
W063 (Continued)	Axis 1 axis operation status	7	Positioning completed input waiting
		8	During deceleration stop
		9	During immediate stop
		10 to 15	Not used
W064	Axis 1 operation status	0	During Origin Search
		1	During Origin Return
		2	During MPG
		3	During JOG/Inching
		4	During absolute movement
		5	During relative movement
		6	During speed control
		7	During interrupt feeding (Interrupt input waiting)
		8	During interrupt feeding (During feeding)
		9	Not used
		10	During deceleration stop
		11	During memory operation
		12 to 14	Not used
		15	During synchronous feeding
W065	Axis 1 control status	0	Origin fix
		1	Origin stop
		2	Latch completed
		3	Not used
		4	Command present position overflow
		5	Command present position underflow
		6	Feedback present position overflow
		7	Feedback present position underflow
		8	Sensor error
		9	Servo error
		10	Execution error
		11	Axis warning
		12	Axis error
		13	Zone 0
		14	Zone 1
		15	Zone 2

6

Direct Operation

6

Direct Operation

Words	Name	Bit	Bit name
W066	Axis 1 external I/O status	0	RUN output
		1	Drive alarm reset output
		2	Error counter reset output
		3	Torque limit output
		4	General-purpose output
W066 (Continued)	Axis 1 external I/O status	5 to 6	Not used
		7	General-purpose input
		8	Forward direction limit input
		9	Reverse direction limit input
		10	Origin proximity input
		11	Origin input
		12	Interrupt input
		13	Emergency stop input
		14	Positioning completed input
		15	Drive alarm input
W067	Axis 1 error code	0 to 15	–
W068	Axis 1 command present position (rightmost word)	0 to 15	–
W069	Axis 1 command present position (leftmost word)	0 to 15	
W070	Axis 1 expanded monitor (rightmost word)	0 to 15	–
W071	Axis 1 expanded monitor (leftmost word)	0 to 15	

Changing of Axis Parameters

First, change [Command Position Unit Setting]. For details, refer to "Command Position Unit Setting" on page 5-30.

Set as follows according to the mechanical configuration.

Parameter name	Function	Set value	Unit
Coordinate Unit System Selection	Select the unit of command values. 0: pulse, 1: mm, 2: degree, 3: inch	1	–
Command Pulse Count Per Motor Rotation	Set the number of pulses per 1 motor rotation.	2000	Pulse
Work Travel Distance Per Motor Rotation	Set the amount of the workpiece movement per 1 motor rotation.	10	Display unit [mm]
Unit Multiplier	Set the ratio relative to the amount of the workpiece movement per 1 motor rotation. 0: 1 time, 1: 10 times, 2: 100 times, 3: 1000 times, 4: 10000 times	2[*1]	–

*1.Setting this selects [0.01 mm] as the command unit.

Next, change [Acceleration/Deceleration Setting]. For details, refer to "Acceleration/Deceleration Setting" on page 5-23.
Similarly, set as follows according to the mechanical configuration.

Parameter name	Function	Set value	Unit
Maximum Speed	Specify the maximum speed of the axis.	50000	Command unit/s [0.01 mm/s]
Starting Speed	Specify the starting speed of the axis.	0	Command unit/s [0.01 mm/s]
Acceleration/ Deceleration Time Selection	Select how to specify the acceleration/deceleration time. 0: Time from starting speed to maximum speed of each axis (acceleration/deceleration specified) 1: Time from present speed to target speed of each axis (time specified)	0	–

📄 **Reference**

♦ Because you have changed the maximum speed to [500.00mm/s], the default values of [Origin Search Speed], [JOG/ Inching Speed] and other speed-related parameters may exceed the maximum speed. For those parameters that exceed the maximum speed, reset the values to the maximum speed or lower.

6

Direct Operation

Program Example

Set data to the Direct Operation Command Memory area and operate the axis.

Data Settings

Although an override setting is available in [Manual Operation Command Memory Area], you do not use it for this example. Keep the default setting unchanged.
Set the position data, speed data, acceleration time and deceleration time in [Direct Operation Command Memory Area].

Words	Name	Contents of setting	
W012	Axis 1 command position (rightmost word)	The position data is 150 mm. Since you set the unit to [0.01 mm], the set value becomes [15,000]. Set this as [3A98 hex] in hexadecimal.	3A98 hex
W013	Axis 1 command position (leftmost word)		0000 hex
W014	Axis 1 command speed (rightmost word)	The same goes with the speed data. Since you set the unit to [0.01 mm] for 250 mm/s, the set value becomes [25,000]. Set this as [61A8 hex] in hexadecimal.	61A8 hex
W015	Axis 1 command speed (leftmost word)		0000 hex
W018	Axis 1 acceleration time (rightmost word)	The unit of acceleration time is [ms]. If you set an acceleration time of [0.2 s], the set value becomes [200 ms]. Set this as [00C8 hex] in hexadecimal.	00C8 hex
W019	Axis 1 acceleration time (leftmost word)		0000 hex
W020	Axis 1 deceleration time (rightmost word)	The unit of deceleration time is [ms]. If you set a deceleration time of [0.2 s], the set value becomes [200 ms]. Set this as [00C8 hex] in hexadecimal.	00C8 hex
W021	Axis 1 deceleration time (leftmost word)		0000 hex

6

Direct Operation

Ladder Program

The chart below shows a relative movement program.

```
            W06101
   |↑|        |/|              ┌─────────┐
 Start switch  Relative        │ MOVL    │    Position data setting
            movement           │#00003A98│
   W01001   received           │    W012 │
   |↑|                         ├─────────┤
 Relative movement             │ MOVL    │    Speed data setting
                               │#000061A8│
                               │    W014 │
                               ├─────────┤
                               │ MOVL    │    Acceleration time setting
                               │#000000C8│
                               │    W018 │
                               ├─────────┤
                               │ MOVL    │    Deceleration time setting
                               │#000000C8│
                               │    W020 │
                               └─────────┘
                     W01001
                      ( )
                  Relative movement
```
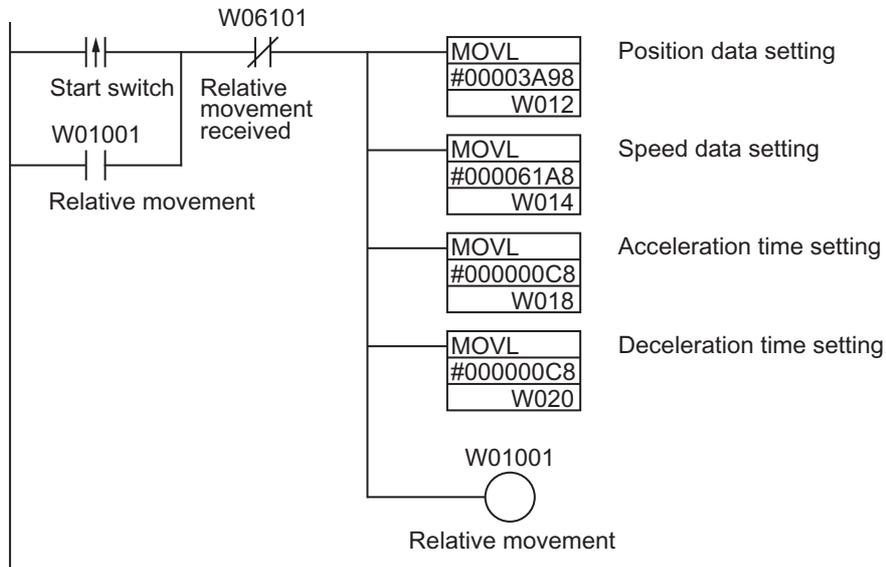
Program Example by High-speed PTP Start

Programming examples are given below that rewrite the above programming using IOWR(223) and NCDMV(218).

Ladder Programming Using NCDMV(218)

```
   |↑|                         ┌─────────┐
 Start switch                  │ MOVL    │    Sets the position data.
                               │#00003A98│
                               │    W012 │
                               ├─────────┤
                               │ MOVL    │    Sets the speed data.
                               │#000061A8│
                               │    W014 │
                               ├─────────┤
                               │ MOVL    │    Sets the acceleration time.
                               │#000000C8│
                               │    W018 │
                               ├─────────┤
                               │ MOVL    │    Sets the deceleration time.
                               │#000000C8│
                               │    W020 │
                               └─────────┘
   |↑|                         ┌─────────┐
 Start switch                  │ NCDMV   │    Relative movement for axis 1, Destination unit number: 2
                               │#00020101│    First word in Direct Operation Command Memory Area
                               │    W010 │
                               └─────────┘
```

Ladder Programming Using IOWR(223)

MOVL #00003A98 W012	Sets the position data.
MOVL #000061A8 W014	Sets the speed data.
MOVL #000000C8 W018	Sets the acceleration time.
MOVL #000000C8 W020	Sets the deceleration time.

IOWR
#8101
W010
#000C0002

Relative movement of axis 1
Direct Operation Command Settings for Axis 1
Destination unit number: 2,
Number of transfer words: 12 (000C hex)

6

Direct Operation

6-8 Monitoring with CX-Programmer

You can monitor direct operation by using CX-Programmer.
This section explains the monitor procedure.

1. **Connect CX-Programmer to the PLC.**

2. **Start the PCU Setting Window.**

3. **Click the [PCU] on the menu and select [Unit Monitor].**
   This window appears.
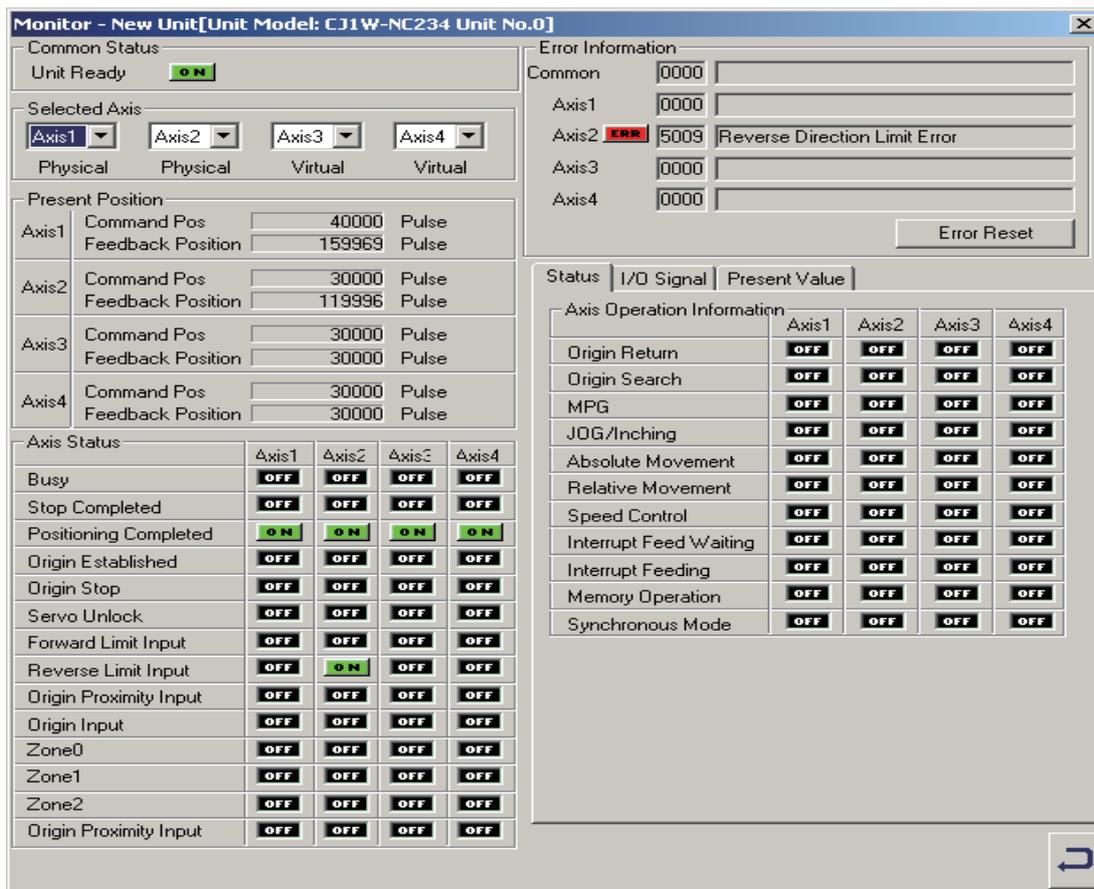
4. **Select the axis you want to monitor.**

5. **Select the [Status], [I/O Signal] and [Present Value] tabs according to the items you want to monitor, and monitor the selected items.**

6-9 Direct Operation with CX-Programmer

You can perform the direct operation with CX-Programmer.

> **Precautions for Correct Use**
>
> • When you execute JOG operation, direct operation or Origin Search from CX-Programmer command, the motor actually operates at the specified speed.
> Before you execute operation, thoroughly confirm absence of danger which may be caused by motor operation.
>
> • When you operate with CX-Programmer, install an external emergency stop circuit or take other appropriate measures to safely stop the motor. CX-Programmer may not be able to issue commands if a computer error, etc. occurs.
>
> • Click the [Save] button, and the settings are reflected in the axis parameters.
> To perform Origin Search from a ladder by using the parameters which you set on the test RUN window, be sure to click the [Save] button.

Direct Operation Procedure

1. **On the data setting window of the PCU, click the [PCU] menu and select [Test Run].**
   When the caution dialog box below appears, read the message carefully. After you confirm a safe condition, click [OK].

   Test Run

   CAUTION
   This function actually operates the motor and can be dangerous.
   Make sure to refer to the Operation Manual before execution.
   The following items require special attention.

   Confirm safety around the operating section.
   Press the JOG Buttons to operate the motor at the designated speed. Execute only after confirming the safety.

   Provide an emergency stop device externally.
   There is a possibility that the operation on the personal computer may not stop the motor operation. To be able to stop the motor immediately, provide an emergency stop device externally.

   Cautions during Operation
   All commands from CPU are invalid during operation because of software occupied mode.

   Starts operation. Proceed?

   [OK]   [Cancel]

> **Precautions for Correct Use**
>
> • When you click [OK], the PCU enters the SOFTWARE EXCLUSIVE mode (Test Run).
> For the SOFTWARE EXCLUSIVE mode (Test Run), refer to "Outline of Manual Operation" on page 3-1.

1. **Select the [Direct Operation] tab on the manual operation window.**
   The manual operation window appears.
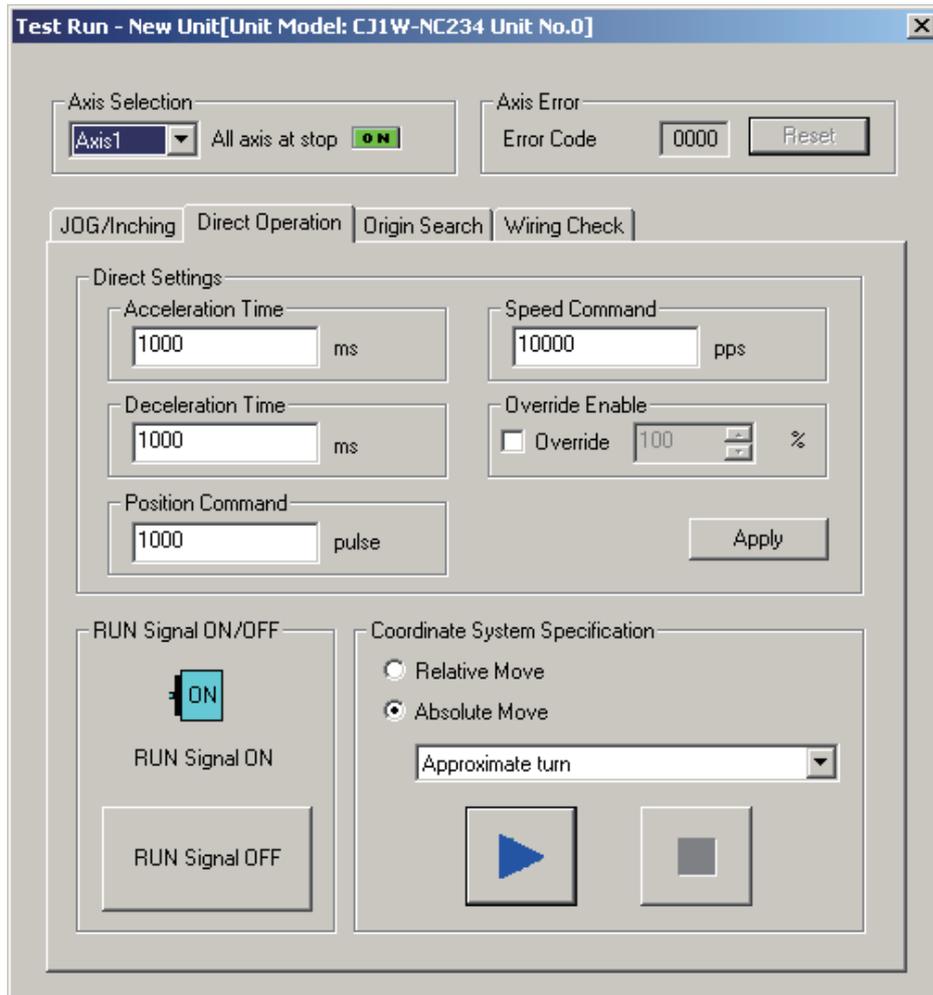
2. **Select the axis you want to perform direct operation for.**
3. **Enter the values of acceleration time, deceleration time, speed command and position command, and click the [Apply] button.**
   Be sure to click the [Apply] button before you execute operation.
4. **If you are using the RUN output of the PCU, click the [RUN Signal ON] button to turn ON the RUN output.**
5. **Select [Absolute Move] or [Relative Move].**
   Also specify the operating direction if the COUNT mode of the selected axis is ROTATION AXIS mode and you want to perform absolute movement.
6. **Execute the operation.**

7

Memory Operation

This chapter explains the procedure to perform memory operation, setting of memory data, and operating methods, etc.

7-1 Outline of Memory Operation

7-1

In memory operation, perform positioning sequentially based on commands from the PLC according to the memory operation data which you set beforehand in the PCU.
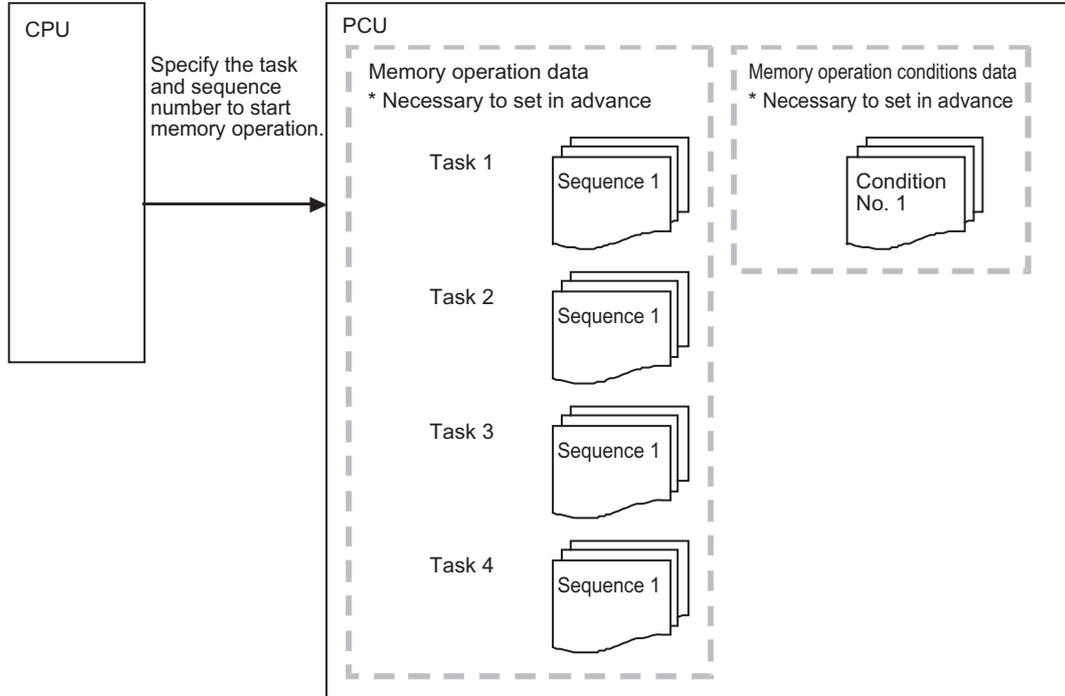
Memory operation is controlled in units of execution called tasks.

This PCU can execute up to 4 tasks simultaneously.

Set axes that are controlled by tasks by memory operation parameters.

You do not need to allocate all axes to a given task, but you cannot allocate one axis to multiple tasks.

Memory operation data consists of sequences. One sequence consists of [Command], [Sequence Start Condition], [Sequence Skip Condition], [End Pattern] and [Positioning Completion Input Monitor Valid].

There are memory operation data for each task, and one task has 500 sequences.

Also as condition data to be referenced in memory operation data, 100 sets of memory operation condition data are available for common use by tasks.

7
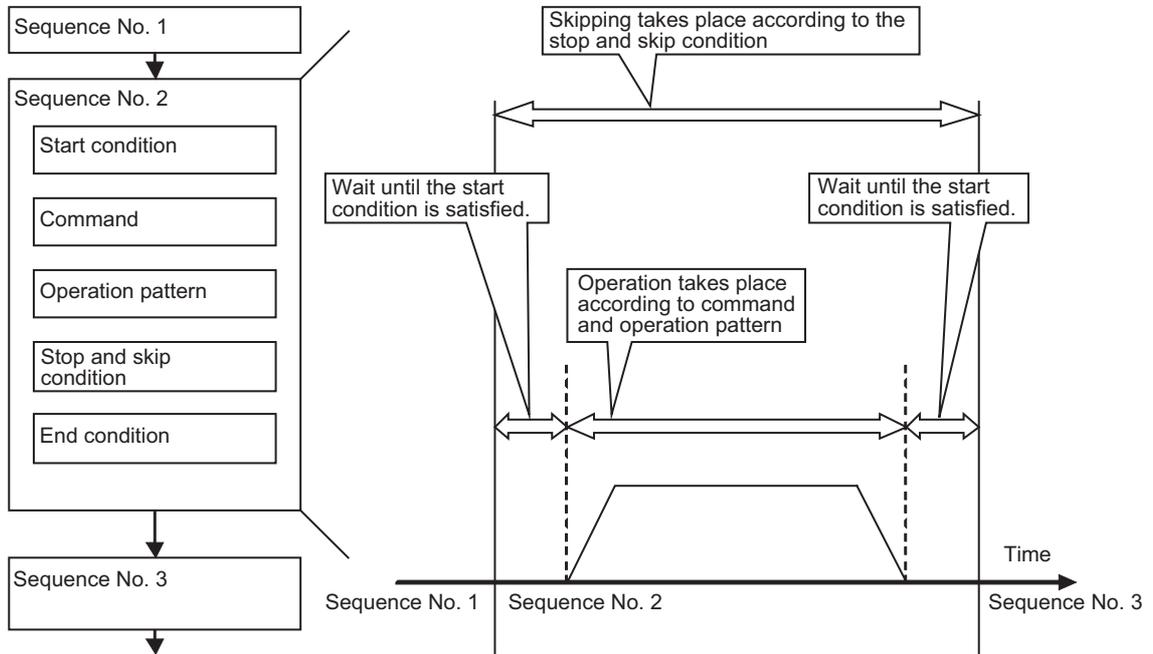
Memory Operation

Memory Operation Procedure

This section explains the procedure to perform memory operation.

1. **Common parameter settings**

   To perform memory operation, always set the 3 areas: [Manual Operation Command Memory Area], [Memory Operation Command Memory Area] and [Memory Operation Status Memory Area].
   For the setting of areas, refer to "Common Parameters" on page 5-6.

2. **Axis parameter settings**

   Set the axis parameters for maximum speed, pulse output method, etc.
   For the axis parameters, refer to "Axis Parameters" on page 5-13.

3. **Memory operation parameter settings**

   Set the axis configuration of each task, settings when the interpolated axis generates an error, and so on.
   For the memory operation parameters, refer to "Memory Operation Parameter" on page 5-56.

4. **Memory operation data settings**

   Set sequence data. You can set 500 sets of sequence data for each task.
   For memory operation data, refer to "Memory Operation Data" on page 5-87.

5. **Memory operation condition data settings**

   Set the conditions for sequence data. You can set 100 conditions for common use by tasks.
   For the memory operation condition data, refer to "Memory Operation Condition Data" on page 5-102.

6. **Data transfer**

   Transfer to the PCU the common parameters, axis parameters and memory operation parameters which you set.

7. **Saving data**

   Save the data to the flash memory in the PCU.

8. **Restart of the PCU**

9. **Put the driver in operating status.**

10. **Execution of origin search**

11. **Starting memory operation**

    Set the [Sequence No.] of the operation you want to use in [Memory Operation Command Memory Area] of each task, and then turn ON [Sequence No. Enable].
    Operation stars at the rising of [Memory Operation].
    Operation starts for each task.

📝 **Reference**

♦ The sequence number increments automatically. In other words, once the execution of sequence No. 1 is completed, [Executing Sequence Number] automatically changes to sequence No. 2.

♦ Only when you execute [END] under [Command], the sequence number returns to the one that was effective when you turned ON [Sequence No. Enable].

7

Memory Operation

7-2   Memory Operation Data Settings

Set operation sequences, positions, speeds, acceleration/deceleration time and other items that relate to memory operation by using [Memory Operation Data].
Under [Memory Operation Data], you can register 500 sets of sequence data per task.
You can also set 100 conditions under [Memory Operation Condition Data] for common use by tasks.

For the setting methods and details of [Common Parameter], refer to "Common Parameters" on page 5-6. For [Axis Parameter] and [Memory Operation Parameter], refer to "Axis Parameters" on page 5-13 and "Memory Operation Parameter" on page 5-56, respectively.

Memory Operation Data List

Each sequence data includes the set data below. However, you need not set all data depending on the data attribute. For details, refer to "Commands" on page 7-15.

Data name	Function	Setting range	Unit	Default values
Axis 1 command position	Set the command position.	–2147483648 to 2147483647	Command unit	0
Axis 2 command position	Set the command position.	–2147483648 to 2147483647	Command unit	0
Axis 3 command position	Set the command position.	–2147483648 to 2147483647	Command unit	0
Axis 4 command position	Set the command position.	–2147483648 to 2147483647	Command unit	0
Command	0000 hex: No sequence data 8### hex: NOP (Treat it as a comment.) [Sequence commands] 0001 hex: JUMP,　　0002 hex: FOR 0003 hex: NEXT,　　0004 hex: PSET 0005 hex: PRSET,　　004F hex: END [Operation commands] 0800 hex: Positioning operation,　　0801 hex: Linear interpolation operation 0802 hex: Circular interpolation (clockwise direction),　　0803 hex: Circular interpolation (counterclockwise direction) 081E hex: Speed control,　　081F hex: Interrupt feeding (positioning operation) 0820 hex: Interrupt feeding (speed control)			0000 hex
JUMP/ repeat conditions	Set the memory operation condition data number for JUMP and FOR. 0: Execute unconditionally 1 to 100: Memory operation condition data No.	0 to 100	–	0

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Memory Operation

Data name	Function	Setting range	Unit	Default values
JUMP destination sequence No.	Use a sequence data number for the JUMP destination.	1 to 500	–	0
Repeat loop No.	Set the correspondence of FOR and NEXT combinations.	0 to 49	–	0
Output signal	Specify the destination of forced output. 0000 hex: No output ##00 hex: RUN output[*1] ##01 hex: Drive alarm reset output ##02 hex: Error counter reset output [*1] ##03 hex: General-purpose output ##04 hex: Torque limit output ##: 01 to 04 (Physical Axis 01: Axis 1, 02: Axis 2, 03: Axis 3, 04: Axis 4) 8000 to 800F: Memory Operation Auxiliary Memory area (8,000 to 800F hex correspond to bits 0 to 15, respectively.)			0000 hex
Sequence start condition	Set the starting condition. 0: No start condition 1 to 100: Memory operation condition data No.	0 to 100	–	0
Sequence skip condition	Set the stopping/skipping condition. 0: No sequence skip condition 1 to 100: Memory operation condition data No.	0 to 100	–	0
End pattern	Set the operation completion pattern. 0: Individual 1: Automatic 2: Continuous 1 (Until the next sequence speed) 3: Continuous 2 (Acceleration/deceleration starts at the next sequence) 4: Continuous 3 (Pass: Superimpose deceleration of the present sequence and acceleration at the next sequence)	0 to 4	–	0
Dwell timer	Set a dwell time if the end pattern is individual or automatic. 0: No dwell time 1 to 1000: Dwell time	0 to 1000	10 ms	0
Positioning completion input monitor valid	Select the in-position check to be applied when the operating axis stops. 0: Not wait for the positioning completion 1: Wait for the positioning completion	0 to 1	–	0
M code	Set the M code after positioning completed. 0: Without M code 1 to 499: M code that waits for the M code reset 500 to 999: M code that does not wait for the M code reset	0 to 999	–	0
Axis specification	Set the axis to start. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4 Issue a start command when each bit turns ON.	0 to F	–	0
Circular interpolation method	Select the specification method of circular interpolation. 0: Specify the circular center 1: Specify the radius 2: Specify the passing point	0 to 2	–	0

Data name	Function	Setting range	Unit	Default values
Position specification	Select whether to use a relative position or absolute position for the command position. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4 When each bit is ON, it indicates relative position specification. If it is OFF, it indicates absolute position specification.	0 to F	–	0
Interpolation speed	Set the interpolation speed.	1 to 8000000	Command unit/s	0
Interpolation acceleration time	Set the interpolation acceleration time.	0 to 250000	ms	0
Interpolation deceleration time	Set the interpolation deceleration time.	0 to 250000	ms	0
Interpolation starting speed	Set the interpolation starting speed.	0 to 8000000	Command unit/s	0
Interpolation acceleration/ deceleration curve selection	Select the curve for interpolated acceleration/ deceleration. 0: Trapezoid, 1: S-curve (Cubic curve)	0 to 1	–	0
Interpolation acceleration/ deceleration time selection	Select the specification method for interpolation acceleration/deceleration time. 0: Time from starting speed to maximum speed of each axis (Acceleration/deceleration specified) 1: Time from present speed to target speed of each axis (Time specified)	0 to 1	–	0
Axis 1 circular center/ passing point position	Set the center position of the arc.	−2147483648 to 2147483647	Command unit	0
Axis 2 circular center/ passing point position	Set the center position of the arc.	−2147483648 to 2147483647	Command unit	0
Axis 3 circular center/ passing point position	Set the center position of the arc.	−2147483648 to 2147483647	Command unit	0
Axis 4 circular center/ passing point position	Set the center position of the arc.	−2147483648 to 2147483647	Command unit	0
Circular radius	Set the arc radius.	−2147483648 to 2147483647	Command unit	0
Axis 1 rotation axis direction	If you select rotation axis in the applicable axis parameter, select the operating direction of positioning operation (PTP) by absolute movement designation. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified	0 to 3	–	0

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Memory Operation

Data name	Function	Setting range	Unit	Default values
Axis 2 rotation axis direction	If you select rotation axis in the applicable axis parameter, select the operating direction of positioning operation (PTP) by absolute movement designation. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified	0 to 3	–	0
Axis 3 rotation axis direction	If you select rotation axis in the applicable axis parameter, select the operating direction of positioning operation (PTP) by absolute movement designation. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified	0 to 3	–	0
Axis 4 rotation axis direction	If you select rotation axis in the applicable axis parameter, select the operating direction of positioning operation (PTP) by absolute movement designation. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified	0 to 3	–	0
Axis 1 command speed	Set the target speed of each axis in positioning operation (PTP) and speed control. The command range is 1 to 2,147,483,647 for positioning, and −2,147,483,648 to 2,147,483,647 for speed control.	−2147483648 to 2147483647	Command unit/s	0
Axis 2 command speed	Set the target speed of each axis in positioning operation (PTP) and speed control. The command range is 1 to 2,147,483,647 for positioning, and −2,147,483,648 to 2,147,483,647 for speed control.	−2147483648 to 2147483647	Command unit/s	0
Axis 3 command speed	Set the target speed of each axis in positioning operation (PTP) and speed control. The command range is 1 to 2,147,483,647 for positioning, and −2,147,483,648 to 2,147,483,647 for speed control.	−2147483648 to 2147483647	Command unit/s	0
Axis 4 command speed	Set the target speed of each axis in positioning operation (PTP) and speed control. The command range is 1 to 2147483647 for positioning, and −2147483648 to 2147483647 for speed control.	−2147483648 to 2147483647	Command unit/s	0
Axis 1 acceleration time	Set the acceleration time in positioning operation (PTP).	0 to 250000	ms	0
Axis 2 acceleration time	Set the acceleration time in positioning operation (PTP).	0 to 250000	ms	0
Axis 3 acceleration time	Set the acceleration time in positioning operation (PTP).	0 to 250000	ms	0
Axis 4 command speed	Set the acceleration time in positioning operation (PTP).	0 to 250000	ms	0
Axis 1 acceleration time	Set the deceleration time in positioning operation (PTP).	0 to 250000	ms	0

Data name	Function	Setting range	Unit	Default values
Axis 2 acceleration time	Set the deceleration time in positioning operation (PTP).	0 to 250000	ms	0
Axis 3 acceleration time	Set the deceleration time in positioning operation (PTP).	0 to 250000	ms	0
Axis 4 acceleration time	Set the deceleration time in positioning operation (PTP).	0 to 250000	ms	0
Interpolation speed specification method	Select the interpolated speed designation method for linear interpolation. 0: Specify the interpolation path speed 1: Specify the maximum speed	0 to 1	–	0
Interrupt feeding reference position selection	Select whether to use the command position or feedback position for the reference position of constant-pitch positioning upon interrupt input. 0: Command position 1: Feedback position	0 to 1	–	0
Interrupt input undetected error enable	Select whether to output an error when an interrupt input is not input before positioning is completed during interrupt constant-pitch feeding by position control. 0: Without error detection 1: With error detection	0 to 1	–	0
Interrupt feeding amount	Set the amount of movement in interrupt constant-pitch feeding.	−2147483648 to 2147483647	Command unit	0

*1.Selection is possible only when you use this signal as a general-purpose output.

Memory Operation Condition Data List

Each condition data includes the set data below. You do not need to set all data depending on the condition data. For details, refer to "Details of Memory Operation Condition Data" on page 5-104.

Parameter name	Function	Setting range	Unit	Default values
Condition	Set the comparison condition. 0000 hex: Condition data not yet set 0010 hex: ON (bit comparison)　　0011 hex: OFF (bit comparison) 0012 hex: AND (bit comparison)　　0013 hex: OR (bit comparison) 0020 hex: = (data comparison: 2 words)　　0021 hex: ≠ (data comparison: 2 words) 0022 hex: ≥ (data comparison: 2 words, signed)　　0023 hex: ≤ (data comparison: 2 words, signed) 0030 hex: Timer (time specification)　　0040 hex: Counter (count specification) [You can only specify the starting condition.] 0101 hex: Axis 1 external interrupt input　　0102 hex: Axis 2 external interrupt input 0103 hex: Axis 3 external interrupt input　　0104 hex: Axis 4 external interrupt input			0000 hex
Edge Selection	Select how to evaluate true/false of the conditional expression. 0: Level assessment 1: Edge assessment	0 to 1	–	0

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Memory Operation

Parameter name	Function	Setting range	Unit	Default values
Data 1 Area Selection	Specify the data 1 area for comparison. 0: Unit Control Memory Area (OUT/IN) 1: Manual Operation Command Memory area 2: Direct Operation Command Memory area 3: Memory Operation Command Memory area 4: Axis Status Memory area 5: Memory Operation Status Memory area F: Constant (You can only set either data 1 or data 2 in the data comparison)	0 to 5, 000F hex	–	0
Data 1 Word	Specify the word position as the offset from the beginning word, relative to the target area which you specified by data 1 area selection.	0 to 255	–	0
Data 1 Bit	Specify the bit position relative to the target word which you specified by data 1 area selection and data 1 word. It is only enabled for the bit comparison.	0 to 15	–	0
Data 2 Area Selection	Specify the data 2 area for comparison. 0: Unit Control Memory area (OUT/IN) 1: Manual Operation Command Memory area 2: Direct Operation Command Memory area 3: Memory Operation Command Memory area 4: Axis Status Memory area 5: Memory Operation Status Memory area F: Constant (You can only set either data 1 or data 2 in the data comparison)	0 to 5, 000F hex	–	0
Data 2 Word	Specify the word position as the offset from the beginning word, relative to the target area which you specified by data 2 area selection.	0 to 255	–	0
Data 2 Bit	Specify the bit position relative to the target word which you specified by data 2 area selection and data 2 word. It is only enabled for the bit comparison.	0 to 15	–	0
Timer	Set the time to be applied when you specify a timer for the conditional expression.	0 to 1000	10 ms	0
Counter	Specify the count to be applied when you specify a counter for the conditional expression.	0 to 10000	times	0
Constant	Set a constant when the condition is data comparison and the data 1 or data 2 specifies a constant.	−2147483648 to 2147483647	–	0

📖 **Reference**

- The Data 1 Word Offset, Data 1 Bit, Data 2 Word Offset, and Data 2 Bit can be set by selecting the axis number and bit name from the PCU Setup Window on the CX-Programmer.

Memory Areas to Use in Memory Operation

This section explains the memory areas used in memory operation with axis 1 and task1 as an example.

Manual Operation Command Memory Area

This is the memory area for servo lock, Origin Search, etc.
The table below shows the allocation when you select [A] as the beginning word in the Manual Operation Command Memory area.

Words	Name	Bit	Bit name	Function
A	Axis 1 Manual Operation Command Memory area	0	Servo lock	The RUN output turns ON the moment the bit turns ON. If you set the RUN output function to general-purpose output, ON/OFF of this output becomes ON/OFF of the RUN output.
		1	Drive alarm reset output	When this turns ON, reset drive alarm reset.
		2	Error counter reset output	Turn ON/OFF the error counter reset.
		3	Torque limit output	Turn ON/OFF the torque limit output.
		4	General-purpose output	Turn ON/OFF the built-in general-purpose output.
		5	Override enable	Specify whether to enable/disable override.
		6	JOG/Inching speed selection	Select the JOG speed/inching speed. Speed 1 is selected when this bit is OFF, while speed 2 is selected when it is ON.
		7	Forward direction JOG/Inching	Perform JOG operation or inching operation in the forward direction when this bit is ON.
		8	Reverse direction JOG/Inching	Perform JOG operation or inching operation in the reverse direction when this bit is ON.
		9	MPG enable	MPG operation is enabled when this bit is ON.
		10	Origin Search	Origin search starts the moment the bit turns ON.
		11	Origin Return	Origin return starts the moment the bit turns ON.
		12 to 13	Not used	Do not use.
		14	Deceleration stop	Deceleration stop starts the moment the bit turns ON.
		15	Servo unlock	The RUN output turns OFF the moment the bit turns ON. If you set the RUN output function to general-purpose output, this bit becomes disabled.
A+1	Axis 1 override	0 to 15	–	Set the override value in hexadecimal. You can set a desired value from 1 to 50,000 (0001 to C350 hex), which corresponds to 0.01% to 500.00%.

Memory Operation Command Memory Area

These are memory areas for sequence number setting, sequence number enable, memory operation and M code reset.

The table below shows the allocation when you select [D] as the beginning word in the Manual Operation Command Memory area.

Words	Name	Bit	Bit name	Function
D	Task 1 Memory Operation Command Memory area	0	Sequence No. enable	Specify whether to enable/disable the sequence number for Operation Data area at memory operation start.
		1	Memory operation start	Memory operation starts the moment the bit of turns ON.
		2	Memory operation independent start	Memory operation starts the moment the bit of turns ON. Perform independent operation, except when you set END for [Command].
		3	Not used	Do not use.
		4	M code reset	This resets M codes.
		5	Teaching	Perform teaching the moment the bit of turns ON.
		6 to 14	Not used	Do not use.
		15	Memory operation stop	Memory operation decelerates to a stop the moment the bit of turns ON.
D+1	Task 1 sequence No.	0 to 15		Specify the starting sequence number of memory operation.
D+2	Task 1 teaching address No.	0 to 15		Set the position data number (sequence number) to use in position teaching. Set in hexadecimal*.

Memory Operation Status Memory Area

This is the memory area to check the task status, such as memory operation busy flag and memory operation start permitted.

The table below shows the allocation when you select [E] as the beginning word in the Manual Operation Command Memory area.

Words	Name	Bit	Bit name	Function
E	Task 1 memory operation command received	0	Sequence No. enable received	This turns ON at a sequence number enable reception.
		1	Memory operation start received	This turns ON at a memory operation reception.
		2	Memory operation independent start received	This turns ON at a memory operation independent start reception.
		3	Not used	Do not use.
		4	M code reset received	This turns ON at a M code reset reception.
		5	Teaching received	This turns ON at a teaching reception.

Words	Name	Bit	Bit name	Function
E (Continued)	Task 1 memory operation command received	6 to 14	Not used	Do not use.
		15	Memory operation stop received	This turns ON at a memory operation stop reception.
E+1	Task 1 memory operation command status	0	Memory operation busy	This remains ON while a task command is in progress. This remains ON while a task configuration axis is busy or task function is in progress.
		1	Memory operation start available	This turns ON at memory operation start available. This remains OFF while a task configuration axis is busy or task function is in progress.
		2 to 3	Not used	Do not use.
		4	During memory operation stop input	This remains ON while decelerating after receiving a memory operation stop command.
		5 to 7	Not used	Do not use.
		8	Memory operation start invalid	The Memory Operation Start Invalid Flag turns ON when an error occurs, such as a memory operation duplicate start error, due to a problem in the execution conditions or command values when a command for memory operation is executed.
		9	Teaching invalid	This turns ON when the PCU could not receive a teaching command.
		10 to 11	Not used	Do not use.
		12	Memory operation stop executed	This turns ON when memory operation stops for a memory operation stop command, error stop, or a command with an individual axis stop during memory operation.
		13	Memory operation completed	This turns ON when memory operation is completed normally.
		14	Teaching completed	This turns ON when the teaching command is completed.
		15	Not used	Do not use.

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Memory Operation

Words	Name	Bit	Bit name	Function
E+2	Task 1 memory operation control status	0	During memory operation stop	This remains ON while you do not execute memory operation.
		1	Memory operation waiting	This remains ON while memory operation is on standby. This remains ON while the memory operation stops without END executed after you start the memory operation.
		2	During memory operation axis operation	This remains ON while the axis is operating during memory operation. This remains ON while any configuration axis is not stationary.
		3	Condition input waiting	This remains ON while the PCU is waiting for the input of conditions during memory operation.
		4	Dwell timer waiting	This remains ON while the PCU is waiting for the dwell time during memory operation.
		5	M code reset waiting	This remains ON while the PCU is waiting for the M code reset during memory operation.
		6	M strobe	This remains ON while a M code is output during memory operation.
		7 to 9	Not used	Do not use.
		10	Memory operation execution error	This turns ON when the task function generates an operation error.
E+2 (Continued)	Task 1 memory operation control status	11	Memory operation warning	This turns ON when a warning occurs.
		12	Memory operation error	This turns ON when a memory operation error occurs.
		13 to 15	Not used	Do not use.
E+3	Task 1 memory operation error code	0 to 15	Return a task error code.	
E+4	Task 1 executing sequence No.	0 to 15	Return the executing sequence number of memory operation.	
E+5	Task 1 M code	0 to 15	Return the M code (output code) of memory operation.	

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Memory Operation

7-3   Memory Operation

This section explains memory operation.

Starting Memory Operation

When you issue a memory operation start command, specify the sequence number first.
2 starting methods below are available:

(1) Turn memory operation from OFF to ON.
(2) Turn memory operation independent start from OFF to ON.

📝   **Reference**

⬧ To perform memory operation for the first time, you must set a sequence number and turn ON the sequence number enable bit.
⬧ The sequence number is cleared upon servo lock, Origin Search, Origin Return, or present position preset.
⬧ An error occurs if you start memory operation without specifying a sequence number when a sequence number has not been set.
⬧ When you start memory operation based on a sequence number which is different from the execution sequence number, you must set the sequence number again and turn ON the sequence number enable bit.

Memory Operation Execution

For a start via [Memory Operation], after you execute the started sequence, automatically execute the next sequence number.
Execution continues until [END] is found in the sequence data [Command].
If you select [Individual] under [End Pattern], however, operation stops temporarily.
To execute the subsequent sequence number, you must start [Memory Operation] again.
If [JUMP] to another sequence number or [FOR to NEXT] loop does not occur until sequence No. 500, you can assume that [END] has been executed after sequence No. 500.
Also, an error occurs if you have not set sequence number when [Memory Operation] starts.

Memory Operation Independent Start Execution

For a start via [Memory Operation Independent Start], perform all operations as [Individual] for [End Pattern], regardless of sequence data designation.
Use [Memory Operation Independent Start] for debugging by step execution.
Perform operation according to the specified sequence number, after which [Executing Sequence No.] is updated based on the execution result and then the operation ends.
In normal operation, use [Memory Operation].

Commands

[Command] is a data that allocates the attribute each sequence data has.
2 types of [Command] data are available: data with sequence attribute and data with operation attribute.

Sequence

Sequence commands have the 2 functions below:

⬧ Function to branch and repeat the sequences according to the control conditions during continuous operation.
⬧ Function to forcibly turn ON/OFF the contact information to be output to the CPU and outside the PCU.

For the memory operation condition data, refer to "Memory Operation Condition Data" on page 5-102.

NOP

Regarded as a comment.
Nothing happens and the sequence number changes to the next one.

JUMP

Sequence data for JUMP instruction.
If you set a JUMP instruction under [Command], you can set the 4 types of sequence data below.

Data name	Function
Command	Select [JUMP].
Sequence start condition	Use a memory operation condition data number to set the starting condition. You can also set this item to no condition.
JUMP/ Repeat conditions	Set the memory operation condition data number. You can also set this item to no condition.
JUMP destination sequence No.	Set the sequence number for the JUMP destination.

The program jumps to the specified sequence number under the specified condition.
If the condition is False, the sequence number changes to the next one. If it is True, the sequence number changes to the specified number.

FOR

Sequence data for FOR instruction. (Up to 50 nests are possible.)
If you set a FOR instruction under [Command], you can set the 4 types of sequence data below.

Data name	Function
Command	Select [FOR].
Sequence start condition	Use a memory operation condition data number to set the starting condition. You can also set this item to no condition.
JUMP/ Repeat conditions	Set the memory operation condition data number. You can also set this item to no condition.
Repeat loop No.	Set the correspondence of FOR and NEXT combinations. The repeat loop number for FOR must be the same as the repeat loop number for NEXT.

Perform repeat control by the FOR to NEXT loop according to the specified condition.
If the condition is True, the sequence number changes to the next one. If it is False, the sequence number changes to the sequence number next to the NEXT.
You must always set FOR and NEXT as a pair. Accordingly, specify [Repeat Loop Number] separately for FOR and NEXT, and perform repeat control between FOR and NEXT of the same [Repeat Loop Number].
Execution of FOR and NEXT whose [Repeat Loop Number] is not a pair generates an error.
You can select a desired number from 0 to 49 for [Repeat Loop Number]. An error also occurs if there is any duplicate [Repeat Loop Number].
You can set up to 50 nests for the FOR to NEXT loop.

NEXT

Sequence data for NEXT instruction.
If you set a NEXT instruction under [Command], you can set the 3 types of sequence data below.

Data name	Function
Command	Select [NEXT].
Sequence start condition	Use a memory operation condition data number to set the starting condition. You can also set this item to no condition.
Repeat loop No.	Set the correspondence of FOR and NEXT combinations. The repeat loop number for FOR must be the same as the repeat loop number for NEXT.

The sequence number returns to the one that corresponds to the FOR instruction for repeat control by the FOR to NEXT loop.
You must always set FOR and NEXT as a pair. Accordingly, specify [Repeat Loop Number] separately for FOR and NEXT, and perform repeat control between FOR and NEXT of the same repeat loop number.
Execution of FOR and NEXT whose [Repeat Loop Number] is not a pair generates an error.
You can select a desired number from 0 to 49 for [Repeat Loop Number]. An error also occurs if there is any duplicate [Repeat Loop Number].
You can set up to 50 nests for the FOR to NEXT loop.

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Memory Operation

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Memory Operation

PSET

Sequence data that forcibly turns ON the PCU outputs.
If you set a PSET instruction under [Command], you can set the 3 types of sequence data below.

Data name	Function
Command	Select [PSET].
Sequence start condition	Use a memory operation condition data number to set the starting condition. You can also set this item to no condition.

Output signal	Specify the destination of forced output.
	0000 hex: No output
	##00 hex: RUN Output[1]
	##01 hex: Drive alarm reset output
	##02 hex: Error counter reset output[1]
	##03 hex: General-purpose output
	##04 hex: Torque limit output
	
	##: 01 to 04
	   (Physical Axis 01: Axis 1, 02: Axis 2, 03: Axis 3, 04: Axis 4)
	8000 to 800F hex: Memory Operation Auxiliary Memory area
	   (8,000 to 800F hex correspond to bits 0 to 15, respectively.)

*1.Selection is possible only when you use this signal as a general-purpose output.

You can forcibly output only the signals for the configuration axis of the applicable task.
Outputs are retained during memory operation, and the PSET instruction is canceled when memory operation stops.
This instruction operates based on the OR with any output instruction from the PLC.

You can select the RUN output and error counter output only when you use them as general-purpose outputs. If you select the RUN output and error counter output for PSET when they have already been selected as the RUN output and error counter output functions, an error occurs. For the settings of the RUN output and error counter reset, refer to "I/O Function Selection" on page 5-19.

PRSET

Sequence data that forcibly turns OFF the PCU outputs.
If you set a PRSET instruction under [Command], you can set the 3 types of sequence data below.

Data name	Function
Command	Select [PRSET].
Sequence start condition	Use a memory operation condition data number to set the starting condition. You can also set this item to no condition.

Output signal	Specify the destination of forced output.
	0000 hex: No output
	##00 hex: RUN Output[1]
	##01 hex: Drive alarm reset output
	##02 hex: Error counter reset output[1]
	##03 hex: General-purpose output
	##04 hex: Torque limit output
	
	##: 01 to 04
	    (Physical Axis 01: Axis 1, 02: Axis 2, 03: Axis 3, 04: Axis 4)
	8000 to 800F hex: Memory Operation Auxiliary Memory area
	    (8,000 to 800F hex correspond to bits 0 to 15, respectively.)

*1. Selection is possible only when you use this signal as a general-purpose output.

You can forcibly turn OFF only the signals for the configuration axis of the applicable task.
Outputs OFF is retained during memory operation, and the PRSET instruction is canceled when memory operation stops.
This instruction operates based on the AND with any output instruction from the PLC.

You can select the RUN output and error counter output only when you use them as general-purpose outputs. If you select the RUN output and error counter output for PSET when they have already been selected as the RUN output and error counter output functions, an error occurs. For the settings of the RUN output and error counter reset, refer to "I/O Function Selection" on page 5-19.

END

Sequence data for END of memory operation.
If you set an END instruction under [Command], you can set the 2 types of sequence data below.

Data name	Function
Command	Select [END].
Sequence start condition	Use a memory operation condition data number to set the starting condition. You can also set this item to no condition.

When you execute END, [Executing Sequence No.] changes to the one that was effective when you turned ON [Sequence No. Enable].

Operation

Operation commands have functions to control positioning operation, speed control, etc.

Positioning Operation (PTP)

Sequence data for positioning operation.
If you set a positioning operation instruction under [Command], you can set the sequence data below.

Data name	Function
Axis 1 command position	Set the position data. −2147483648 to 2147483647 (command unit) Only the position data for an axis in the axis configuration which you specified by a memory operation parameter becomes enabled.
Axis 2 command position	
Axis 3 command position	
Axis 4 command position	
Command	Select [Positioning Operation].
Sequence start condition	Use a memory operation condition data number to set the starting condition. You can also set this item to no condition.
Sequence skip condition	Use a memory operation condition data number to set the starting condition. You can also set this item to no condition.
End pattern[*1]	Set the operation completion pattern. 0: Individual 1: Automatic 2: Continuous 1 (Until the next sequence speed) 3: Continuous 2 (Acceleration/deceleration starts at the next sequence) 4: Continuous 3 (Pass: Superimpose deceleration of the present sequence and acceleration at the next sequence)
Positioning completion input monitor valid	Select the in-position check that applies when the operating axis stops. 0: Not wait for the positioning completion 1: Wait for the positioning completion
Dwell timer	If the completion pattern is independent or automatic, set a dwell time. 0: No dwell time 0.01 to 10.00s: Dwell time (10 ms unit)
M code	Set the M code after positioning completed. 0: Without M code 1 to 499: M code that waits for the M code reset 500 to 999: M code that does not wait for the M code reset
Axis specification	Set the axis to start. Issue a start command when each bit turns ON. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4 Execute start only for an axis in the axis configuration which you specified by a memory operation parameter.
Position specification	Select whether to set the command position as a relative position or absolute position. When each bit is ON, it indicates relative position designation. When the bit is OFF, it indicates absolute position designation. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4

Data name	Function
Axis 1 rotation axis direction	If you select rotation axis in the applicable axis parameter, select the operating direction of positioning operation (PTP) by absolute movement designation. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified
Axis 2 rotation axis direction	
Axis 3 rotation axis direction	
Axis 4 rotation axis direction	Specify the rotation axis move command only for an axis in the axis configuration which you specified by a memory operation parameter.
Axis 1 command speed	Set the target speed at which each axis performs positioning operation (PTP). The specification range is 1 to 2147483647 (command unit/s).
Axis 2 command speed	Specify the command speed only for an axis in the axis configuration which you specified by a memory operation parameter.
Axis 3 command speed	
Axis 4 command speed	
Axis 1 acceleration time	Set the acceleration time to use when you perform positioning operation (PTP). 0 to 250,000 (ms)
Axis 2 acceleration time	Specify the acceleration time only for an axis in the axis configuration which you specified by a memory operation parameter.
Axis 3 acceleration time	
Axis 4 acceleration time	
Axis 1 deceleration time	Set the deceleration time to use when you perform positioning operation (PTP). 0 to 250,000 (ms)
Axis 2 deceleration time	Specify the deceleration time only for an axis in the axis configuration which you specified by a memory operation parameter.
Axis 3 deceleration time	
Axis 4 deceleration time	

*1 If 2 (continuous 1), 3 (continuous 2), or 4 (continuous 3) is selected, the operation will be the same as if 1 (automatic) was selected.

Perform position control (PTP) of up to 4 axes based on the specified sequence data as well as [Maximum Speed], [Starting Speed], [Acceleration/Deceleration Curve Selection] and [Acceleration/Deceleration Time Selection] which you set by axis parameters.
You can issue commands for each axis in the case of override. For override, refer to "Override" on page 9-12.

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Linear Interpolation Operation

Sequence data for linear interpolation operation.

If you set a linear interpolation operation instruction under [Command], you can set the sequence data below.

For linear interpolation, also refer to "Linear Interpolation" on page 7-38.

Data name	Function
Axis 1 command position	Set the position data. −2147483648 to 2147483647 (command unit)
Axis 2 command position	Only the position data for an axis in the axis configuration which you specified by a memory operation parameter becomes enabled.
Axis 3 command position	
Axis 4 command position	
Command	Select [Circular interpolation (clockwise direction)] or [Circular interpolation (counterclockwise direction)].
Sequence start condition	Use a memory operation condition data number to set the start condition. You can also set this item to no condition.
Sequence skip condition	Use a memory operation condition data number to set the skip condition. You can also set this item to no condition.
End pattern	Set the operation end pattern. 0: Individual 1: Automatic 2: Continuous 1 (Until the next sequence speed) 3: Continuous 2 (Acceleration/deceleration starts at the next sequence) 4: Continuous 3 (Pass: Superimpose deceleration of the present sequence and acceleration at the next sequence)
Positioning completion input monitor valid	Select the in-position check that applies when the operating axis stops. 0: Not wait for the positioning completion 1: Wait for the positioning completion
Dwell timer	If the end pattern is individual or automatic, set a dwell time. 0: No dwell time 0.01 to 10.00s: Dwell time (10 ms unit)
M code	Set the M code after positioning completed. 0: Without M code 1 to 499: M code that waits for the M code reset 500 to 999: M code that does not wait for the M code reset
Axis specification	Set the axis to start. Issue a start command when each bit turns ON. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4 Execute start only for an axis in the axis configuration which you specified by a memory operation parameter.
Position specification	Select whether to set the command position as a relative position or absolute position. When each bit is ON, it indicates relative position specification. When the bit is OFF, it indicates absolute position specification. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4
Interpolation speed	Set the interpolation speed.1 to 8000000 (command unit/s)

Data name	Function
Interpolation acceleration time	Set the interpolation acceleration time. 0 to 250,000 (ms)
Interpolation deceleration time	Set the interpolation deceleration time. 0 to 250,000 (ms)
Interpolation starting speed	Set the interpolation starting speed. 0 to 8000000 (command unit/s)
Interpolation acceleration/ deceleration curve selection	Select the curve for interpolation acceleration/deceleration. 0: Trapezoid, 1: S-curve (Cubic curve)
Interpolation acceleration/ deceleration time selection	Select the specification method for interpolation acceleration/deceleration time. 0: Time from starting speed to maximum speed of each axis (Acceleration/deceleration specified) 1: Time from present speed to target speed of each axis (Time specified)
Interpolation speed specification method	Select the interpolation speed designation method for linear interpolation. 0: Specify the interpolation path speed 1: Specify the maximum speed

Perform positioning of up to 4 axes by linear interpolation based on the specified sequence data.

In the case of override, you can issue commands to priority axes among the task configuration axes. For override, refer to "Override" on page 9-12.

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Memory Operation

Circular Interpolation

Sequence data for circular interpolation.

To perform circular interpolation, you must set linear axis for [AXIS FEEDING Mode] of the interpolated axes. For [AXIS FEEDING Mode], refer to "Command Position Unit Setting" on page 5-30.

If you use a circular interpolation instruction under [Command], you can set the sequence data below.

For circular interpolation, also refer to "Circular Interpolation" on page 7-42.

Data name	Function
Axis 1 command position	Set the position data for the end point. –2147483648 to 2147483647 (command unit)
Axis 2 command position	For an absolute position specification, specify the absolute position of the end point.
Axis 3 command position	For a relative position specification, specify the relative position of the end point from the start point.
Axis 4 command position	Only the position data for an axis in the axis configuration which you specified by a memory operation parameter becomes enabled.
Command	Select [Circular Interpolation].
Sequence start condition	Use a memory operation condition data number to set the start condition. You can also set this item to no condition.
Sequence skip condition	Use a memory operation condition data number to set the skip condition. You can also set this item to no condition.
End pattern	Set the operation end pattern. 0: Individual 1: Automatic 2: Continuous 1 (Until the next sequence speed) 3: Continuous 2 (Acceleration/deceleration starts at the next sequence) 4: Continuous 3 (Pass: Superimpose deceleration of the present sequence and acceleration at the next sequence)
Positioning completion input monitor valid	Select the in-position check that applies when the operating axis stops. 0: Not wait for the positioning completion 1: Wait for the positioning completion
Dwell timer	If the end pattern is individual or automatic, set a dwell time. 0: No dwell time 0.01 to 10.00s: Dwell time (10 ms unit)
M code	Set the M code after positioning completed. 0: Without M code 1 to 499: M code that waits for the M code reset 500 to 999: M code that does not wait for the M code reset
Axis specification	Set the axis to start. Issue a start command when each bit turns ON. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4 Execute start only for an axis in the axis configuration which you specified by a memory operation parameter.
Position specification	Select whether to set the command position as a relative position or absolute position. When each bit is ON, it indicates relative position specification. When the bit is OFF, it indicates absolute position specification. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4

Data name	Function
Interpolation speed	Set the interpolation speed. 1 to 8000000 (command unit/s)
Interpolation acceleration time	Set the interpolation acceleration time. 0 to 250,000 (ms)
Interpolation deceleration time	Set the interpolation deceleration time. 0 to 250,000 (ms)
Interpolation starting speed	Set the interpolation starting speed. 0 to 8000000 (command unit/s)
Interpolation acceleration/ deceleration curve selection	Select the curve for interpolation acceleration/deceleration. 0: Trapezoid, 1: S-curve (Cubic curve)
Interpolation acceleration/ deceleration time selection	Select the specification method for interpolation acceleration/deceleration time. 0: Time from starting speed to maximum speed of each axis (Acceleration/ deceleration specified) 1: Time from present speed to target speed of each axis (Time specified)
Axis 1 circular center/ passing point position	If you select center point designation under [Circular Interpolation Method], set the center position of the circle. If you select passing point designation, set the position of a passing point. −2147483648 to 2147483647 (command unit)
Axis 2 circular center/ passing point position	
Axis 3 circular center/ passing point position	
Axis 4 circular center/ passing point position	
Circular radius	If you select radius designation under [Circular Interpolation Method], set the circular radius. −2147483648 to 2147483647 (command unit)
Circular interpolation method	Select the specification method of circular interpolation. 0: Specify the circular center 1: Specify the radius 2: Specify the passing point

Perform positioning of 2 axes by circular interpolation based on the specified sequence data. In the case of override, you can issue commands to priority axes among the task configuration axes. For override, refer to "Override" on page 9-12.

As for [Backlash Output Method], only Servomotor method is enabled. If stepping motor method is selected, an error occurs. For [Backlash Output Method], refer to "Backlash Compensation Function Setting" on page 5-28.

Speed Control

Sequence data for speed control. Specify speed control separately for each axis.
If you set a speed control instruction under [Command], you can set the sequence data below.

Data name	Function
Command	Select [Speed Control].
Sequence start condition	Use a memory operation condition data number to set the start condition. You can also set this item to no condition.
Sequence skip condition	Use a memory operation condition data number to set the skip condition. You can also set this item to no condition.

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Data name	Function
End pattern[*1]	Set the operation end pattern. 0: Individual 1: Automatic 2: Continuous 1 (Until the next sequence speed) 3: Continuous 2 (Acceleration/deceleration starts at the next sequence) 4: Continuous 3 (Pass: Superimpose deceleration of the present sequence and acceleration at the next sequence)
Positioning completion input monitor valid	Select the in-position check that applies when the operating axis stops. 0: Not wait for the positioning completion 1: Wait for the positioning completion
Dwell timer	If the end pattern is individual or automatic, set a dwell time. 0: No dwell time 0.01 to 10.00s: Dwell time (10 ms unit)
M code	Set the M code after positioning completed. 0: Without M code 1 to 499: M code that waits for the M code reset 500 to 999: M code that does not wait for the M code reset
Axis specification	Set the axis to start. Issue a start command when each bit turns ON. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4 Execute start only for an axis in the axis configuration which you specified by a memory operation parameter.
Command speed	Set the target speed to use in speed control. The specification range is −2147483648 to 2147483647 (command unit/s).
Acceleration time	Set the acceleration time to use in speed control. 0 to 250,000 (ms)
Deceleration time	Set the deceleration time to use in speed control. 0 to 250,000 (ms)

*1 If 2 (continuous 1), 3 (continuous 2), or 4 (continuous 3) is selected, the operation will be the same as if 1 (automatic) was selected.

Perform speed control for 1 axis based on the specified sequence data as well as [Maximum Speed], [Starting Speed], [Acceleration/Deceleration Curve Selection] and [Acceleration/ Deceleration Time Selection] which you set by axis parameters.
You can issue commands in the case of override. For override, refer to "Override" on page 9-12.

Interrupt Feeding (Positioning Operation)

Sequence data for interrupt feeding (positioning operation).
Specify interrupt feeding separately for each axis.
If you set an interrupt feeding (positioning operation) instruction under [Command], you can set the sequence data below.

Data name	Function
Axis 1 command position	Set the position data. −2147483648 to 2147483647 (command unit)
Axis 2 command position	Only the position data for an axis in the axis configuration which you specified by a memory operation parameter becomes enabled.
Axis 3 command position	
Axis 4 command position	

Data name	Function
Command	Select [Interrupt Feeding (Positioning Operation)].
Sequence start condition	Use a memory operation condition data number to set the start condition. You can also set this item to no condition.
Sequence skip condition	Use a memory operation condition data number to set the skip condition. You can also set this item to no condition.
End pattern[*1]	Set the operation end pattern. 0: Individual 1: Automatic 2: Continuous 1 (Until the next sequence speed) 3: Continuous 2 (Acceleration/deceleration starts at the next sequence) 4: Continuous 3 (Pass: Superimpose deceleration of the present sequence and acceleration at the next sequence)
Positioning completion input monitor valid	Select the in-position check that applies when the operating axis stops. 0: Not wait for the positioning completion 1: Wait for the positioning completion
Dwell timer	If the end pattern is individual or automatic, set a dwell time. 0: No dwell time 0.01 to 10.00s: Dwell time (10 ms unit)
M code	Set the M code after positioning completed. 0: Without M code 1 to 499: M code that waits for the M code reset 500 to 999: M code that does not wait for the M code reset
Axis specification	Set the axis to start. Issue a start command when each bit turns ON. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4 Execute start only for an axis in the axis configuration which you specified by a memory operation parameter.
Position specification	Select whether to set the command position as a relative position or absolute position. When each bit is ON, it indicates relative position specification. When the bit is OFF, it indicates absolute position specification. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4
Rotation axis direction	If you select rotation axis in the applicable axis parameter, select the operating direction of interrupt feeding (positioning operation) by absolute movement designation. 0: Shortest route 1: Forward direction 2: Reverse direction 3: Not specified Specify the rotation axis move command only for an axis in the axis configuration which you specified by a memory operation parameter.
Command speed	Set the target speed at which each axis performs interrupt feeding (positioning operation). The specification range is 1 to 2147483647 (command unit/s).
Acceleration time	Set the acceleration time to use when you perform interrupt feeding (positioning operation). 0 to 250,000 (ms)
Deceleration time	Set the deceleration time to use when you perform interrupt feeding (positioning operation). 0 to 250,000 (ms)

Data name	Function
Interrupt feeding reference position selection	Select whether to use the command position or feedback position for the target value of constant-pitch positioning upon interrupt input. 0: Command position 1: Feedback position
Interrupt feeding amount	Set the amount of movement to use in interrupt feeding. −2147483648 to 2147483647 (command unit)
Interrupt input undetected error enable	Select whether to output an error when an interrupt input is not input before positioning is completed during interrupt feeding by position control. 0: Without error detection 1: With error detection

*1 If 2 (continuous 1), 3 (continuous 2), or 4 (continuous 3) is selected, the operation will be the same as if 1 (automatic) was selected.

Perform interrupt feeding (positioning operation) for 1 axis based on the specified sequence data as well as [Maximum Speed], [Starting Speed], [Acceleration/Deceleration Curve Selection] and [Acceleration/Deceleration Time Selection] which you set by axis parameters. You can issue commands in the case of override. For override, refer to "Override" on page 9-12.

Interrupt Feeding (Speed Control)

Sequence data for interrupt feeding (speed control).
Specify interrupt feeding separately for each axis.
If you set an interrupt feeding (speed control) instruction under [Command], you can set the sequence data below.

Data name	Function
Command	Select [Interrupt Feeding (Speed Control)].
Sequence start condition	Use a memory operation condition data number to set the start condition. You can also set this item to no condition.
Sequence skip condition	Use a memory operation condition data number to set the start condition. You can also set this item to no condition.
End pattern[1]	Set the operation end pattern. 0: Individual 1: Automatic 2: Continuous 1 (Until the next sequence speed) 3: Continuous 2 (Acceleration/deceleration starts at the next sequence) 4: Continuous 3 (Pass: Superimpose deceleration of the present sequence and acceleration at the next sequence)
Positioning completion input monitor valid	Select the in-position check that applies when the operating axis stops. 0: Not wait for the positioning completion 1: Wait for the positioning completion
Dwell timer	If the end pattern is individual or automatic, set a dwell time. 0: No dwell time 0.01 to 10.00s: Dwell time (10 ms unit)
M code	Set the M code after positioning completed. 0: Without M code 1 to 499: M code that waits for the M code reset 500 to 999: M code that does not wait for the M code reset
Axis specification	Set the axis to start. Issue a start command when each bit turns ON. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4 Execute start only for an axis in the axis configuration which you specified by a memory operation parameter.
Command speed	Set the target speed at which each axis performs interrupt feeding (speed control). The specification range is −2147483648 to 2147483647 (command unit/s).
Acceleration time	Set the acceleration time to use when you perform interrupt feeding (speed control). 0 to 250,000 (ms)
Deceleration time	Set the deceleration time to use when you perform interrupt feeding (speed control). 0 to 250,000 (ms)
Interrupt feeding reference position selection	Select whether to use the command position or feedback position for the target value of constant-pitch positioning upon interrupt input. 0: Command position 1: Feedback position
Interrupt feeding amount	Set the amount of movement to use in interrupt feeding. −2147483648 to 2147483647 (command unit)

*1 If 2 (continuous 1), 3 (continuous 2), or 4 (continuous 3) is selected, the operation will be the same as if 1 (automatic) was selected.

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Memory Operation

Perform interrupt feeding (speed control) for 1 axis based on the specified sequence data as well as [Maximum Speed], [Starting Speed], [Acceleration/Deceleration Curve Selection] and [Acceleration/Deceleration Time Selection] which you set by axis parameters.

You can issue commands in the case of override. For override, refer to "Override" on page 9-12.

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Memory Operation

Setting of Conditions

This section explains [Start Condition], [Sequence Skip Condition], [Dwell Time] for the completion condition, [Positioning Completion Input Monitor Valid], and [M Code].

Start Condition

Use a memory operation condition data number to specify the sequence starting condition.
If you set no condition, the sequence starts unconditionally.
If the condition is False, the program does not start the sequence, but continues to wait until it becomes True.
Once the condition becomes True, the program executes memory operation based on the sequence number.

Sequence Skip Condition

You can specify the sequence skipping condition when you specify an operation command under [Command].
If you set no condition, the sequence does not stop or skip.
If the sequence skipping condition is True at the start of sequence, the sequence skips and the program executes the next sequence.
If the sequence skipping condition changes from False to True while the sequence is executed, the executing sequence stops. If the axis operation is in progress, the axis stops. If it is waiting, waiting is interrupted. If the completion pattern is [Automatic] or [Continuous], however, the next sequence starts after the stop. If the completion pattern is [Individual], the sequence number increments and then the sequence stops.

Dwell Timer

You can specify dwell time when you specify an operation command under [Command] and the completion pattern is [Individual] or [Automatic].
[Dwell Timer] starts after the positioning of the sequence completes successfully. Completion of the positioning of the sequence is determined according to the setting of [Positioning Completion Input Monitor Valid].
Waiting does not occur if the axis stops due to a deceleration stop command.
If the axis stops due to an error, deceleration stop command or sequence skipping condition during dwell time is waiting, waiting is interrupted.

Positioning Completion Input Monitor Valid

You can specify positioning completed input monitoring judgment when you specify an operation command under [Command] and the completion pattern is [Individual] or [Automatic].
If you set [Not Wait for the Positioning Completion], it judges completion of positioning upon completion of pulse output.
As for [Dwell Timer], waiting starts after [Positioning Completion Input Monitor Valid].
In the case of linear interpolation operation or circular interpolation operation, not only the axes which are currently operating, but all configuration axes for the task, become the target of positioning completed judgment.
If you set [0] for the Position Monitoring Time axis parameter, the positioning completed input will not be monitored regardless of the Positioning Completed Input Function parameter set.
For details, refer to "In-position Check" on page 9-24.

M Code

M codes are the codes which you use to align timings with external devices to the PLC in each positioning operation process.

You can specify M codes when you specify an operation command under [Command], for each memory operation sequence block.

There are 2 types of M codes: M code No. 1 to 499 that require M code reset, and M code No. 500 to 999 that do not require reset.

You can specify M codes that require M code reset when the completion pattern is independent or automatic.

End Pattern

Set the operation completion pattern.

You can specify a completion pattern when you specify an operation command under [Command].

Precautions for Correct Use

• Specifying continuous 1 to 3 is enabled only when the applicable sequence is an interpolation operation. If the sequence is not an interpolation operation, the operation conforms to the one which takes place when you specify automatic.

• To implement continuous operation, you must set [Linear Interpolation] or [Circular Interpolation] under [Command], and you must not set [Sequence Start Condition] for the next sequence.

• An attempt to execute continuous operation will generate an error and fail if any of the limit input is ON for the configuration axes within the task.

The operation under each completion pattern is as follows.

Individual

When [Memory Operation] under [Memory Operation Command Memory Area] turns ON, execute the specified sequence number, after which [Executing Sequence No.] is updated and then the operation ends.

Since the sequence number is updated to the next number, the next sequence number is executed when [Memory Operation] turns ON again.

Automatic

When [Memory Operation] under [Memory Operation Command Memory Area] turns ON, execute the specified sequence number. When the condition for the next sequence number is satisfied, also the next sequence number is executed automatically.

Continuous 1 (Until the Next Sequence Speed)

When [Memory Operation] under [Memory Operation Command Memory Area] turns ON, execute the specified sequence number, after which the next sequence number is executed successively.

For continuous 1, the speed of the next sequence is reached at the position of the specified sequence number.

Continuous 2 (Acceleration/Deceleration Starts at the Next Sequence)

When [Memory Operation] under [Memory Operation Command Memory Area] turns ON, execute the specified sequence number, after which execute the next sequence number successively.

For continuous 2, the acceleration or deceleration of the next sequence starts at the position of the specified sequence number.

Continuous 3 (Superimpose Deceleration in the Applicable Sequence and Acceleration in the Next Sequence)

When [Memory Operation] under [Memory Operation Command Memory Area] turns ON, execute the specified sequence number, after which the next sequence number is executed successively.

For continuous 3, superimposing deceleration in the specified sequence number on acceleration in the next sequence realizes smooth interpolation operation.

Precautions for Correct Use

Notes on continuous operation

⬧ Continuous 1 to 3 can be specified for linear interpolation and circular interpolation operation.
  To implement continuous operation, the next sequence must also be linear interpolation or circular interpolation and must not have any sequence starting condition set.

⬧ For the sequences you want to operate continuously, set the amount of movement that requires a positioning time of 2 control cycles or longer. If the required positioning time is less than 1 control cycle, the operation conforms to the [Automatic] pattern.

⬧ If the sequence next to the one for which you specified the continuous start includes a NOP command or comment, the sequence skips up to 4 sequences and operation continues with the next sequence. If there are 5 or more sets of sequence data that includes a NOP command or comment, the operation conforms to one that would be performed if you set automatic.

Axis Status during Continuous Operation

The [During Pass] flag that indicates an axis status remains ON while the axis movement in continuous 1 and continuous 3 is accelerating or decelerating toward the target speed of the next sequence.

If you select continuous 2, the [During Pass] flag does not turn ON because the next sequence starts at the present speed.
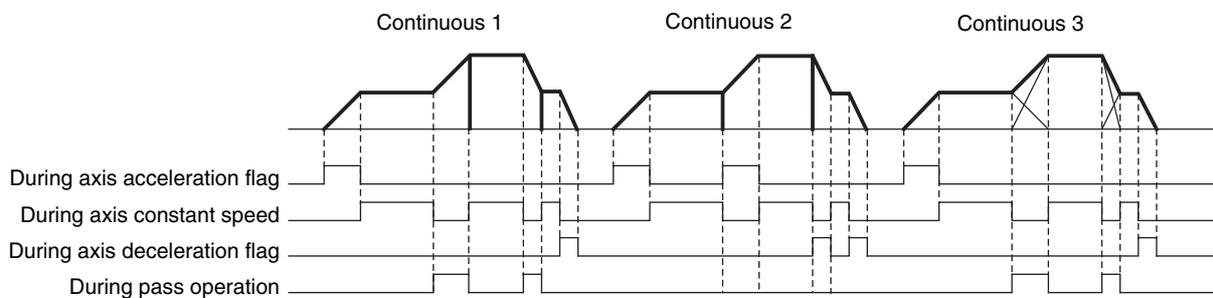
In the case of continuous 2, the pass operation in progress flag is not set.

Stopping of Memory Operation

The following are the 5 possible causes of the axis stop during memory operation.

- The Memory Operation Stop Memory area turned ON.
- The Deceleration Stop Memory area of each axis turned ON.
- The Servo Unlock Memory area of each axis turned ON.
- The Error Counter Reset Memory area of each axis turned ON.
- The axis stopped due to an error.

This section explains the operation that follows when the axis is stopped by above causes.

Memory Operation Stop Memory Area

The current memory operation stops and all configuration axes of memory operation decelerate to a stop.
The deceleration time for stopping conforms to the deceleration time which you set by the current memory operation data. In the case of interpolation operation, the axes decelerate to a stop along the interpolation path.

Deceleration Stop Memory Area of Each Axis

If you execute a deceleration stop on any of the configuration axes of the current memory operation, operation depends on the currently executed command as explained below.
You can assume that the deceleration stop input is effective even if the axis is not operating.

PTP Commands

The axis for which you execute a deceleration stop decelerates to a stop according to the deceleration time that you set in the memory operation data.

The deceleration time is set as follows according to the Acceleration/Deceleration Time Selection axis parameter.

- When a Constant Acceleration/Deceleration Rate is selected for the Acceleration/Deceleration Time Selection axis parameter, an axis is decelerated to a stop while maintaining the deceleration rate for the ongoing operation.

- When a Constant Acceleration/Deceleration Time is selected for the Acceleration/Deceleration Time Selection axis parameter, an axis is decelerated to a stop based on the deceleration time in the memory operation data.

All other operating axes continue positioning according to the PTP commands.

With PTP commands, the operation of each axis is individual and thus operational changes to one axis do not affect the other axes.

Precautions for Correct Use

When a Constant Acceleration/Deceleration Time is selected for the Acceleration/Deceleration Time Selection axis parameter, an axis may go beyond the target position at the time of a deceleration stop during positioning operation. For details, refer to *5-3 Axis Parameters* on page 5-13.

Memory Operation

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Linear Interpolation/Circular Interpolation Command

The axis stops as follows, according to the setting of the memory operation parameter [Interpolated Axis Stop Method].

Interpolated axis stopping method	Stopping operation
Interpolation path deceleration stop	All interpolated axes decelerate to a stop along the interpolated path. The applicable deceleration time conforms to the deceleration time which you set by the current memory operation data. If you use multiple continuous patterns, the axes stop according to the time in each pattern.
Immediate stop	The axis on which you execute a deceleration stop decelerates to a stop according to the axis parameter [Single Axis Deceleration Time at Interpolation]. Other interpolated axes stop immediately.
RUN OFF	The axis on which you execute a deceleration stop decelerates to a stop according to the axis parameter [Single Axis Deceleration Time at Interpolation]. Other interpolated axes make free-running stop.
Single axis deceleration stop	All interpolated axes, which include the axis on which you execute a deceleration stop, decelerate to a stop according to the parameter [Single Axis Deceleration Time at Interpolation] of each axis.

Applicable axes to be stopped by interpolation commands are the interpolated axes, not memory configuration axes.
Therefore, if axes 1 and 2 are interpolated under a task of axis configuration of axes 1 to 4, only axes 1 and 2 can be stopped. Stopping operation and RUN OFF can not be applied to axes 3 and 4.

Servo Unlock Memory Area and Error Counter Reset Memory Area of Each Axis

If you execute a deceleration stop on any of the configuration axes of the current memory operation, operation depends on the currently executed command as explained below.
You can assume that the deceleration stop input is effective even if the axis is not operating.

PTP Command

Servo unlock and error counter reset operations are executed for the axis on which you executed servo unlock and error counter reset outputs. All other operating axes continue with their positioning according to the PTP command.

Linear Interpolation/Circular Interpolation Command

Servo unlock and error counter reset operations are executed for the axis on which you executed servo unlock and error counter reset outputs. Other interpolation axes stop as follows, according to the setting of the memory operation parameter [Interpolation Axis Stop Method].

Interpolated axis stopping method	Stopping operation
Interpolation path deceleration stop	Because you cannot specify this, it functions as the single axis deceleration stop under this setting.
Immediate stop	The axis on which you execute a deceleration stop decelerates to a stop according to the axis parameter [Single Axis Deceleration Time at Interpolation]. Other interpolated axes stop immediately.
RUN OFF	The axis on which you execute a deceleration stop decelerates to a stop according to the axis parameter [Single Axis Deceleration Time at Interpolation]. Other interpolated axes make free-running stop.
Single axis deceleration stop	All interpolated axes, which include the axis on which you execute a deceleration stop, decelerate to a stop according to the parameter [Single Axis Deceleration Time at Interpolation] of each axis.

Applicable axes to be stopped by interpolation commands are the interpolated axes, not memory configuration axes.

Therefore, if axes 1 and 2 are interpolated under a task of axis configuration of axes 1 to 4, only axes 1 and 2 can be stopped. Stopping operation and RUN OFF can not be applied to axes 3 and 4.

Occurrence of Error

If an error occurs, the axes decelerate to a stop, as a rule.

Upon occurrence of the emergency stop, limit input or a sensor error in the drive alarm, however, the operation of the axis that generated the error conforms to the input signal function setting parameter of each axis.

- If a deceleration stop is executed due to a memory operation error, the operation is the same as the memory operation stop.
- In case of an axis error, a memory operation error (configuration axis error, error code: 6C02) occurs to the task of the configuration axes this axis belongs to, and the operation is the same as the memory operation stop.
- For the immediate stop, limit input or a sensor error in the drive alarm, if the specified stopping method is not deceleration stop, the operation is the same as the Servo Unlock Memory area or Error Counter Reset Memory area and each axis.

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Memory Operation

Stopping on Interpolation Path

If you execute a deceleration stop during continuous interpolation operation, the axes decelerate without deviating from the path. The applicable deceleration time conforms to the deceleration time in the sequence. If you execute a deceleration stop over multiple sequences, the deceleration curve changes based on the deceleration time in each sequence. The sequence number changes in the same manner as during normal operation.
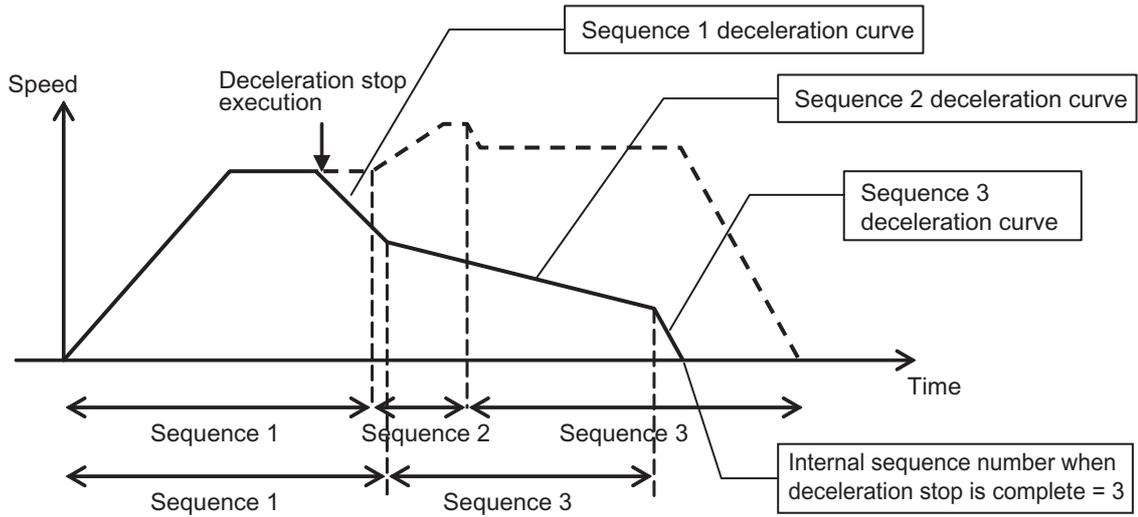
7-4 Linear Interpolation

Linear interpolation is a function to perform positioning with axes 1 to 4 so that the point at which the axis currently stops and the specified point are aligned on a straight line.
For setting details, refer to "Linear Interpolation Operation" on page 7-21.

The chart below shows a linear interpolation of 2 axes, namely axes 1 and 2, from point A to point B.
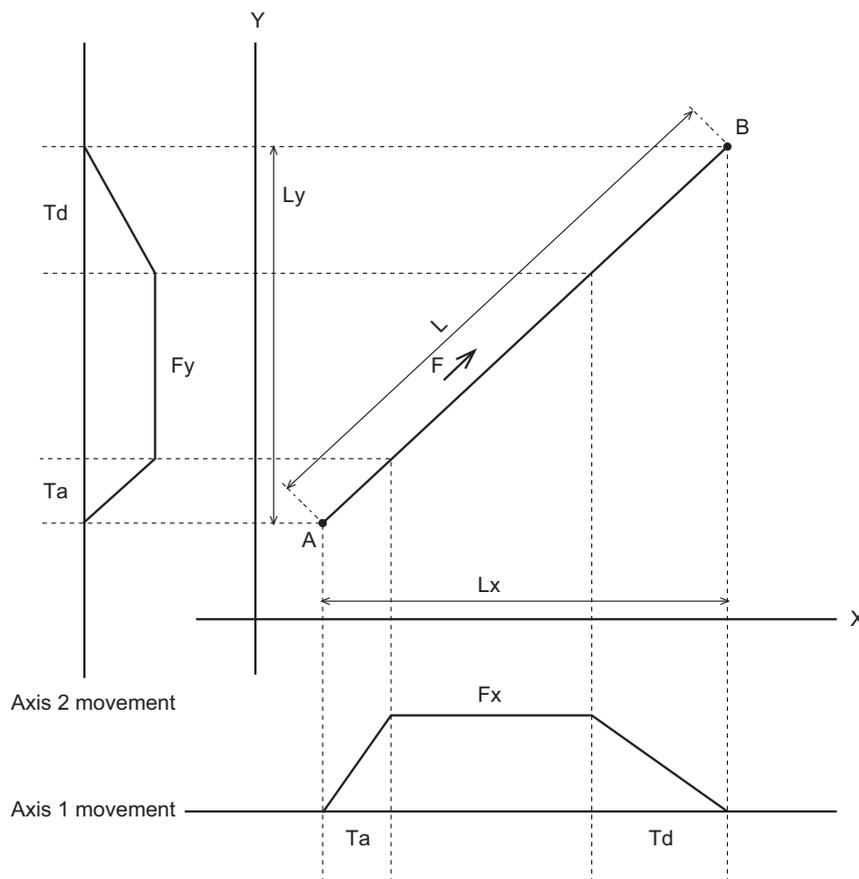
F: Specified interpolation feeding speed
Fx: Interpolation feeding speed based on expansion of F to axis 1
Fy: Interpolation feeding speed based on expansion of F to axis 2
Ta: Interpolation acceleration time
Td: Interpolation deceleration time
If the amount of movement along the path is given by L and amounts of movement of axes 1 and 2 by Lx and Ly, Fx and Fy can be expressed by the formula below:

$$Fx = \frac{Lx}{L} \times F$$

$$Fy = \frac{Ly}{L} \times F$$

Precautions for Correct Use

- The status of each axis during interpolation operation, interpolation axis accelerating, constant-speed movement, or decelerating, is not the output of the independent status of the axis, but the status of the path.
  Accordingly, all interpolation axes have the same status during interpolation operation.

Linear Interpolation Speed

You can select the speed of each axis during linear interpolation via [Interpolation Speed Specification Method] of the sequence data.
Under [Interpolation Speed Specification Method], specify [Specify Interpolation Path Speed] or [Maximum Speed Specification].

Interpolated path speed designation

Although the interpolated path speed conforms to [Interpolation Speed] of the sequence data, the speed of each axis is determined by the calculation formulas below (the same calculation formulas also apply to linear interpolation that involves 2 or 3 axes).

Example) Simultaneous linear interpolation of 4 axes
Speed of axis 1 = Interpolation speed × Movement of axis 1 / Total movement
Speed of axis 2 = Interpolation speed × Movement of axis 2 / Total movement
Speed of axis 3 = Interpolation speed × Movement of axis 3 / Total movement
Speed of axis 4 = Interpolation speed × Movement of axis 4 / Total movement

$$\text{Total movement} = \sqrt{\text{Axis 1 movement}^2 + \text{Axis 2 movement}^2 + \text{Axis 3 movement}^2 + \text{Axis 4 movement}^2}$$

If you break down the interpolation speed into the speed of each axis according to the above formulas and that speed exceeds the [Maximum Speed] parameter of the applicable axis, the interpolation speed is automatically lowered so that you can operate any of the axes that perform linear interpolation at the maximum speed.

Maximum speed designation

Automatically calculate the interpolation speed so that you can operate any of the axes at the [Maximum Speed] of the axis parameter.
Under this specification, [Interpolation Speed] of the sequence data is disabled.

Interpolation Acceleration Time and Interpolation Deceleration Time

Set the acceleration time and deceleration time of interpolation control.
For the interpolation acceleration time and interpolation deceleration time, [Interpolated Acceleration/Deceleration Time Selection] determines the operation.

Interpolated Acceleration/Deceleration Time Selection

Under interpolated acceleration/deceleration time selection, you can select [Acceleration/deceleration specified] or [Time specified].
Use [Acceleration/deceleration specified] to shorten the positioning time of linear interpolation which involves only 1 axis.

Fixed acceleration

[During starting]
    TA: Acceleration time
    Ta1: Actual acceleration time
    A: Degree of acceleration

[During speed change]
    TA: Acceleration time
    Ta2: Actual acceleration time
    A: Degree of acceleration

[During deceleration]
    TD: Deceleration time
    Td: Actual deceleration time
    D: Degree of deceleration

Fixed acceleration/deceleration time

[During starting]
    TA: Acceleration time
    A1: Degree of acceleration

[During speed change]
    TA: Acceleration time
    A2: Degree of acceleration

[During deceleration]
    TD: Deceleration time
    D: Degree of deceleration

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Memory Operation

Stepping Motor Usage Precautions

When you perform continuous linear interpolation operation with stepping motors, use [1: Automatic] for [End Pattern] of the sequence data.

During interpolation, the axes start at the target speed and acceleration/deceleration time upon a start command. Accordingly, high pulses may be output suddenly or pulse output may stop abruptly if you select [Continuous 1 to 3] for [End Pattern]. The motor may not be able to accommodate such changes in pulses and step out as a result.

For example, you started axis 1 to execute the linear interpolation operation that involves 2 axes, namely axes 1 and 2 as follows.

The movement of axis 2 from point A to point B is 0.

Position path
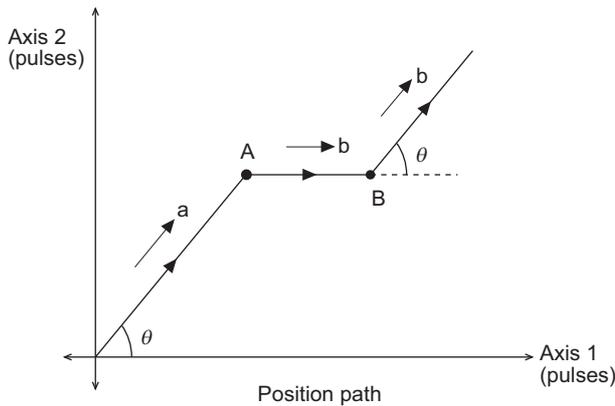
The interpolation speed until point A is given by a, while the interpolation speed until point B and thereafter is given by b. If you select [Continuous 1 to 3] for [End Pattern], the interpolation speed and speeds of axes 1 and 2 are calculated as follows, and accordingly abrupt output or stopping of pulses occurs.
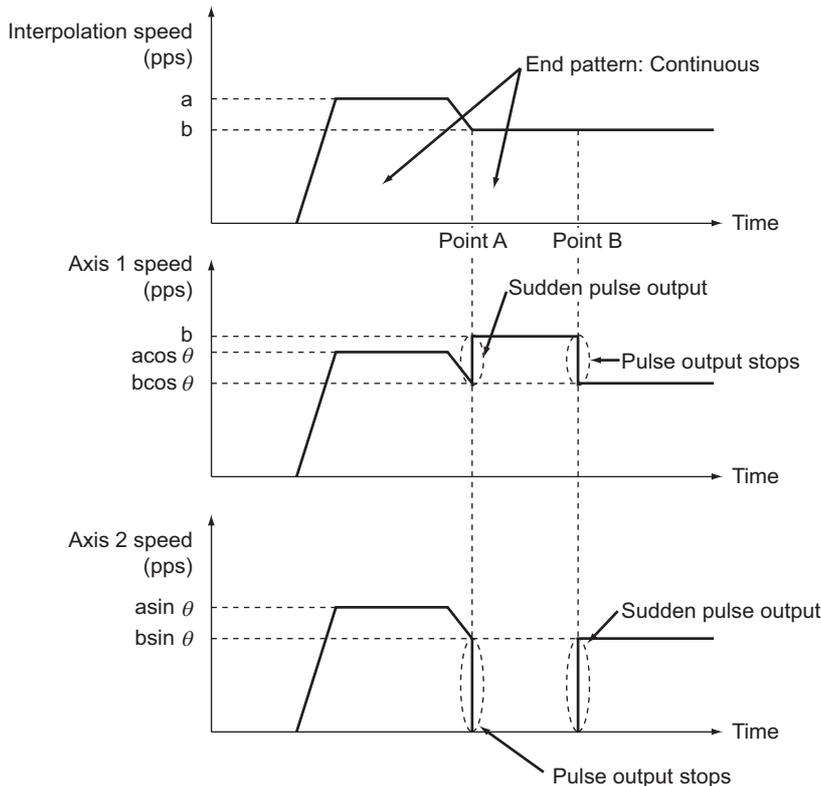
7-5 Circular Interpolation

In circular interpolation, 2 axes perform positioning in a circular pattern between the start point and end point.

For setting details, refer to "Circular Interpolation" on page 7-23.

In circular interpolation control, you must specify all interpolated axes as linear axes.

For the setting method of linear axes, refer to "Command Position Unit Setting" on page 5-30.

You can use the methods below to specify circular interpolation:

Command method	Description
Circular Center Specification	Use the present position as the start point and specify the end point, center point and rotation direction, to perform circular interpolation.
Radius Specification	Use the present position as the start point and specify the end point, radius and rotation direction, to perform circular interpolation. If you specify the same position as the start point and end point, an error occurs.
Passing point Specification	Use the present position as the start point and specify the end point and passing point, to perform circular interpolation. Specifying 3 points, namely the start point, passing point and end point, determines the rotation direction. Accordingly, the specification of circular direction is ignored. If the start point and end point are the same, however, the rotation direction is not determined and thus follows the circular direction.

The rotation direction is determined by the path direction on the coordinate plain formed by the vertical and horizontal axes. Of circular axes, the axis with higher priority is the horizontal axis. The priorities are assigned to each axis as follows: axis 1 (highest) > axis 2 > axis 3 > axis 4 (lowest).
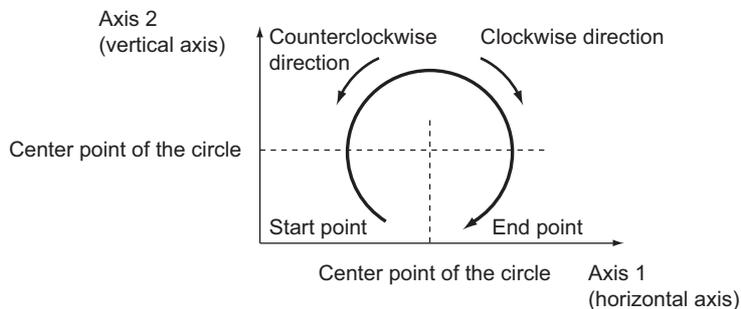
Precautions for Correct Use

- The status of each axis during interpolation operation, interpolation axis accelerating, constant-speed movement, or decelerating, is not the output of the independent status of the axis, but the status of the path.
  Accordingly, all interpolation axes have the same status during interpolation operation.

- An attempt to execute circular interpolation will generate an error and fail if the limit input of any one of the configuration axes within the task is ON.

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Memory Operation

> 📝 **Reference**

If the start point and end point are clear and you want to perform avoidance operation along the circular path, circular center specification is useful.

Essentially, circular center specification calculates the center point to perform complete circular operation.

In avoidance operation, however, it is difficult to obtain the center point accurately, although the start point and end point are clear.

If you specify the center point offset, therefore, calculate the average of two radii, namely the radius of specified center point to start point and radius of specified center point to end point, and recalculate the center point from that radius to perform normal circular interpolation. The specified rotation direction is maintained.
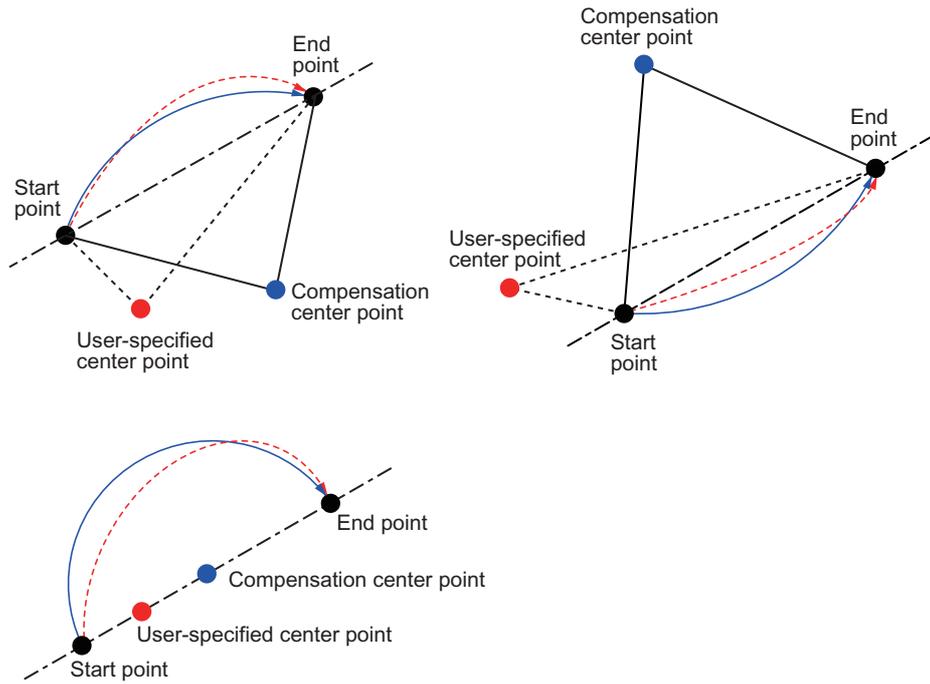
7-6 Timing Chart

This section explains the timing charts for using the Memory Operation Start Bit and Memory Operation Independent Start Bit. Axis 1 is used as an example.

Operation Preparation

Before you perform memory operation, this section explains the Sequence No. Enable and Memory Operation Start Available Memory areas.

Sequence No. Enable

Use sequence No. enable to specify the sequence number from which to start operation.
After you set the sequence number and sequence No. enable is turned ON, execute the specified sequence number the moment memory operation independent start or memory operation turns ON.

The chart below shows a timing chart when you set the end pattern of each sequence data with axis 1 of a 4-axis PCU as an example.
Continuous 1 for sequence No. 10 and No. 20, automatic for sequence No. 11, END command for sequence No. 12, and individual for sequence No. 21.
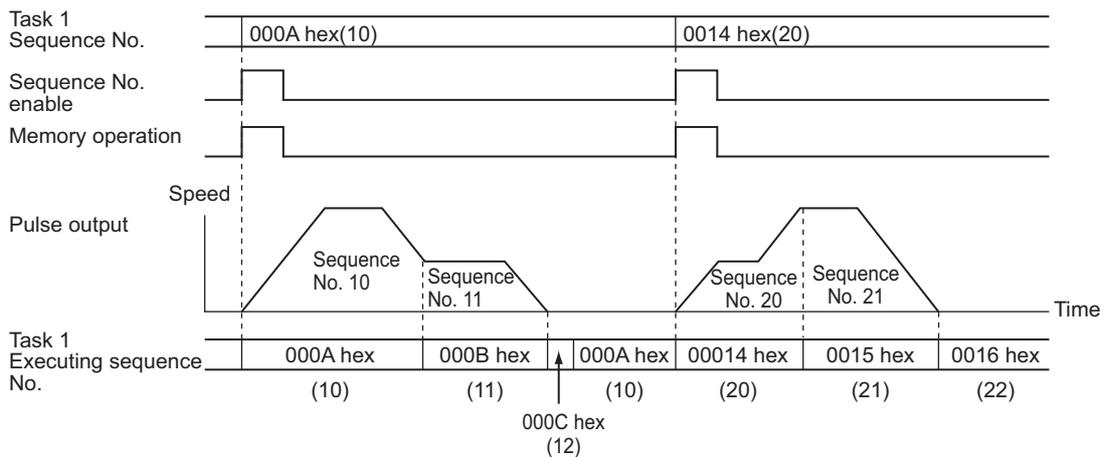
Reference

- To perform memory operation for the first time, you must set a sequence number and turn ON the Sequence No. Enable Memory area.
- The sequence number is cleared upon servo lock, Origin Search, Origin Return, or present position preset.
- An error occurs if you perform memory operation without specifying a sequence number when the sequence number has not been set.
- When you start memory operation based on a sequence number which is different from the execution sequence number, you must set the sequence number again and turn ON the Sequence No. Enable Memory area.

Memory Operation Start Available

This turns ON at a task start reception. This remains OFF while the task configuration axes are busy or a task function is in progress.
You must write the program so that it turns ON the Memory Operation Start Bit or Memory Operation Independent Start Bit while the Memory Operation Start Available Flag is ON.

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Memory Operation

Timing Chart for Memory Operation

Memory Operation Independent Start

Use the Memory Operation Independent Start Bit to make a stop for each sequence data.
With the Memory Operation Independent Start Bit, the completion pattern is always deemed individual regardless of the pattern which is set in the sequence data, and therefore operation stops after each start.
You can use individual memory operation for debugging programs by step execution.

The chart below shows a timing chart when you set the completion pattern of each sequence data with axis 1 of a 4-axis PCU as an example.
Continuous 1 for sequence No. 1 and No. 10, automatic for sequence No. 2, and individual for sequence No. 11.
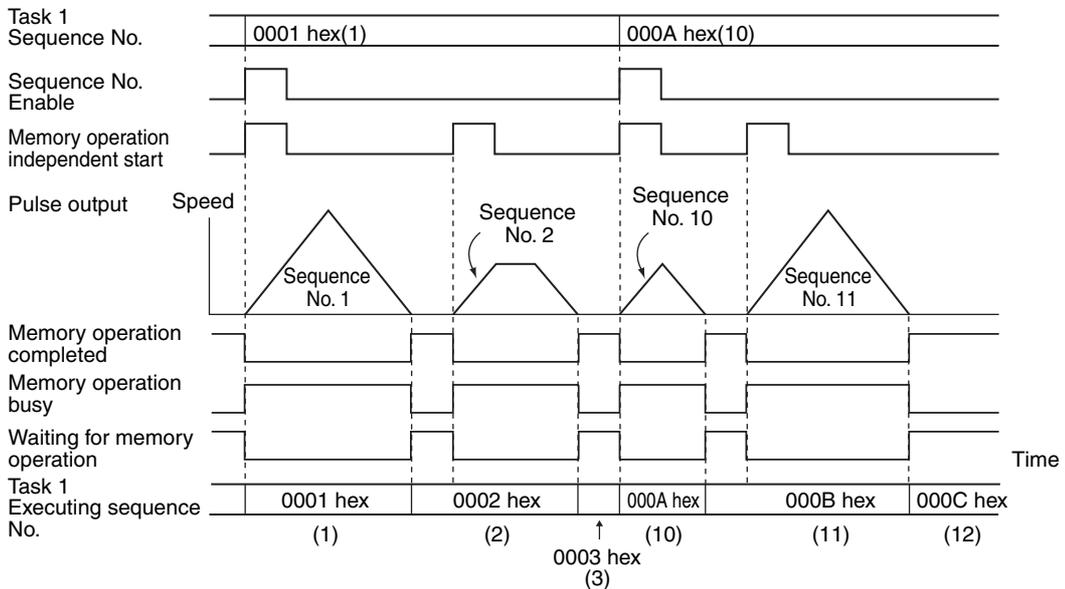
If you turn ON the Memory Operation Independent Start Bit again while sequence No. enable is OFF, the sequence number to be executed changes as follows.

Condition immediate before		Individual memory operation turns OFF to ON while sequence enable remains OFF.
Start	**End pattern**	
Memory operation independent start	Individual Automatic Continuous 1 to 3	Last executed sequence number + 1
Memory operation start	Individual	Last executed sequence number + 1
	Automatic Continuous 1 to 3	Stopping never occurs under this condition.
[END] under [Command]		Sequence number that was effective when you last turned ON sequence No. enable
Deceleration stop		Execute again the sequence number under which operation stopped.

Memory Operation

Execute memory operation from a desired sequence number according to the end pattern for each sequence data.

if you execute a sequence number whose end pattern is set to [Individual], operation stops upon completion of positioning.

Since the sequence number is updated to the next number, the next sequence number is executed when [Memory Operation] turns ON again.

The chart below shows a timing chart when you set the end pattern of each sequence data with axis 1 of a 4-axis PCU as an example.

Continuous 1 for sequence No. 1 and No. 4, individual for sequence No. 2, automatic for sequence No. 3 and No. 5, and END command for No. 6.
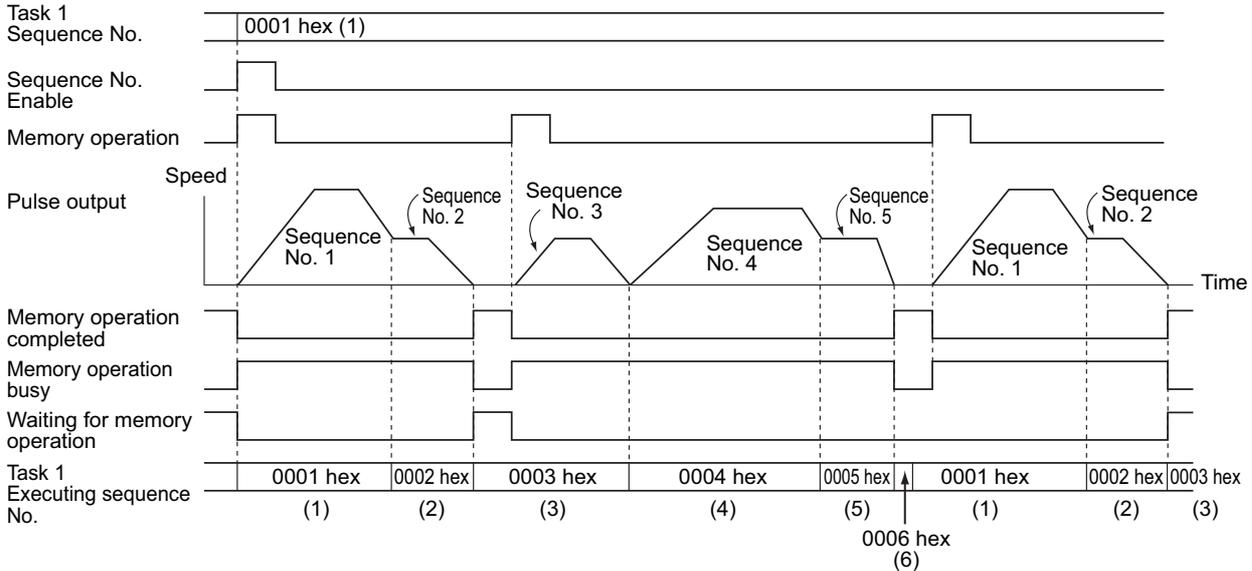
The sequence number to execute when you turn ON the Memory Operation Start Bit again while the Sequence No. Enable Bit is still OFF is the same as for the Memory Operation Independent Start Bit.

Reference

‣ The positioning operation completed bit in the Axis Status Memory area does not change during the memory operation. Use the memory operation completed bit or the M code in the Memory Operation Status Memory area when you check the completion of the memory operation.

Data Change Timings

You can change the position data, speed data, acceleration time, and other sequence data during memory operation. If the end pattern is set to continuous 1 to 3, however, changing the data may be delayed.

For a succession of sequence data with continuous 1 to 3 end patterns, up to five sets of sequence data, which include the current sequence data, are read in advance. Therefore, changes that you make to the fifth or subsequent sequences from the current sequence will be made. If you change any earlier sequences, the changes are made when you execute the sequence again.
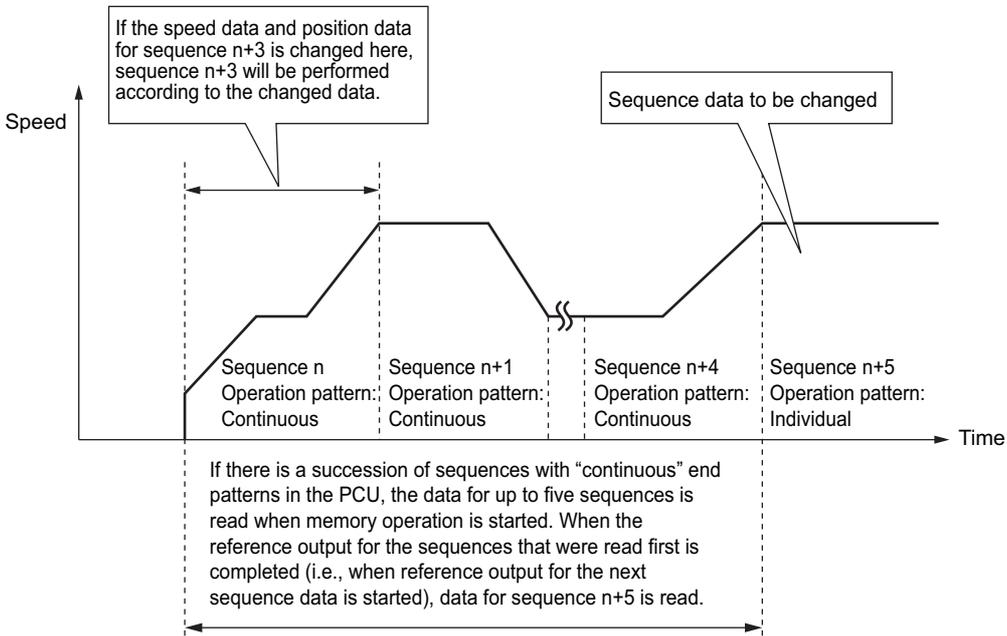
7-7 Acceleration/Deceleration Operation

The operation time based on the acceleration time and deceleration time which you specified in the sequence data, is determined by the axis parameter [Acceleration/Deceleration Time Selection].

Similarly, the operation time based on the interpolated acceleration time and interpolated deceleration time is determined by the sequence data [Interpolation Acceleration/Deceleration Time Selection].

If you specify [0: Acceleration/deceleration specified] under [Acceleration/Deceleration Time Selection] or [Interpolation Acceleration Time Selection], the time to reach [Maximum Speed] from [Starting Speed] is the acceleration time, while the time to reach [Starting Speed] from [Maximum Speed] is the deceleration time.

If you specify [1: Time specified], the acceleration time and deceleration time are the time needed to reach the target speed from the present speed.

This section explains the acceleration time and deceleration time when you specify [0: Acceleration/deceleration specified] under [Acceleration/Deceleration Time Selection] or [Interpolation Acceleration/Deceleration Time Selection].

Calculation of Basic Acceleration/Deceleration Time

Acceleration time T1 and deceleration time T2 are determined by the formulas below:

Acceleration time $T1 = (V1 - V0) / (Vmax - V0) \times Ta$
Deceleration time $T2 = (V1 - V0) / (Vmax - V0) \times Td$

• Parameters to use: 2 parameters below which you specified by axis parameters
   • Maximum speed   Vmax (pps)
   • Starting speed   V0 (pps)
• Data to use: 4 data below which you specified in the Direct Operation Command Memory area
   • Position command
   • Command speed   V1 (pps)
   • Acceleration time   Ta (ms)
   • Deceleration time   Td (ms)
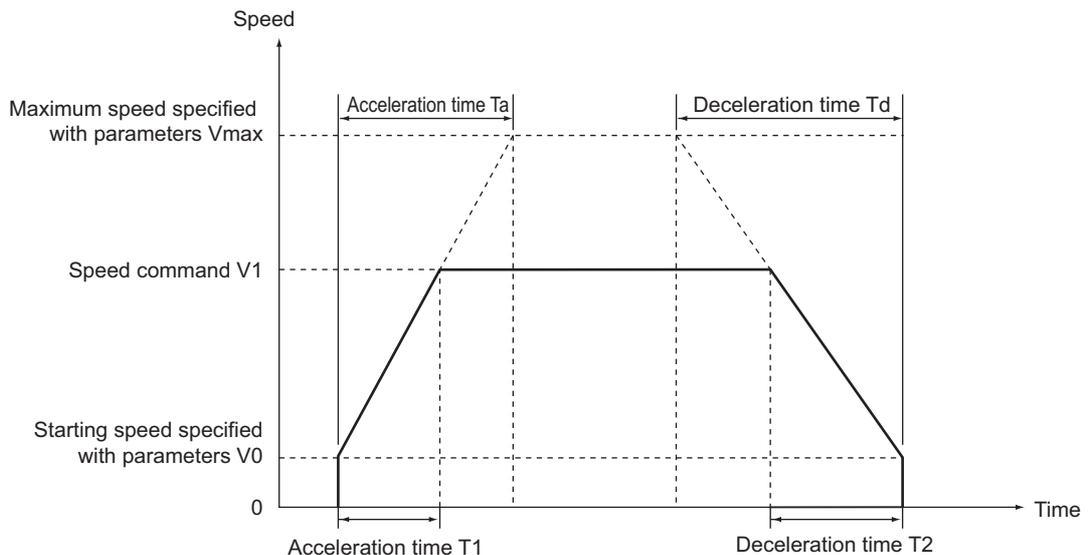
Reference

- The command speed is calculated as follows when override is enabled:
  Command speed = Command speed in [Direct Operation Command Memory Area] × Override in [Manual Operation Command Memory Area] / 100

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Memory Operation

Calculation of Acceleration/Deceleration Time in Continuous Positioning

The example below assumes that the completion pattern of sequence data is continuous 1. It shows as an example, calculation formulas for acceleration time and deceleration time based on execution of sequence No. 0 to 2.

Acceleration time $T1 = (V1 - V0) / (Vmax - V0) \times Ta1$
Acceleration time $T2 = (V2 - V1) / (Vmax - V0) \times Ta1$
Deceleration time $T3 = (V2 - V3) / (Vmax - V0) \times Td2$
Deceleration time $T4 = (V3 - V0) / (Vmax - V0) \times Td3$

- Parameters to use: 2 parameters below which you specified by axis parameters
    - Maximum speed   Vmax (pps)
    - Starting speed   V0 (pps)
- Data to use: Data below which you specified in the sequence data
    - No. 0
        - Command position
        - Starting speed   V0 (pps)
        - Command speed   V1 (pps)
        - Acceleration time   Ta1 (ms)
        - Deceleration time   Td1 (ms)
    - No. 1
        - Command position
        - Starting speed   V0 (pps)
        - Command speed   V2 (pps)
        - Acceleration time   Ta2 (ms)
        - Deceleration time   Td2 (ms)
    - No. 2
        - Command position
        - Starting speed   V0 (pps)
        - Command speed   V3 (pps)
        - Acceleration time   Ta3 (ms)
        - Deceleration time   Td3 (ms)

In the case of continuous 1, use the acceleration time or deceleration time under the present sequence data until the sequence data changes to the next one, as shown by the above calculation formulas.

If the speed under the next sequence data to be executed is higher than the present speed, use the acceleration time. If the speed under the next sequence data to be executed is lower than the present speed, use the deceleration time.
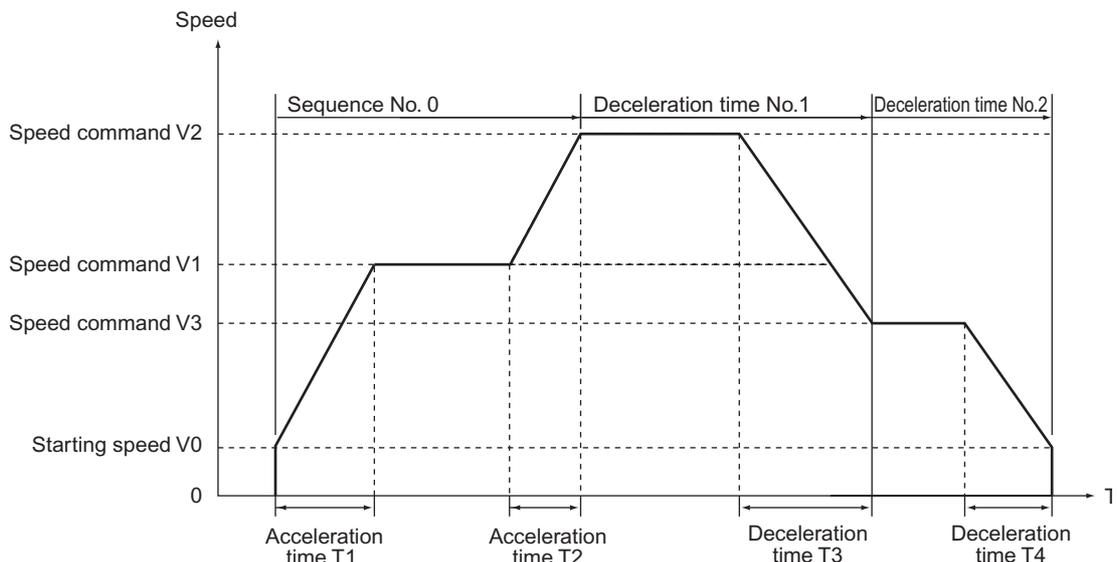
7-8 Sample Program

This section shows a sample program in which the axis is started by the operation specified below.
This sample only uses axis 1 in task 1.

📄 **Reference**

♦ In this sample program, change only the necessary parameters and use other parameters with default values. If you change any of the remaining parameters, the operation below may not be achieved.

Description of Operation

Set the mechanical configuration and machine movement as follows.

Mechanical Configuration

♦ Set the encoder resolution to 2,000 pulses/rotation.
♦ Use a Servomotor whose rated rpm is 3,000 r/min.
♦ The workpiece advances by 5 mm per motor rotation.
♦ Use [mm] as the unit system and issue commands in units of 0.01 mm.

Machine Movement

♦ Position axis 1 to a 150.00-mm position at a speed of 250 mm/s by relative movement and then further move the axis to a 100.00-mm position at a speed of 100 mm/s to complete the positioning.

♦ Output M code No. 500 during low-speed movement.
♦ Set the maximum speed to 250 mm/s (3,000 r/min).
♦ Set both the acceleration time and deceleration time to 0.1 s as fixed acceleration.
♦ To use a Servomotor, set the starting speed to [0].
♦ Use [Automatic] as the completion pattern.
♦ Set the Manual Operation Command Memory area to start from W000 word, Memory Operation Output Command area from W120 word, and Memory Operation Input Command Memory area from W140 word.
♦ Do not change the speed by the override.
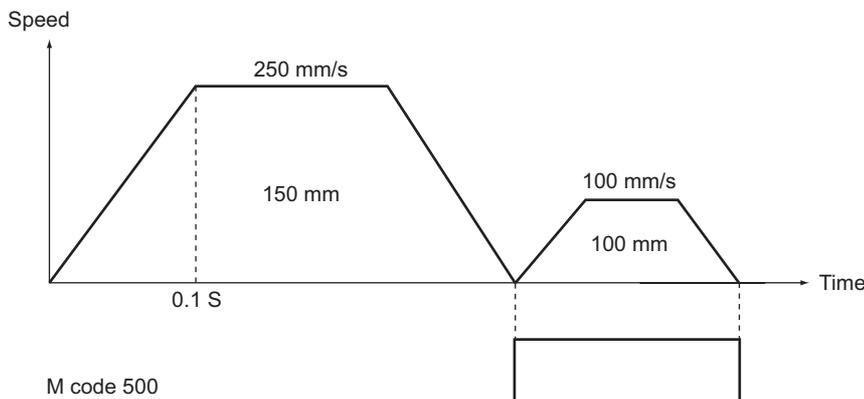
Parameter Settings

Change the necessary parameters according to the operation.
Change only the parameters relating to task 1 and axis 1.

Changing of Common Parameters

Set 3 parameters: [Manual Operation Command Memory Area], [Memory Operation Output Command Memory Area] and [Memory Operation Input Command Memory Area]. For details on common parameters, refer to "Common Parameters" on page 5-6.

Setting of Manual Operation Command Memory Area

Set [W000 word] for the Manual Operation Command Memory area.
When you set the common parameters, the Manual Operation Command Memory area is allocated as follows.

Words	Name	Bit	Bit name
W000	Axis 1 Manual Operation Command Memory area	0	Servo lock
		1	Drive alarm reset output
		2	Error counter reset output
		3	Torque limit output
		4	General-purpose output
		5	Override valid
		6	JOG/Inching speed selection
		7	Forward direction JOG/Inching
		8	Reverse direction JOG/Inching
		9	MPG valid
		10	Origin Search
		11	Origin Return
		12 to 13	Not used
		14	Deceleration stop
		15	Servo unlock
W001	Axis 1 override	0 to 15	–

Memory Operation

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Memory Operation Output Command Memory Area

Set [W120 word] for the Memory Operation Output Command Memory area.
When you set the common parameter, the Memory Operation Output Command Memory area is allocated as follows.

Words	Name	Bit	Bit name	Function
W120	Task 1 memory operation command	0	Sequence No. enable	Specify whether to enable/disable the sequence number for Operation Data area at memory operation start.
		1	Memory operation start	Memory operation starts the moment the bit turns ON.
		2	Memory operation independent start	Memory operation starts the moment the bit turns ON. Perform independent operation, except when you set END under [Command].
		3	Not used	Do not use.
		4	M code reset	This resets M codes.
		5	Teaching	Perform teaching the moment the bit turns ON (monitor type).
		6 to 14	Not used	Do not use.
		15	Memory operation stop	Memory operation decelerates to a stop the moment the bit turns ON.
W121	Task 1 sequence No.	0 to 15		Specify the start sequence number of memory operation.
W122	Task 1 teaching address	0 to 15		Set the position data number (sequence number) to use in position teaching. Set in hexadecimal.

Memory Operation Input Command Memory Area

Set [W140 word] for the Memory Operation Input Command Memory area.
When you set the common parameter, the Memory Operation Input Command Memory area is allocated as follows.

Words	Name	Bit	Bit name	Function
W140	Task 1 memory operation command received	0	Sequence No. enable received	This turns ON at a sequence number enable reception.
		1	Memory operation start received	This turns ON at a memory operation reception.
		2	Memory operation independent start received	This turns ON at a memory operation independent start reception.
		3	M code reset received	This turns ON at a M code reset reception.
		4	Teaching received	This turns ON at a teaching reception.
		5 to 14	Not used	Do not use.
		15	Memory operation stop received	This turns ON at a memory operation stop reception.

Words	Name	Bit	Bit name	Function
W141	Task 1 memory operation command status	0	Memory operation busy	This remains ON while a task command is in progress. This remains ON while a task configuration axis is busy or task function is in progress.
		1	Memory operation start available	This turns ON at a task start reception. This remains OFF while a task configuration axis is busy or task function is in progress.
		2 to 3	Not used	Do not use.
		4	During memory operation stop input	This remains ON while decelerating after receiving a memory operation stop command.
		5 to 7	Not used	Do not use.
		8	Memory operation start invalid	The Memory Operation Start Invalid Flag turns ON when an error occurs, such as a memory operation duplicate start error, due to a problem in the execution conditions or command values when a command for memory operation is executed.
		9	Teaching invalid	This turns ON when the PCU could not receive a teaching command.
		10 to 11	Not used	Do not use.
		12	Memory operation stop executed	This turns ON when memory operation stops for a memory operation stop command, error stop, or a command with an individual axis stop during memory operation.
		13	Memory operation completed	This turns ON when memory operation is completed normally.
		14	Teaching completed	This turns ON when the PCU completes the execution of a teaching command.
		15	Not used	Do not use.

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Memory Operation

Words	Name	Bit	Bit name	Function
W142	Task 1 memory operation control status	0	During memory operation stop	This remains ON while memory operation is not executed.
		1	Memory operation waiting	This remains ON while memory operation is on standby. This remains ON while the memory operation stops without END executed after you start the memory operation.
		2	During memory operation axis operation	This remains ON while the axis is operating during memory operation. This remains ON while any configuration axis is not stationary.
		3	Condition input waiting	This remains ON while the PCU is waiting for the input of conditions during memory operation.
		4	Dwell timer waiting	This remains ON while the PCU is waiting for the dwell timer during memory operation.
		5	M code reset waiting	This remains ON while the PCU is waiting for the M code reset during memory operation.
		6	M strobe	This remains ON while a M code command is output during memory operation.
		7 to 9	Not used	Do not use.
		10	Memory operation execution error	This turns ON when the task function generates an operation error.
		11	Memory operation warning	This turns ON when a warning occurs.
		12	Memory operation error	This turns ON when a memory operation error occurs.
		13 to 15	Not used	Do not use.
W143	Memory operation error code	0 to 15	Return a code that corresponds to each memory operation error.	
W144	Executing sequence No.	0 to 15	Return the executing sequence number of memory operation.	
W145	M code	0 to 15	Return the M code (output code) of memory operation.	

Changing of Axis Parameters

First, change [Command Position Unit Setting]. For details, refer to "Command Position Unit Setting" on page 5-30.

Set as follows according to the mechanical configuration.

Parameter name	Function	Set value	Unit
Display Unit	Select the unit of command values. 0: pulse, 1: mm, 2: degree, 3: inch	1	–
Command Pulse Count Per Motor Rotation	Set the number of pulses per 1 motor rotation.	2,000	Pulse
Work Travel Distance Per Motor Rotation	Set the amount of the workpiece movement per 1 motor rotation.	5	Display unit [mm]

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Memory Operation

Parameter name	Function	Set value	Unit
Unit Multiplier	Set the ratio relative to the amount of the workpiece movement per 1 motor rotation. 0: 1 time, 1: 10 times, 2: 100 times, 3: 1000 times, 4: 10000 times	2*1	–

*1.Setting this selects [0.01 mm] as the command unit.

Next, change [Acceleration/Deceleration Setting]. For details, refer to "Acceleration/ Deceleration Setting" on page 5-23.

Similarly, set as follows according to the mechanical configuration.

Parameter name	Function	Set value	Unit
Maximum Speed	Specify the maximum speed of the axis.	25,000	Command unit/s [0.01 mm/s]
Starting Speed	Specify the starting speed of the axis.	0	Command unit/s [0.01 mm/s]
Acceleration/ Deceleration Time Selection	Select how to specify the acceleration/ deceleration time. 0: Time from starting speed to maximum speed of each axis (Acceleration/ deceleration specified) 1: Time from present speed to target speed of each axis (Time specified)	0	–

Reference

- Because you have changed the maximum speed to [250.00 mm/s], the values of [Origin Search Speed], [JOG/Inching Speed] and other speed-related parameters may exceed the maximum speed. For those parameters that exceed the maximum speed, reset the set value lower than the maximum speed.

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Memory Operation

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Memory Operation

Changes to Memory Operation Parameters

Select the configuration axes of the task. Use task 1 to operate only axis 1.
For details, refer to "Configuration Axis" on page 5-57.

Parameter name	Function	Set value	Unit

Configuration Axis	Select the configuration axes of the task.
	Bits 00 to 03 correspond to axes 1 to 4, respectively.
	   0: Not use as configuration axis
	   1: Use as configuration axis
	
	0000 hex: Not use this task
	0001 hex: Use axis 1 only 0002 hex: Use axis 2 only
	0003 hex: Use axes 1 and 2 0004 hex: Use axis 3 only
	0005 hex: Use axes 1 and 3 0006 hex: Use axes 2 and 3
	0007 hex: Use axes 1 to 3 0008 hex: Use axis 4 only
	0009 hex: Use axes 1 and 4 000A hex: Use axes 2 and 4
	000B hex: Use axes 1, 2 and 4 000C hex: Use axes 3 and 4
	000D hex: Use axes 1, 3 and 4 000E hex: Use axes 2 to 4
	000F hex: Use axes 1 to 4
		0001 hex	_

Memory Operation Data Settings

Set data for sequence No. 1 and No. 2 according to the operation.

Setting of Sequence No. 1

Set the sequence data for moving the axis to 150.00 mm at a speed of 250 mm/s according to the movement of the machine.

Data name	Function	Set value	Unit
Axis 1 command position	Set the position data.	15000	Command unit [0.01 mm]
Command	Select [Positioning Operation Linear Interpolation Operation].	–	–
Sequence start condition	Use a memory operation condition data number to set the start condition. Set [No Start Condition].	0	–
Sequence skip condition	Use a memory operation condition data number to set the start condition. Set [No Condition].	0	–
End pattern	Set the operation end pattern. 0: Individual 1: Automatic 2: Continuous 1 (Until the next sequence speed) 3: Continuous 2 (Acceleration/deceleration starts at the next sequence) 4: Continuous 3 (Pass: Superimpose deceleration of the present sequence and acceleration at the next sequence)	1	–
Dwell timer	If the end pattern is independent or automatic, set a dwell time. 0: No dwell time 0.01 to 10.00s: Dwell time (10 ms unit)	0	–
Positioning completion input monitor valid	Select the in-position check that applies when the operating axis stops. 0: Not wait for the positioning completion 1: Wait for the positioning completion	1	–
M code	Set the M code after positioning completed. 0: Without M code 1 to 499: M code that waits for the M code reset 500 to 999: M code that does not wait for the M code reset	500	–
Axis specification	Set the axis to start. Issue a start command when each bit turns ON. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4	0001 hex	–

Data name	Function	Set value	Unit
Position specification	Select whether to set the command position as a relative position or absolute position. When each bit is ON, it indicates relative position specification. When the bit is OFF, it indicates absolute position specification. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4	0001 hex	–
Axis 1 command speed	Set the target speed at which each axis performs positioning operation (PTP).	25,000	Command unit/s [0.01 mm/s]
Axis 1 acceleration time	Set the acceleration time to be used when you perform positioning operation (PTP).	100	ms
Axis 1 deceleration time	Set the deceleration time to be used when you perform positioning operation (PTP).	100	ms

Setting of Sequence No. 2

Set the sequence data for moving the axis by 100.00 mm at a speed of 100 mm/s and stopping it according to the movement of the machine.

Data name	Function	Set value	Unit
Axis 1 command position	Set the position data.	10,000	Command unit [0.01 mm]
Command	Select [Positioning Operation].	–	–
Sequence start condition	Use a memory operation condition data number to set the start condition. Set [No Start Condition].	0	–
Sequence skip condition	Use a memory operation condition data number to set the start condition. Set [No Condition].	0	–
End pattern	Set the operation end pattern. 0: Individual 1: Automatic 2: Continuous 1 (Until the next sequence speed) 3: Continuous 2 (Acceleration/deceleration starts at the next sequence) 4: Continuous 3 (Pass: Superimpose deceleration of the present sequence and acceleration at the next sequence)	1	–
Dwell timer	If the end pattern is independent or automatic, set a dwell time. 0: No dwell time 0.01 to 10.00s: Dwell time (10 ms unit)	0	–
Positioning completion input monitor valid	Select the in-position check that applies when the operating axis stops. 0: Not wait for the positioning completion 1: Wait for the positioning completion	1	–

Sidebar: **7** **Memory Operation**

Data name	Function	Set value	Unit
M code	Set the M code after positioning completed. 0: Without M code 1 to 499: M code that waits for the M code reset 500 to 999: M code that does not wait for the M code reset	0	–
Axis specification	Set the axis to start. Issue a start command when each bit turns ON. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4	0001 hex	–
Position specification	Select whether to set the command position as a relative position or absolute position. When each bit is ON, it indicates relative position specification. When the bit is OFF, it indicates absolute position specification. Bit 0: Axis 1 Bit 1: Axis 2 Bit 2: Axis 3 Bit 3: Axis 4	0001 hex	–
Axis 1 command speed	Set the target speed at which each axis performs positioning operation (PTP).	10,000	Command unit/s [0.01 mm/s]
Axis 1 acceleration time	Set the acceleration time to be used when you perform positioning operation (PTP).	100	ms
Axis 1 deceleration time	Set the deceleration time to be used when you perform positioning operation (PTP).	100	ms

Setting of Sequence No. 3

Set END for the sequence.

Data name	Function	Set value	Unit
Command	Select [END].	–	–
Sequence start condition	Use a memory operation condition data number to set the start condition. Set [No Starting Condition].	0	–

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Memory Operation

Ladder Program

The figure below shows the ladder program.
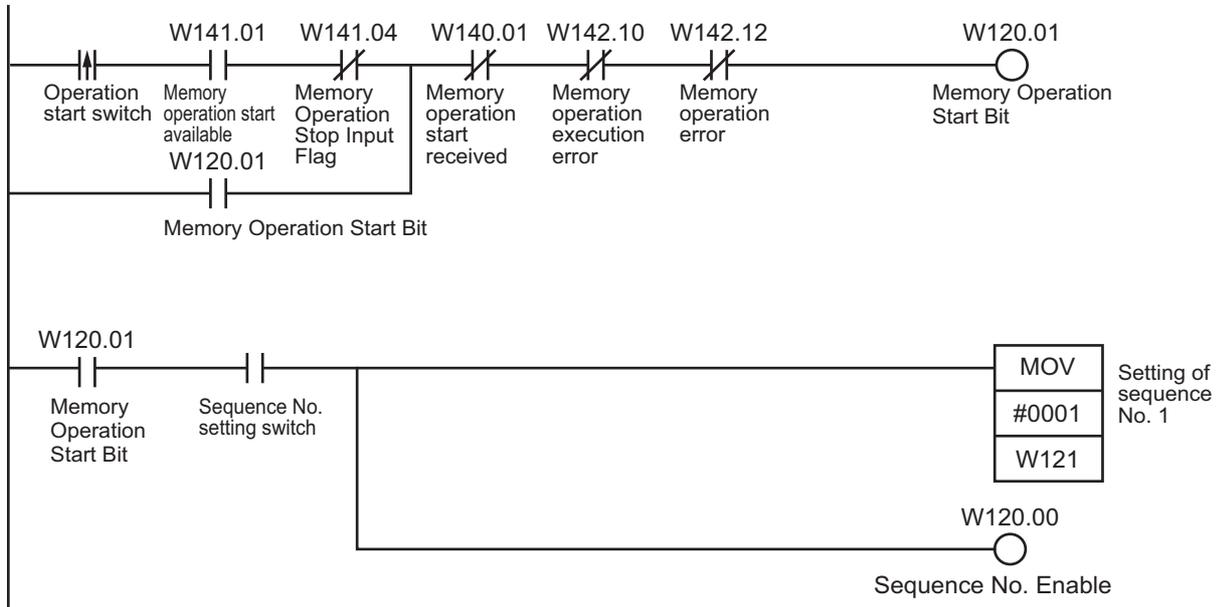
7-9 Monitoring with the CX-Programmer

You can use CX-Programmer to monitor memory operation.

Monitoring Memory Operation

This section explains the procedure to monitor memory operation.

1. **Connect the CX-Programmer to the PLC.**
2. **Start the PCU Setting Window.**
3. **Click the [NC Unit] menu and select [Memory Operation Monitor].**
   The following dialog box appears and monitoring memory operation will be enabled.

7-10 Memory Operation Preview with CX-Programmer

The memory operation preview allows you to check the suitability of the data set in a memory operation table before transferring the data to the actual system. You can display graphs of axis positions and speeds plotted against time or paths of 2-axis interpolation.

Memory Operation Preview

The memory operation preview provides the following advantages.

⬧ Malfunctions caused by setting mistakes can be prevented.
⬧ Causes of operating problems that occur when debugging on the actual system can be easily isolated.

Procedure

Perform the following procedure to use the memory operation preview.

1. **Create the data in the memory operation table.**

2. **Start the memory operation preview and confirm the suitability of the data by displaying graphs of axis positions and speeds plotted against time or tracks of 2-axis interpolation.**

3. **Correct or adjust the data.**

4. **Confirm the data again using the memory operation preview.**

By repeating steps 3 and 4 until the data is suitable, confirmation work and time on the actual system is reduced and debugging is completed quickly.

Starting the Memory Operation Preview Operation

There are three ways that you can use to start the memory operation preview.

Starting method 1	Select [NC Unit]	[Memory Operation Preview] from the main menu.
Starting method 2	Right-click a task number in the project tree and select [Memory Operation Preview] from the pop-up menu.
Starting method 3	Click the [Memory Operation Preview] button.

7
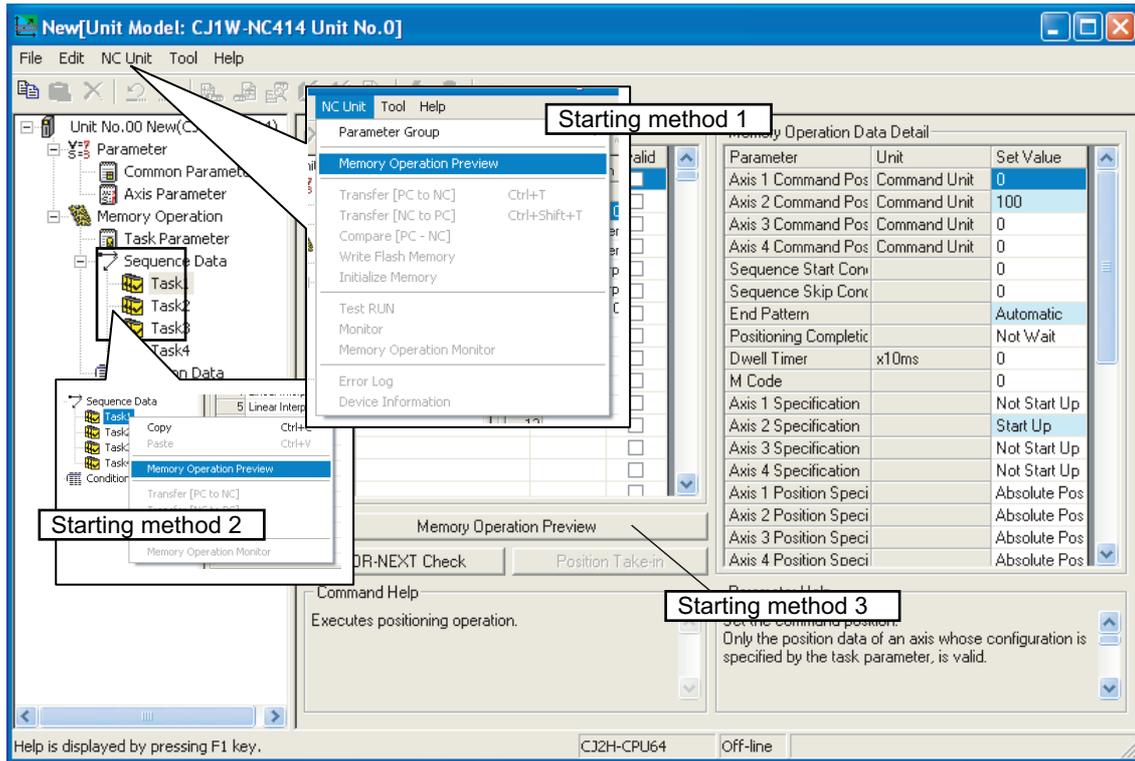
Memory Operation

Displaying Graphs for One Axis

Changes in the position and speed of one axis over time can be checked on graphs. The sequence numbers are displayed in the graph so that you can easily compare them to the data in the memory operation table.

Refreshes the graph.

Selects the task to monitor (1 to 4).

Inputs or selects the first sequence to monitor (1 to 500).

Displays and hides sequence numbers in the graph.

Changes the graphs that are displayed.

Selects the axis to monitor.

Display the changes in the position and speed of the selected graph over time.*1

Pointers are displayed.

Described under "Replay Track."

*1: The graph will display from the specified first sequence to the END command or to the first sequence with "independent" set for the end pattern. End patterns are specified in the memory operation data details.

Displaying Graphs for Two-axis Interpolation

Displaying two interpolated axes lets you visualize the interpolated operation, which is difficult from the memory operation table. The replay function can be used to move the pointer on the track to check movements in advance.
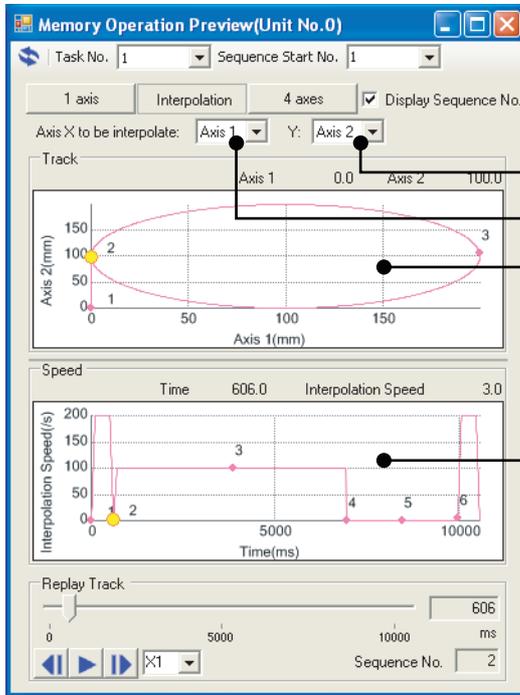
Specifies the Y axis for interpolation on the graph.

Specifies the X axis for interpolation on the graph.

Displays a graph for checking the interpolated track of the two axes specified for interpolation.

Displays a graph for checking changes in the interpolated speed of the two axes specified for interpolation.

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Displaying All Axes

Changes in the positions and speeds of all axes can be lined up on the display to check the operation timing of the axes.
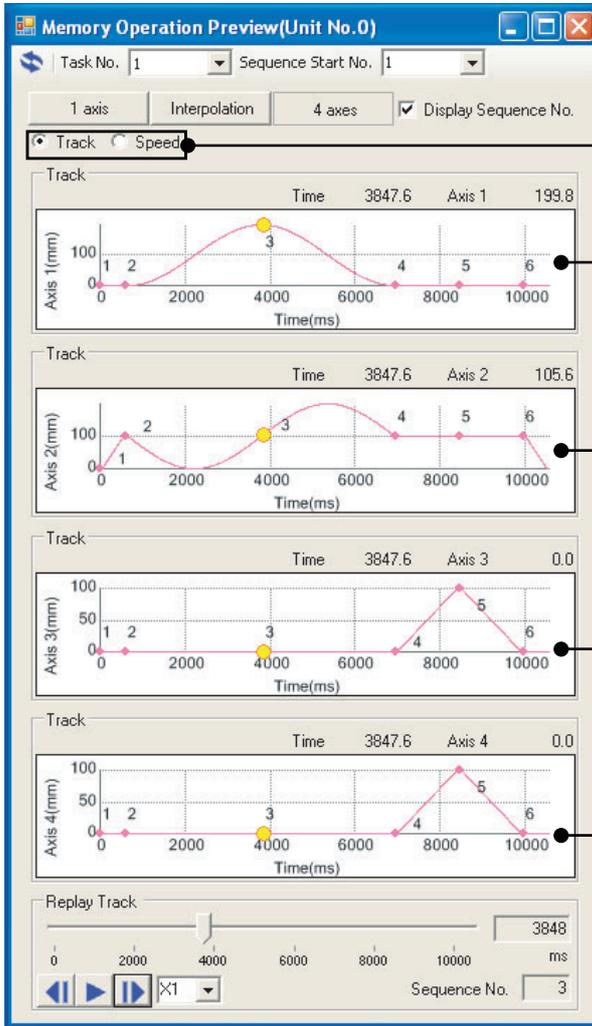
Switches between track graphs and speed graphs.

The vertical axes are the positions or speeds of the axes, and the horizontal axes are the time.

📑 **Reference**

♦ If you display multiple continuous operation previews, some points on the graphs are omitted and the actual movement may not match the preview.

Operation Path Replay

Pointers that show the current location on position or speed graphs are displayed. The pointers move on the graphs as time elapses.

Automatic or Manual Replay

Pointers that show the current location on position or speed graphs are displayed. The pointers move on the graphs as time elapses.

The pointers will move automatically if you click the [replay] button (automatic replay).

When automatic replay is not in progress, you can move the cursor on the slider to replay the status at any point in time (manual replay). The sequence number is displayed on the pointers as the pointers move on the graphs. This allows you to easily confirm the sequence number that is being replayed.

Replay Speed

A factor can be set for the speed that is used for automatic replay. The factor is x1 when the memory operation preview is started. The replay speed can be selected from x0.5, x1, and x2. These will change the replay speed to half the normal speed, the normal speed, or twice the normal speed.

Frame Advance

The Frame Advance buttons can be used to quickly move the pointers to the starting point of the next or previous sequence from the sequence where the pointers are currently displayed. If a Frame Advance button is pressed during automatic replay, automatic replay will be stopped and the pointers will move to the starting point of the next or previous sequence.
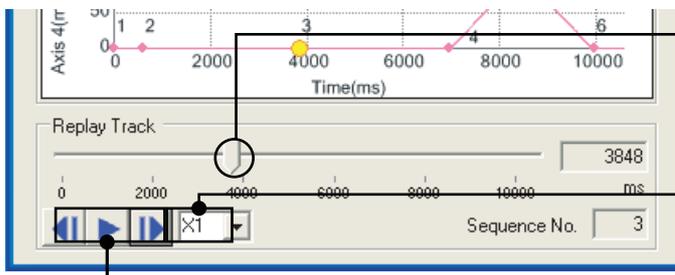
You can move the cursor on the slider for manual replay.

You can change the replay speed for automatic replay.

These buttons are to reverse the frame, start automatic replay, and advance the frame.

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Memory Operation

Memory Operation

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Supported Commands

The following five commands are supported for the memory operation preview. If unsupported commands are input, a warning dialog box will appear to tell you so. The preview will be displayed from the specified first sequence number until one command before the unsupported command.
The dwell timer setting is not reflected to the memory operation preview.

- Positioning operation
- Linear interpolation operation
- Circular interpolation operation (clockwise direction)
- Circular interpolation operation (counterclockwise direction)
- END
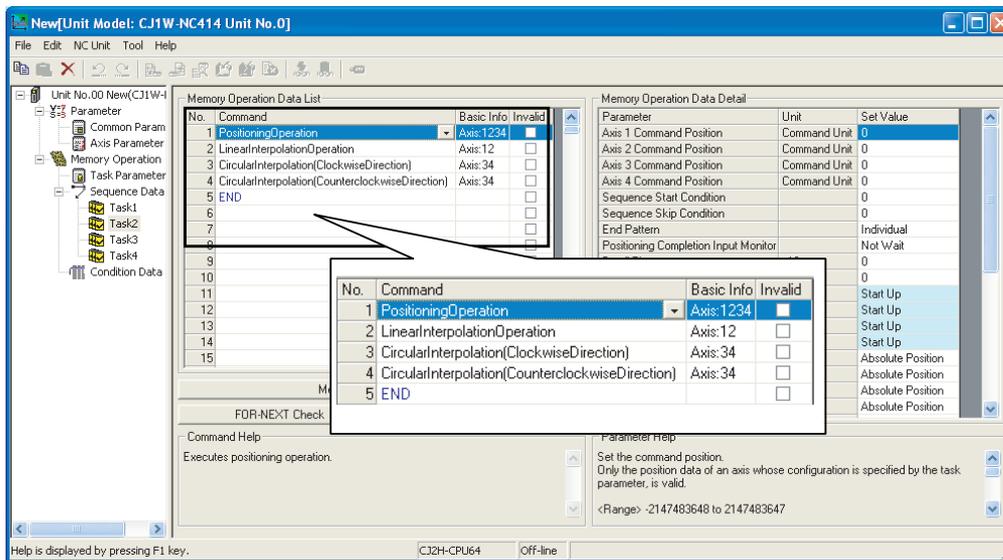
Reference

- Commands without settings and NOP commands are ignored when the preview is displayed.

Error Messages

This section lists the error messages that can appear during operation and describes the remedies for them.

Message	Probable cause of error	Remedy
An error was detected during running. Sequence No. xx Error description: Memory operation data error	There is a mistake in the parameters set in the sequence data.	Correct the parameter in sequence number xx in the Memory Operation Data List.
An error was detected during running. Sequence No. xx Error description: Memory allocation failed.	There is not enough memory in the computer you are using.	Increase the amount of available memory on your computer.
Replaying speed can be scaled by a value between 0.01 and 100. (A value can be set to two places of decimals.)	A number smaller than 0.01 or larger than 100 was input in the [Replay Speed] box.	Input a replay speed scale value between 0.01 and 100.
Effective sequence numbers are 1 to 500.	A number smaller than 1 or larger than 500 was input in the [Sequence Start No.] box.	Input a number between 1 and 500 in the [Sequence Start No.] box.
Enter a value (The value you entered has a format error.)	A character string or symbol was input in the [Replay Speed] box or [Sequence Start No.] box.	Input a number between 0.01 and 100 in the [Replay Speed] box and a number between 1 and 500 in the [Sequence Start No.] box.
Unspecified memory operation command is included. Sequence No. xx Simulation ends at the above sequence No.	A command that is not supported for the memory operation preview is included in the memory operation data.	---

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Memory Operation

8

Transferring and Saving Data

This chapter explains the data transfer method from the PLC CPU Unit and the data transfer method with the CX-Programmer.

8-1 Outline of Data Transfer

This section explains the transfer method (write and read) of parameters and memory operation data, etc. between the CPU Unit and the PCU.

Types of Transfer

There are 3 types of transfer methods.

Transfer with Data Transfer Bit

You can execute this type of transfer regardless of the RUN mode of the CPU Unit.

Use the data transfer bit to change or read a large volume of data.

You can transfer data by changing from OFF to ON or through force-set by the OUT instructions, etc. in the ladder program.

For details, refer to "Data Write with Data Transfer Bit" on page 8-21 and "Data Read with Data Transfer Bit" on page 8-26.

CJ-series CPU Unit   PCU   Ladder program

Parameters, data reading

Parameters, data writing

n+1CH
n+2CH
n+3CH
n+4CH
n+5CH
Write data   n word, bit 12

n+1CH
n+2CH
n+3CH
n+4CH
n+5CH
Read data   n word, bit 13
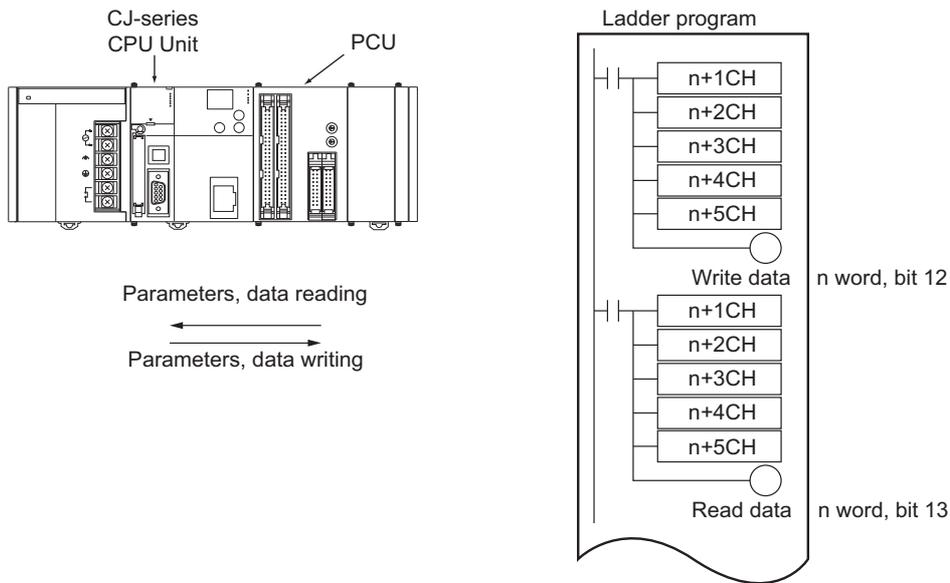
Transfer with IOWR or IORD Instruction

You can execute this type of transfer only when the CPU Unit operation is in progress. Therefore, you can only transfer the type of data that are changeable at any moment.

Use the IOWR or IORD instructions to quickly change or read a small amount of data.

Additionally, you cannot use the IOWR instruction to transfer data that exist in multiple sequences. Always transfer data within 1 sequence.

For details, refer to "Data Write with IOWR Instruction" on page 8-30 and "Data Read with IORD Instruction" on page 8-36.
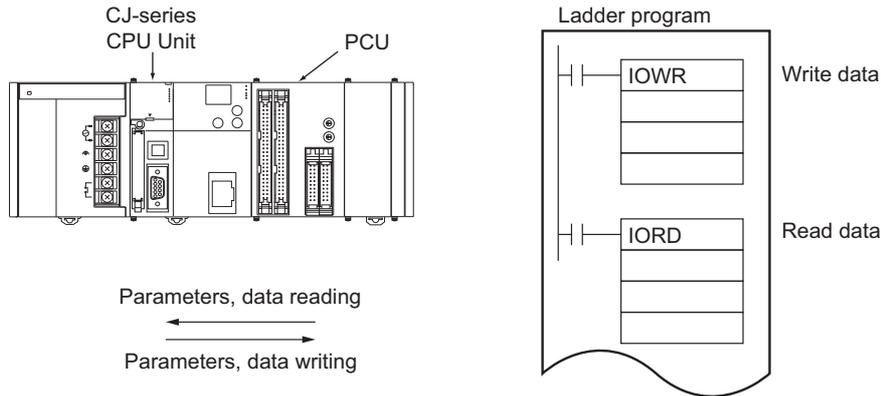
Transfer with CX-Programmer

You can execute a transfer with the CX-Programmer to change all data.

You can download the parameters and the memory operation data which you created with the CX-Programmer to the PCU, and upload the internal data on the PCU.

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Transferring and Saving Data
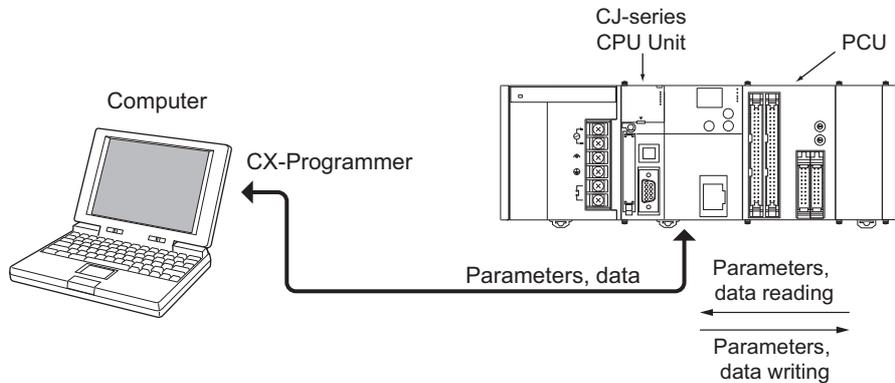
Saving Data

The transferred parameters or memory operation data are written to the internal memory of the PCU to operate, and will be lost if you turn OFF the power supply or restart the PCU.
You need to save the data to a flash memory to save the transferred data on the PCU.
For details, refer to "Saving Data" on page 8-42.

Once you save the data to a flash memory, the data is used when you turn ON the power supply or restart the PCU.
If you only transferred the data, but did not save, the data content is restored to the previously saved content when you turn OFF the power supply or restart the PCU.
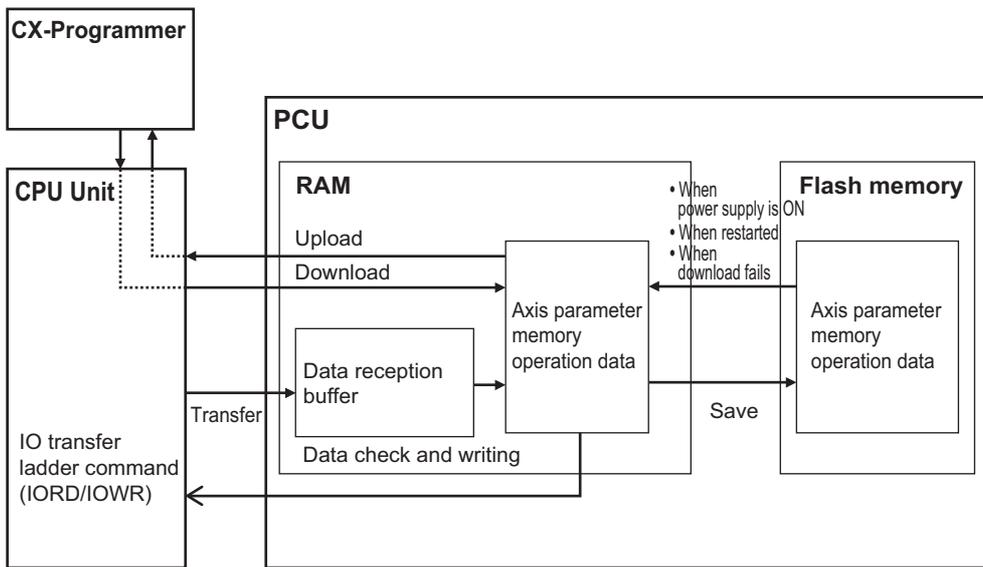
> **Reference**

• The saved data is automatically read from the flash memory to the internal memory when you turn ON the power supply or restart the PCU.

Data Address

8-4

Each data item contains an address within the PCU. When you transfer data, specify this address to distinguish the write destination or read source. 1 address indicates 1 word (bit 16) data.

✍ **Precautions for Correct Use**

- When you transfer data, transfer for the number of words that constitute the data.
  For data configuration, refer to chapter 5, Setting Data.

- Transfer data by the parameter type below. You cannot transfer data of multiple types together.

- You cannot write the parameters that become valid when you turn ON the power supply, restart or setup the PCU with the IOWR or the data transfer bit during a normal operation. You can write these parameters only through a data transfer with the CX-Programmer or the data transfer bit during the PCU setup.

√: Transfer permitted, –: Transfer not permitted

Data name	Parameter type	Address range	Data Write	Data Read	IOWR instruction	IORD instruction	Transfer from the software
Common parameter	0100 hex	0001 to 0033 hex	√	√	√	–	√
Axis 1 parameter	0201 hex	0000 to 006F hex					
Axis 2 parameter	0202 hex	0000 to 006F hex	√	√	√	–	√
Axis 3 parameter	0203 hex	0000 to 006F hex					
Axis 4 parameter	0204 hex	0000 to 006F hex					
External encoder axis parameter	02F1 hex	0000 to 0067 hex	√	√	√	–	√
Task 1 memory operation parameter	0301 hex	0000 to 0005 hex					
Task 2 memory operation parameter	0302 hex	0000 to 0005 hex	√	√	√	–	√
Task 3 memory operation parameter	0303 hex	0000 to 0005 hex					
Task 4 memory operation parameter	0304 hex	0000 to 0005 hex					

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Transferring and Saving Data

Data name	Parameter type	Address range	Data Write	Data Read	IOWR instruction	IORD instruction	Transfer from the software
Task 1 memory operation data	0401 hex	0000 to 61A7 hex	√	√	√	–	√
Task 2 memory operation data	0402 hex	0000 to 61A7 hex					
Task 3 memory operation data	0403 hex	0000 to 61A7 hex					
Task 4 memory operation data	0404 hex	0000 to 61A7 hex					
Memory operation condition data	0500 hex	0000 to 03E7 hex	√	√	√	–	√
Axis 1 feedback counter present value	1101 hex	–	–	–	√	√	–
Axis 2 feedback counter present value	1102 hex	–					
Axis 3 feedback counter present value	1103 hex	–					
Axis 4 feedback counter present value	1104 hex	–					
External encoder axis count value	11F1 hex	–					
Axis 1 latch data	1201 hex	–	–	–	–	√	–
Axis 2 latch data	1202 hex	–					
Axis 3 latch data	1203 hex	–					
Axis 4 latch data	1204 hex	–					

Common Parameter Addresses List

The Unit Addresses of the common parameters are as listed below.

Parameter type

Data name	Parameter type
Common parameter	0100 hex

Unit Address

√: Always valid, –: Valid at power supply ON, restart or setup

Parameter name	Unit Address	Number of words	Valid timing
Manual Operation Command Memory Area Selection	0001 hex	1	–
First Word of Manual Operation Command Memory Area	0002 hex	1	–
Direct Operation Command Memory Area Selection	0003 hex	1	–
First Word of Direct Operation Command Memory Area	0004 hex	1	–

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Transferring and Saving Data

Parameter name	Unit Address	Number of words	Valid timing
Memory Operation Command Memory Area Selection	0005 hex	1	–
First Word of Memory Operation Command Memory Area	0006 hex	1	–
Axis Status Memory Area Selection	0007 hex	1	–
First Word of Axis Status Memory Area	0008 hex	1	–
Memory Operation Status Memory Area Selection	0009 hex	1	–
First Word of Memory Operation Status Memory Area	000A hex	1	–
Synchronous Data Send Selection 1	0014 hex	1	–
Synchronous Data Send Selection 2	0015 hex	1	–
Synchronous Data Send Selection 3	0016 hex	1	–
Synchronous Data Send Selection 4	0017 hex	1	–
Synchronous Data Send Selection 5	0018 hex	1	–
Synchronous Data Send Selection 6	0019 hex	1	–
Synchronous Data Send Selection 7	001A hex	1	–
Synchronous Data Send Selection 8	001B hex	1	–
MPG Magnification 1 (Numerator)	0028 hex	1	√
MPG Magnification 1 (Denominator)	0029 hex	1	√
MPG Magnification 2 (Numerator)	002A hex	1	√
MPG Magnification 2 (Denominator)	002B hex	1	√
MPG Magnification 3 (Numerator)	002C hex	1	√
MPG Magnification 3 (Denominator)	002D hex	1	√
MPG Magnification 4 (Numerator)	002E hex	1	√
MPG Magnification 4 (Denominator)	002F hex	1	√
Latch 1 Object Axis Selection	0030 hex	1	–
Latch 2 Object Axis Selection	0031 hex	1	–
Latch 3 Object Axis Selection	0032 hex	1	–
Latch 4 Object Axis Selection	0033 hex	1	–

Axis Parameter Addresses List

An axis parameter exists for each axis. The parameter type is different for each axis, but the Unit Address is the same.

Parameter type

Data name	Parameter type
Axis 1 Parameter	0201 hex
Axis 2 Parameter	0202 hex
Axis 3 Parameter	0203 hex
Axis 4 Parameter	0204 hex

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Transferring and Saving Data

Unit Address

√: Always valid, −: Valid at power supply ON, restart or setup

Parameter name	Unit Address	Number of words	Valid timing
Axis Type	0000 hex	1	−
I/O Logic Selection[*1]	0001 hex	1	−
I/O Function Selection[*2]	0002 hex	1	−
Emergency Stop Input Stop Method	0003 hex	1	−
Limit Input Stop Method	0004 hex	1	−
Drive Alarm Input Stop Method	0005 hex	1	−
Error Counter Reset Output Time	0006 hex	1	−
Drive Alarm Reset Output Time	0007 hex	1	−
Positioning Monitoring Time	0008 hex	1	−
Maximum Speed	0009 hex	2	−
Starting Speed	000B hex	2	−
Operation at Reverse Rotation Command	000D hex	1	−
Acceleration/Deceleration Curve Selection	000E hex	1	−
Acceleration/ Deceleration Time Selection	000F hex	1	−
Single Axis Deceleration Time at Interpolation	0010 hex	2	√
Backlash Output Method	0012 hex	1	−
Backlash Compensation Amount	0013 hex	1	−
Backlash Compensation Speed	0014 hex	2	−
Pulse Output Method	0016 hex	1	−
Pulse Output Direction	0017 hex	1	−
Axis Feeding Mode	0018 hex	1	−
Rotation Axis Upper Limit	0019 hex	2	−
Display Unit	001B hex	1	−
Command Pulse Count Per Motor Rotation	001C hex	2	−
Work Travel Distance Per Motor Rotation	001E hex	2	−
Unit Multiplier	0020 hex	1	−
Compensation Ratio Numerator	0021hex	2	−
Compensation Ratio Denominator	0023 hex	2	−
Starting Present Position Clear Enable	0025 hex	1	−
Software Limit Function Selection	0026 hex	1	√
Reverse Direction Software Limit	0027 hex	4[*3]	√
Forward Direction Software Limit			
Zone 0 Function Selection	002B hex	1	√
Zone 0 Lower Limit	002C hex	4[*3]	√
Zone 0 Upper Limit			
Zone 1 Function Selection	0030 hex	1	√

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Transferring and Saving Data

Parameter name	Unit Address	Number of words	Valid timing
Zone 1 Lower Limit	0031 hex	4[*3]	√
Zone 1 Upper Limit			
Zone 2 Function Selection	0035 hex	1	√
Zone 2 Lower Limit	0036 hex	4[*3]	√
Zone 2 Upper Limit			
Interrupt Feeding Setting[*4]	003A hex	1	√
Interrupt Feeding Amount	003B hex	2	√
Origin Search Operation Mode	003D hex	1	√
Operation at Forward Direction Limit Input	003E hex	1	√
Operation at Reverse Direction Limit Input	003F hex	1	√
Origin Search Direction[*5]	0040 hex	1	√
Origin Search Holding Time	0041 hex	1	√
Origin Input Mask Amount	0042 hex	2	√
Origin Compensation Value	0044 hex	2	√
Origin Position Offset	0046 hex	2	√
Origin Search Speed	0048 hex	4[*3]	√
Origin Search Approach Speed			
Origin Search Compensation Speed	004C hex	2	√
Origin Search Acceleration Time	004E hex	2	√
Origin Search Deceleration Time	0050 hex	2	√
Origin Return Speed	0052 hex	2	√
Origin Return Acceleration Time	0054 hex	2	√
Origin Return Deceleration Time	0056 hex	2	√
Inching Width	0058 hex	1	√
JOG/ Inching Speed 1	0059 hex	2	√
JOG/ Inching Speed 2	005B hex	2	√
JOG Acceleration Time	005D hex	2	√
JOG Deceleration Time	005F hex	2	√
Feedback Pulse Input Method	0061 hex	1	–
Feedback Pulse Input Function Setting[*6]	0062 hex	1	–
Feedback Pulse Count Per Motor Rotation	0063 hex	2	–
Encoder Type	0065 hex	1	–
ABS Encoder Origin Position Offset	0066 hex	2	–
Expanded Monitor Type	0068 hex	1	√
Error Monitor Setting[*7]	0069 hex	1	√
Feedback Speed Sampling Period	006A hex	1	√
Speed Error Monitor Wait Time	006B hex	1	√
Speed Error Limit Value	006C hex	1	√
Position Error Limit Value	006D hex	1	√
Synchronous Group Stop Selection	006E hex	1	–

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Transferring and Saving Data

Parameter name	Unit Address	Number of words	Valid timing
Synchronous Feeding Command Position Data	006F hex	1	√

*1. Use each bit to set this parameter. The bit allocations are as follows:

Bit	Parameter name
00 to 07	Not used. Set 0.
08	Forward Direction Limit Input Logic
09	Reverse Direction Limit Input Logic
10	Origin Proximity Input Logic
11	Origin Input Logic
12	Interrupt Input Logic
13	Emergency Stop Input Logic
14	Positioning Completed Input Logic
15	Drive Alarm Input Logic

*2. Use each bit to set this parameter. The bit allocations are as follows:

Bit	Parameter name
00	RUN Output Function
01	Drive Alarm Reset Output Function
02	Error Counter Reset Output Function
03 to 09	Not used. Set 0.
10	Origin Proximity Input Signal Selection
11	Origin Input Signal Selection
12	Interrupt Input Function
13	Not used. Set 0.
14	Positioning Completed Input Function
15	Drive Alarm Input Function

*3. The forward/reverse direction software limits, zone 0, 1 and 2 upper/lower limits, and Origin Search Speed and Origin Search Approach Speed, are handled as a set of data, respectively. If you want to transfer these data, handle 4 words of data, as follows.
Take note that the words below are relative words that correspond to the Unit Addresses of respective data.

Data name	Words	Setting
Forward direction software limit Reverse direction software limit	+0	Reverse direction software limit (rightmost word)
	+1	Reverse direction software limit (leftmost word)
	+2	Forward direction software limit (rightmost word)
	+3	Forward direction software limit (leftmost word)

Data name	Words	Setting
Zone 0, 1 and 2 upper limit, lower limit	+0	Zone lower limit (rightmost word)
	+1	Zone lower limit (leftmost word)
	+2	Zone upper limit (rightmost word)
	+3	Zone upper limit (leftmost word)
Origin Search speed Origin Search approach speed	+0	Origin Search speed (rightmost word)
	+1	Origin Search speed (leftmost word)
	+2	Origin Search approach speed (rightmost word)
	+3	Origin Search approach speed (leftmost word)

*4. Use each bit to set this parameter. The bit allocations are as follows:

Bit	Parameter name
00	Interrupt Feeding Reference Position/ Latch Target Position Selection
01	Interrupt Input Undetected Error Enable
02 to 15	Not used. Set 0.

*5. Use each bit to set this parameter. The bit allocations are as follows:

Bit	Parameter name
00	Origin Search Start Direction
01	Origin Input Detecting Direction
02 to 15	Not used. Set 0.

*6. Use each bit to set this parameter. The bit allocations are as follows:

Bit	Parameter name
00	Feedback Pulse Input Direction
01	Feedback Pulse Input Backlash Enable
02	Feedback Pulse Input Position Monitoring Enable
03	Feedback Pulse Input Position Reflection Method Selection
04 to 15	Not used. Set 0.

*7. Use each bit to set this parameter. The bit allocations are as follows:

Bit	Parameter name
00	Speed Error Monitor Enable
01	Position Error Monitor Enable
02 to 15	Not used. Set 0.

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Transferring and Saving Data

External Encoder Axis Parameter Addresses List

Parameter type

Data name	Parameter type
External encoder axis parameter	02F1 hex

Unit Address

√: Always valid, −: Valid at power supply ON, restart or setup

Parameter name	Unit Address	Number of words	Valid timing
Display Unit	001B hex	1	−
Work Travel Distance Per Motor Rotation	001E hex	2	−
Unit Multiplier	0020 hex	1	−
Feedback Pulse Input Method	0061 hex	1	−
Feedback Pulse Input Function Setting	0062 hex	1	−
Feedback Pulse Count Per Motor Rotation	0063 hex	2	−

Memory Operation Parameter Addresses List

A memory operation parameter exists for each task. The parameter type is different for each task, but the Unit Address is the same.

Parameter type

Data name	Parameter type
Task 1 Memory Operation Parameter	0301 hex
Task 2 Memory Operation Parameter	0302 hex
Task 3 Memory Operation Parameter	0303 hex
Task 4 Memory Operation Parameter	0304 hex

Unit Address

√: Always valid, −: Valid at power supply ON, restart or setup

Parameter name	Unit Address	Number of words	Valid timing
Configuration Axis	0000 hex	1	−
Teaching Object	0001 hex	1	√
Interpolation Axis Stop Method	0002 hex	1	−
Error Between Axes Monitor Enable	0003 hex	1	√
Error Between Axes Limit Value	0004 hex	1	√
Error Between Axes Monitor Target Axis	0005 hex	1	√

Memory Operation Data Addresses List

Although memory operation data exists for each task, the parameter type is different for each task.

The memory operation data for one task consists of up to 500 sequence data.

Note, however, that the address consists of the sequence data varies depending on the command.

All memory operation data are always enabled.

Parameter type

Data name	Parameter type	Address range
Task 1 memory operation data	0401 hex	0000 to 61A7 hex
Task 2 memory operation data	0402 hex	0000 to 61A7 hex
Task 3 memory operation data	0403 hex	0000 to 61A7 hex
Task 4 memory operation data	0404 hex	0000 to 61A7 hex

Sequence Data Configuration

Treat one sequence data as the data for 50 words when you transfer it.

Sequence number	Unit Address
Sequence data 1	0000 to 0031 hex (0 to 49 words)
Sequence data 2	0032 to 0063 hex (50 to 99 words)
Sequence data 3	0064 to 0095 hex (100 to 149 words)
Sequence data 4	0096 to 00C7 hex (150 to 199 words)
Sequence data 5	00C8 to 00F9 hex (200 to 249 words)
:	:
Sequence data 500	6,176 to 61A7 hex (24,950 to 24,999 words)

Unit Address

The Unit Address of the memory operation data varies depending on the command.

Pay attention to the Unit Address when you transfer memory operation data.

Unit Address	Command		
	JUMP	FOR	NEXT
+0	Axis 1 command position (rightmost word)[1]	Axis 1 command position (rightmost word)[1]	Axis 1 command position (rightmost word)[1]
+1	Axis 1 command position (leftmost word)[1]	Axis 1 command position (leftmost word)[1]	Axis 1 command position (leftmost word)[1]
+2	Axis 2 command position (rightmost Word)[1]	Axis 2 command position (rightmost word)[1]	Axis 2 command position (rightmost word)[1]
+3	Axis 2 command position (leftmost word)[1]	Axis 2 command position (leftmost word)[1]	Axis 2 command position (leftmost word)[1]
+4	Axis 3 command position (rightmost word)[1]	Axis 3 command position (rightmost word)[1]	Axis 3 command position (rightmost word)[1]
+5	Axis 3 command position (leftmost word)[1]	Axis 3 command position (leftmost word)[1]	Axis 3 command position (leftmost word)[1]

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Transferring and Saving Data

Unit Address	Command		
	JUMP	**FOR**	**NEXT**
+6	Axis 4 command position (rightmost word)[1]	Axis 4 command position (rightmost word)[1]	Axis 4 command position (rightmost word)[1]
+7	Axis 4 command position (leftmost word)[1]	Axis 4 command position (leftmost word)[1]	Axis 4 command position (leftmost word)[1]
+8	Command	Command	Command
+9	Sequence start condition	Sequence start condition	Sequence start condition
+10	JUMP/ repeat conditions	JUMP/ repeat conditions	Repeat loop No.
+11	JUMP destination sequence No.	Repeat loop No.	Not used.[2]
+12 to +49	Not used.[2]	Not used.[2]	

*1. You can have a command position set although it is not necessary. A set value is ignored.
*2. Set 0000 hex for unused addresses.

Unit Address	Command		
	PSET	**PRSET**	**END**
+0	Axis 1 command position (rightmost word)[1]	Axis 1 command position (rightmost word)[1]	Axis 1 command position (rightmost word)[1]
+1	Axis 1 command position (leftmost word)[1]	Axis 1 command position (leftmost word)[1]	Axis 1 command position (leftmost word)[1]
+2	Axis 2 command position (rightmost word)[1]	Axis 2 command position (rightmost word)[1]	Axis 2 command position (rightmost word)[1]
+3	Axis 2 command position (leftmost word)[1]	Axis 2 command position (leftmost word)[1]	Axis 2 command position (leftmost word)[1]
+4	Axis 3 command position (rightmost word)[1]	Axis 3 command position (rightmost word)[1]	Axis 3 command position (rightmost word)[1]
+5	Axis 3 command position (leftmost word)[1]	Axis 3 command position (leftmost word)[1]	Axis 3 command position (leftmost word)[1]
+6	Axis 4 command position (rightmost word)[1]	Axis 4 command position (rightmost word)[1]	Axis 4 command position (rightmost word)[1]
+7	Axis 4 command position (leftmost word)[1]	Axis 4 command position (leftmost word)[1]	Axis 4 command position (leftmost word)[1]
+8	Command	Command	Command
+9	Sequence start condition	Sequence start condition	Sequence start condition
+10	Output signal	Output signal	Not used.[2]
+11 to +49	Not used.[2]	Not used.[2]	

*1. You can have a command position set although it is not necessary. A set value is ignored.
*2. Set 0000 hex for unused addresses.

Unit Address	Command		
	Positioning Operation	**Linear interpolation operation**	**Circular Interpolation (clockwise/counterclockwise direction)**
+0	Axis 1 command position (rightmost word)	Axis 1 command position (rightmost word)	Axis 1 command position (rightmost word)
+1	Axis 1 command position (leftmost word)	Axis 1 command position (leftmost word)	Axis 1 command position (leftmost word)

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Transferring and Saving Data

Unit Address	Command		
	Positioning Operation	**Linear interpolation operation**	**Circular Interpolation (clockwise/counterclockwise direction)**
+2	Axis 2 command position (rightmost word)	Axis 2 command position (rightmost word)	Axis 2 command position (rightmost word)
+3	Axis 2 command position (leftmost word)	Axis 2 command position (leftmost word)	Axis 2 command position (leftmost word)
+4	Axis 3 command position (rightmost word)	Axis 3 command position (rightmost word)	Axis 3 command position (rightmost word)
+5	Axis 3 command position (leftmost word)	Axis 3 command position (leftmost word)	Axis 3 command position (leftmost word)
+6	Axis 4 command position (rightmost word)	Axis 4 command position (rightmost word)	Axis 4 command position (rightmost word)
+7	Axis 4 command position (leftmost word)	Axis 4 command position (leftmost word)	Axis 4 command position (leftmost word)
+8	Command	Command	Command
+9	Sequence start condition	Sequence start condition	Sequence start condition
+10	Sequence skip condition	Sequence skip condition	Sequence skip condition
+11	End pattern	End pattern	End pattern
+12	Positioning completion input monitor valid	Positioning completion input monitor valid	Positioning completion input monitor valid
+13	Dwell timer	Dwell timer	Dwell timer
+14	M code	M code	M code
+15	Axis specification	Axis specification	Axis specification
+16	Position specification	Position specification	Position specification
+17	Axis 1 rotation axis direction	Not used.[1]	Not used.[1]
+18	Axis 1 command speed (rightmost word)	Interpolation speed (rightmost word)	Interpolation speed (rightmost word)
+19	Axis 1 command speed (leftmost word)	Interpolation speed (leftmost word)	Interpolation speed (leftmost word)
+20	Axis 1 acceleration time (rightmost word)	Interpolation acceleration time (rightmost word)	Interpolation acceleration time (rightmost word)
+21	Axis 1 acceleration time (leftmost word)	Interpolation acceleration time (leftmost word)	Interpolation acceleration time (leftmost word)
+22	Axis 1 deceleration time (rightmost word)	Interpolation deceleration time (rightmost word)	Interpolation deceleration time (rightmost word)
+23	Axis 1 deceleration time (leftmost word)	Interpolation deceleration time (leftmost word)	Interpolation deceleration time (leftmost word)
+24	Axis 2 rotation axis direction	Interpolation starting speed (rightmost word)	Interpolation starting speed (rightmost word)
+25	Axis 2 command speed (rightmost word)	Interpolation starting speed (leftmost word)	Interpolation starting speed (leftmost word)
+26	Axis 2 command speed (leftmost word)	Interpolation acceleration/ deceleration curve selection	Interpolation acceleration/ deceleration curve selection
+27	Axis 2 acceleration time (rightmost word)	Interpolation acceleration/ deceleration time selection	Interpolation acceleration/ deceleration time selection

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Transferring and Saving Data

Unit Address	Command		
	Positioning Operation	**Linear interpolation operation**	**Circular Interpolation (clockwise/counterclockwise direction)**
+28	Axis 2 acceleration time (leftmost word)	Interpolation speed specification method	Axis 1 circular center/ passing point position (rightmost word)
+29	Axis 2 deceleration time (rightmost word)		Axis 1 circular center/ passing point position (leftmost word)
+30	Axis 2 deceleration time (leftmost word)		Axis 2 circular center/ passing point position (rightmost word)
+31	Axis 3 rotation axis direction	Not used.[1]	Axis 2 circular center/ passing point position (leftmost word)
+32	Axis 3 command speed (rightmost word)		Axis 3 circular center/ passing point position (rightmost word)
+33	Axis 3 command speed (leftmost word)		Axis 3 circular center/ passing point position (leftmost word)
+34	Axis 3 acceleration time (rightmost word)		Axis 4 circular center/ passing point position (rightmost word)
+35	Axis 3 acceleration time (leftmost word)		Axis 4 circular center/ passing point position (leftmost word)
+36	Axis 3 deceleration time (rightmost word)		Circular radius (rightmost word)
+37	Axis 3 deceleration time (leftmost word)		Circular radius (leftmost word)
+38	Axis 4 rotation axis direction		Circular interpolation method
+39	Axis 4 command speed (rightmost word)	Not used.[1]	Not used.[1]
+40	Axis 4 command speed (leftmost word)		
+41	Axis 4 acceleration time (rightmost word)		
+42	Axis 4 acceleration time (leftmost word)		
+43	Axis 4 deceleration time (rightmost word)		
+44	Axis 4 deceleration time (leftmost word)		
+45 to +49	Not used.[1]		

*1. Set 0000 hex for unused addresses.

Unit Address	Command		
	Speed control	**Interrupt feeding (Positioning operation)**	**Interrupt feeding (Speed control)**
+0	Axis 1 command position (rightmost word)[1]	Axis 1 command position (rightmost word)	Axis 1 command position (rightmost word)[1]
+1	Axis 1 command position (leftmost word)[1]	Axis 1 command position (leftmost word)	Axis 1 command position (leftmost word)[1]
+2	Axis 2 command position (rightmost word)[1]	Axis 2 command position (rightmost word)	Axis 2 command position (rightmost word)[1]

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Transferring and Saving Data

Unit Address	Command		
	Speed control	Interrupt feeding (Positioning operation)	Interrupt feeding (Speed control)
+3	Axis 2 command position (leftmost word)[*1]	Axis 2 command position (leftmost word)	Axis 2 command position (leftmost word)[*1]
+4	Axis 3 command position (rightmost word)[*1]	Axis 3 command position (rightmost word)	Axis 3 command position (rightmost word)[*1]
+5	Axis 3 command position (leftmost word)[*1]	Axis 3 command position (leftmost word)	Axis 3 command position (leftmost word)[*1]
+6	Axis 4 command position (rightmost word)[*1]	Axis 4 command position (rightmost word)	Axis 4 command position (rightmost word)[*1]
+7	Axis 4 command position (leftmost word)[*1]	Axis 4 command position (leftmost word)	Axis 4 command position (leftmost word)[*1]
+8	Command	Command	Command
+9	Sequence start condition	Sequence start condition	Sequence start condition
+10	Sequence skip condition	Sequence skip condition	Sequence skip condition
+11	End pattern	End pattern	End pattern
+12	Positioning completion input monitor valid	Positioning completion input monitor valid	Positioning completion input monitor valid
+13	Dwell timer	Dwell timer	Dwell timer
+14	M code	M code	M code
+15	Axis specification	Axis specification	Axis specification
+16	Not used.[*2]	Position specification	Not used.[*2]
+17		Rotation axis direction	
+18	Command speed (rightmost word)	Command speed (rightmost word)	Command speed (rightmost word)
+19	Command speed (leftmost word)	Command speed (leftmost word)	Command speed (leftmost word)
+20	Acceleration time (rightmost word)	Acceleration time (rightmost word)	Acceleration time (rightmost word)
+21	Acceleration time (leftmost word)	Acceleration time (leftmost word)	Acceleration time (leftmost word)
+22	Deceleration time (rightmost word)	Deceleration time (rightmost word)	Deceleration time (rightmost word)
+23	Deceleration time (leftmost word)	Deceleration time (leftmost word)	Deceleration time (leftmost word)
+24	Not used.[*2]	Feeding reference position selection (0 bit)/Interrupt input undetected error enable (1 bit)	Feeding reference position selection (0 bit)
+25		Interrupt feeding amount (rightmost word)	Interrupt feeding amount (rightmost word)
+26		Interrupt feeding amount (leftmost word)	Interrupt feeding amount (leftmost word)
+27 to +49		Not used.[*2]	Not used.[*2]

*1. You can have a command position set although it is not necessary. A set value is ignored.

*2. Set 0000 hex for unused addresses.

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Transferring and Saving Data

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Transferring and Saving Data

Memory Operation Condition Data Addresses List

The memory operation condition data is shared by all tasks.
All memory operation condition data are always valid.

Parameter type

Data name	Parameter type
Memory operation condition data	0500 hex

Memory Operation Condition Data Configuration

Condition data	Unit Address
Condition data 1	0000 to 0009 hex (0 to 9CH)
Condition data 2	000A to 0013 hex (10 to 19CH)
Condition data 3	0014 to 001D hex (20 to 29CH)
Condition data 4	001E to 0027 hex (30 to 39CH)
Condition data 5	0028 to 0031 hex (40 to 49CH)
:	:
Condition data 100	03DE to 03E7 hex (990 to 999CH)

Unit Address

Unit Address	Condition data name
+0	Condition
+1	Edge selection
+2	Data 1 area selection
+3	Data 1 word
+4	Data 1 bit
+5	Data 2 area selection
+6	Data 2 word
+7	Data 2 bit
+8	Constant data (rightmost word)
+9	Constant data (leftmost word)

Other Addresses List

In addition, there are 2 data as explained below.

Feedback Counter Present Value

You can read and write the position information of the feedback counter.
Pay careful attention because the feedback position will be preset when you write it.

Data name	Parameter type	Number of words
Axis 1 feedback counter present value	1101 hex	2
Axis 2 feedback counter present value	1102 hex	2
Axis 3 feedback counter present value	1103 hex	2
Axis 4 feedback counter present value	1104 hex	2

External Encoder Axis Count Value

You can read and write the counter value of the MPG and external encoder axis.

Data name	Parameter type	Number of words
External encoder axis count value	11F1 hex	2

Precautions for Correct Use

Any attempt to use MPG operation or external encoder axis count value to perform synchronous transmission will result in a significant behavior change if you change the count value. Do not change the external encoder axis count value while these operations are still in progress.

Latch Data

This is the area that is written when you use the present position latch function to load the present value to the PCU.
This is read-only by the IORD instruction.

Data name	Parameter type	Number of words
Axis 1 latch data	1201 hex	2
Axis 2 latch data	1202 hex	2
Axis 3 latch data	1203 hex	2
Axis 4 latch data	1204 hex	2

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Transferring and Saving Data

Data Check

The data checking method varies depending on the transfer method. Furthermore, an error may occur depending on the transfer method when you transfer the type of data that exist in multiple sequences.

Check When You Transfer the Data with Data Transfer Bit

When you write data with the data transfer bit, the data is first received in the receive buffer. If the received data are within the normal range, all data is written to the axis parameters and the memory operation data.

If even one data item is in an abnormal range, a warning is output and all received data is discarded.

Note, however, that the data is not checked when it is written during a PCU setup. Check the consistency of all data when you save the data.

Furthermore, although you can write all data during a PCU setup, you can only write the data that are rewritable at any time during a normal operation. For details, refer to "Operation status and Data Transfer" on page 8-20.

When you use the data transfer bit, you can transfer the type of data that exist in multiple sequences.

Check When You Transfer the Data with IOWR Instruction

When you write data with the IOWR instruction, the data is written, not to the receive buffer, but directly to the axis parameters, the memory operation data, etc.

If even one data item is in an abnormal range, a warning is output and all received data is discarded.

When you transfer the memory operation data with the IOWR instruction, you cannot transfer the data that exist in multiple sequences. Always transfer data within 1 sequence. An error occurs if you transfer the type of data that exist in multiple sequences.

IOWR instruction
Overwriting possible

Sequence 2 data
50 words

IOWR instruction
Overwriting not possible

OK

Sequence 3 data
50 words

NG

Overwriting is possible
within 1 sequence

Sequence 4 data
50 words
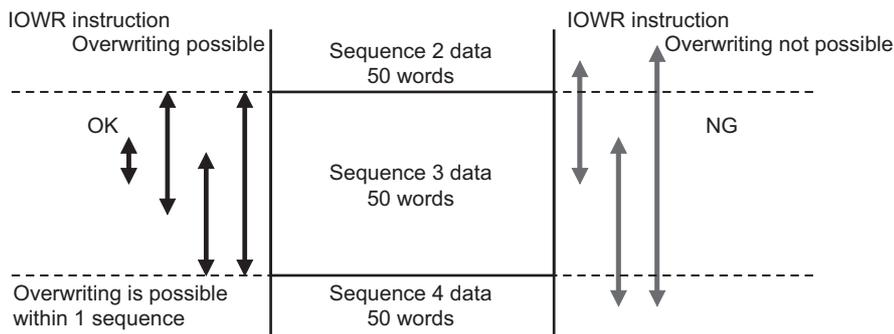
Precautions for Correct Use

- If a warning occurs as a result of a data check, turn ON the warning reset once, and transfer the normal data again.
- Do not execute any command, such as data save or start, without transferring the normal data again. Doing so may result in an unexpected operation because the data since the warning occurred has not been transferred.

  All data is transferred when you execute the IOWR or IORD instructions. Therefore, pay careful attention when you execute the IOWR or IORD instructions consecutively within the same scan because the error code at the time of the transfer may not be output.

Operation status and Data Transfer

The PCU has these operating status. Operation you can perform with the PLC varies depending on the operation status.

The table below shows the relationship between the operation status of the PCU in terms of data transfer and the transfer means.

√: Permitted, –: Not permitted

Operating status	Explanation of operating status	Transfer means		
		Data transfer bit	IOWR/IORD	CX-Programmer
Initializing	From the status in which you turn ON the power supply or execute a restart until the unit starts. In this status, the PCU ready (n+11 word, bit 15) is OFF.	–	–	–
PCU setup in progress	The PCU Setup Memory area (n word, bit 15) is ON and the PCU ready is OFF.	√	–	–
SOFTWARE EXCLUSIVE mode (Data Transfer)	A mode by a CX-Programmer command. In this mode, data transfer by CX-Programmer is possible. Ladder program output is disabled.	–	–	√
SOFTWARE EXCLUSIVE mode (Test Run)	A mode by a CX-Programmer command. In this mode, operation by CX-Programmer is possible. Ladder program output is disabled.	–	–	√ (Always only)[1]
Normal operation	The PCU ready is ON. Regardless of the means, you can specify writing only the data that is always reflected. You can read all data types.	√ (Always only)[1]	√ (Always only)[1]	√ (Always only)[1]

[1]. "Always only" refers to the parameter data, memory operation data and memory operation condition data that is always rewritable.

8-2 Data Write with Data Transfer Bit

This section explains the procedures for and the program example of writing data to the PCU by using the Data Write Memory area (n word, bit 12) of the PCU Control Memory area.

> ☑ **Precautions for Correct Use**
>
> ---
>
> ⬩ Do not turn OFF the power supply or restart the PCU while you write the data. The PCU may not operate properly if you could not transfer all data. In such a case, transfer all data again.

Writing Procedures

This section explains the procedures for writing data to the PCU with task 1 memory operation data as an example.
Use the Special I/O Unit Memory area to write data with the data transfer bit.
You can determine the Special I/O Unit Memory area by the formula below:

Beginning word in Special I/O Unit Memory area (n) $n = 2{,}000 + 10 \times$ unit number

The memory areas that are necessary for transfer are as listed below.

PCU Control Output Memory Area

Words	Name	Bit	Bit name	Function
n	PCU Control Command Memory area	12	Write data	Writing data starts the moment the bit turns ON.
		14	Save data	Saving data starts the moment the bit turns ON.
		15	PCU setup	Reset the PCU the moment the bit turns ON. Hold the reset status while this bit is ON.
n+1	Number of data transfer words	0 to 15	–	Set the number of words which you use for writing/reading data.
n+2	CPU data transfer area type	0 to 15	–	Set the area type on the CPU side. 00B0 (hex): I/O Memory area (CIO) 00B1 (hex): Internal Auxiliary Memory area (WR) 00B2 (hex): Holding Memory area (HR) 0082 (hex): DM area (DM) 0050 to 0068 (hex): EM Area (EM) in CJ2 CPU Units*1 0050 (hex): EM bank No. 0 0051 (hex): EM bank No. 1 : 0068 (hex): EM bank No. 18 00A0 to 00AF (hex): EM Area (EM) in CJ1 CPU Units*1 00A0 (hex): EM bank No. 0 (hex) 00A1 (hex): EM bank No. 1 (hex) : 00AF (hex): EM bank No. F (hex) *1. The number of available banks varies depending on the CPU.

8 Transferring and Saving Data

Words	Name	Bit	Bit name	Function
n+3	CPU data transfer beginning word	0 to 15	–	Set the beginning word on the CPU side. Specify the location to store the transferred data of the CPU I/O memory, together with the area type setting. Example: When you specify D00100 CPU area type (n+2): 0082 (hex) CPU Starting Word (n+3): 0064 (hex)
n+4	PCU data transfer area type	0 to 15	–	Set the area type on the PCU side. Set in hexadecimal.
n+5	PCU data transfer beginning word	0 to 15	–	Set the beginning word on the PCU side. Set in hexadecimal.

PCU Control Input Memory Area

Words	Name	Bit	Bit name	Function
n+11	PCU control command received	12	Write data received	This turns ON at the data write reception.
		14	Save data received	This turns ON at the data save reception.
		15	PCU ready	Turn this ON when the PCU is ready.
n+12	PCU control status	0	Data transferring	This remains ON while data transfer is in progress.
		1	Data transfer invalid	This turns ON when data transfer failed.
		2	Data transfer completed	This turns ON when data write, read, or save is completed successfully.
		3	Save data request	This turns ON at the situation in which information will be lost when you cut off the power supply, unless you save the data.

Procedures

1. **Specify data in n+1 to n+5 (word).**
   Specify the number of data transfer words (n+1 word), CPU data transfer area type (n+2 word), CPU data transfer beginning word (n+3 word), PCU data transfer area type (n+4 word), and PCU data transfer area beginning word (n+5 word).

2. **Turn the Data Write Memory area of (n word, bit 12) from OFF to ON, and write the data to the PCU.**
   At that time, if you turn ON the PCU Setup Memory area (n word, bit 15) before the Data Write Memory area, the operation of the PCU stops and you can write all data.
   If the PCU Setup Memory area is OFF, you can write only the type of data that is always rewritable.

3. **Change the Data Save Memory area setting from OFF to ON to save the data which you wrote to the PCU (n word, bit 14).**
   This operation is not necessary if you do not save the written data.

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Transferring and Saving Data

Timing Chart

The following shows the timing chart for data writing.

Number of data transfer words (n+1 word)	2 hex (2 words)
CPU data transfer area type (n+2 word)	0082 hex
CPU data transfer beginning word (n+3 word)	0000 hex(0 words)
PCU data transfer area type (n+4 word)	0401 hex
PCU data transfer area beginning word (n+5 word)	0000 hex
Write data (n word, bit 12)	
Write data received (n+11 word, bit 12)	
Data transferring (n+12 word, bit 0)	
Data transfer completed (n+12 word, bit 2)	
Save data request (n+12 word, bit 3)	

When data writing is complete, data transfer completed (n+12 word, bit 2) turns ON.
If an error occurs at the time of the data transfer execution, the data transfer invalid (n+12 word, bit 1) turns ON. The error code is output to (n+14 word).

Program Example

This section explains a sample program that is used to write the following position data to the PCU.
In this example, you set the PCU to unit number 3.

Content of the Data to be Transferred

The data to be written are the axis 1 command position of sequence No. 1, and the axis 2 command position of sequence No. 2.
The first word of the transfer source data is D00000 and the setting is as follows.

Task number	Parameter type	Sequence number	Transfer destination name	Transfer destination address	Transfer Source area	Contents of setting
1	0401 hex	1	Axis 1 command position (rightmost word)	0000 hex	D00000	157C hex
			Axis 1 command position (leftmost word)	0001 hex	D00001	0000 hex (5,500)
		2	Axis 2 command position (rightmost word)	0034 hex	D00002	1F40 hex
			Axis 2 command position (leftmost word)	0035 hex	D00003	0000 hex (8,000)

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Transferring and Saving Data

Ladder Program Example
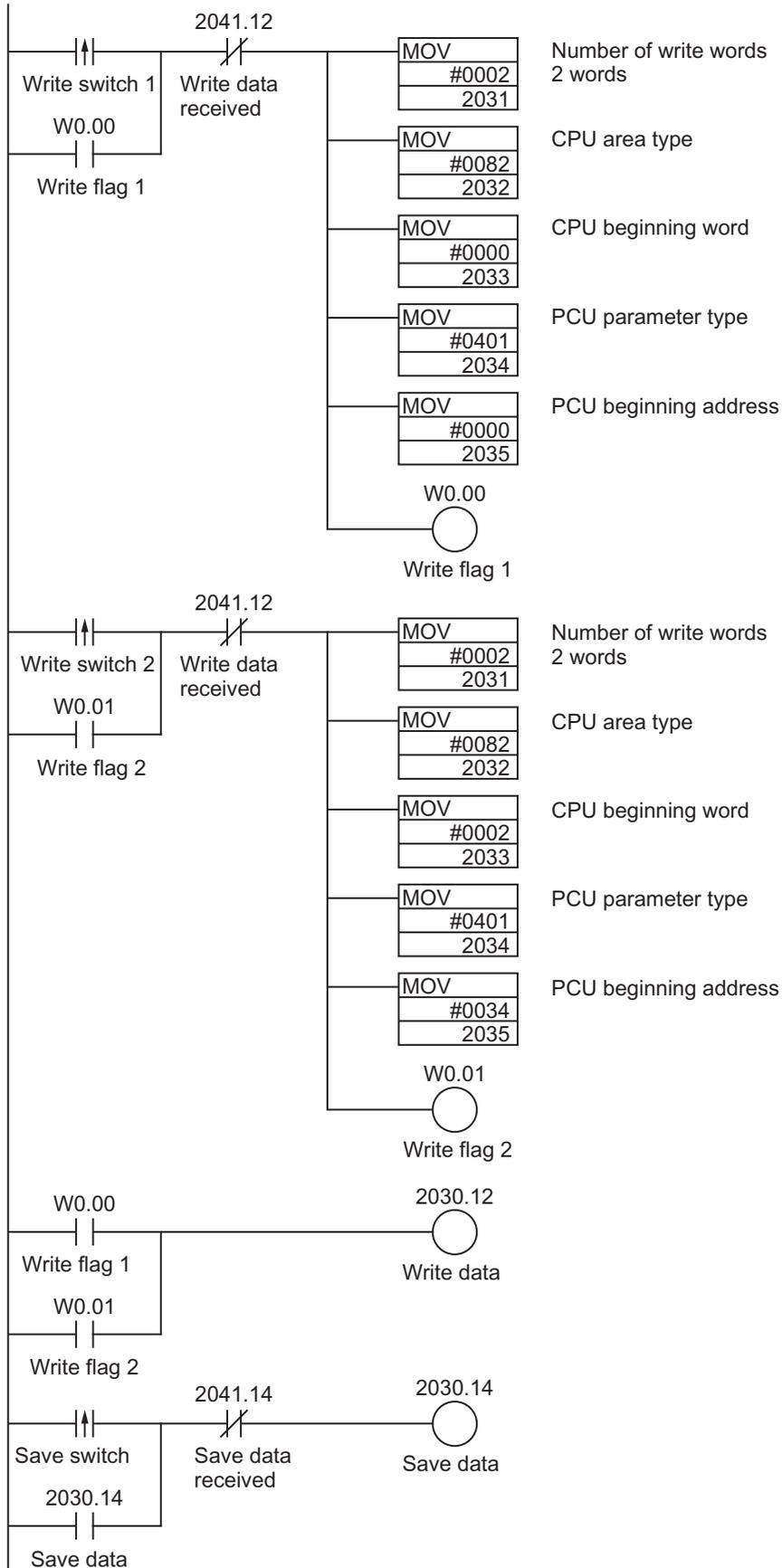
8-3   Data Read with Data Transfer Bit

This section explains the procedures for and the program example of reading data from the PCU by using the Data Read Memory area (n word, bit 13) of the PCU Control Memory area.

> **Precautions for Correct Use**
>
> • Always transfer in units of data when you read the data, and do not start or end in the middle of data.

Reading Procedures

This section explains the procedures for reading data from the PCU with task 1 memory operation data as an example.
Use the Special I/O Unit Memory area to read data with the data transfer bit.
You can determine the Special I/O Unit Memory area by the formula below:

Beginning word in Special I/O Unit Memory area (n) $n = 2{,}000 + 10 \times$ unit number

The Memory areas that are necessary for transfer are as listed below.

PCU Control Output Memory Area

Words	Name	Bit	Bit name	Function
n	PCU Control Command Memory area	13	Data read	Reading data starts the moment the bit turns ON.
n+1	Number of data transfer words	0 to 15	–	Set the number of words which you use for writing/reading data.

n+2	CPU data transfer area type	0 to 15	–	Set the area type on the CPU side.
				00B0 (hex): I/O Memory area (CIO)
				00B1 (hex): Internal Auxiliary Memory area (WR)
				00B2 (hex): Holding Memory area (HR)
				0082 (hex): DM area (DM)
				0050 to 0068 (hex): EM Area (EM) in CJ2 CPU Units*1
				0050 (hex): EM bank No. 0
				0051 (hex): EM bank No. 1
				   :
				0068 (hex): EM bank No. 18
				00A0 to 00AF (hex): EM Area (EM) in CJ1 CPU Units*1
				00A0 (hex): EM bank No. 0 (hex)
				00A1 (hex): EM bank No. 1 (hex)
				   :
				00AF (hex): EM bank No. F (hex)
				*1. The number of available banks varies depending on the CPU.

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Transferring and Saving Data

Words	Name	Bit	Bit name	Function
n+3	CPU data transfer beginning word	0 to 15	–	Set the beginning word on the CPU side. Specify the location to store the transferred data of the CPU I/O memory, together with the area type setting. Example: When you specify D00100 CPU area type (n+2): 0082 (hex) CPU beginning word (n+3): 0064 (hex)
n+4	PCU data transfer area type	0 to 15	–	Set the area type on the PCU side. Set in hexadecimal.
n+5	PCU data transfer beginning word	0 to 15	–	Set the beginning word on the PCU side. Set in hexadecimal.

PCU Control Input Memory Area

Words	Name	Bit	Bit name	Function
n+11	PCU control command received	13	Read data received	This turns ON at the data read reception.
n+12	PCU control status	0	Data transferring	This remains ON while data transfer is in progress.
		1	Data transfer invalid	This turns ON when data transfer failed.
		2	Data transfer completed	This turns ON when data write, read, or save is completed successfully.

Procedures

1. **Specify data in n+1 to n+5 (word).**
   Specify the number of data transfer words (n+1 word), CPU data transfer area type (n+2 word), CPU data transfer beginning word (n+3 word), PCU data transfer area type (n+4 word), and PCU data transfer area beginning word (n+5 word).

2. **Turn the Data Read Memory area of (n word, bit 13) from OFF to ON, and read the data from the PCU.**

Timing Chart

The following shows the timing chart for data reading.

Number of data transfer words (n+1 word)	8 hex (8 words)
CPU data transfer area type (n+2 word)	0082 hex
CPU data transfer beginning word (n+3 word)	000A hex (10 words)
PCU data transfer area type (n+4 word)	0401 hex
PCU data transfer area beginning word (n+5 word)	0000 hex
Read data (n word, bit 13)	
Read data received (n+11 word, bit 13)	
Data transferring (n+12 word, bit 0)	
Data transfer completed (n+12 word, bit 2)	

When data reading is complete, the data transfer completed (n+12 word, bit 2), which is the same as for data writing, turns ON.
If an error occurs at the time of the data transfer execution, the data transfer invalid (n+12 word, bit 1) turns ON. The error code is output to (n+14 word).

Program Example

This section explains a sample program that is used to read the following position data from the PCU.
In this example, you set the PCU to unit number 3.

Content of the Data to be Transferred

The data to be read include the axis 1 command position, axis 2 command position, and axis 3 command position of sequence No. 1.
The first word of the transfer destination is D00010 and the setting is as follows.

Task number	Parameter type	Sequence number	Transfer source name	Transfer source address	Transfer destination area	Content to be read
1	0401 hex	1	Axis 1 command position (rightmost word)	0000 hex	D00010	2710 hex
			Axis 1 command position (leftmost word)	0001 hex	D00011	0000 hex (10,000)
			Axis 2 command position (rightmost word)	0002 hex	D00012	3A98 hex
			Axis 2 command position (leftmost word)	0003 hex	D00013	0000 hex (15,000)
			Axis 3 command position (rightmost word)	0004 hex	D00014	4650 hex
			Axis 3 command position (leftmost word)	0005 hex	D00015	0000 hex (18,000)

Ladder Program Example
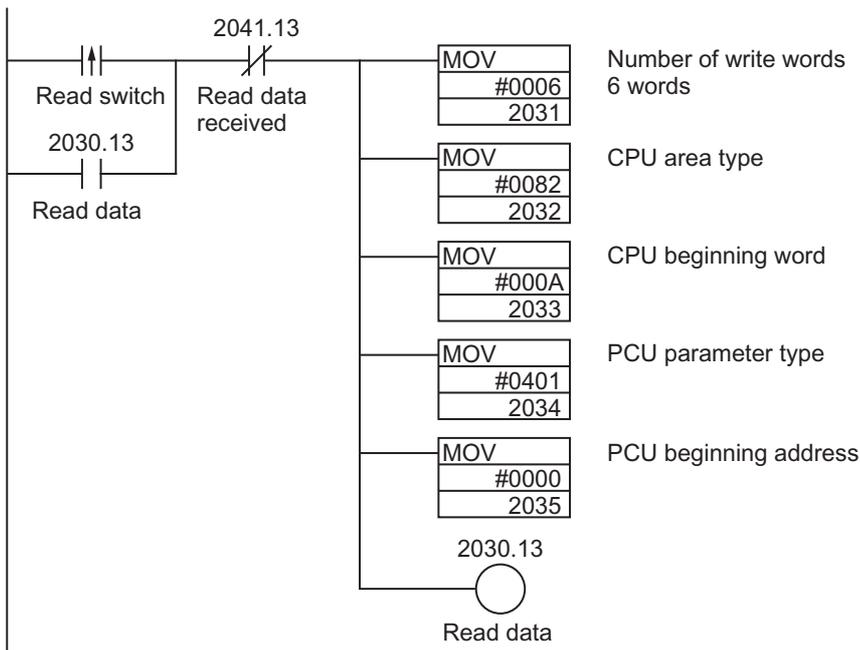
8-4 Data Write with IOWR Instruction

This section explains the procedures for and the program example of writing data to the PCU by using the IOWR instruction.

☑ **Precautions for Correct Use**

- One IOWR instruction transfers all specified data. Therefore, the ladder cycle time increases for the amount of the time that is necessary to transfer the data.
- Write one item at a time when you write common parameters, axis parameters and memory operation parameters with the IOWR instruction.
- When you write the memory operation data with the IOWR instruction, you cannot transfer the data that exist in multiple sequences. Always transfer data within 1 sequence.

Writing Procedures

The procedure below explains the writing procedures when you use the IOWR instruction.

1. **Set the IOWR instruction.**

   C: Setting the parameter type for transfer.

   S: First word number on the CPU

   W: PCU unit number of the transfer destination and the number of words for the data to be written

2. **Data Settings**
   Set the data in the area which you set in S.

3. **Execute the data write.**
   Execute the IOWR instruction.

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Transferring and Saving Data

IOWR Instruction Specification

This section explains the format of the IOWR instruction. For details, refer to "Instructions Reference Manual (W474)" for the CS/CJ-series PLC.

IOWR		@IOWR	
C		C	C: Control data
S		S	S: Beginning word number of transfer source
W		W	W: Transfer destination unit number and number of transfer words

Operand	Explanation
C	Set the parameter type on the PCU in hexadecimal.
S	Specify the first word of the PLC where you set the data to be transferred.

W	W: PCU unit number of the transfer destination
	W+1: Number of transfer words
	    Only one item per instruction in the case of parameters.
	    Data within 1 sequence in the case of memory operation data.
	    One condition in the case of memory operation condition data.

C: Control Data

Specify the parameter type of the data to be written in hexadecimal.

The amount of common, axis or memory operation parameters that are writable per instruction corresponds to 1 Unit Address. You cannot write multiple parameters with 1 instruction.

The memory operation data and memory operation condition data that are writable per instruction is within for 1 sequence or within the range of 1 condition. You cannot write the data of multiple sequences or multiple conditions with 1 instruction.

S: Rightmost Word Number of Transfer Source

Prepare the transfer data as follows in the word which you specified in S.

Words	Set data	Description
S	Unit address	Set the Unit Address of the data to be transferred in hexadecimal.
S+1 S+2	Transfer data	Set the transfer data. In the case of transferring data of 2 words, set the rightmost word data in S+1 and the leftmost word data in S+2.

However, the transfer data for the feedback counter present value (parameter type: 1101 to 1104 hex) and external encoder axis count value (parameter type: 11F1 hex) are as follows:

Words	Set data	Description
S S+1	Transfer data	Set the transfer data (present value preset value). Set the rightmost word data in S, and leftmost word data in S+1.

W: Transfer Destination Unit Number and Number of Transfer Words

Set the PCU unit number to which the data is to be transferred, and the total number of words of the data to be transferred.

Transfer destination unit number	: 0000 to 005E hex (unit numbers from 0 to 94)
Number of transfer words	: Set the number of words of the data to be transferred + 1.

[Example]

If you transfer the maximum speed of the axis parameter to the PCU unit No. 5, set as follows.

No. 00030005 (Number of transfer words: 0003 [3 words], unit No. 0005 [No. 5])

Condition Flags Movement

Name	Label	Description
Error flag	P_ER	• Turns ON when the transfer word number data of W is not within the range of decimal data between 1 and 128, or hex data between No. 0001 and 0080.
		• Turns ON when the unit number designation of W is not within the range of decimal data between 0 and 94, or hex data between No. 0000 and 005E or No. 8000 and 800F.
		• Turns ON when you specify S as a constant, and the transfer word number data of W is not 1.
		• Turns ON when the specified Special I/O Unit is on SYSBUS.
		• Turns ON when you specify a Special I/O Unit (or a CPU Bus Unit) that does not support the IOWR instruction.
		• Turns ON when there is a PCU setting error or you specify the PCU with an error.
		• Turns OFF in all other conditions.
=flag	P_EQ	• Turns ON when you complete the writing process successfully.
		• Turns OFF when you do not complete the writing process successfully.

Note 1. The = flag turns OFF if the PCU is in the busy status and you cannot complete the writing process successfully.

Note 2. An error occurs if there is an I/O Unit verification error on the PCU, a Special I/O Unit setup error, or a Special I/O Unit error.

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Transferring and Saving Data

Function

The data for the number of transfer words (W+1) from the transfer source rightmost word number of S is output to the Memory area of the PCU which you specified in the W unit number. Only is PCU that is mounted on the CPU Rack or an Expansion Rack is applicable.
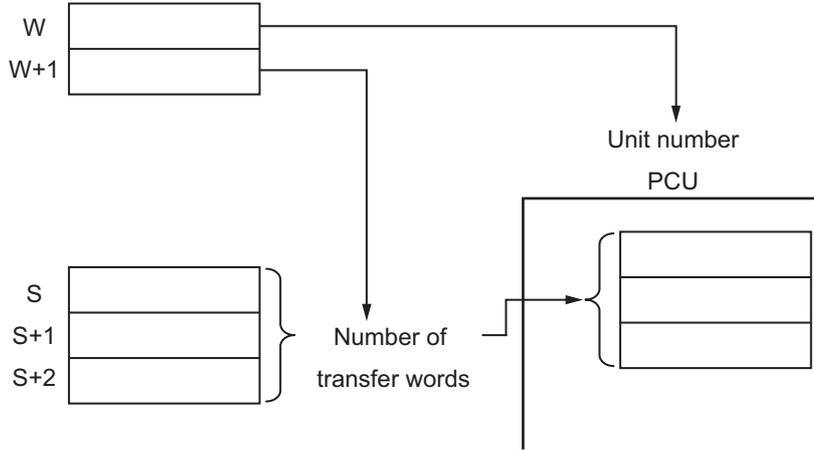
Program Example

This section explains a sample program that is used to write the following position data to the PCU. In this example you set the PCU to unit number 2.

Content of the Data to be Transferred

The first word number of the data to be transferred is D00100 and the setting is as follows.

Task number	Parameter type	Sequence number	Transfer destination name	Transfer destination address	Transfer Source area	Content to be written
1	0401 hex	1	Axis 2 command position (rightmost word)	0002 hex	D00101	3A98 hex
			Axis 2 command position (leftmost word)	0003 hex	D00102	0000 hex (15,000)
			Axis 3 command position (rightmost word)	0004 hex	D00103	4650 hex
			Axis 3 command position (leftmost word)	0005 hex	D00104	0000 hex (18,000)

In addition to the above data:

Transfer Source area	Content to be written	Content of transfer
D00100	0002	Transfer destination address
D00200	0002	Unit No. 2
D00201	0005	Number of transfer data

Ladder Program Example

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Transferring and Saving Data
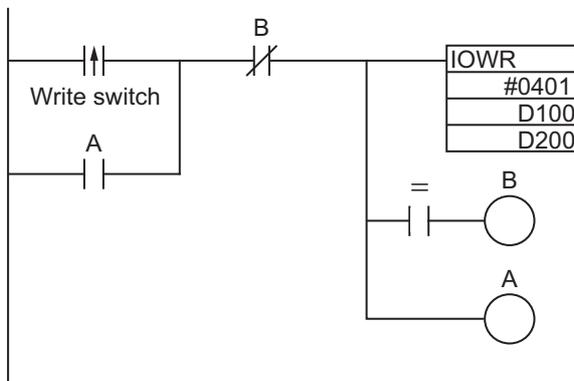
> 📝 **Reference**
>
> • When you execute the IOWR instruction, the execution result is reflected in the Condition Flags. The = flag turns ON when the reading process is completed. Input Condition Flags, such as = flag, based on output branching from the same input condition as the IOWR instruction.
> • You cannot write any data when the PCU is busy. Therefore, use = flag to configure a self-holding circuit so that you execute the instruction in every cycle until you can start writing the data.
> • Self-hold at contact A when the input conditions are satisfied. The IOWR instruction is executed in every cycle until = flag turns ON. Self-holding is released when = flag turns ON and contact B turns ON upon completion of the writing process.
> • If you place the Condition Flags after a different instruction, the Condition Flags change according to the execution result of the instruction. Be sure to place the Condition Flags immediately after the IOWR instruction.

> ☑ **Precautions for Correct Use**
>
> You can use the IOWR instruction in the interrupt task. Accordingly, you can execute the high-speed response processing of specific I/O by interrupting.
> However, in such a case, always set to prohibit the cyclic refresh with the Special I/O Unit (1: Disabled) in the Special I/O Unit cyclic refresh setting under the PLC Setup.
> If you execute one of 2 below in an interrupt task when you set to perform a cyclic refresh with the Special I/O Unit (0: Enabled), it results in multiple refreshing and a non-fatal error occurs, then the interrupt task error flag (A402.13) turns ON.
>
> • When you execute an I/O refresh on the same Special I/O Unit with the IORF or FIORF instructions.
>
> • When you read data from or write data to the Memory area of the same Special I/O Unit with the IORD or IOWR instructions.

8-5 Data Read with IORD Instruction

This section explains the procedures for and the program example of reading data from the PCU by using the IORD instruction.

You can use an IORD instruction to read the feedback counter present value and latch data for each axis.

Precautions for Correct Use

⬧ One IORD instruction transfers all specified data. Therefore, the ladder cycle time increases for the amount of the time that is necessary to transfer the data.

Reading Procedures

The following is the reading procedures when you use the IORD instruction.

Procedures

1. Set the IORD instruction.

C: Setting the PCU parameter type

W: PCU unit number of the transfer source and the number of words for the data to be read

D: CPU first word

2. Execute the data read.
Execute the IORD instruction.

IORD Instruction Specification

This section explains the format of the IORD instruction. For details, refer to "Instructions Reference Manual (W474)" for the CS/CJ-series PLC.

IORD		@IORD		
C		C		C: Control code
W		W		W: Transfer destination unit number and number of transfer words
D		D		D: Beginning word number of transfer destination

Operand	Explanation
C	Set the parameter type on the PCU in hexadecimal.
W	Set the PCU unit number of the transfer source and the number of words for the data to be read.
D	Set the CPU first word of the transfer destination.

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Transferring and Saving Data

C: Control Data

Set the parameter type of the data to be read in hexadecimal.
You can read these 3 data types with the IORD instruction.

Axis 1 to Axis 4 feedback counter present values:	1101 to 1104 hex
External encoder axis count value:	11F1 hex
Axis 1 to Axis 4 latch data:	1201 to 1204 hex

W: Transfer Source Unit Number and Number of Transfer Words

Specify the unit number for the data transfer, and the total number of words of the data to be transferred.

Transfer source unit number:	0000 to 005E hex (unit numbers from 0 to 94)
Number of transfer words:	Set the number of words of the data to be transferred. Fix the number of transfer words at 2 since the data types which you can read with the IORD instruction are only the feedback counter present values and the capture data.

[Example]

If you read the axis 1 feedback counter present value from the PCU unit No. 5, set as follows.

No. 00020005 (Number of transfer words: 0002 [2 words], unit No. 0005 [No. 5])

D: Rightmost Word Number of Transfer Destination

Set the CPU beginning word of the transfer destination.

Condition Flags Movement

Name	Label	Description
Error flag	P_ER	• Turns ON when the transfer word number data of W is not within the range of decimal data between 1 and 128, or hex data between No. 0001 and 0080. • Turns ON when the unit number designation of W is not within the range of decimal data between 0 and 94, or hex data between No. 0000 and 005E or No. 8000 and 800F. • Turns ON when the specified PCU is on SYSBUS. • Turns ON when there is a Special I/O Unit settings error or you specify the PCU with a Special I/O Unit error. • Turns OFF in all other conditions.
=flag	P_EQ	• Turns ON when you complete the reading process successfully. • Turns OFF when you do not complete the reading process successfully.

Function

The content of the Memory area of the PCU which you specified in the unit number of W is read for the number of transfer words, and is output to D.
Only the PCU that is mounted on the CPU Rack or an Expansion Rack is applicable.
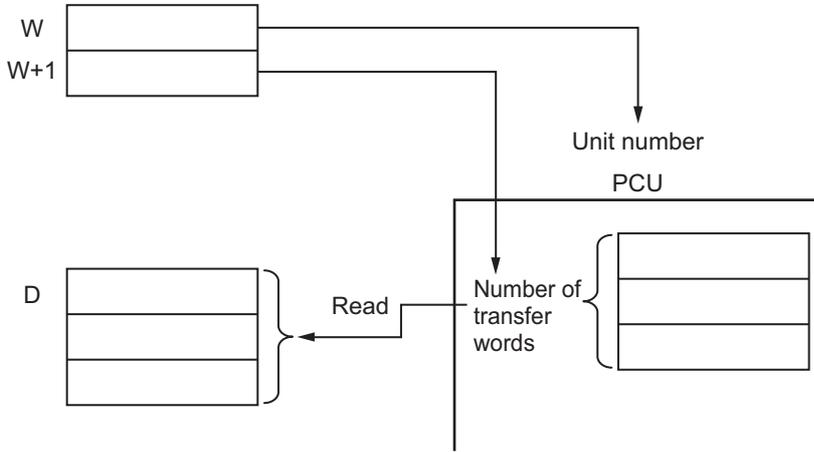
Program Example

This section explains a sample program that is used to read the following position data from the PCU. In this example, you set the PCU to unit number 2.

Content of the Data to be Transferred

The first word of the transfer destination is D00300 and the setting is as follows.

Parameter type	Transfer source name	Transfer Destination area
1101 hex	Axis 1 feedback counter present value	D00300

In addition to the above data:

Transfer Source area	Content to be written	Content of transfer
D00400	0002	Unit No. 2
D00401	0002	Number of transfer data (Fixed at 0002.)

Ladder Program Example

```
         |↑|           B
       --| |---------/|/------  |IORD    |
       Read switch                |#1101   |
                                   |D400    |
         A                         |D300    |
       --| |---
                           =        B
                         --| |------( )

                                    A
                                  --( )
```
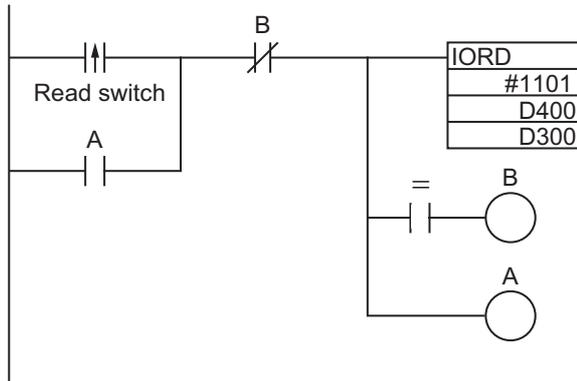
📝 Reference

- When you execute the IORD instruction, the execution result is reflected in the Condition Flags. The = flag turns ON when the reading process is completed. Input Condition Flags, such as = flag, based on output branching from the same input condition as the IORD instruction.
- You cannot read any data when the PCU is busy. Therefore, use = flag to configure a self-holding circuit so that you execute the instruction in every cycle until you can start reading the data.
- Self-hold at contact A when the input conditions are satisfied. The IORD instruction is executed in every cycle until = flag turns ON. Self-holding is released when = flag turns ON and contact B turns ON upon completion of the reading process.
- If you place the Condition Flags after a different instruction, the Condition Flags change according to the execution result of the instruction. Be sure to place the Condition Flags immediately after the IORD instruction.

🖐 Precautions for Correct Use

You can use the IORD instruction in the interrupt task. Accordingly, you can execute the high-speed response processing of special I/O by interrupting.
However, in such a case, always set to the prohibit cyclic refresh with the Special I/O Unit (1: Do not perform a cyclic refresh) in the Special I/O Unit cyclic refresh setting under the PLC Setup.
If you execute one of 2 below in an interrupt task when you set to the perform a cyclic refresh with the Special I/O Unit (0: Perform a cyclic refresh), it results in multiple refreshing and a non-fatal error occurs, then the interrupt task error flag (A402.13) turns ON.

- When you execute an I/O refresh on the same Special I/O Unit with the IORF or FIORF instructions.
- When you read data from or write data to the Memory area of the same Special I/O Unit with the IORD or IOWR instructions.

8-6 Transfer with CX-Programmer

You can use the CX-Programmer to monitor the write data, read data, save and PCU operation status.

Transfer Procedures

1. **In the PCU Setting Window, select [Transfer Selection [PC to NC]] under the [PCU] menu.**

   The window below appears.
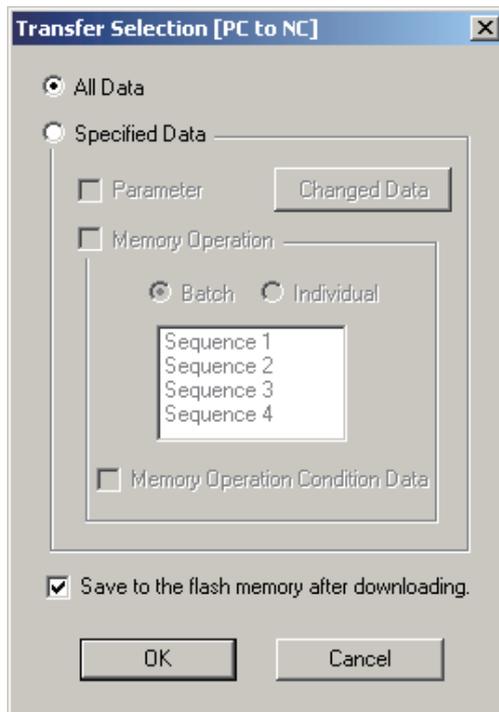
2. **Tick the applicable boxes.**

Item	Function	
All data	Tick this box to transfer all data. If you select [All Data], you cannot select [Specified Data].	
Specified data	Tick this box to transfer the individual data below. If you select [Specified Data], you cannot select [All Data].	
	Parameter	Tick this box when you transfer common parameters, axis parameters or task parameters.
		When you click [Changed Data], you only transfer the edited parameters.

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Transferring and Saving Data

Item		Function
Specified Data	Memory operation	Tick this box to transfer the memory operation data. Note, however, that this is not available if no task is registered.
		If you select [Batch], you transfer all tasks. If you select [Individual], you transfer only the tasks on the list (multiple selections permitted).
	Memory operation condition data	Tick this box to transfer the memory operation condition data.
Save to the flash memory after downloading.		Select this check box to save each data to the flash memory after the transfer.

3. Click the [OK] button to transfer the data.

Precautions for Correct Use

• Do not execute more than one transfer at a time from the CX-Programmer against the same PCU. Doing so may cause the data transfer to be executed improperly and result in an unexpected operation.

8-7 Saving Data

The data which you transferred to the PCU is lost if you turn OFF the PLC power supply or restart the PCU. Save the transferred data to the internal flash memory on the PCU to keep the data. Once you save the data, you can then use the saved data when you turn ON the power supply or restart the PCU next time.
When you execute the data save, you save all parameters and data as of that time.

Precautions for Correct Use

- Do not turn OFF the power supply or restart the PCU while data save is in progress. It may cause a failure of the internal flash memory on the PCU. Consequently, you may not be able to run the PCU properly.
- If you save data when there is a flash memory failure, a Special I/O Unit memory error (user data) (error code: 0010) occurs. It may take up to 30 seconds to save data.
- Execute the data save operation when all axes are stationary and no other command is in progress. If you execute the operation in any other conditions, the data save will not be executed, and a duplicate start error (error code: 8200) occurs.

Data to be Saved

The content of the internal memory on the PCU is lost when you turn OFF the power supply or restart the PCU.
You can save the content of the internal memory to a flash memory and save the parameters and data by performing the data save operation.
The data below are saved to a flash memory.

- Common parameter
- Axis parameters
- Task memory operation parameter
- External encoder axis parameter
- Memory operation data
- Memory operation condition data

All data for the number of axes of the PCU is saved together.

The parameters and the data that are saved to a flash memory are written into the internal memory on the PCU when you turn ON the power supply or restart the PCU.
At that time, if the parameters and the data on the flash memory are damaged, a Special I/O Unit memory error (user data) (error code: 0010) occurs, and the PCU starts up with the default settings (default setting).

Reference

- If parameter destruction or data destruction occurs, operations other than to transfer and save data are not allowed. Execute the data save operation, or execute it after data transfer, and turn the power supply from OFF to ON or restart the PCU.

8

Transferring and Saving Data

Execution of Data Save

Use the data save bit of the Unit Control Output Memory area or the CX-Programmer.

Execution with Data Save Bit

The memory areas that are necessary for transfer are as listed below.

PCU Control Output Memory area

Words	Name	Bit	Bit name	Function
n	PCU Control Command Memory area	14	Save data	Saving data starts the moment the bit turns ON.

PCU Control Input Memory area

Words	Name	Bit	Bit name	Function
n+11	PCU control command received	12	Write data received	This turns ON at the data write reception.
		14	Save data received	This turns ON at the data save reception.
		15	PCU ready	Turn this ON when the PCU is ready.
n+12	PCU control status	0	Data transferring	This remains ON while data transfer is in progress.
		1	Data transfer invalid	This turns ON when data transfer failed.
		2	Data transfer completed	This turns ON when data write, read, or save is completed successfully.
		3	Save data request	This turns ON at the situation in which information will be lost when you cut off the power supply, unless you save the data.

Timing Chart

You cannot execute data save and data transfer at the same time. Doing so will result in a duplicate start error (error code: 8200). Furthermore, you cannot save data during a pulse output. The following shows the timing chart when you save data.
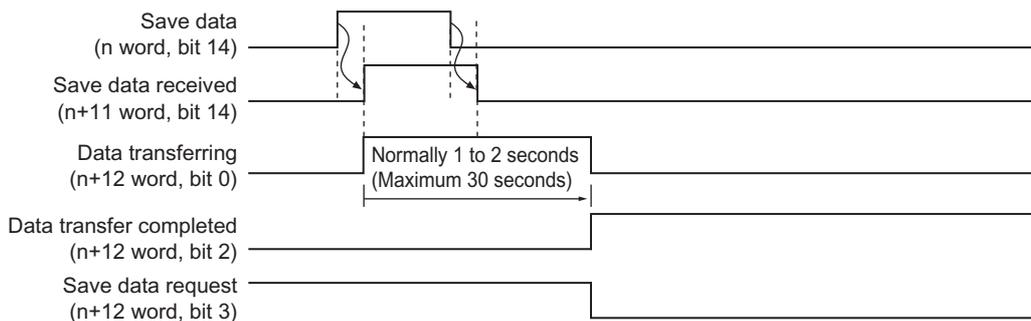
When data saving is complete, data transfer completed (n+12 word, bit 2) turns ON.

Transferring and Saving Data

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Execution with CX-Programmer

The procedures for saving data with the CX-Programmer are as follows.

1. **Connect CX-Programmer to the PLC.**
2. **Start the PCU Setting Window.**
3. **Select [Write Flash Memory] under the [PCU] menu.**

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Transferring and Saving Data

8-8 PCU Setup

If you change a parameter that requires the power supply to be turned ON again, you need to restart the PCU.
If you restart the PCU, the CPU Unit of the PLC stops during the restarting process.
For this reason, this is a PCU setup function to restart only the PCU without stopping the CPU of the PLC.

Outline of Operation

The PCU setup function can be used to initialize the PCU without stopping CPU Unit operation. You can use the PCU setup function regardless of the status of the PCU by turning ON the PCU Setup Bit in the PCU Control Output Memory Area. When you execute the function, all output signals of the PCU are turned OFF.

When setup has been completed, the PCU Ready Flag will turn ON and the output bits from the CPU Unit will be output to the PCU output signals.
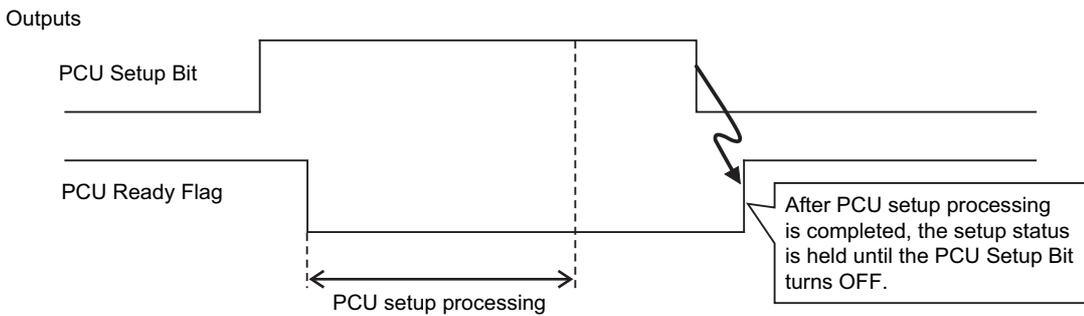
Outputs

PCU Setup Bit

PCU Ready Flag

After PCU setup processing is completed, the setup status is held until the PCU Setup Bit turns OFF.

PCU setup processing

Operating Status of PCU

The PCU has these operating status. Operation you can perform with the PLC varies depending on the operating status.

Operating status	Explanation of operating status	PLC status			Operation from PLC
		PCU ready	External input	External output	
Initializing	From the status in which you turn ON the power supply or execute a restart until the unit starts. In this condition, the PCU ready (n+11 word, bit 15) is OFF.[1]	OFF	Disabled	Output cutoff	Not possible
PCU setup in progress	The PCU Setup area (n word, bit 15)[1] is ON and the PCU ready is OFF.	OFF	Disabled	Output cutoff	Only the PCU Control memory area can operate.
SOFTWARE EXCLUSIVE mode (Data Transfer)	A mode by a CX-Programmer command. In this mode, data transfer by CX-Programmer is possible. Ladder program output is disabled.	OFF	Disabled	Output cutoff	Not possible
SOFTWARE EXCLUSIVE mode (Test Run)	A mode by a CX-Programmer command. In this mode, operation by CX-Programmer is possible. Ladder program output is disabled.	OFF	Enabled	Retain the status before the SOFTWARE EXCLUSIVE mode (Test Run) transition.	Not possible
Normal operation[2]	The PCU ready is ON.	ON	Normal operation	Normal operation	Possible

*1. n word indicates a Special I/O Unit memory area. You can determine the Special I/O Unit memory area by the formula below: First word in Special I/O Unit memory area (n) $n = 2,000 + 10 \times$ unit number

*2. Turn OFF the PCU Setup memory area (n word, bit 15) to enable normal operation.

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Transferring and Saving Data

[When not in SOFTWARE EXCLUSIVE (Test Run) mode]

Power ON/Restart PCU
PCU setup SOFTWARE
EXCLUSIVE mode
(Data Transfer) start

Return to normal operation status

[IN]
PCU ready

External output signal

Output cutoff

The return to normal operation status causes output to be performed based on the settings and commands enabled when the return occurred (output is updated).

When in SOFTWARE EXCLUSIVE (Test Run) mode

SOFTWARE EXCLUSIVE mode (Test Run) start

Return to normal operation status

[IN]
PCU ready

External output signal

Output hold

During SOFTWARE EXCLUSIVE mode (Test Run), the output status when SOFTWARE EXCLUSIVE mode (Test Run) started is held.

The return to normal operation status causes output to be performed based on the settings and commands enabled when the return occurred (output is updated).

8-9 Simple Backup

If you mount the PCU on the CPU Unit, all data within the CPU Unit and the internal data on the PCU are backed up to a Memory Card, restored and verified via a simple backup operation of the CPU Unit.

Outline of Operation

The data below on the internal flash memory of the PCU are backed up, restored and verified.

- Parameters (common parameters, axis parameters and memory operation parameters)
- Memory operation data
- Memory operation condition data

The aforementioned data on the internal flash memory of the PCU are backed up on the Memory Card under the file name below as "the Unit/Board backup file" when you write the data to the Memory Card via a simple backup operation. The size of the backup data per unit is 220 KB.

File name: BACKUPxx.PRM

(Note: xx indicates the PCU unit address = unit number + 20 hex)

You can also read and verify this file from a Memory Card.
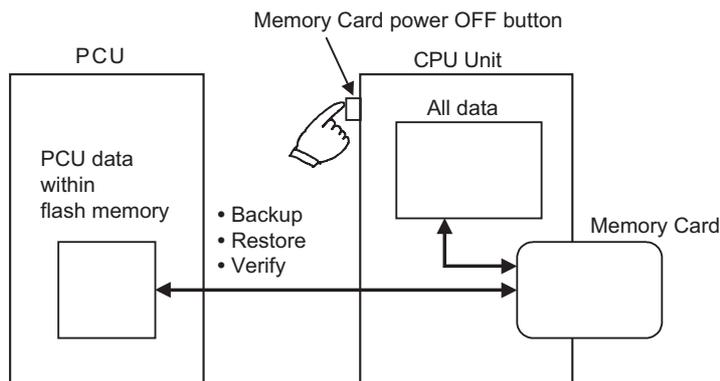
Application

You can back up the data on the entire PLC, which includes the CPU Unit, PCU, DeviceNet Unit, Serial Communication Unit and board. Since you can transfer all data at once by using this function, it is a convenient function when you replace the unit.

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Transferring and Saving Data

Operation Method

This section explains the operation methods of backing up, restoring and verifying data.

Backup

Transferring data on the PCU to a Memory Card is referred to as a backup.

Set the DIP switch on the front panel of the CPU Unit as shown below, and press and hold down the Memory Card power OFF button for 3 seconds.

DIP switch on the front panel of the CPU Unit	
SW7	**SW8**
ON	OFF
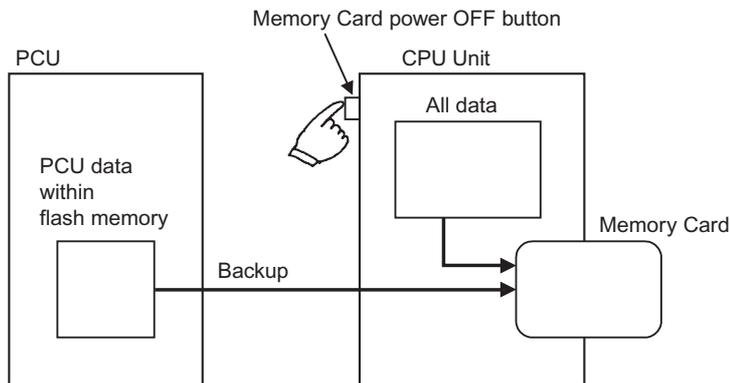
Through this operation, a PCU data file is created and is written to a Memory Card along with other backup files.
When you press and hold down the Memory Card power OFF button, the MCPWR LED on the front panel of the CPU Unit flashes once, and then turns ON when the data write is in progress. It turns OFF after the data write is completed successfully.

Restore

Transferring data from a Memory Card to the PCU is referred to as a restore.

Set the DIP switch on the front panel of the CPU Unit as shown below, and turn the power supply of the CPU Unit from OFF to ON.

DIP switch on the front panel of the CPU Unit	
SW7	**SW8**
ON	OFF
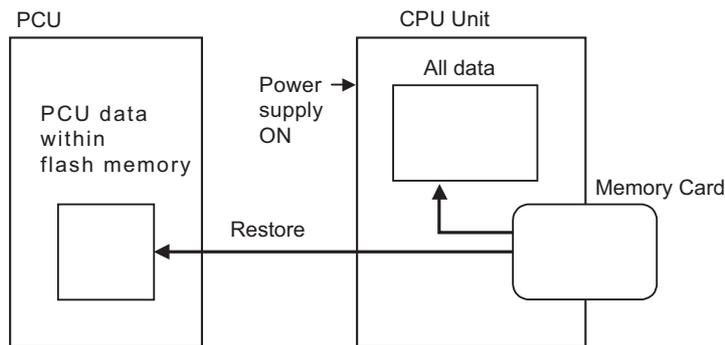
Through this operation, an PCU data file on the Memory Card is read and restored to the PCU.

![precautions icon] **Precautions for Correct Use**

♦ With the simple backup function, you must restore the data to a PCU with the same model number. You cannot restore the data to a PCU with a different model number.

![reference icon] **Reference**

♦ When you restore data, the data is read from the Memory Card onto the RAM of the PCU, and then checked. If the operation is normal, the data is automatically written to the flash memory. If the operation is not normal, a CPU Bus Unit memory error (user data) (error code: 0010) will occur. If there is a problem, a CPU Bus Unit memory error (user data) (error code: 0010) will occur.

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Transferring and Saving Data

Verification

Comparing the data on the PCU and the data on the Memory Card is referred to as a verification.

Set the DIP switch on the front panel of the CPU Unit as shown below, and press and hold down the Memory Card power OFF button for 3 seconds.

DIP switch on the front panel of the CPU Unit	
SW7	**SW8**
OFF	OFF
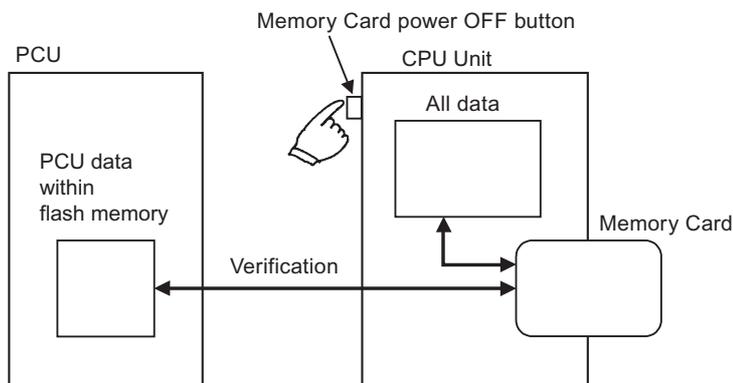
Through this operation, the data on the Memory Card and the data on the internal flash memory of the PCU are verified.
When you press and hold down the Memory Card power OFF button, the MCPWR LED on the front panel of the CPU Unit flashes once, and then turns ON when the verification is in progress. The LED turns OFF if the data are consistent after verification.

✍ **Precautions for Correct Use**

• Do not save data to flash memory in the PCU during the verification operation. It may make the verification results inaccurate.

9

Operating Functions

This chapter explains the auxiliary operation functions such as feedback position monitoring function, interrupt feeding, override and teaching.

9-1 Feedback Position Monitoring Function

With PCU of pulse-output type, the position control loop is at the driver side regardless of whether the application is of semi-closed loop or full-closed loop method.
However, this PCU can input encoder feedback.
You can use either an incremental encoder or absolute encoder.

Outline of Operation

The functional purpose of the feedback position counter on the PCU side is to perform operation checks against command positions.
Depending on the settings, you can also have the command present position and feedback position reflected in both directions, and use the feedback position for position monitoring.
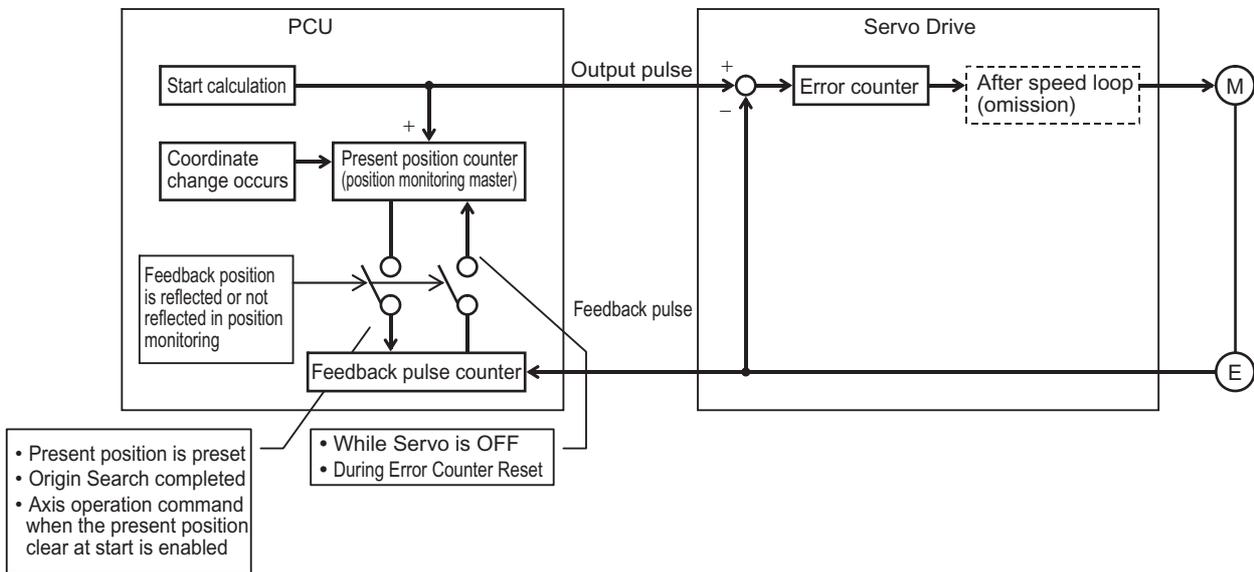
The table below shows how the command position and feedback position change at each timing.

Item	Do not use feedback positions in position monitoring		Use feedback positions in position monitoring	
	Present position counter	**Feedback position counter**	**Present position counter**	**Feedback position counter**
Power supply ON	"0"	"0"	"0"	"0"
During servo unlock	No change Hold the current command position.	Feedback position count value	Always updated by the feedback position count value.[1]	Feedback position count value
Servo lock in progress	Command count value Read value of absolute data in the case of a motor with absolute encoder[2]	Feedback position count value Read value of absolute data in the case of a motor with absolute encoder[2]	Command count value Read value of absolute data in the case of a motor with absolute encoder[2]	Feedback position count value Read value of absolute data in the case of a motor with absolute encoder[2]
During servo lock (During axis stop/ During axis operation)	Command count value	Feedback position count value	Command count value	Feedback position count value
Present position preset in progress	Preset command value	Feedback position count value	Preset command value	Preset command value
Origin Search completed	0 or origin search preset value	Feedback position count value	0 or origin search preset value	0 or Origin Search preset value
Starting present position clear enable	Preset to 0.	Feedback position count value	Preset to 0.	Preset to 0.
Starting present position clear enable	No change Hold the current command position.	No change Hold the current feedback position.	The feedback position count value is preset.[3]	No change Hold the current feedback position.

*1. Even if you execute the servo unlock after the origin is confirmed by origin search, etc., the confirmed origin is held.

*2. When connected to a Servomotor with an absolute encoder and the servo locked status changes to the servo unlocked status, the absolute data is preset in both the present position counter and the feedback position counter.

*3. After this operation, the origin confirmed status immediately before is held.

Reference

⬩ If you want to directly preset a position to the feedback position counter, you can write the position only with an IOWR instruction. For the Address areas, refer to "Other Addresses List" on page 8-18.

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Operating Functions

Axis Parameter Settings

To use the feedback position monitoring function, you must set axis parameters.
For axis parameters other than those which this section explains, refer to "Axis Parameters" on page 5-13.

Feedback Pulse Input Setting

Set the feedback method and direction of feedback pulses. For details, refer to "Feedback Pulse Input Setting" on page 5-46.

Parameter name	Function	Setting range	Unit	Default value
Feedback Pulse Method	Select the feedback pulse method to be input. 0: Phase difference pulse input (1 multiplier) 1: Phase difference pulse input (Doubler) 2: Phase difference pulse input (Quadruple) 3: Forward/Reverse direction pulse input 4: Pulse plus direction input	0 to 4	–	2
Feedback Pulse Input Direction	Select the direction of input according to the input pulse. 0: Count as the forward direction when forward direction pulse/ phase A advance pulse are input. 1: Count as the forward direction when reverse direction pulse/ phase B advance pulse are input.	0 to 1	–	1
Feedback Pulse Input Backlash Enable	Set whether to enable or disable the backlash compensation function for input feedback pulses. 0: Valid, 1: Invalid	0 to 1	–	0
Feedback Pulse Input Position Monitoring Enable	Select whether or not to reflect input pulse positions in position monitoring. 0: Not reflect, 1: Reflect	0 to 1	–	0
Feedback Pulse Input Position Reflection Mode Selection	Set the reflection method for input pulse position upon error counter reset output, when you set feedback pulse input position monitoring enable to "Reflect".[1] 0: Reflect once when the error counter reset output is ON 1: Reflect always when the error counter reset output is ON	0 to 1	–	0
Feedback Pulse Count Per Motor Rotation Mode Selection	Set the number of pulses per motor rotation for feedback position.	1 to 1,048,576	Number of pulses	10,000
Encoder Type	0: Incremental encoder 1: Absolute encoder[2] (OMNUC G5/W series) 2: Absolute encoder (OMNUC G series)	0 to 2	–	0
ABS Encoder Origin Position Offset	This stores the compensation value for absolute encoder to be taken in when you execute absolute origin setting.	–	Command unit	0

*1. Make a selection depending on whether the driver side Error Counter Reset input conforms to ON rising edge detection or ON level detection.

*2. An OMNUC G5-series absolute encoder is applicable to the PCU Unit version 1.1 or later.

Expanded Monitor Type Setting

Select the type of expanded monitor. For details, refer to "Expanded Monitor Setting" on page 5-49.

Parameter name	Function	Setting range	Unit	Default value
Expanded Monitor Type	Select the type of expanded monitor. 0: Feedback present position 1: Command present position 2: Position error 3: Present speed 4: Present command speed	0 to 4	–	0

Error Monitor Function Setting

Set the items that are necessary to monitor the position error between the command position and feedback position, and speed error between the command speed and feedback speed. For details, refer to "Error Monitor Function Setting" on page 5-51.

Parameter name	Function	Setting range	Unit	Default value
Speed Error Monitor Valid	Select whether to enable or disable the speed error monitor function. 0: Invalid, 1: Valid	0 to 1	–	0
Position Error Monitor Valid	Select whether to enable or disable the position error monitor function. 0: Invalid, 1: Valid	0 to 1	–	0
Feedback Speed Sampling Cycle	Set the sampling cycle at which to measure the feedback speed.	1 to 20	ms	10
Speed Error Monitor Dwell Time	Set the time from the output start of command speed, until the speed error monitor start.	10 to 10,000	ms	1000
Speed Error Limit Value	Set the speed error you want to monitor.	1 to 65,000	–	100
Position Error Limit Value	Set the position error you want to monitor.	1 to 65,000	Command unit	100

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Operating Functions

Other Axis Parameters

Some of the position-related parameters are commonly used for command position parameters.

Command Position Unit Setting

Set only [Feedback Pulse Count Per Motor Rotation] separately, and all other parameters use the corresponding axis parameters for command positions.
However, no compensation ratio setting function is available for feedback positions.

Software Limit Setting

Use set values in common. Use [Software Limit Function Selection] to select either the command position or feedback position.

Zone Setting

Use set values in common. Under [Zone 0 Function Selection], [Zone 1 Function Selection] and [Zone 2 Function Selection], select either the command position or feedback position.

Backlash Setting

Use set values in common.

Error between Axes Limit Value

With this function, all linear interpolation axes that use feedback positions decelerates to a stop when the difference between the feedback positions of 2 axes becomes equal to or greater than the set value of [Error Between Axes Limit Value].
This is enabled only during linear interpolation.
Use the memory operation parameter [Error Between Axes Monitor Setting] to make a setting.
For details on parameters, refer to "Error between Axes Monitor Setting" on page 5-59.

Parameter name	Function	Setting range	Unit	Default value
Error Between Axes Monitor Enable	Select whether or not to monitor the feedback counter between axes. 0: Not monitor, 1: Monitor	0 to 1	–	0
Error Between Axes Limit Value	Set the allowable error amount for the feedback counter between axes.	0 to 65535	Command unit	0
Error Between Axes Monitor Target Axis	Select the axes to monitor. 0: Not Monitor 1: Not Monitor 2: Not Monitor 3: Axes 1 and 2 4: Not Monitor 5: Axes 1 and 3 6: Axes 2 and 3 7: Axes 1 to 3 8: Not Monitor 9: Axes 1 and 4 A: Axes 2 and 4 B: Axes 1, 2 and 4 C: Axes 3 and 4 D: Axes 1, 3 and 4 E: Axes 2 to 4 F: Axes 1 to 4	0 to F	–	0

This function allows you to perform bilateral operation of 2 axes based on the completely identical command positions. This function is available only for linear interpolation operation. If a deviation occurs between the 2 axes due to an error to one axis, you can stop the axis operation automatically.

Bilateral operation of 2 axes.

Axis on one side becomes stuck and gap appears in the position error between axes.

Both axes are stopped.
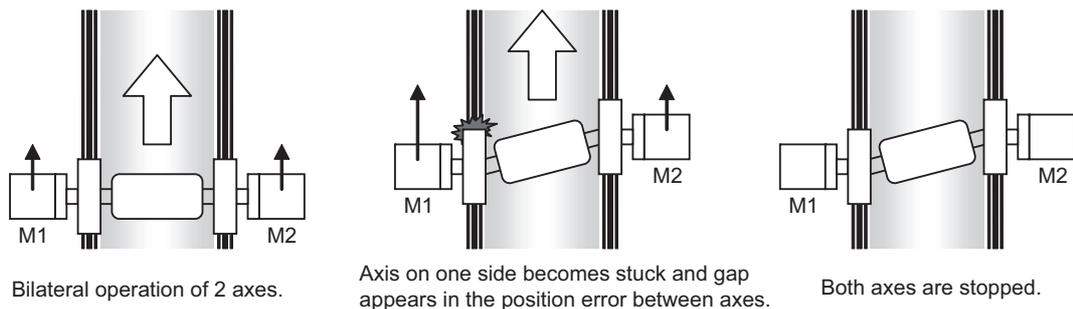
To make it easier to obtain the error between axes limit value in applications such as the above, the maximum value of an error is saved in the internal memory of the PCU during the checking of error between axes.
You can read this error between axes maximum value with [Memory Operation Monitor] in the CX-Programmer.
Take note that the error between axes maximum value which is saved in PCU is cleared to zero when the Memory Operation Start Bit or Memory Operation Independent Start Bit turns ON.

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Operating Functions

9-2   Interrupt Feeding

Interrupt feeding is a positioning function of the axis which is started in position control or speed control.
Positioning is performed by moving the axis for the specified amount from the position in which the external interrupt input is input.

Outline of Operation

Interrupt feeding for direct operation and interrupt feeding for memory operation are available. There are also 3 starting methods available for each operation: speed control, absolute movement and relative movement.
When you specify absolute movement or relative movement, you can also specify whether or not to generate an error if an interrupt input is not input within the specified amount of movement.

Movement by a constant-pitch amount
in the moving direction
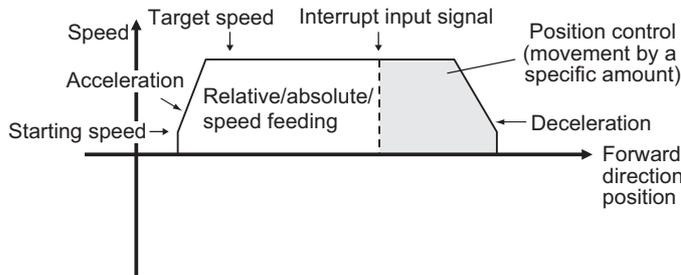
Movement by a specific amount
in the direction opposite to the moving direction
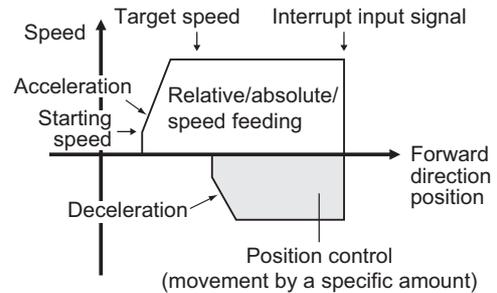
⚠️ **Precautions for Correct Use**

♦ The axis does not accelerate/decelerate when it reverses and moves in the direction opposite to the moving direction if the command position is selected for the interrupt feeding reference position.

♦ Operation when the axis reverses and moves in the direction opposite to the moving direction is controlled by the setting of the Reverse Rotation Command axis parameter if the feedback position is selected for the interrupt feeding reference position.

When the AXIS FEEDING mode is set to rotation axis, you can also set a value which is equal to or greater than the rotation axis upper limit that defines the maximum value per rotation. In other words, you can implement a stop after multiple rotations.

For the feeding reference position, you can use an axis parameter or memory operation data to select the command position or feedback position.
If you select the command position, the axis moves by the feeding amount from the command position where an interrupt input is input.
If you select the feedback position, the axis moves by the feeding amount from the feedback position where an interrupt input is input.

<Specify the feedback position>

Movement by a specified amount in the moving direction
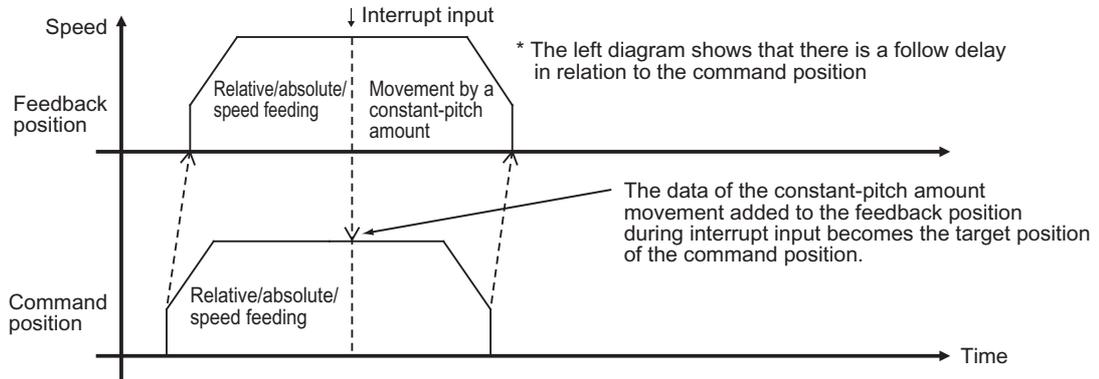
An interrupt input mask function is also available to detect only interrupt inputs within the specified range.
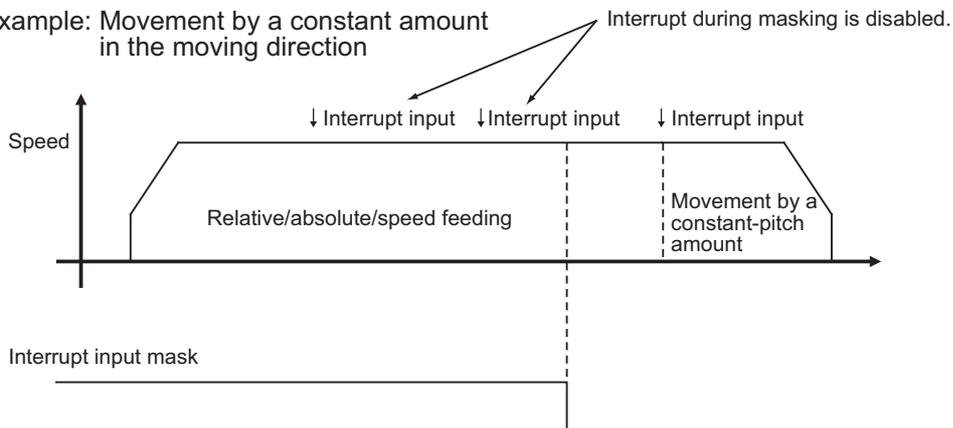
Interrupt Feeding by Direct Operation

Use axis parameters and Operation Output Memory area to set interrupt feeding by direct operation.
For direct operation, refer to Chapter 6, Direct Operation.

Axis Parameter Settings

For axis parameters other than those which this section explains, refer to "Axis Parameters" on page 5-13.

1. **Selection of [Interrupt Signal Function Selection] under [IO Function Selection]**
   Select an interrupt input as a trigger for interrupt feeding.
   For details, refer to "I/O Function Selection" on page 5-19.

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Operating Functions

2. Setting of [Interrupt Feeding Setting]

Parameter name	Contents of setting
Interrupt Feeding Reference Position/ Latch Target Position Selection	Select whether to use the command position or feedback position for the constant-pitch feeding reference position.
Interrupt Input Undetected Error Enable	Select whether to output an error when no interrupt input is input before positioning is completed, in the case of interrupt feeding by positioning control.
Interrupt Feeding Amount	Set the movement amount after an interrupt input.

For details, refer to "Interrupt Feeding Setting" on page 5-40.

Setting of Operation Output Memory Area

For the Operation Output Memory area, refer to "Direct Operation Command Memory Area" on page 5-68.

The setting method and starting method vary, between positioning control and speed control as follows.

Positioning Control

1. Setting of [Command Position]
Since you have already set the amount of movement after interrupt input by an axis parameter, specify the stopping position in case of no interrupt input here.

2. Setting of [Command Speed], [Acceleration Time] and [Deceleration Time]

3. Starting interrupt feeding
First, turn ON the [Interrupt Feeding Specification] bit.
For startup, the bit to turn ON varies depending on whether you use an absolute position or relative position for positioning control.
If you use an absolute position, turn ON the [Absolute Movement] bit. If you use a relative position, turn ON the [Relative Movement] bit.
To mask interrupt inputs during operation, turn ON the interrupt input mask bit.
Turning ON the interrupt input mask bit prevents reception of interrupt inputs.

Command position	2710 hex(10000)(position command value when there is no interrupt input)
Command speed	03E8 hex(1000)
Acceleration time	0064hex(100)
Deceleration time	0064 hex(100)
Interrupt feeding specification	
Absolute movement or relative movement	
Axis 1 interrupt input (input to PCU)	
Pulse output	Speed / Movement by a constant-pitch amount / Time
Positioning operation completed	
Axis busy	

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Operating Functions
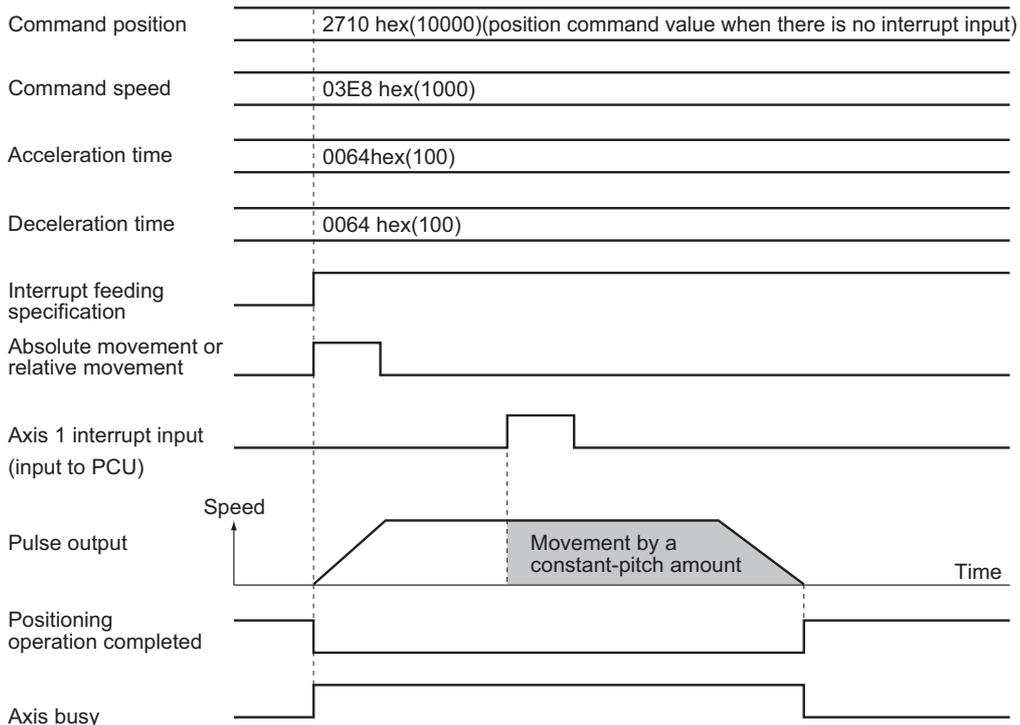
Speed Control

1. **Setting of [Command Speed], [Acceleration Time] and [Deceleration Time]**
2. **Starting interrupt feeding**

   First, turn ON the [Interrupt Feeding Specification] bit.

   Next, turn ON the [Speed Control] bit.

   To mask interrupt inputs during operation, turn ON the interrupt input mask bit.

   Turning ON the interrupt input mask bit prevents reception of interrupt inputs.

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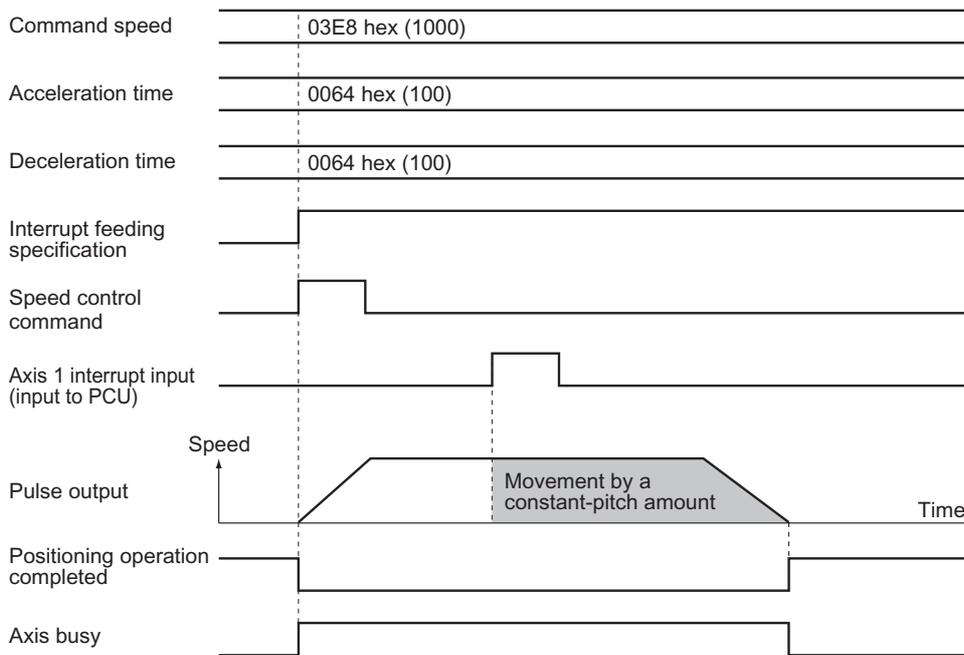
📑 **Reference**

An interrupt input is not acceptable while the operations below are in progress during interrupt feeding:

- Backlash compensation interval during interrupt feeding
- Deceleration stop interval for reversing upon duplicate starts of interrupt feeding
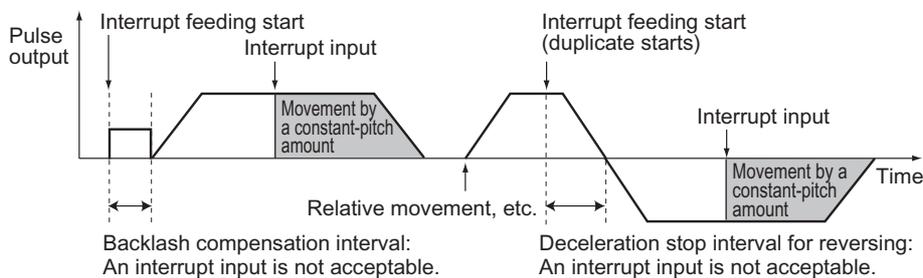
Interrupt Feeding by Memory Operation

Use axis parameters and memory operation data to set interrupt feeding by memory operation. For memory operation, refer to Chapter 7, Memory Operation.

Axis Parameter Settings

For axis parameters other than those which this section explains, refer to "Axis Parameters" on page 5-13.

1. **Selection of [Interrupt Signal Function Selection] under [IO Function Selection]**
   Select an interrupt input as a trigger for interrupt feeding.
   For details, refer to "I/O Function Selection" on page 5-19.

Memory Operation Data Settings

For memory operation data, refer to "Memory Operation Data" on page 5-87.

Just as the same as direct operation, the setting of memory operation data varies between positioning control and speed control.

Positioning Control

1. **Setting of the sequence data [Command]**
   Set [Interrupt Feeding (Positioning Operation)] in the sequence data [Command].
   For details on the setting method for sequence data, refer to "Interrupt Feeding (Positioning Operation)" on page 7-25.
2. **Execution of memory operation**
   Execute memory operation.
   For memory operation, refer to Chapter 7, Memory Operation.

Speed Control

1. **Setting of the sequence data [Command]**
   Set [Interrupt Feeding (Speed Control)] in the sequence data [Command].
   For details on the setting method for sequence data, refer to "Interrupt Feeding (Speed Control)" on page 7-28.
2. **Execution of memory operation**
   Execute memory operation.
   For memory operation, refer to Chapter 7, Memory Operation.

9-3 Override

Override is a function that uniformly decreases or increases all operation speeds without changing the speeds which you specified by command speed.
The PCU multiplies each specified speed by a desired ratio to calculate the operating speed and changes the current speed to the calculated speed.

Outline of Operation

Load the set value of [Override] to change the speed while [Override Valid] in the Manual Operation Command Memory area is ON.

$$\text{Target speed} = \text{Speed command} \times \frac{\text{Override}}{100}$$

You can set a desired value between 0.00 and 500.00%. If you specify 0.00%, the PCU functions in the same manner as when you set 0.01%.

Override is enabled during the operations below:

* Direct operation
* Memory operation
* JOG operation/inching operation
* Origin Return

If the target speed exceeds the maximum speed which you set by an axis parameter, the target speed becomes the maximum speed.
Override is disabled during Origin Search and MPG operation and also when the synchronization control function is active.

Override value can be loaded and speed can be changed when override is enabled.
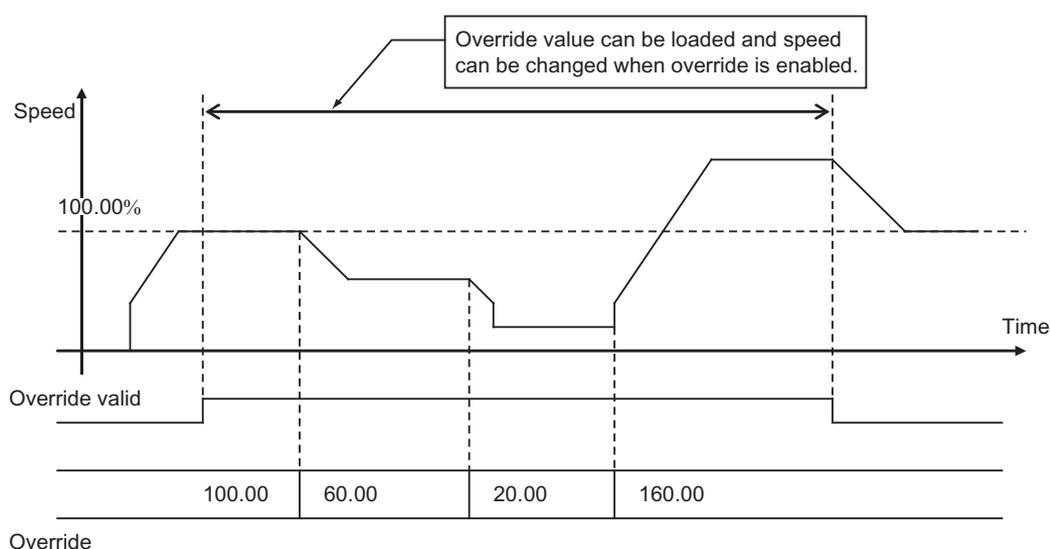
Precautions for Correct Use

* Use caution when you turn OFF the override enabled memory area because doing so turns the override value back to 100%.

Override in Operations Other than Memory Operation

The effective ranges of override in direct operation, interrupt feeding, JOG operation/inching operation and Origin Return are as follows.

In direct operation, override functions in the same manner as the command speed change during operation.

Override can be performed at any time during this span. (While the speed is changing (accelerating, decelerating) due to an override change, the speed can be changed again by changing the override.)

Override cannot be performed during deceleration for stopping.
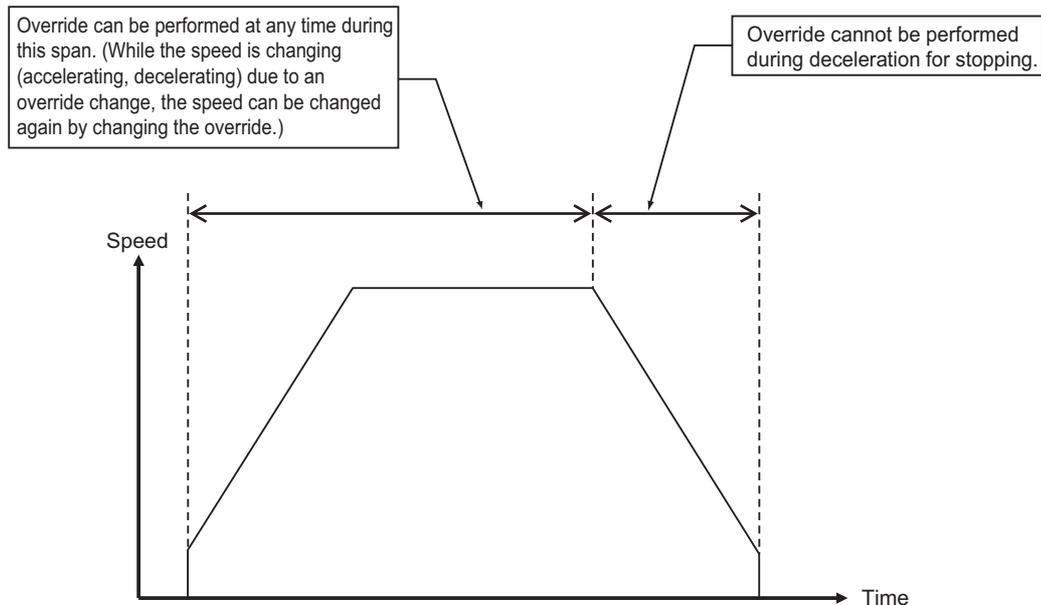
If you change the override value during operation, the axis accelerates/decelerates to the target speed that reflects the override value. If the acceleration/deceleration designation method is [Acceleration/Deceleration Time Selection], the axis starts to accelerate/decelerate toward the changed speed from the moment the override is changed.

Override in Memory Operation

In memory operation, the operation varies depending on [Command] and [End Pattern].

Difference by Command

Positioning Operation

Override is enabled for each axis.

Linear Interpolation Operation

Use the override of the highest priority axis among the task configuration axes.

📑 **Reference**

⬩ The axis priorities are axis 1, axis 2, axis 3 and axis 4, in the order from high to low.

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Circular Interpolation

Use the override of the highest priority axis among the task configuration axes.

Speed Control

Override is enabled for each axis.

Interrupt Constant-pitch Feeding

Override is enabled for each axis.

Difference by End Pattern

In memory operation, load the override setting at the timing as follows:

Independent or Automatic

Continuous 1

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Continuous 2

Override is enabled during this interval.

Override changes are immediately reflected even while speed changes to the next sequence data are occurring. Refer to Override Change during Passing.

Override is disabled during the deceleration interval for stopping

Speed

Sequence 1   Sequence 2   Time
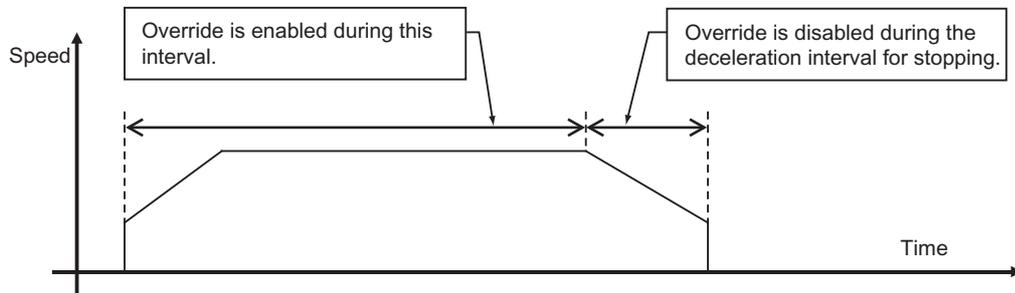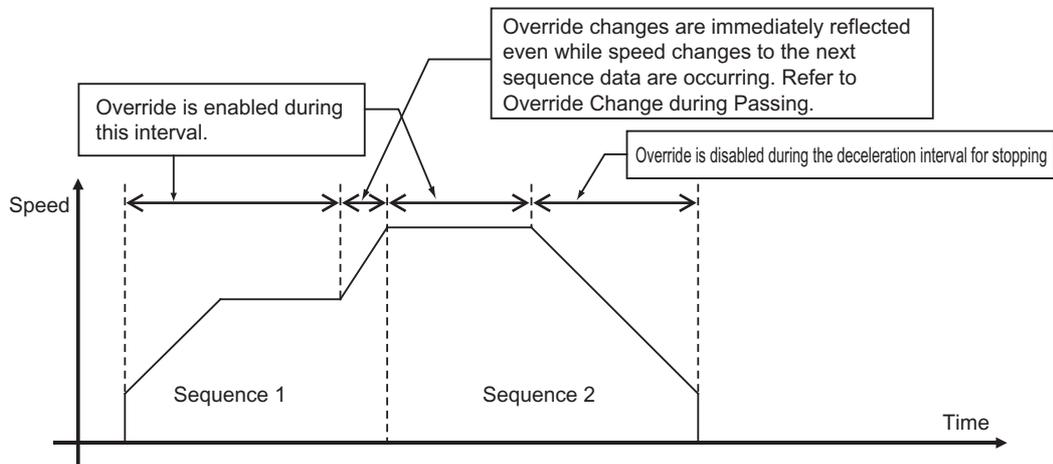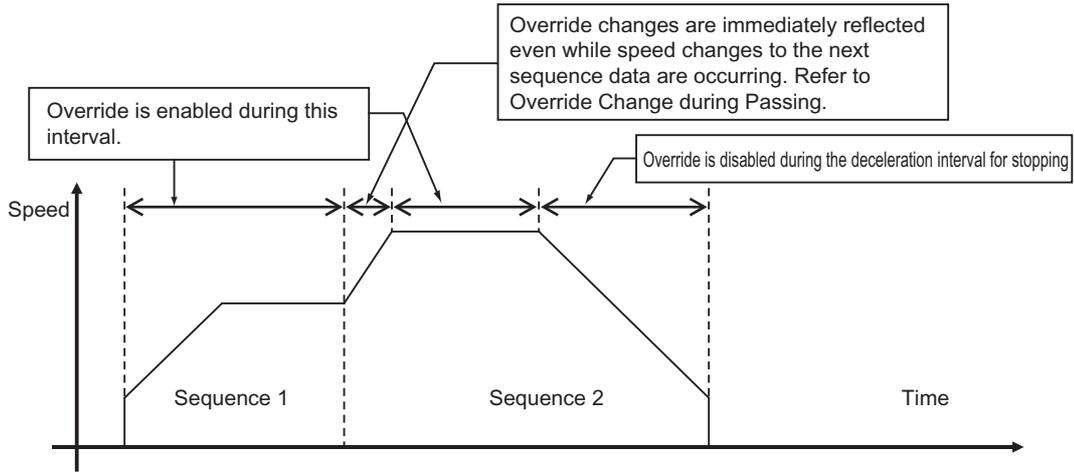
Continuous 3

Override changes are received during passing in sequence data, but the actual speed change does not take place until after passing is complete.

Override is enabled during this interval.

Override is disabled during the deceleration interval for stopping

Speed

Sequence 1   Sequence 2   Time

Override Change during Passing of Continuous 1 and Continuous 2

If the completion pattern is [Continuous 1] or [Continuous 2], any change in the override value which you make during acceleration/deceleration between sequences is reflected immediately. The acceleration/deceleration behavior changes at the switching point of sequences.

This section explains how the axis moves when you change the override value to 150% while sequence 1 is shifting to sequence 2 in case of [Continuous 1].

When Acceleration/Deceleration Time Selection is [Acceleration/Deceleration Specified]

If you select [Acceleration/Deceleration Specified], the axis starts to accelerate/decelerate to ward the changed speed according to the acceleration/deceleration which you specified in sequence 1 by changing the override.
Thereafter when the amount of movement in sequence 1 is completed, the sequence switches to sequence 2 and the axis operates according to the acceleration/deceleration which you specified in sequence 2.

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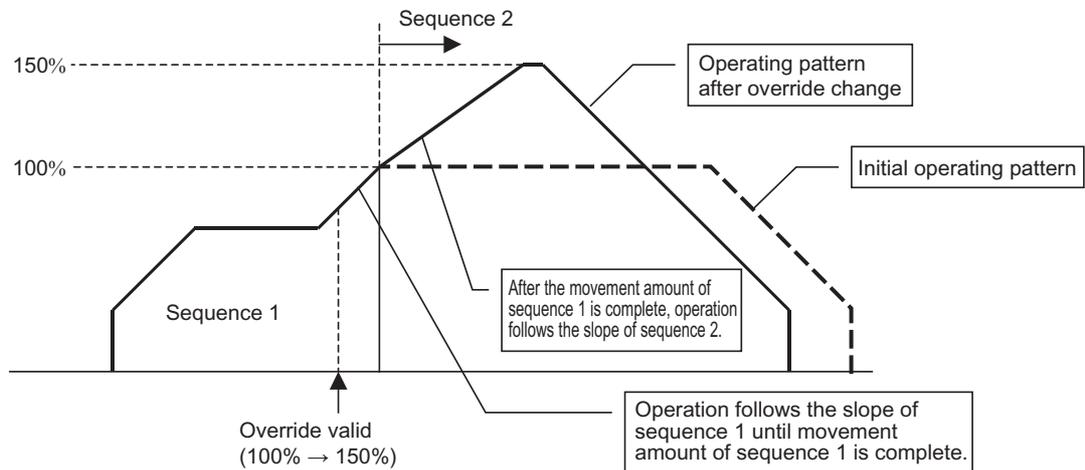
When Acceleration/Deceleration Time Selection is [Time Specified]

If you select [Time Specified], the axis starts to accelerate/decelerate toward the changed speed from the moment the override is changed according to the acceleration/deceleration time which you specified in sequence 1.

Thereafter when the amount of movement in sequence 1 is completed, the sequence switches to sequence 2. The moment the sequences switch, the axis starts to accelerate/decelerate according to the acceleration/deceleration time which you specified in sequence 2.

If acceleration/deceleration time is specified, from the moment the override is changed, acceleration/deceleration starts toward the changed speed according to the acceleration/deceleration time specified in sequence 1. If the sequence 1 target position is reached during the acceleration/deceleration, sequence 2 takes over and from that moment on acceleration/deceleration starts toward the changed speed (after override change) according to the acceleration/deceleration time specified in sequence 2.

Memory Area to Be Used

Use the Manual Operation Command Memory area to set the override function for both direct operation and memory operation.

Use the [Override Valid] bit in the Manual Operation Command Memory area and [Override] bit.

[Override Valid] and [Override] are available for each axis.

For details, refer to "Manual Operation Command Memory Area" on page 5-67.

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9-4   Torque Limit

This function turns ON/OFF the torque limit output to the Servo Drive from the PCU.
Turning ON/OFF the [Torque Limit Output] bit in the [Manual Operation Command Memory Area] turns ON/OFF the torque limit output at the Servo Drive connector.

> **Reference**
>
> ◆ Even when the torque limit output of the Origin Search function is controlled automatically, you can still turn ON/OFF the torque limit output. In this case, however, whether the signal is output is determined based on the OR condition with the automatic control.

Normal Torque Limit

Torque limit by normal positioning, such as holding control, is based on ON/OFF control of the torque limit output by a ladder program.

Automatic Control during Origin Search

If you select [B: Proximity Rev Turn/ Holding Time], [C: Proximity Rev Turn/ Holding Origin Input] or [D: No Origin Proximity Input/ Holding Origin Input] for Origin Search operation, the torque limit output is controlled automatically.

Under automatic control of the torque limit output during Origin Search, the torque limit output remains ON even after Origin Search completed (after the origin confirmation).
For details, refer to "Operation by 11: Proximity Reverse Turn and Holding Time Specified" on page 4-31, "Operation by 12: Proximity Reverse Turn and Holding Origin Input Specified" on page 4-31 and "Operation by 13: No Origin Proximity Input and Holding Origin Input Specified" on page 4-32.

If the axis moves in the direction opposite to the origin input detection direction, the torque limit output turns OFF.
If you perform origin compensation operation in the reverse direction against the origin input detection direction, for example, the torque limit output turns OFF at the start of origin compensation operation.

Connection with Servo Drive

If you use the torque limit function, a torque limit switch input is necessary for the Servo Drive. Change the Servo Drive setting so as to use the torque limit switch input below:

Servo Drive	Input signal to be used	Necessary setting	Remarks
G5 Series (R88D-KTx)	TLSEL (Torque limit switch)	Torque Limit Selection (Pn521) = 3 or 6	TLSEL is set to be allocated to pin 8, 9, or 26 to 33 of the control input connector (CN1). Set it as a NO input.

Servo Drive	Input signal to be used	Necessary setting	Remarks
G-series (R88D-GTx)	TLSEL (Torque limit switch)	Torque Limit Selection (Pn03) = 3	TLSEL is allocated to pin 27 of the control input (CN1).
W-series[1] (R88D-WTx)	PCL (forward current limit input) or NCL (reverse current limit input)	PCL Signal Input Terminal Allocation (Pn50b.02), NCL Signal Input Terminal Allocation (Pn50b.03)[2]	PCL and NCL are allocated to pins 40 to 46 of the control input (CN1) according to the settings. Set a value in a range of 0 to 6. (The setting becomes effective with an "L" input.)
SMARTSTEP2 Series (R7D-BPx)	TLSEL (torque limit switch)	Zero Speed Designation/ Torque Limit Switch (Pn06) = 2	TLSEL is allocated to pin 5 of the control input (CN1).

*1. The PCL signal and NCL signal are allocated to pins 45 and 46 respectively as the default settings of the W-series Servo Drive.

*2. Allocate a signal in the direction which requires the torque limit.

Note. The torque limit function is not available with the SMARTSTEP A-series Servo Drive (R7D-APx).

Connection example
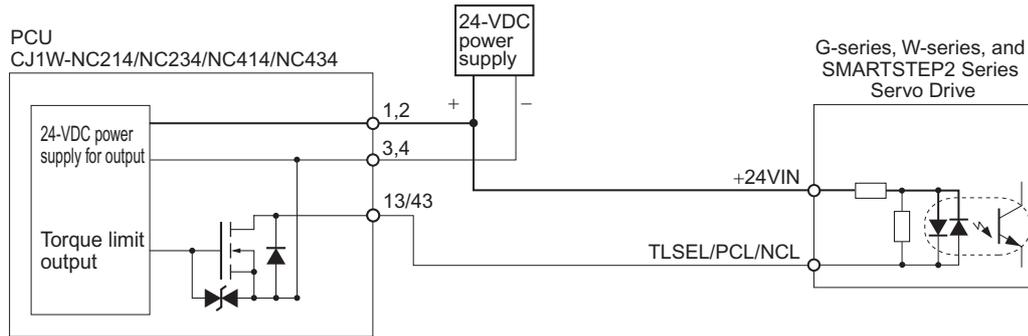
Note. If you are using a W-series Servo Drive, set and connect the signals so as to enable the torque limit in the Origin Search direction (origin input detection direction).

Torque Limit Operation

The torque limit operation of the Servo Drive is as follows.

Servo Drive	Torque limit output OFF	Torque limit output ON
G5 Series (R88D-KTx)	Torque Limit Selection (Pn521) = 3: No. 1 Torque Limit (Pn013) limits the motor output torque. Torque Limit Selection (Pn521) = 6: No. 1 Torque Limit (Pn013) limits the motor output torque for forward rotation and No. 2 Torque Limit (Pn522) limits the motor output torque for reverse rotation.	Torque Limit Selection (Pn521) = 3: No. 2 Torque Limit (Pn522) limits the motor output torque. Torque Limit Selection (Pn521) = 6: Forward External Torque Limit (Pn525) limits the motor output torque for forward rotation and Reverse External Torque Limit (Pn526) limits the motor output torque for reverse rotation.
G-series (R88D-GTx)	No. 1 Torque Limit (Pn5E) limits the motor output torque.	No. 2 Torque Limit (Pn5F) limits the motor output torque.

Servo Drive	Torque limit output OFF	Torque limit output ON
W-series (R88D-WTx)	The Forward External Torque Limit (Pn404) or Reverse External Torque Limit (Pn405) does not limit the motor output torque.	When the PCL signal is ON: The Forward External Torque Limit (Pn404) limits the motor output torque in forward direction. When the NCL signal is ON: The Reverse External Torque Limit (Pn405) limits the motor output torque in reverse direction.
SMARTSTEP2 Series (R7D-BPx)	The Torque Limit (Pn5E) limits the motor output torque.	No. 2 Torque Limit (Pn71) limits the motor output torque.

Note. For details on the torque limit function of the Servo Drive, refer to the User's Manual for each model. In the automatic control of torque limit output during Origin Search, the output signal turns ON when a torque limit is applied. Set an appropriate torque limit value so as to match the aforementioned operation when the torque limit output turns ON with that of the holding direction.

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9-5 Teaching

Teaching refers to the process of moving the axis to a desired position and then loading the present position of the axis as position data.
The position data which received teaching is taken in the PCU as memory operation data.

Outline of Operation

Perform teaching for each task.
When [Teaching] bit in the Memory Operation Command Memory area turns ON, the present positions of all axes which are included in the task are taken in the specified sequence number.
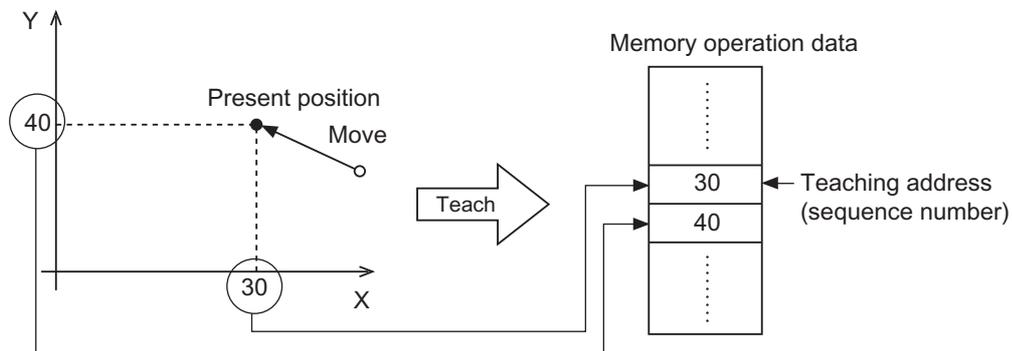
Precautions for Correct Use

- Although you can execute teaching regardless of whether the origin is confirmed, exercise caution because the captured position data may be different from the data which you loaded before the origin confirmation.
- Any position data you loaded into the PCU via teaching is lost if you turn OFF the PLC power supply or restart the unit. To save the loaded position data, save the data. For the save, refer to "Saving Data" on page 8-42.
- To move the axis to a position loaded by teaching, select [Specify Absolute Position] for [Position Specification]. If you select [Specify Relative Position], the axis may move to a position which is different from the teaching position.

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Teaching Procedure

Follow the procedure below to execute teaching:

1. **Set the memory operation parameter [Teaching Object]**
   Select whether to use the command position or feedback position for the target position data of teaching.

2. **Move the axis to the position you want to perform teaching**
   Move each axis to the position which you want to perform teaching by using JOG, etc.

3. **Set [Teaching Address] in the Memory Operation Command Memory area**
   Set the sequence number under which you want to store the position data which received teaching.

4. **Execution of teaching**
   Turn ON the [Teaching] bit to execute teaching.

Timing Chart

The following shows the timing chart of position data to be taken in sequence No. 2.
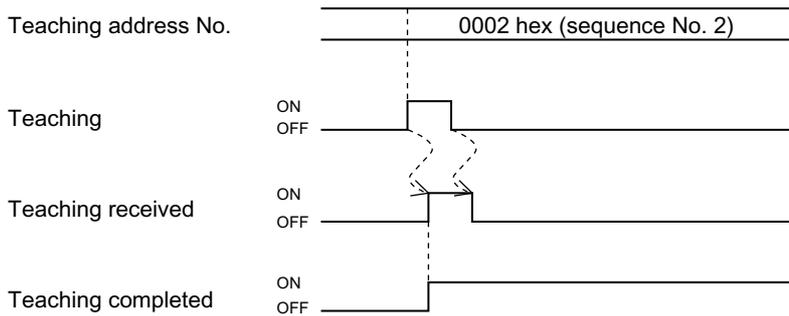
9-6 In-position Check

This function judges the completion of positioning by loading in the PCU the positioning completed signal of the Servo Drive at the completion of positioning to the command position.

Operating Procedures

Follow the procedure below to use the in-position check function.

1. **Setting of the axis parameter [Positioning Completed Input Function]**
   Use [Positioning Completed Input Function] to select whether or not to load the positioning operation completed signal from the Servo Drive to the PCU.
   This is settable for each axis, because some Servo Drives have no positioning completed signal.

2. **Setting of the sequence data [Positioning Monitoring Time]**
   Set any value other than [0] for the Position Monitoring Time to enable the positioning completion input monitor. Setting this parameter in combination with the [Positioning Completed Input Function] setting enables in-position check.

3. **Setting of the sequence data [Positioning Completed Input Monitor Valid]**
   In memory operation, use the sequence data [Positioning Completed Input Monitor Valid] setting in combination with above settings 1 and 2 to set whether or not to perform in-position check.

Operating Method

You can set whether or not to perform in-position check on the position control operations of direct operation and memory operation.
Accordingly, start the next operation without waiting for in-position check if you want to perform the operation as quickly as possible.
On the contrary, perform in-position check if you want to confirm completion of positioning before the next operation starts.

Note, however, that in-position check is not performed for the stopping of operations below:

• Synchronous control
• JOG operation
• MPG operation
• Deceleration stop
• Stopping due to an error
• Stopping of reversing operation during Origin Search
• Stopping of reversing operation due to duplicate starts
• Stopping of reversing operation under interrupt feeding control

Precautions for Correct Use

• Even if you select [1] (use as positioning completed input) for the Positioning Completed Input Function axis parameter, setting [0] for the Position Monitoring Time will disable the monitoring the positioning completed input from the Servo Drive. If you wish to use the positioning completed signal from the Servo Drive to check the completion of the positioning operation, set any value other than [0] for the Position Monitoring Time parameter.

📑 **Reference**

• You can also combine this function with the axis parameter [Positioning Monitoring Time Setting] to output an error when a positioning completed signal is not input from the Servo Drive within the monitoring time after the output of a positioning command pulse.

• If you set [0] for the Position Monitoring Time axis parameter, the positioning completed input will not be monitored regardless of this setting. To use in-position check function, set any value other than [0] for the Position Monitoring Time.

● Using the in-position check function with any value other than [0] set for the Position Monitoring Time

After outputting the pulse command, the PCU monitors the positioning completion input signal. (If the signal is not input within the Position Monitoring Time set, an error will occur.)

Speed

Command speed

Time

Positioning completed input signal

The positioning completed flag turns ON through reception of the positioning completed input signal.

Positioning operation completed

● Not using the in-position check function or setting [0] for the Position Monitoring Time

Speed

Command speed

Time

The positioning completed flag turns ON at completion of using speed command pulses output regardless of using the positioning completed input signal or not.

Positioning operation completed

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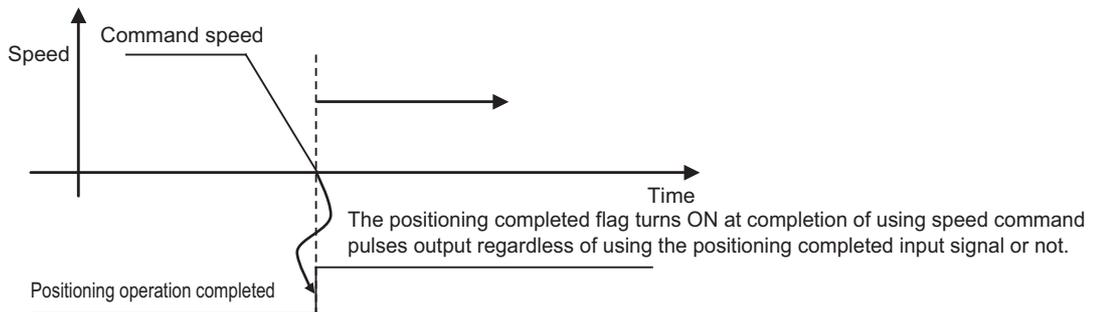
9-7 Present Position Latch Function

The present position latch function loads into the PCU the position data which is valid at the time an external interrupt input is input.
You can select the command position or feedback position for the position data.

Operating Procedures

If you use the present position latch function, follow the procedure below to set the function:

1. **Setting of the common parameter [Latch Object Axis Selection]**
   Use [Latch Object Axis Selection] to set the axis whose present position you want to latch upon interrupt input through the external signal connector.
   Present position latch 1 target axis selection corresponds to the interrupt input for axis 1. Similarly, present position latch 2 target axis selection, present position latch 3 target axis selection and present position latch 4 target axis selection correspond to the interrupt inputs for axes 2, 3 and 4, respectively.
   You can specify a desired axis for each latch signal, but you cannot set 3 latch signals and more for 1 axis.

2. **Setting of the axis parameter [Interrupt Signal Function Selection] under [Interrupt Signal Function Selection]**
   For each axis, use [Interrupt Signal Function Selection] to select the use of an interrupt input signal as a present position latch signal.

3. **Setting of the axis parameter [Interrupt Feeding Reference Position/ Latch Target Position Selection] under interrupt feeding setting**
   Use [Interrupt Feeding Reference Position/Latch Target Position Selection] to select whether to use the command position or feedback position for the position to be latched.

4. **Turning ON the present position latch enabled**
   Turn ON the [Interrupt Input Mask Enable/Present Position Latch Enable] bit in the Direct Operation Command Memory area.
   Turning OFF the present position latch enabled prevents reception of interrupt input.

5. **Starting the interrupt input**
   Load position data into the PCU the moment the interrupt input turns ON. When the present position latch is executed, [Latch Completed] in the Axis Status Memory area will turn ON.

6. **Read data**
   To read the latched position data, use an IORD instruction.
   The data address is as follows:

Data name	Parameter type	Unit Address
Axis 1 latch data	1201 hex	0000 hex (rightmost word)
		0001 hex (leftmost word)
Axis 2 latch data	1202 hex	0000 hex (rightmost word)
		0001 hex (leftmost word)
Axis 3 latch data	1203 hex	0000 hex (rightmost word)
		0001 hex (leftmost word)
Axis 4 latch data	1204 hex	0000 hex (rightmost word)
		0001 hex (leftmost word)

For data read, refer to Chapter 8, Data Transfer.

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7. Resetting the latch completed flag

You cannot execute the next latch unless you reset the current latch.

To reset the latch completed flag, turn ON [Latch Completed Clear] in the Direct Operation Command Memory area. Turning ON [Latch Completed Clear] also clears the latch data to 0.

Timing Chart

The following shows the timing chart when you use the present position latch function.
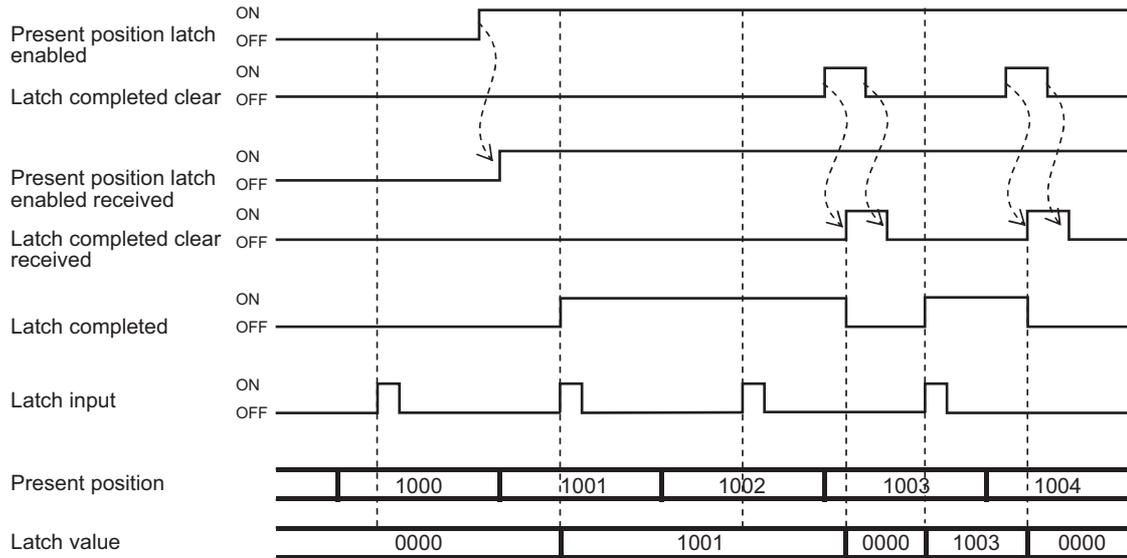
When present position latch enabled is OFF, the present position is not latched even if there is latch input.

If the present position latch is executed, latch completed turns ON. The next present position latch will not be executed until latch completed is cleared.

9-8 Backlash Compensation

Backlash refers to the meshing error between the driving side and driven side.
If there is a backlash, a positioning deviation occurs by the amount of backlash in both forward and reverse directions. Perform backlash compensation to reduce this deviation.

Outline of Operation

A backlash occurs when the axis performs positioning in the reverse direction after positioning in the forward direction, or when the positioning direction reverses. Output additional pulses by the number of pulses which you set by the backlash compensation amount, to compensate for the backlash.

```
                            Backlash
Driven side                             Positioning in forward direction
                                        Driving side position = Driven side position

Positioning in forward direction
              Driving side

                                        Positioning in reverse direction
                                        Driving side position = Driven side position – backlash compensation amount

                      Positioning in reverse direction

                 Same position
```
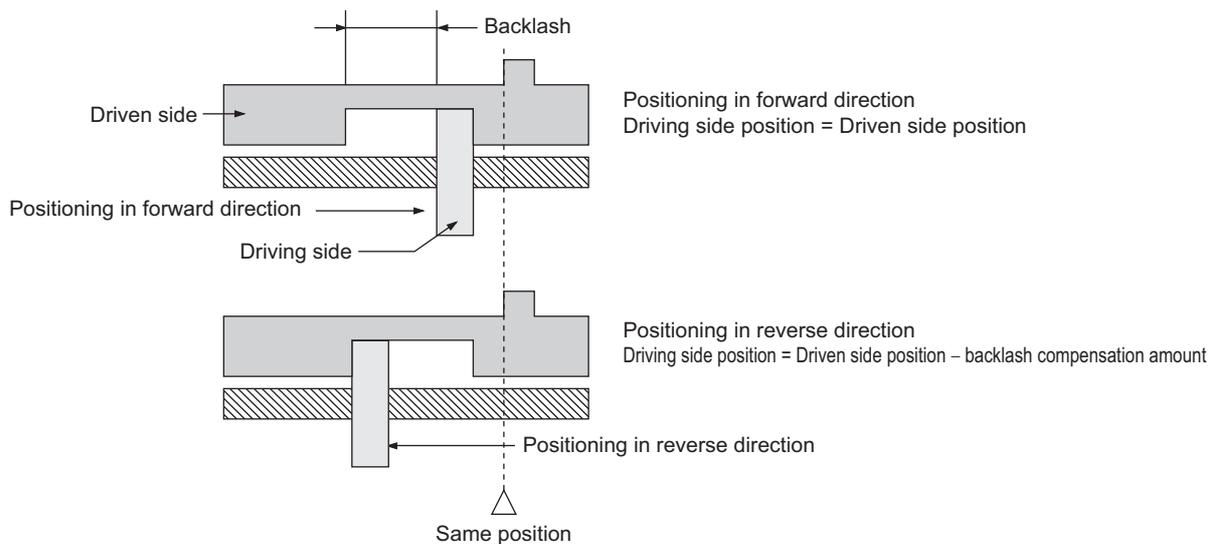
Backlash compensation is not performed during the initial operation after you turn ON the PCU power supply or restart the PCU. The compensation function becomes effective when the axis moves in the opposite direction next.
With the PCU, you can specify the backlash compensation amount and compensation speed by axis parameters.
If you set the backlash compensation speed to 0, the compensation is output at the initial speed for starting the axis.

✋ Precautions for Correct Use

• When deceleration stop is turned ON while outputting the pulse for the backlash compensation amount, a deceleration stop is not executed immediately but a stop is executed after output of the pulse for the backlash compensation amount is completed. Be careful if a large value will be set for the backlash compensation amount.

•With a rotation axis, you cannot set a backlash compensation amount that exceeds the rotational axis upper limit. Doing so generates a parameter error.

• If the AXIS FEEDING mode is set to Linear axis, the upper/lower limits of the effective range of command positions are reduced by the backlash compensation amount.

📝 Reference

• Backlash compensation is not performed during Origin Search, MPG operation and synchronous feeding. In the case of a Virtual Axis, backlash compensation is disabled.

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Backlash Output Method

2 output methods are available for backlash compensation value: a method to superimpose compensation amount at start of positioning, and a method to perform compensation operation before start of positioning.

Method to Superimpose Compensation Amount at Start of Positioning

This is a method to add the backlash compensation amount to the first command value of positioning operation.

Speed

Compensation amount + first command pulse is output over the time of 1 control cycle

Time
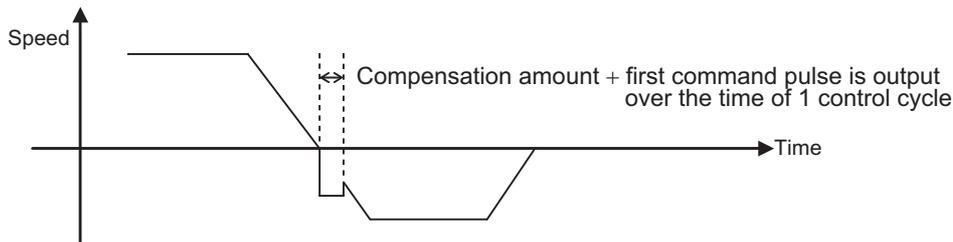
Precautions for Correct Use

• Under the method to superimpose compensation amount at start of positioning, the backlash compensation amount is output within 1 control cycle. Accordingly, the backlash compensation amount is limited by the control cycle and maximum speed. An error occurs if you cannot output the backlash compensation amount within 1 control cycle.

Method to Perform Compensation Operation before Start of Positioning

This is a method to output the compensation value according to the backlash compensation amount and compensation speed specification.

Speed

Movement time according to backlash compensation amount and compensation speed

Time
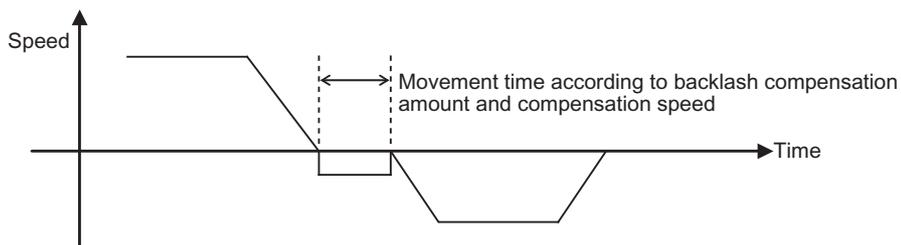
Precautions for Correct Use

• In circular interpolation control and end pattern [Continuous 3], you cannot use the method to perform compensation operation before start of positioning. Doing so generates an error at the start.

Backlash Compensation to Feedback Positions

Backlash compensation is also effective for feedback positions. This setting uses the axis parameter [Backlash Setting].

To perform backlash compensation for feedback positions, the [Command Pulse Count Per Motor Rotation] settings for command position and feedback position must be matched.

For the command position, refer to "Command Position Unit Setting" on page 5-30. For the feedback position, refer to "Error Monitor Function Setting" on page 5-51.

You can also use [Feedback Pulse Input Backlash Enable] to enable/disable the backlash compensation function only for feedback positions.

This is because there is a semi-closed loop method and a full-closed loop method for feedback. Backlash compensation is enabled under the semi-closed loop method and disabled under the full-closed loop method.

For [Feedback Pulse Input Backlash Enable], refer to "Feedback Pulse Input Setting" on page 5-46.

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Synchronous Unit Operation Function

This chapter explains an outline of the Synchronous Unit Operation function and procedure to use this function.

10-1 Outline

When you combine the PCU with a CJ2 CPU (unit version 1.1 or later), the PCU makes it possible to use the synchronous unit operation function that synchronizes the CPU with the I/O processes of the PCU at specified intervals.

This section explains an outline of the synchronous unit operation function and procedure to use this function.

Synchronous Unit Operation Function

This function synchronizes the start timing of the internal processes and data exchange between the CPU Unit and multiple Special I/O Units via synchronization signals which the CPU Unit sends at specified intervals.

Synchronized Starting of Internal Processes

The CPU Unit can execute interrupt tasks in synchronization with data exchange with the Special I/O Unit.

Multiple Special I/O Units synchronize the start timing of their internal processes according to the synchronization signals from the CPU Unit.

Synchronized Data Exchange

Between the CPU Unit and multiple Special I/O Units, or among the Special I/O Units, data is exchanged according to the timing of the synchronization signal.

CJ2 CPU Unit
(unit version 1.1 or later)

Special I/O Units
(units for the synchronous unit operation function)

Synchronous signals

(1) The CPU Unit sends the synchronous signals.

(2) Internal processing of each unit is synchronized with each other.

Synchronized interrupt task   Internal processing of each unit

Synchronous data refresh

(3) Data is exchanged according to the synchronized timing.

Data exchange is possible with the operation of multiple Special I/O Units synchronized with each other.

Precautions for Correct Use

To use the synchronous unit operation function, you must combine these units.

⬩ CJ2H CPU Unit of version 1.1 or later
⬩ Special I/O Unit which supports the synchronous unit operation function (hereinafter called as Synchronous Unit)

To use the synchronous unit operation function, the internal control cycle of the PCU synchronizes with the synchronous operation cycle of the CPU Unit. Accordingly, the responsiveness of the PCU varies depending on the synchronous operation cycle.

Setting Procedure

The synchronous unit operation functions for Synchronous Units installed on the CPU Rack. Register Synchronous Units on the PLC Settings window of the CPU and enable synchronous unit operation, and the units will operate under synchronous unit operation.

The following is the procedure to perform synchronous unit operation.

1. Registration on PLC Setup
Select the [Use Synchronous Operation] check box under [Synchronous Unit Operation Settings] on the PLC Settings window of CX-Programmer.
Set [Synchronous Cycle Time] and register [Synchronous Unit] as well as [Input Size] and [Output Size] of the Synchronous Data Refresh area.
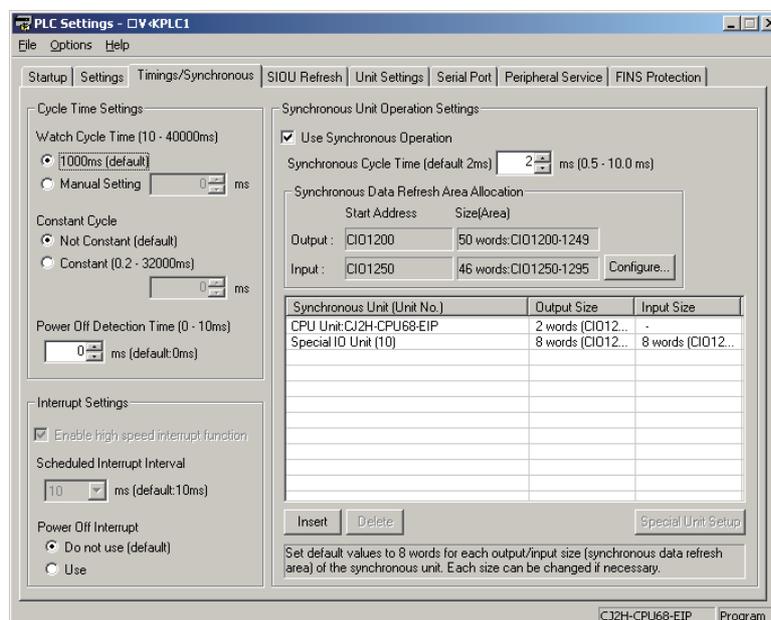
Precautions for Correct Use

♦ To perform synchronous unit operation with the PCU, set a synchronous cycle time in a range of 1 to 10 ms.

2. Setting of Synchronous Operation Parameters for PCU

On the [Synchronous Unit Operation Settings] of the PLC Settings window, select [Special Unit Setup] and allocate [Output] and [Input] for the PCU.
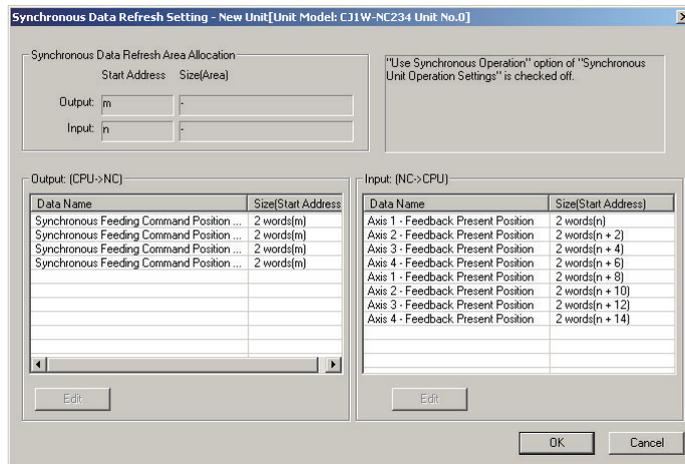
3. Transfer of PLC Settings and PCU Setup

On the transfer window of CX-Programmer, select [Settings] and [Special Unit Setup] and transfer the setup data to the PLC.
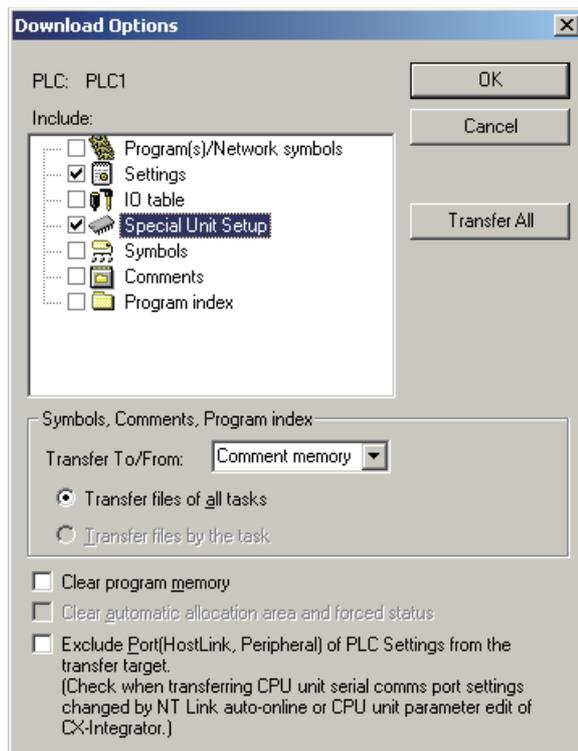
For the synchronous data refresh by synchronous unit operation, and the synchronous feeding function of the PCU that uses the synchronous data refresh, refer to "Synchronous Data Refresh" on page 10-9 and "Synchronous Feeding" on page 10-15.

Synchronous Unit Operation Function

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Special I/O Unit Precautions

When you execute the synchronous unit operation function, Special I/O Unit restart functions as follows.

Special I/O Unit Restart (AR502)

Since the CPU and All Synchronous Units operate at the same control timing under synchronous unit operation, you cannot restart Synchronous Units individually. If you execute a Special I/O Unit restart for a given Synchronous Unit, All Synchronous Units restart and effectively execute a restart of the entire synchronous unit operation function.

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Synchronous Unit Operation Function

10-2 Parameter Settings

This section explains [Common Parameter] and [Axis Parameter] which you use in synchronous unit operation.

Common Parameter Settings

You can only set the parameters below for the common parameters in relation to the synchronous unit operation function.

SYNCHRONOUS OPERATION Mode Selection

This is enabled only when you set the synchronous data refresh for output to the CPU. SYNCHRONOUS OPERATION mode selection becomes enabled at power ON, restart, or setup.

Parameter name	Function	Setting range	Default value
Synchronous Data Send Selection 1	Select the axis number and monitor type for each selected data.		Axis 1, feedback present position
Synchronous Data Send Selection 2	The first 2 digits of the word indicate the axis number, while the last 2 digits indicate the monitor type.		Axis 2, feedback present position
Synchronous Data Send Selection 3			Axis 3, feedback present position
Synchronous Data Send Selection 4	Axis number 01 to 04: Physical axis number F1: External encoder axis	0100 to 0404 hex F100 to F104 hex	Axis 4, feedback present position
Synchronous Data Send Selection 5	Monitor type		Axis 1, feedback present position
Synchronous Data Send Selection 6	00: Feedback present position 01: Command present position 02: Position error		Axis 2, feedback present position
Synchronous Data Send Selection 7	03: Present speed (calculation from the feedback position)		Axis 3, feedback present position
Synchronous Data Send Selection 8	04: Present command speed		Axis 4, feedback present position

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Synchronous Unit Operation Function

Axis Parameter Settings

You can set 2 axis parameters in relation to the synchronous unit operation function: [Synchronous Group Stop Selection] and [Synchronous Feeding Command Position Data].

Synchronous Group Stop Selection

Synchronous Data Refresh areas are allocated to the I/O areas 1,200 to 1,295 words in the CPU.
You can set the CPU and PCUs, respectively, to exchange data between the CPU and the allocated areas of each PCU.
Synchronous group stop selection supports bits 00 to 14 in the Synchronous Data Refresh area 1,200 word. Select whether or not to stop axis movement when each bit turns ON.

Parameter name	Bit	Function	Setting range	Default value
Synchronous Group Stop Selection	00	Select the operation that takes place when bit 00 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 00. 1: Stop when bit 00 turns ON.	0 to 1	0
	01	Select the operation that takes place when bit 01 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 01. 1: Stop when bit 01 turns ON.	0 to 1	0
	02	Select the operation that takes place when bit 02 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 02. 1: Stop when bit 02 turns ON.	0 to 1	0
	03	Select the operation that takes place when bit 03 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 03. 1: Stop when bit 03 turns ON.	0 to 1	0
	04	Select the operation that takes place when bit 04 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 04. 1: Stop when bit 04 turns ON.	0 to 1	0
	05	Select the operation that takes place when bit 05 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 05. 1: Stop when bit 05 turns ON.	0 to 1	0
	06	Select the operation that takes place when bit 06 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 06. 1: Stop when bit 06 turns ON.	0 to 1	0

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Synchronous Unit Operation Function

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Parameter name	Bit	Function	Setting range	Default value
Synchronous Group Stop Selection (Continued)	07	Select the operation that takes place when bit 07 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 07. 1: Stop when bit 07 turns ON.	0 to 1	0
	08	Select the operation that takes place when bit 08 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 08. 1: Stop when bit 08 turns ON.	0 to 1	0
	09	Select the operation that takes place when bit 09 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 09. 1: Stop when bit 09 turns ON.	0 to 1	0
	10	Select the operation that takes place when bit 10 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 10. 1: Stop when bit 10 turns ON.	0 to 1	0
	11	Select the operation that takes place when bit 11 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 11. 1: Stop when bit 11 turns ON.	0 to 1	0
	12	Select the operation that takes place when bit 12 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 12. 1: Stop when bit 12 turns ON.	0 to 1	0
	13	Select the operation that takes place when bit 13 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 13. 1: Stop when bit 13 turns ON.	0 to 1	0
	14	Select the operation that takes place when bit 14 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 14. 1: Stop when bit 14 turns ON.	0 to 1	0
	15	–	–	–

For synchronous group stop, refer to "Synchronous Unit Stop Function" on page 10-11.

Synchronous Feeding Command Position Data

Select the output data for Synchronous Data Refresh areas which you use as command positions under the synchronous feeding function.

Parameter name	Function	Setting range	Default value
Synchronous Feeding Command Position Data	Set relative positions (words) based on the first word of output data for synchronous data refresh which is allocated to the applicable PCU by the CPU.	0000 hex to maximum output size	Axis 1: 0000 hex Axis 2: 0002 hex Axis 3: 0004 hex Axis 4: 0006 hex

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Synchronous Unit Operation Function

10-3 Synchronous Data Refresh

Data exchange between the CPU and Synchronous Units uses Synchronous Data Refresh areas. Synchronous Data Refresh areas are allocated to the I/O areas 1,200 to 1,295 words in the CPU. You can set the CPU and Synchronous Units, respectively, to set the types of data which you exchange between the CPU and the allocated areas of each unit.
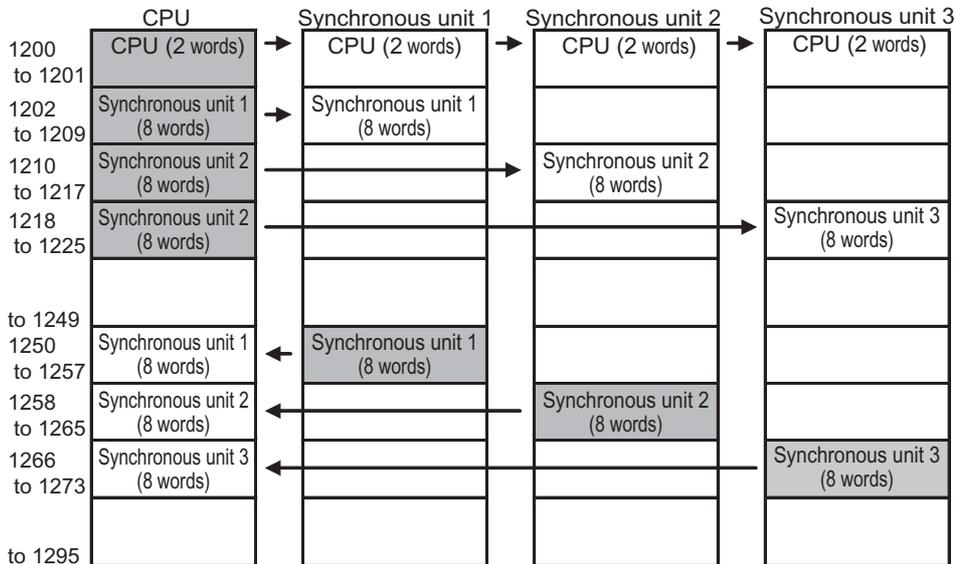
Synchronous Data Refresh Setting

First, set the allocation of the Synchronous Data Refresh areas on the PLC Settings of the CPU.

1. **Setting of Input Area Start Position**
   On the PLC Settings, set the start address of [Input] of synchronous data refresh from the [Synchronous Data Refresh Area Allocation] setting. This divides the Synchronous Data Refresh area into the output (from CPU to PCU) area and the input (from PCU to CPU) area.

2. **Registration of Synchronous Units**

3. **Setting of Output Sizes and Input Sizes**
   Set the output sizes and input sizes of synchronous data refresh for registered Synchronous Units. This sequentially allocates the output area of the set size, from the beginning of the Synchronous Data Refresh area, and the input area from the input area start address, respectively.

Setting Example
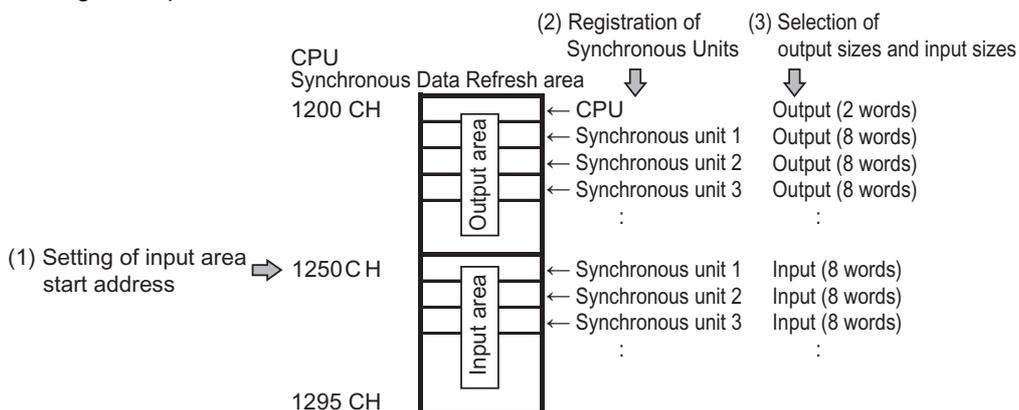
Next, use the applicable parameters of the Synchronous Unit to set the type of I/O data for synchronous data refresh.

4. **Output Area Allocation Selection for Synchronous Units**

    Set how each Synchronous Unit uses the data given to the output area that is allocated to each Synchronous Unit. In the case of a PCU, select the words whose data you use as synchronous feeding command position data for each axis.

5. **Input Area Allocation Selection for Synchronous Units**

    Set which data to pass from each Synchronous Unit to the input area that is allocated to the Synchronous Units. In the case of a PCU, you can select the command present position or feedback present position of each axis.

Setting Example

(4) Output area allocation selection
for Synchronous Units
(selection of output destination)
⇩

1218 CH Axis 1 synchronous feeding command position data
1220 CH Axis 1 synchronous feeding command position data
1222 CH Axis 1 synchronous feeding command position data
1224 CH Axis 1 synchronous feeding command position data

(5) Input area allocation selection
for Synchronous Units
(selection of input data type)
⇩

1266-1267 CH Axis 1 feedback present position
1268-1269 CH Axis 1 feedback present position
1270-1271 CH Axis 1 feedback present position
1272-1273 CH Axis 1 feedback present position

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Synchronous Unit Operation Function

10-4 Synchronous Unit Stop Function

This function allows you to issue from the CPU a command to stop the current functions toward all Synchronous Units executing synchronous unit operation or Synchronous Units of a desired combination.

There are 2 kinds of the Synchronous Unit stop function: All Synchronous Unit stop for issuing a stop command to all Synchronous Units, and the synchronous group stop for issuing a stop command to units of a preset combination.
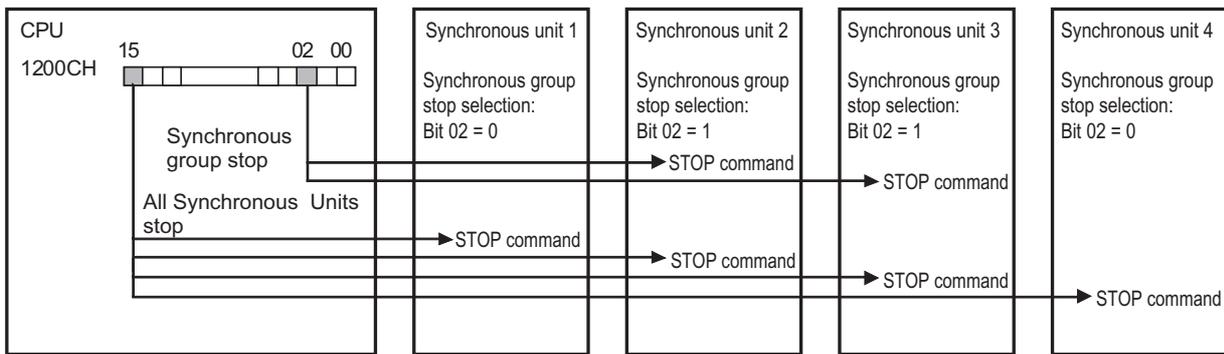
All Synchronous Unit Stop

Bit 15 in the Synchronous Data Refresh area 1,200 word is an All Synchronous Unit stop bit. When this bit turns ON, it issues a command to stop the executed operation simultaneously to All Synchronous Units.

Synchronous Group Stop

Bit 00 to 14 in the Synchronous Data Refresh area 1,200 word are an all synchronous group stop bit. When this bits turn ON, it issues a command to stop the executed operation to the Synchronous Unit whose bit has been selected by [Synchronous Group Stop Selection] in the axis parameter of the Synchronous Unit.

The table below describes the settings of [Synchronous Group Stop Selection] in the axis parameter.

Parameter name	Bit	Function	Setting range	Default value
Synchronous Group Stop Selection	00	Select the operation that takes place when bit 00 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 00. 1: Stop when bit 00 turns ON.	0 to 1	0
	01	Select the operation that takes place when bit 01 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 01. 1: Stop when bit 01 turns ON.	0 to 1	0
	02	Select the operation that takes place when bit 02 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 02. 1: Stop when bit 02 turns ON.	0 to 1	0

Parameter name	Bit	Function	Setting range	Default value
Synchronous Group Stop Selection (Continued)	03	Select the operation that takes place when bit 03 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 03. 1: Stop when bit 03 turns ON.	0 to 1	0
	04	Select the operation that takes place when bit 04 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 04. 1: Stop when bit 04 turns ON.	0 to 1	0
	05	Select the operation that takes place when bit 05 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 05. 1: Stop when bit 05 turns ON.	0 to 1	0
	06	Select the operation that takes place when bit 06 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 06. 1: Stop when bit 06 turns ON.	0 to 1	0
	07	Select the operation that takes place when bit 07 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 07. 1: Stop when bit 07 turns ON.	0 to 1	0
	08	Select the operation that takes place when bit 08 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 08. 1: Stop when bit 08 turns ON.	0 to 1	0
	09	Select the operation that takes place when bit 09 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 09. 1: Stop when bit 09 turns ON.	0 to 1	0
	10	Select the operation that takes place when bit 10 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 10. 1: Stop when bit 10 turns ON.	0 to 1	0
	11	Select the operation that takes place when bit 11 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 11. 1: Stop when bit 11 turns ON.	0 to 1	0
	12	Select the operation that takes place when bit 12 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 12. 1: Stop when bit 12 turns ON.	0 to 1	0
	13	Select the operation that takes place when bit 13 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 13. 1: Stop when bit 13 turns ON.	0 to 1	0

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Synchronous Unit Operation Function

Parameter name	Bit	Function	Setting range	Default value
Synchronous Group Stop Selection (Continued)	14	Select the operation that takes place when bit 14 turns ON in the Synchronous Data Refresh area 1,200 word. 0: Ignore ON of bit 14. 1: Stop when bit 14 turns ON.	0 to 1	0
	15	–	–	–

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Synchronous Unit Operation Function

10-5 Errors Detected by Synchronous Units

The control process of all synchronous units is interconnected by synchronizing with the CPU synchronous cycle time in the synchronous unit operation function.
For this reason, this function has a unique error detection function.
This section explains errors in relation to synchronous unit operation.

Synchronous Time Monitor Timeout

This error occurs when a timing signal, which is given by the CPU to the Synchronous Unit for each synchronization cycle time, is delayed by 100 ms or more from the last notification.
If this error occurs, the Synchronous Unit stops the executing process and synchronous unit operation stops. To reset from the error, you must remove the cause of the error and then restart the Synchronous Unit.

Synchronous Data Receive Error

This error occurs when you cannot receive a timing signal successfully twice consecutively, which is given by the CPU to the Synchronous Unit for each synchronous cycle time.
If this error occurs, the Synchronous Unit stops the executing process but synchronous unit operation continues. To reset the error, you must remove the cause of the error and then execute the error reset of the Synchronous Unit.

Synchronous Data Receive Warning

This error occurs when you cannot receive a timing signal successfully once, which is given by the CPU to the Synchronous Unit for each synchronous cycle time.
This error becomes a non-fatal error as a warning, which disables the synchronous data of the cycle in which this error occurs, and the control of the Synchronous Unit continues based on the data that is given in the previous cycle.

Synchronous Processing Time Over

This error occurs when the Synchronous Unit process cannot be made in time because the specified synchronous cycle time is shorter than the processing time of the Synchronous Unit. When a synchronous processing time over error occurs, the Synchronous Processing Time Over Flag (n+13, bit 3) will turn ON, but operation will continue. The synchronous data is ignored in the cycle in which the error occurred. The Synchronous Unit will continue to perform control operations based on the previous data. The Synchronous Processing Time Over Flag will turn OFF the next time Synchronous Unit processing is performed normally.

10-6 Synchronous Feeding

Synchronous feeding is a function to allow the CPU to give a command position to each PCU sequentially via synchronous data refresh so as to perform positioning operation in control cycles that correspond to the synchronous cycle time.

Outline of Operation

While [Synchronous Feeding Bit] in the Direct Operation Command Memory area is ON, this function outputs the movement amount which is required to perform positioning in the cycle of the next synchronous cycle time.

Set the movement amount by using an absolute position in the Synchronous Data Refresh area which you specify as the synchronous feeding command position data of each PCU axis.

Direct Operation Command Memory area
Synchronous feeding
Axis status Memory area
Synchronous feeding received
Axis busy
During synchronous feeding
Synchronous data refresh output area
Axis 1 synchronous feeding command position data

| 0 | 9 | 17 | 25 | 32 | 38 | 43 | 47 | 49 | 50 | 49 | 47 | 43 | 38 | 32 | 25 | 17 | 9 | 0 |

Present position

Synchronous cycle time
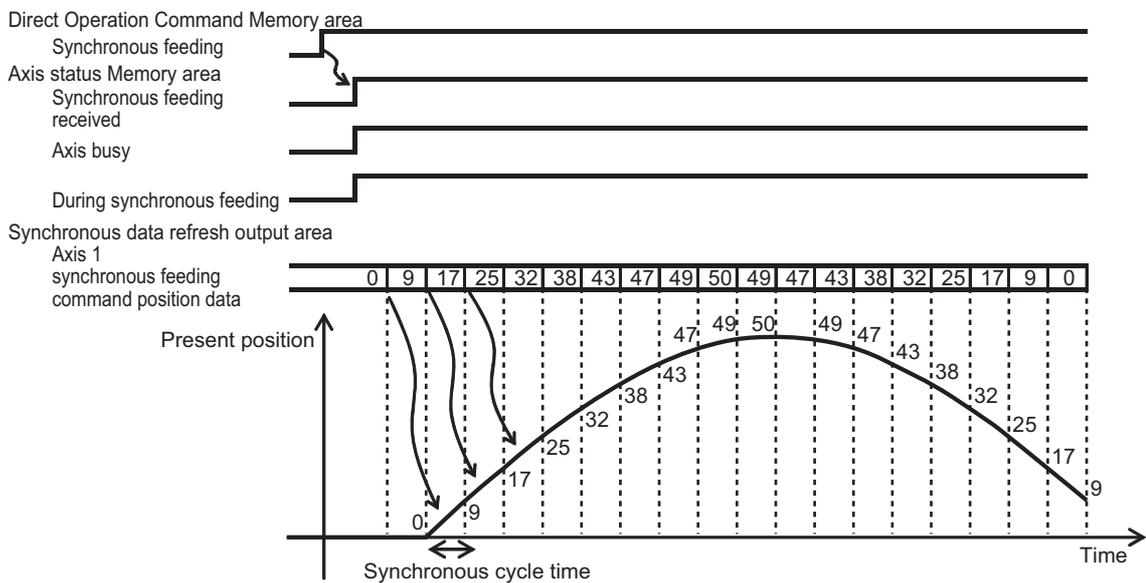
Time

📝 **Precautions for Correct Use**

⬥ Synchronous feeding outputs pulses that correspond to the movement amount specified by which the synchronous feeding command position data from the present position for each cycle of synchronous cycle time. Accordingly, abrupt movement may occur depending on the command position which is given to the synchronous feeding command position data.

⬥ If the AXIS FEEDING mode is rotation axis, synchronous feeding always uses a shorter route.

⬥ In synchronous feeding, the maximum speed set in an axis parameter is disabled.

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Synchronous Unit Operation Function

Synchronous Feeding Procedure

To execute synchronous feeding, you must set applicable items in relation to synchronous unit operation, and allocate the Direct Operation Command Memory area and Axis Status Memory area.

For the Direct Operation Command Memory area, refer to "Direct Operation Command Memory Area" on page 5-68. For the Axis Status Memory area, refer to "Axis Status Memory Area" on page 5-72.

The procedure below assumes that these memory areas are already allocated.

1. **Setting for Synchronous Unit Operation**
   Set the necessary items to enable the synchronous unit operation function based on the CPU as a Synchronous Unit.

2. **Setting of Synchronous Data Refresh**
   Allocate the output area of synchronous feeding command position data for the target axis of synchronous feeding, according to "Synchronous Data Refresh" on page 10-9.

3. **Starting Synchronous Unit Operation**

4. **Put the driver in operating status.**

5. **Starting Synchronous Feeding**
   Set [Synchronous Feeding Bit] in the Direct Operation Command memory area to ON.
   As soon as [Synchronous Feeding Received] in the Axis Status memory area turns ON, synchronous feeding command can be received.

6. **Giving Synchronous Feeding Command Position Data**
   Use an absolute position to give a command position to the output area of synchronous feeding command position data for the synchronous data refresh.

The above procedure enables synchronous feeding.

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Synchronous Unit Operation Function

11

Sample Program

This chapter contains program examples to perform linear interpolation control, circular interpolation control, Origin Search, etc.

11-1 Outline of Program Examples

This section explains the settings when you use a test system to check the operation of any of the program examples which are given in this chapter.

📝 **Precautions for Correct Use**

- The sample programs in this chapter consist only of ladder circuits that pertain to the interfaces between the CPU Unit and PCU for the use of the PCU functions.
- If you write a program for an actual machine, add to the circuits which are shown in this program example those interlock circuits that relate to machine movements, inputs/outputs from other devices, and other circuits that relate to control procedures, etc. Make sure that the program gives intended operation commands to the PCU.
- Before you move on to the actual production operation, conduct thorough operation checks based on the user program which you created.

Devices to be Used

You need at least the devices below to perform positioning with the PCU.

Type	Remarks
PCU	CJ1W-NC214/NC234/NC414/NC434
SYSMAC CJ-series CPU Unit	CJ2H-CPUxx
Power Supply Unit	CJ1W-Pxxxx
Motor and drive set	Servomotor cable, drive and cable between drive and motor Stepping motor, drive and cable between motor and drive Control cable between PCU and drive
24-VDC power supply	DC power supply
Software	CX-Programmer
Computer	You need this to use the CX-Programmer. (A separate cable which you need for connection with the CPU Unit.)

PCU

Use a CJ1W-NC214/NC234 2-axis PCU.

Sample programs in this chapter are created by designating the PCU as unit No. 2. Accordingly, the beginning word in the PCU Control I/O memory area is 2,020 words.
Also, the PLC uses only one PCU.
If you use a different unit number, change the word numbers in the PCU Control I/O memory area according to the formula below.

Beginning word in PCU Control I/O memory area: $n = 2,000 + 10 \times$ Unit number

Installation and Wiring

Install and wire the devices to be used, according to Chapter 3, Installation and Wiring.
It is assumed that the Servo Drive I/O signals connect to a 24-VDC power supply for control input and forward/reverse direction limit inputs.
To execute Origin Search, also connect an origin proximity input.

Mechanical Configuration

Both axes conform to the mechanical configuration below.

Item name	Mechanical configuration
Motor to be used	Servomotor and Servo Drive
Motor's rated rpm	3000r/min
Encoder resolution	2,000 pulses/rotation
Work travel distance per motor rotation	5mm
Unit system	[mm]; minimum unit = [0.01 mm]
Maximum speed	250 mm/s (3,000 r/min)
Starting speed	0 mm/s (to use a Servomotor)
Acceleration time	0.1 s (Acceleration/deceleration specified)
Deceleration time	0.1 s (Acceleration/deceleration specified)

Parameter Settings

In these sample programs, set the common parameters, axis parameters and memory operation parameters as follows.

Common Parameter

Set the Operation I/O memory area allocation setting as follows.
For details on common parameters, refer to "Common Parameters" on page 5-6.

Manual Operation Command Memory Area Selection

Use W100 words as the beginning word.

Direct Operation Command Memory Area Selection

Use W110 words as the beginning word.

Memory Operation Command Memory Area Selection

Use W160 words as the beginning word.

Axis Status Memory Area Selection

Use W180 words as the beginning word.

Memory Operation Status Memory Area Selection

Use W240 words as the beginning word.

Axis Parameters

This section describes only the axis parameters which you need in the sample programs. For details on the axis parameters, refer to "Axis Parameters" on page 5-13.

Axis Type Setting

Select axes 1 and 2 for [Physical Axis], and axes 3 and 4 for [Unused Axis].

Command Position Unit Setting

Parameter name	Setting	Unit
Coordinate Unit System Selection	mm*	–
Feedback Pulse Count Per Motor Rotation	2000	Pulse
Work Travel Distance Per Motor Rotation	5	mm
Unit Multiplier	100 times*	–
Electronic Gear Compensation Numerator	1	–
Electronic Gear Compensation Denominator	1	–

* The position command unit becomes [0.01 mm], and the speed command unit becomes [0.01 mm/s], according to this setting.

Speed and Acceleration/Deceleration Setting

Both axes 1 and 2 use the same settings.

Parameter name	Setting	Unit
Maximum Speed	25000	0.01 mm/s
Starting Speed	0	0.01 mm/s
Acceleration/ Deceleration Curve Selection	Trapezoid	–
Acceleration/ Deceleration Time Selection	Acceleration/ deceleration specified	–
Deceleration Stop Time	100	ms

Origin Search Settings

Parameter name	Setting	Unit
ORIGIN SEARCH OPERATION Mode	Origin Search Deceleration time high speed at reversing	–
Origin Search Speed	10000	0.01 mm/s
Origin Search Proximity Speed	1000	0.01 mm/s
Origin Search Acceleration Time	100	ms
Origin Search Deceleration Time	100	ms

11

Sample Program

11-2 Basic Program Examples

The example below is the ladder program that relates to the basic functions of the PCU.

> ☑ **Precautions for Correct Use**
>
> ⬧ If you use these program examples as a reference, add appropriate interlock circuits according to the operating conditions of your system.

Servo Lock/Servo Unlock

This program example executes servo lock and servo unlock for axis 1.
Note that the Manual Operation Command area selection and Axis Status memory area selection are based on the settings of common parameters.
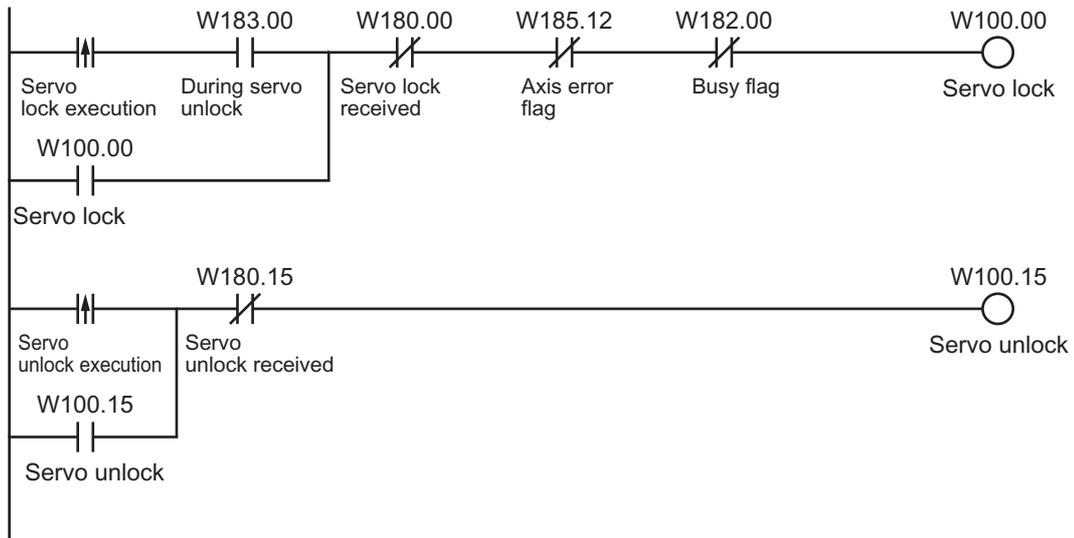
Origin Search

This program executes Origin Search for axis 1.
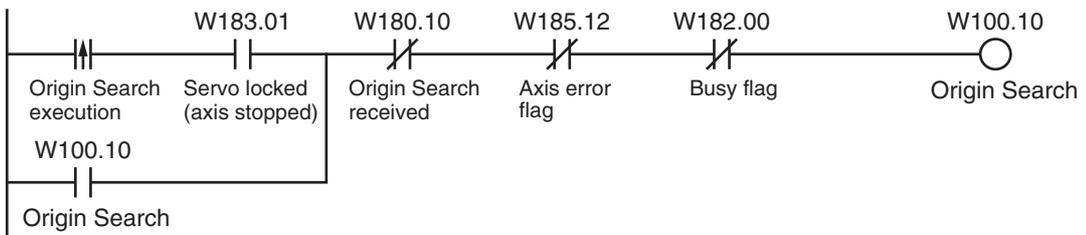
11-3 Direct Operation

The example below is a sample program for direct operation.

> **Precautions for Correct Use**
>
> • If you use these program examples as a reference, add appropriate interlock circuits according to the operating conditions of your system.

Positioning by DM Area

You can sequentially transfer the data in the DM area via direct operation, to perform a series of positioning operations.
The axis executes positioning according to each command data which is set in the Operating Data area.
Determine whether to recognize the set position data as absolute data or incremental data based on whether a start trigger is the absolute movement bit or relative movement bit.

Operation Example

The following is an example of positioning operation by absolute movement based on position data in the DM area.
Set the origin by Origin Search or present position preset beforehand.
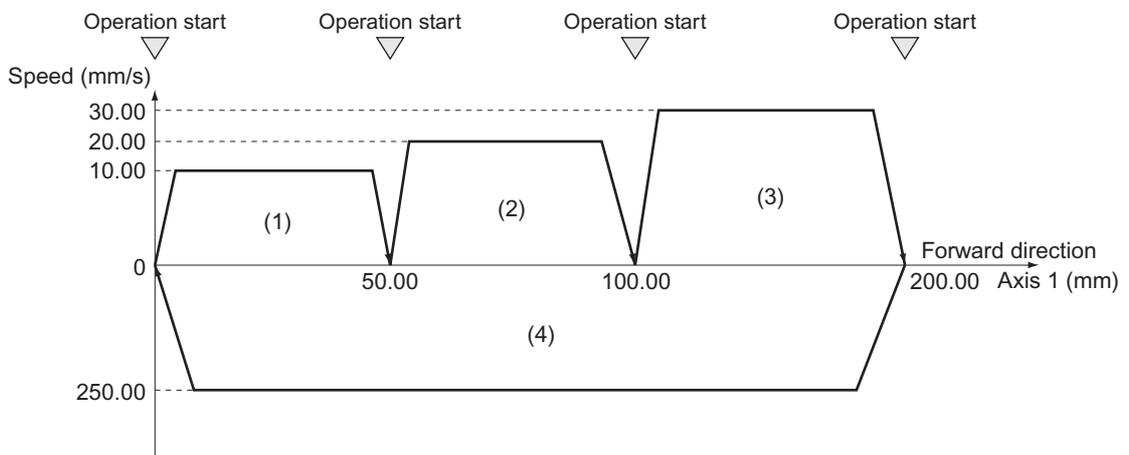
1) When you turn ON the operation start switch at the origin, axis 1 positions itself to 50.00 mm in the forward direction.
2) Thereafter, axis 1 positions itself to 100.00 mm and 200.00 mm every time you turn ON the operation start switch, and consequently returns to the origin and stops.

Note that the acceleration time and deceleration time are both 0.1 s. Whether to use a fixed acceleration or fixed time depends on the axis parameter [Acceleration/Deceleration Setting]. For details, refer to "Acceleration/Deceleration Setting" on page 5-23.

DM Area Setting

This program example uses D00000 to D00019 in the DM Area, and sets the position data below in the Operation Output Memory area.

DM area	Set value	Contents of setting
D00000	5000 (1388 hex)	Position command: 50.00 mm (position at 10 motor rotations)
D00001	0000 hex	
D00002	1000 (03E8 hex)	Command speed: 10.00 mm/s
D00003	0000 hex	
D00004	10000 (2710 hex)	Position command: 100.00 mm (position at 20 motor rotations)
D00005	0000 hex	
D00006	2000 (07D0 hex)	Command speed: 20.00 mm/s
D00007	0000 hex	
D00008	20000 (4E20 hex)	Position command: 200.00 mm (position at 40 motor rotations)
D00009	0000 hex	
D00010	3000 (0BB8 hex)	Command speed: 30.00 mm/s
D00011	0000 hex	
D00012	0000 hex	Position command: 0.00 mm
D00013	0000 hex	
D00014	25000 (61A8 hex)	Command speed: 250.00 mm/s
D00015	0000 hex	
D00016	0064 hex	Acceleration time: 100 ms
D00017	0000 hex	
D00018	0064 hex	Deceleration time: 100 ms
D00019	0000 hex	

Program Example

This program example runs while the Servomotor is locked.

W183.00	W183.09	W183.08	W181.00	W185.10	W185.12		

Operation start switch | During servo unlock | During immediate stop | During deceleration stop | Absolute movement command received | Error flag during execution | Axis error flag

W110.00 — Absolute movement command

@XFER — Transfer DM Area data
&4
@D20
W112

@+ — Add DM Area points
#4
D20
D20

W110.00 — Absolute movement command

=
#10
D20

MOV — Judge data completion
#0
D20

P_First_Cycle — Operation start time 1 cycle ON flag

MOV — Initialize DM Area points
#0
D20

XFER — Transfer DM Area acceleration time and deceleration time data
&4
D16
W118

Use D00020 for indirect addressing.
For the settings of [Absolute Movement] and other memory areas, refer to "Parameter Settings" on page 11-2.

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Sample Program

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Speed Control

This program example uses the speed control bit in the Direct Operation Command Memory area to execute speed control on the Servo Drive which is registered for axis 1.

Operation Example

The following is an operation example of speed change by speed control based on position data in the data memory.
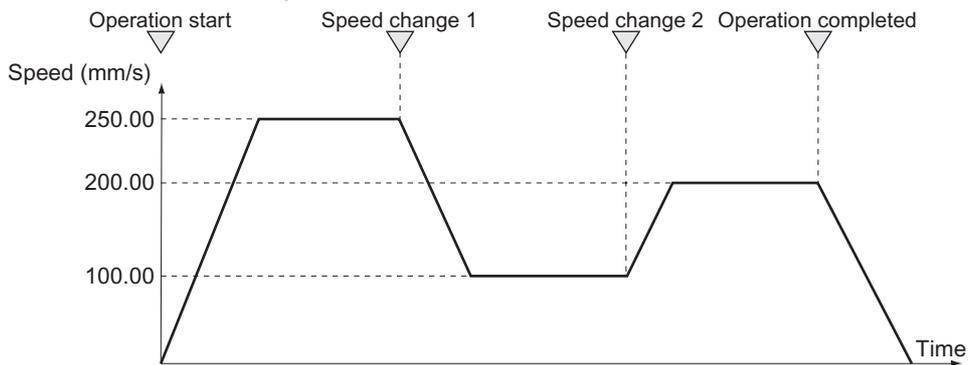
1) When you turn ON the operation start switch, speed control of axis 1 starts at 250.00 mm/s.
2) Thereafter, the speed of axis 1 changes to 100.00 mm/s and 200.00 mm/s every time you turn ON the operation start switch.
3) Finally, turn ON the operation stop switch to stop the Servomotor.

Note that the acceleration time and deceleration time are both 0.1 s. Whether to use a fixed acceleration or fixed time depends on the axis parameter [Acceleration/Deceleration Setting]. For details, refer to "Acceleration/Deceleration Setting" on page 5-23.

DM Area Setting

This program example uses D00000 to D00019 in the DM Area, and sets the position data below in the Operation Output memory area.

DM area	Set value	Contents of setting
D00000	25000 (61A8 hex)	Command speed: 250.00 mm/s
D00001	0000 hex	
D00002	10000 (2710 hex)	Command speed: 100.00 mm/s
D00003	0000 hex	
D00004	20000 (4E20 hex)	Command speed: 200.00 mm/s
D00005	0000 hex	
D00006	0064 hex	Acceleration time: 100 ms
D00007	0000 hex	
D00008	0064 hex	Deceleration time: 100 ms
D00009	0000 hex	

Program Example

This program example runs while the Servomotor is locked.
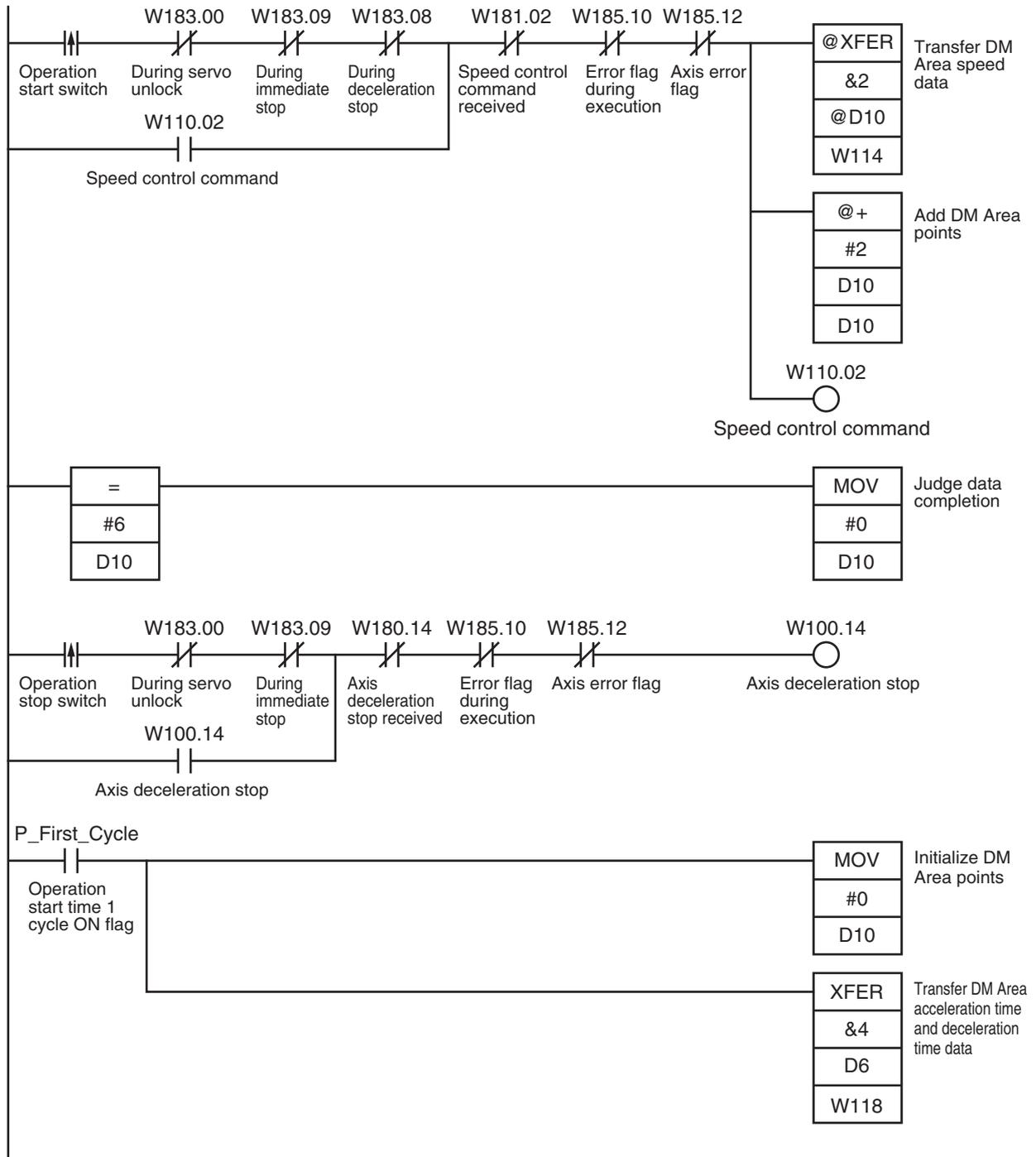
Deceleration Stop and Emergency Stop

This program example uses the deceleration stop bit in the Manual Operation Command memory area to execute deceleration stop on the Servo Drive which is registered for axis 1. Note that emergency stop uses the input to A7 (axis 1) at the external signal connector.
For emergency stop, refer to "External I/O Circuit" on page 2-8.

Program Example

This program runs while the Servomotor is running.

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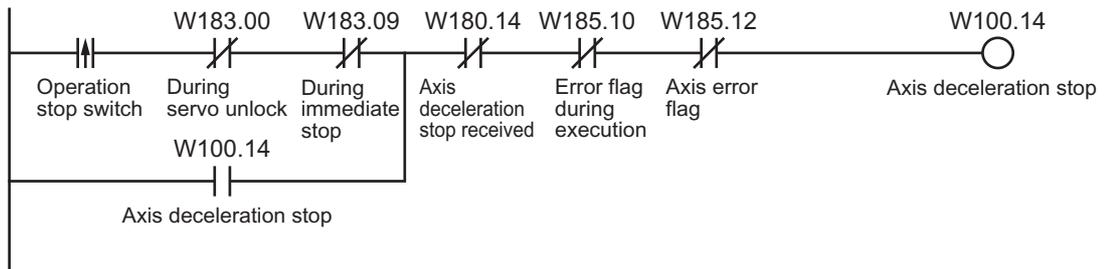
Sample Program

11-4 Memory Operation

The example below is a sample program for memory operation.

> **Precautions for Correct Use**
>
> ◆ If you use these program examples as a reference, add appropriate interlock circuits according to the operating conditions of your system.

Repeated Operation

You can use the completion pattern [END] in memory operation to execute an operation repeatedly.
When you set the completion pattern for sequence data to [END] and execute a restart, the axis returns to the last effective sequence number to execute positioning.

Operation Example

The following is an example of operation that repeats the applicable operation.
Set the origin by Origin Search or present position preset beforehand.
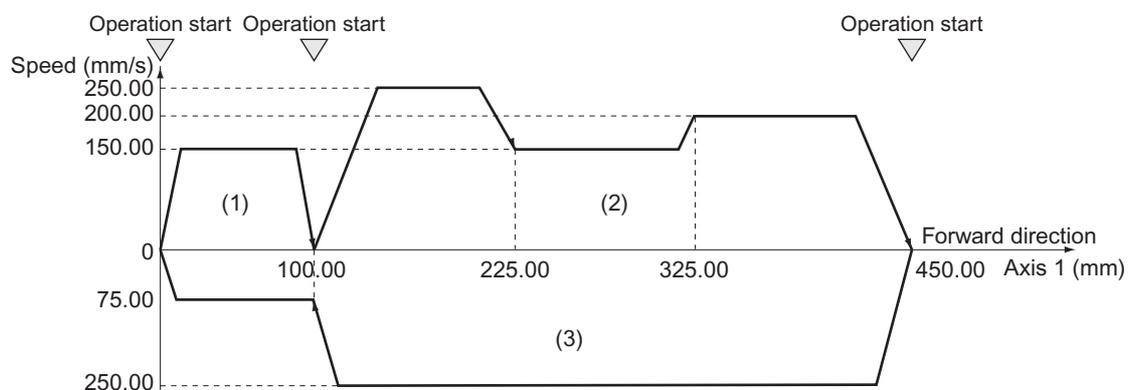
1) When you turn ON the operation start switch at the origin, axis 1 positions itself to 100.00 mm in the forward direction.
2) When you turn ON the operation start switch, the axis 1 performs positioning according to a continuous pattern and stops at 450.00 mm.
3) When you turn ON the operation start switch, the axis 1 performs positioning according to a continuous pattern, position itself to the origin and stops.
4) When you turn ON the operation start switch, repeat above steps 1) to 3).

Memory Operation Parameter

This section describes only the memory operation parameters which you need in the sample programs.
For details on the memory operation parameters, refer to "Memory Operation Parameter" on page 5-56.

Task Configuration Axis Setting

Parameter name	Setting	Unit
Configuration Axis	Use axis 1	–

Memory Operation Data Settings

To move the axis according to the operation example, set the sequence data as follows.
Setting the "Axis Parameters" on page 11-3 selects [0.01 mm] as the command unit.

Sequence No. 1

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	10000	Command unit	M Code	Without M code	–
Command	Positioning operation	–	Axis Specification	Axis 1	–
Sequence Start Condition	No condition	–	Position Specification	Specify absolute position	–
Sequence Skip Condition	No condition	–	Axis 1 Command Speed	15000	Command unit/s
End pattern	Individual	–	Axis 1 Acceleration Time	100	ms
Positioning Completed Input Monitor Valid	Wait	–	Axis 1 Deceleration Time	100	ms
Dwell Timer	No dwell time	–			

Sequence No. 2

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	22500	Command unit	M Code	Without M code	–
Command	Linear interpolation operation	–	Axis Specification	Axis 1	–
Sequence Start Condition	No condition	–	Position Specification	Specify absolute position	–
Sequence Skip Condition	No condition	–	Axis 1 Command Speed	25000	Command unit/s
End Pattern	Continuous 1	–	Axis 1 Acceleration Time	100	ms
Positioning Completed Input Monitor Valid	Not wait	–	Axis 1 Deceleration Time	100	ms
Dwell Timer	No dwell time	–			

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Sample Program

Sequence No. 3

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	32500	Command unit	M Code	Without M code	–
Command	Linear interpolation operation	–	Axis Specification	Axis 1	–
Sequence Start Condition	No condition	–	Position Specification	Specify absolute position	–
Sequence Skip Condition	No condition	–	Axis 1 Command Speed	15000	Command unit/s
End Pattern	Continuous 1	–	Axis 1 Acceleration Time	100	ms
Positioning Completed Input Monitor Valid	Not wait	–	Axis 1 Deceleration Time	100	ms
Dwell Timer	No dwell time	–			

Sequence No. 4

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Specify absolute position	45000	Command unit	M Code	Without M code	–
Command	Positioning operation	–	Axis Specification	Axis 1	–
Sequence Start Condition	No condition	–	Position Specification	Specify absolute position	–
Sequence Skip Condition	No condition	–	Axis 1 Command Speed	20000	Command unit/s
End Pattern	Individual	–	Axis 1 Acceleration Time	100	ms
Positioning Completed Input Monitor Valid	Wait	–	Axis 1 Deceleration Time	100	ms
Dwell Timer	No dwell time	–			

Sequence No. 5

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	10000	Command unit	M Code	Without M code	–
Command	Linear interpolation operation	–	Axis Specification	Axis 1	–
Sequence Start Condition	No condition	–	Position Specification	Specify absolute position	–

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Sequence Skip Condition	No condition	–	Axis 1 Command Speed	25000	Command unit/s
End Pattern	Continuous 1	–	Axis 1 Acceleration Time	100	ms
Positioning Completed Input Monitor Valid	Not wait	–	Axis 1 Deceleration Time	100	ms
Dwell Timer	No dwell time	–			

Sequence No. 6

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	0	Command unit	M Code	Without M code	–
Command	Positioning operation	–	Axis Specification	Axis 1	–
Sequence Start Condition	No condition	–	Axis Specification	Specify absolute position	–
Sequence Skip Condition	No condition	–	Axis 1 Command Speed	7500	Command unit/s
End Pattern	Automatic	–	Axis 1 Acceleration Time	100	ms
Positioning Completed Input Monitor Valid	Wait	–	Axis 1 Deceleration Time	100	ms
Dwell Timer	No dwell time	–			

Sequence No. 7

Parameter name	Setting	Unit
Command	END	–
Sequence Start Condition	No condition	–

Program Example

This program example runs while the Servomotor is locked.

1) First, turn ON the sequence number setting switch.
2) Start the operation with the operation start switch.
3) Turn OFF the sequence number setting switch.
4) The axis executes positioning every time you turn ON the operation start switch.

Turn ON the sequence number setting switch only once at the beginning.
Thereafter, sequence No. 1 is executed repeatedly unless you turn OFF the sequence number setting switch.

11

Sample Program

Linear Interpolation

Use 2 axes to perform positioning by linear interpolation.

Operation Example

The following is an example of operation that performs linear interpolation automatically and then returns to the origin and stops.
Set the origin by Origin Search or present position preset beforehand.
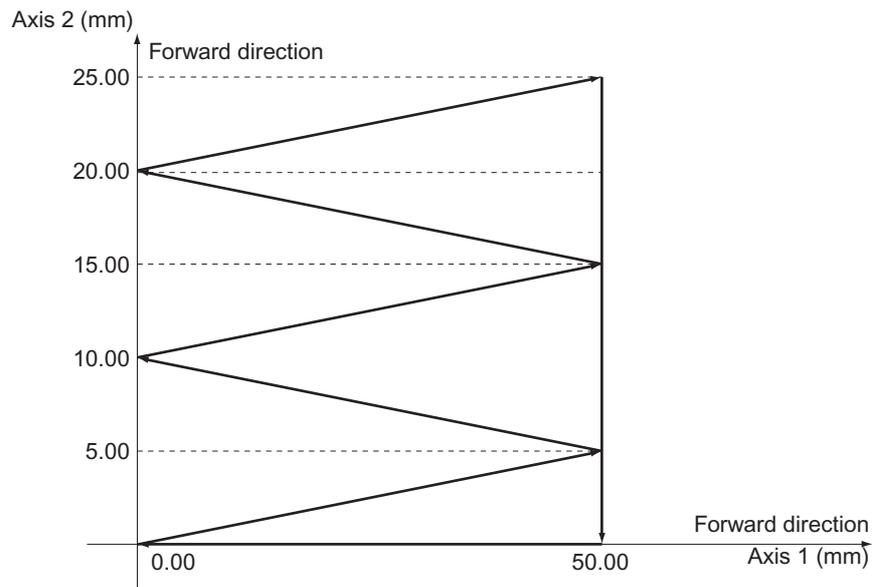
1) When you turn ON the operation start switch at the origin, the axes automatically perform positioning with linear interpolation operation in the following sequence and then stop:
(Axis 1, Axis 2) = (50.00 mm, 5.00 mm), (0 mm, 10.00 mm), (50.00 mm, 15.00 mm), (0 mm, 20.00 mm), (50.00 mm, 25.00 mm), (50.00 mm, 0 mm) and (0 mm, 0 mm)

At this time, the speed is 10.00 mm/s.

Memory Operation Parameter

This section describes only the memory operation parameters which you need in the sample programs.
For details on the memory operation parameters, refer to "Memory Operation Parameter" on page 5-56.

Configuration Axis

Parameter name	Setting	Unit
Configuration Axis	Use axis 1, axis 2	–

Memory Operation Data Settings

To move the axis according to the operation example, set the sequence data as follows. Setting the "Axis Parameters" on page 11-3 selects [0.01 mm] as the command unit.

Sequence No. 1

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	5000	Command unit	Axis Specification	Axis 1, axis 2	–
Axis 2 Position Command	500	Command unit	Position Specification	Axis 1, axis 2 Specify absolute position	–
Command	Linear interpolation operation	–	Interpolation Speed	1000	Command unit/s
Sequence Start Condition	No condition	–	Interpolation Acceleration Time	100	ms
Sequence Skip Condition	No condition	–	Interpolation Deceleration Time	100	ms
End Pattern	Automatic	–	Interpolation Starting Speed	0	Command unit/s
Positioning Completed Input Monitor Valid	Wait	–	Interpolation Acceleration/ Deceleration Curve Selection	Trapezoid	–
Dwell Timer	No dwell time	–	Interpolation Acceleration Time Selection	Up to maximum speed	–
M Code	Without M code	–	Interpolation Speed Specification Method	Specify the interpolation path speed	–

Sequence No. 2

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	0	Command unit	Axis Specification	Axis 1, axis 2	–
Axis 2 Position Command	1000	Command unit	Position Specification	Axis 1, axis 2 Specify absolute position	–
Command	Linear interpolation operation	–	Interpolation Speed	1000	Command unit/s
Sequence Start Condition	No condition	–	Interpolation Acceleration Time	100	ms
Sequence Skip Condition	No condition	–	Interpolation Deceleration Time	100	ms

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Sample Program

Parameter name	Setting	Unit	Parameter name	Setting	Unit
End Pattern	Automatic	–	Interpolation Starting Speed	0	Command unit/s
Positioning Completed Input Monitor Valid	Wait	–	Interpolation Acceleration/ Deceleration Curve Selection	Trapezoid	–
Dwell Timer	No dwell time	–	Interpolation Acceleration Time Selection	Up to maximum speed	–
M Code	Without M code	–	Interpolation Speed Specification Method	Specify the interpolation path speed	–

Sequence No. 3

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	5000	Command unit	Axis Specification	Axis 1, axis 2	–
Axis 2 Position Command	1500	Command unit	Position Specification	Axis 1, axis 2 Specify absolute position	–
Command	Linear interpolation operation	–	Interpolation Speed	1000	Command unit/s
Sequence Start Condition	No condition	–	Interpolation Acceleration Time	100	ms
Sequence Skip Condition	No condition	–	Interpolation Deceleration Time	100	ms
End Pattern	Automatic	–	Interpolation Starting Speed	0	Command unit/s
Positioning Completed Input Monitor Valid	Wait	–	Interpolation Acceleration/ Deceleration Curve Selection	Trapezoid	–
Dwell Timer	No dwell time	–	Interpolation Acceleration Time Selection	Up to maximum speed	–
M Code	Without M code	–	Interpolation Speed Specification Method	Specify the interpolation path speed	–

Sequence No. 4

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	0	Command unit	Axis Specification	Axis 1, axis 2	–
Axis 2 Position Command	2000	Command unit	Position Specification	Axis 1, axis 2 Specify absolute position	–

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Command	Linear interpolation operation	–	Interpolation Speed	1000	Command unit/s
Sequence Start Condition	No condition	–	Interpolation Acceleration Time	100	ms
Sequence Skip Condition	No condition	–	Interpolation Deceleration Time	100	ms
End Pattern	Automatic	–	Interpolation Starting Speed	0	Command unit/s
Positioning Completed Input Monitor Valid	Wait	–	Interpolation Acceleration/ Deceleration Curve Selection	Trapezoid	–
Dwell Timer	No dwell time	–	Interpolation Acceleration Time Selection	Up to maximum speed	–
M Code	Without M code	–	Interpolation Speed Specification Method	Specify the interpolation path speed	–

Sequence No. 5

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	5000	Command unit	Axis Specification	Axis 1, axis 2	–
Axis 2 Position Command	2500	Command unit	Position Specification	Axis 1, axis 2 Specify absolute position	–
Command	Linear interpolation operation	–	Interpolation Speed	1000	Command unit/s
Sequence Start Condition	No condition	–	Interpolation Acceleration Time	100	ms
Sequence Skip Condition	No condition	–	Interpolation Deceleration Time	100	ms
End Pattern	Automatic	–	Interpolation Starting Speed	0	Command unit/s
Positioning Completed Input Monitor Valid	Wait	–	Interpolation Acceleration/ Deceleration Curve Selection	Trapezoid	–
Dwell Timer	No dwell time	–	Interpolation Acceleration Time Selection	Up to maximum speed	–
M Code	Without M code	–	Interpolation Speed Specification Method	Specify the interpolation path speed	–

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Sample Program

Sequence No. 6

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 2 Position Command	0	Command unit	M Code	Without M code	–
Command	Positioning operation	–	Axis Specification	Axis 2	–
Sequence Start Condition	No condition	–	Position Specification	Specify absolute position	–
Sequence Skip Condition	No condition	–	Axis 2 Command Speed	1000	Command unit/s
End Pattern	Automatic	–	Axis 2 Acceleration Time	100	ms
Positioning Completed Input Monitor Valid	Wait	–	Axis 2 Deceleration Time	100	ms
Dwell Timer	No dwell time	–			

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Sample Program

Sequence No. 7

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	0	Command unit	M Code	Without M code	–
Command	Positioning operation	–	Axis Specification	Axis 1	–
Sequence Start Condition	No condition	–	Position Specification	Specify absolute position	–
Sequence Skip Condition	No condition	–	Axis 1 Command Speed	1000	Command unit/s
End Pattern	Automatic	–	Axis 1 Acceleration Time	100	ms
Positioning Completed Input Monitor Valid	Wait	–	Axis 1 Deceleration Time	100	ms
Dwell Timer	No dwell time	–			

Sequence No. 8

Parameter name	Setting	Unit
Command	END	–
Sequence Start Condition	No condition	–

Program Example

This program example runs while the Servomotor is locked.

```
 W0.04      W241.01     W241.04     W240.01     W242.10     W242.12              W160.01
──┤↑├────────┤ ├─────────┤/├──────┬──┤/├─────────┤/├─────────┤/├──────────────────○────
Operation start Memory   Memory   │ Memory      Memory      Memory              Memory Operation
switch        Operation Operation │ Operation   Operation   Operation           Start Bit
              Start Enabled Stop Input Flag │ Start      Execution    Error Flag
 W160.01      Flag                │ Acknowledged Error Flag
──┤ ├──────────────────────────────┘ Flag
Memory Operation
Start Bit

 W160.01     W0.05
──┤ ├─────────┤ ├──────────────────┬──────────────────────────────┤ MOV │ Sets
Memory       Sequence number      │                                │      │ sequence
Operation    switch               │                                │ #0001│ number to 1.
Start Bit                         │                                │ W161 │
                                  │
                                  │                                        W160.00
                                  └──────────────────────────────────────────○────
                                                                    Sequence
                                                                    Number Enable
                                                                    Bit
```

1) First, turn ON the sequence number setting switch and set sequence No. 1.
2) Start the operation with the operation start switch.

If you set the sequence number first and then turn ON the operation start switch, the axes will perform a series of positioning operations by linear interpolation.

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Sample Program
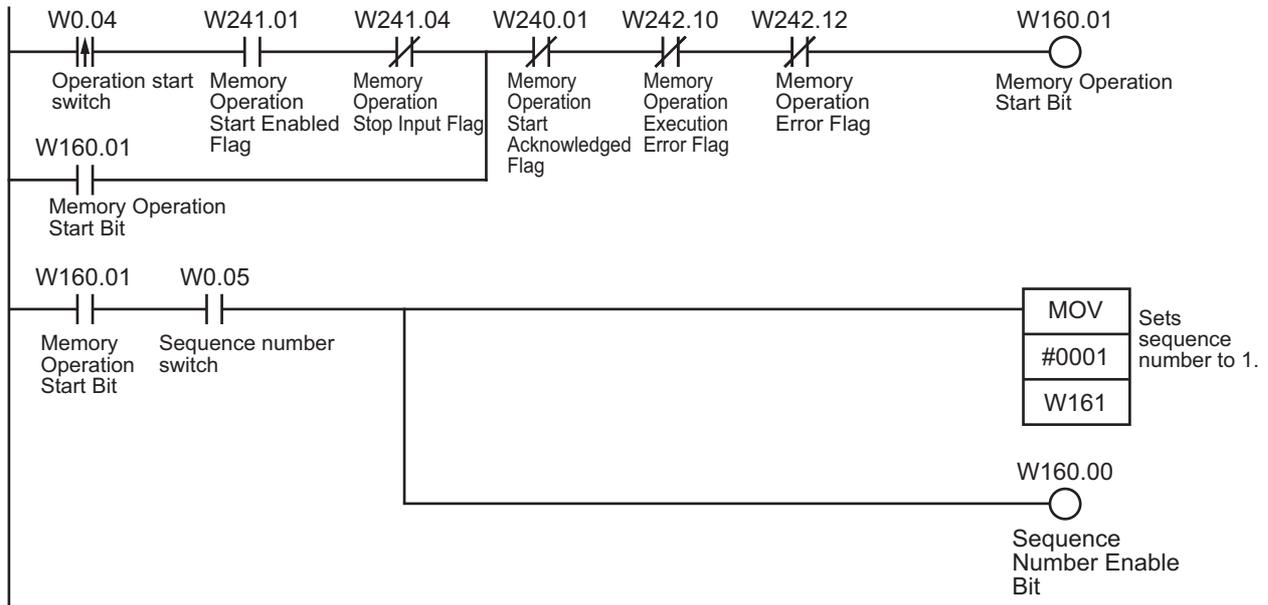
Combination of Linear Interpolation and Circular Interpolation

Perform positioning based on a combination of linear interpolation and circular interpolation.

Operation Example

The following is an example of operation that where the axes automatically performs positioning by using linear interpolation operation and circular interpolation.
Set the origin by Origin Search or present position preset beforehand.
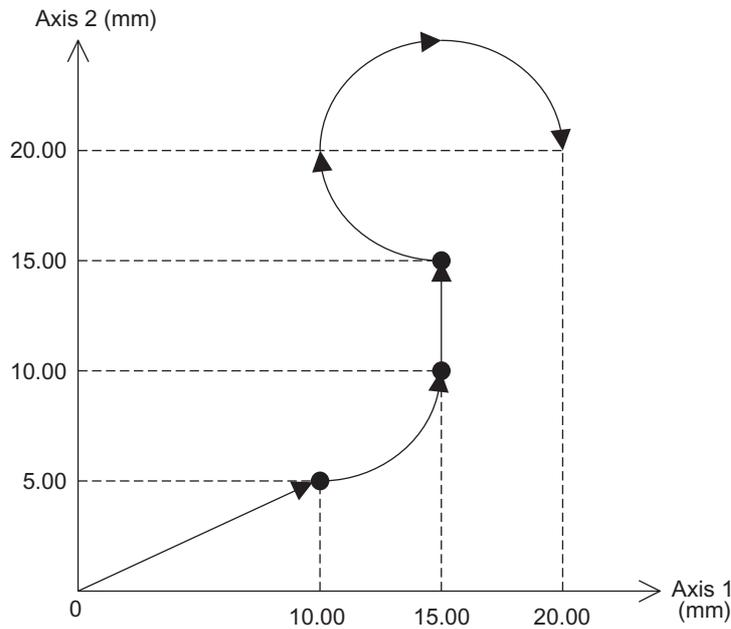
1) When you turn ON the operation start switch at the origin, the axes move to the point (10.00 mm, 5.00 mm) via linear interpolation operation.
The axes continue to move to the point (15.00mm, 10.00 mm) via circular interpolation operation, to the point (15.00 mm, 15.00 mm) via linear interpolation operation, and to the point (20.00mm, 20.00 mm) via circular interpolation operation.
At this time, the speed is 10.00 mm/s.

Memory Operation Data Settings

To move the axis according to the operation example, set the sequence data as follows.
Setting the "Axis Parameters" on page 11-3 selects [0.01 mm] as the command unit.

Sequence No. 1

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	1000	Command unit	Axis Specification	Axis 1, axis 2	–
Axis 2 Position Command	500	Command unit	Position Specification	Axis 1, axis 2 Specify absolute position	–
Command	Linear interpolation operation	–	Interpolation Speed	1000	Command unit/s
Sequence Start Condition	No condition	–	Interpolation Acceleration Time	100	ms
Sequence Skip Condition	No condition	–	Interpolation Deceleration Time	100	ms
End Pattern	Continuous 1	–	Interpolation Starting Speed	0	Command unit/s
Positioning Completed Input Monitor Valid	Not wait	–	Interpolation Acceleration/ Deceleration Curve Selection	Trapezoid	–
Dwell Timer	No dwell time	–	Interpolation Acceleration Time Selection	Up to maximum speed	–
M Code	Without M code	–	Interpolation Speed Specification Method	Specify the interpolation path speed	–

Sequence No. 2

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	1500	Command unit	Interpolation Speed	1000	Command unit/s
Axis 2 Position Command	1000	Command unit	Interpolation Acceleration Time	100	ms
Command	Circular interpolation Counterclock wise direction	–	Interpolation Deceleration Time	100	ms
Sequence Start Condition	No condition	–	Interpolation Starting Speed	0	Command unit/s
Sequence Skip Condition	No condition	–	Interpolation Acceleration/ Deceleration Curve Selection	Trapezoid	–

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Sample Program

Parameter name	Setting	Unit	Parameter name	Setting	Unit
End Pattern	Continuous 1	–	Interpolation Acceleration Time Selection	Up to maximum speed	–
Positioning Completed Input Monitor Valid	Not wait	–	Axis 1 Circular Center/ Passing Point Position	1000	Command unit
Dwell Timer	No dwell time	–	Axis 2 Circular Center/ Passing Point Position	1000	Command unit
M Code	Without M code	–	Circular radius	0	Command unit
Axis Specification	Axis 1, axis 2	–	Circular Interpolation Method	Specify the Circular Center	–
Position Specification	Axis 1, axis 2 Specify absolute position	–			

Sequence No. 3

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	1500	Command unit	Axis Specification	Axis 1, axis 2	–
Axis 2 Position Command	1500	Command unit	Position Specification	Axis 1, axis 2 Specify absolute position	–
Command	Linear interpolation operation	–	Interpolation Speed	1000	Command unit/s
Sequence Start Condition	No condition	–	Interpolation Acceleration Time	100	ms
Sequence Skip Condition	No condition	–	Interpolation Deceleration Time	100	ms
End Pattern	Continuous 1	–	Interpolation Starting Speed	0	Command unit/s
Positioning Completed Input Monitor Valid	Not wait	–	Interpolation Acceleration/ Deceleration Curve Selection	Trapezoid	–
Dwell Timer	No dwell time	–	Interpolation Acceleration Time Selection	Up to maximum speed	–
M Code	Without M code	–	Interpolation Speed Specification Method	Specify the interpolation path speed	–

Sequence No. 4

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	2000	Command unit	Interpolation Speed	1000	Command unit/s
Axis 2 Position Command	2000	Command unit	Interpolation Acceleration Time	100	ms
Command	Circular interpolation Clockwise direction	–	Interpolation Deceleration Time	100	ms
Sequence Start Condition	No condition	–	Interpolation Starting Speed	0	Command unit/s
Sequence Skip Condition	No condition	–	Interpolation Acceleration/ Deceleration Curve Selection	Trapezoid	–
End Pattern	Automatic	–	Interpolation Acceleration Time Selection	Up to maximum speed	–
Positioning Completed Input Monitor Valid	Wait	–	Axis 1 Circular Center/ Passing Point Position	1500	Command unit
Dwell Timer	No dwell time	–	Axis 2 Circular Center/ Passing Point Position	2000	Command unit
M Code	Without M code	–	Circular radius	0	Command unit
Axis Specification	Axis 1, axis 2	–	Circular Interpolation Method	Specify the Circular Center	–
Position Specification	Axis 1, axis 2 Specify absolute position	–			

Sequence No. 5

Parameter name	Setting	Unit
Command	END	–
Sequence Start Condition	No condition	–

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Sample Program

Program Example

This program example runs while the Servomotor is locked.

1) First, turn ON the sequence number setting switch and set sequence No. 1.
2) Start the operation with the operation start switch.

   If you set the sequence number first and then turn ON the operation start switch, the axes will perform a series of positioning operations by linear interpolation and circular interpolation.

Tool Changer (Shorter Route Rotation Control)

When the AXIS FEEDING mode is [Rotation Axis], positioning is performed to the target position by automatically determining the shorter route, turning to the left or right.
For rotary axes, refer to "Command Position Unit Setting" on page 5-30.

Operation Example

Specify the target position in a range of 0 to 360°. The present position returns to 0° once it exceeds the range of 0 to 360°.
The following is an example of positioning operation by absolute movement based on position data in the DM area.
Set the origin by Origin Search or present position preset beforehand.
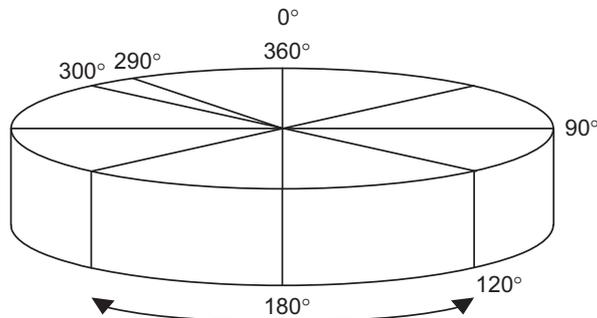
The shorter rotation direction is used for positioning.

1) Specify 4 arbitrary positions, the origin (0°), 90°, 120° and 290°, and the axis moves to the positions.

The axis turns in the direction of the shorter route. The movement speed is 250°/s.

Axis Parameter Settings

Set the AXIS FEEDING mode to [Rotation Axis].

Command Position Unit Setting

Parameter name	Setting	Unit
AXIS FEEDING Mode	Rotation axis (Infinite length)	–
Rotation Axis Upper Limit	359	°

Position Electronic Gear Setting

Parameter name	Setting	Unit
Displayed Unit	Degree	–
Command Pulse Count Per Motor Rotation	2000	Pulse
Work Travel Distance Per Motor Rotation	360	°
Unit Multiplier	1 time	–
Compensation Ratio Numerator	1	–
Compensation Ratio Denominator	1	–

Memory operation data settings

To move the axis according to the operation example, set the sequence data as follows. Because of "Axis Parameter Settings" on page 11-28, the command unit becomes "degree".

Sequence No. 1

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	0	Command unit	M Code	Without M code	–
Command	Positioning operation	–	Axis Specification	Axis 1	–
Sequence Start Condition	No condition	–	Position Specification	Specify absolute position	–
Sequence Skip Condition	No condition	–	Axis 1 Rotation Axis Direction	With the Shortest Route	–
End Pattern	Individual	–	Axis 1 Command Speed	250	Command unit/s
Positioning Completed Input Monitor Valid	Wait	–	Axis 1 Acceleration Time	100	ms
Dwell Timer	No dwell time	–	Axis 1 Deceleration Time	100	ms

Sequence No. 2

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	90	Command unit	M Code	Without M code	–
Command	Positioning operation	–	Axis Specification	Axis 1	–

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Sample Program

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Sequence Start Condition	No condition	–	Position Specification	Specify absolute position	–
Sequence Skip Condition	No condition	–	Axis 1 Rotation Axis Direction	With the Shortest Route	–
End Pattern	Individual	–	Axis 1 Command Speed	250	Command unit/s
Positioning Completed Input Monitor Valid	Wait	–	Axis 1 Acceleration Time	100	ms
Dwell Timer	No dwell time	–	Axis 1 Deceleration Time	100	ms

Sequence No. 3

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	120	Command unit	M Code	Without M code	–
Command	Positioning operation	–	Axis Specification	Axis 1	–
Sequence Start Condition	No condition	–	Position Specification	Specify absolute position	–
Sequence Skip Condition	No condition	–	Axis 1 Rotation Axis Direction	With the Shortest Route	–
End Pattern	Individual	–	Axis 1 Command Speed	250	Command unit/s
Positioning Completed Input Monitor Valid	Wait	–	Axis 1 Acceleration Time	100	ms
Dwell Timer	No dwell time	–	Axis 1 Deceleration Time	100	ms

Sequence No. 4

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Axis 1 Position Command	290	Command unit	M Code	Without M code	–
Command	Positioning operation	–	Axis Specification	Axis 1	–
Sequence Start Condition	No condition	–	Position Specification	Specify absolute position	–
Sequence Skip Condition	No condition	–	Axis 1 Rotation Axis Direction	With the Shortest Route	–
End Pattern	Independent	–	Axis 1 Command Speed	250	Command unit/s

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Sample Program

Parameter name	Setting	Unit	Parameter name	Setting	Unit
Positioning Completed Input Monitor Valid	Wait	–	Axis 1 Acceleration Time	100	ms
Dwell Timer	None	–	Axis 1 Deceleration Time	100	ms

Sequence No. 5

Parameter name	Setting	Unit
Command	END	–
Sequence Start Condition	No condition	–

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Sample Program

Program Example

This program example runs while the Servomotor is locked.
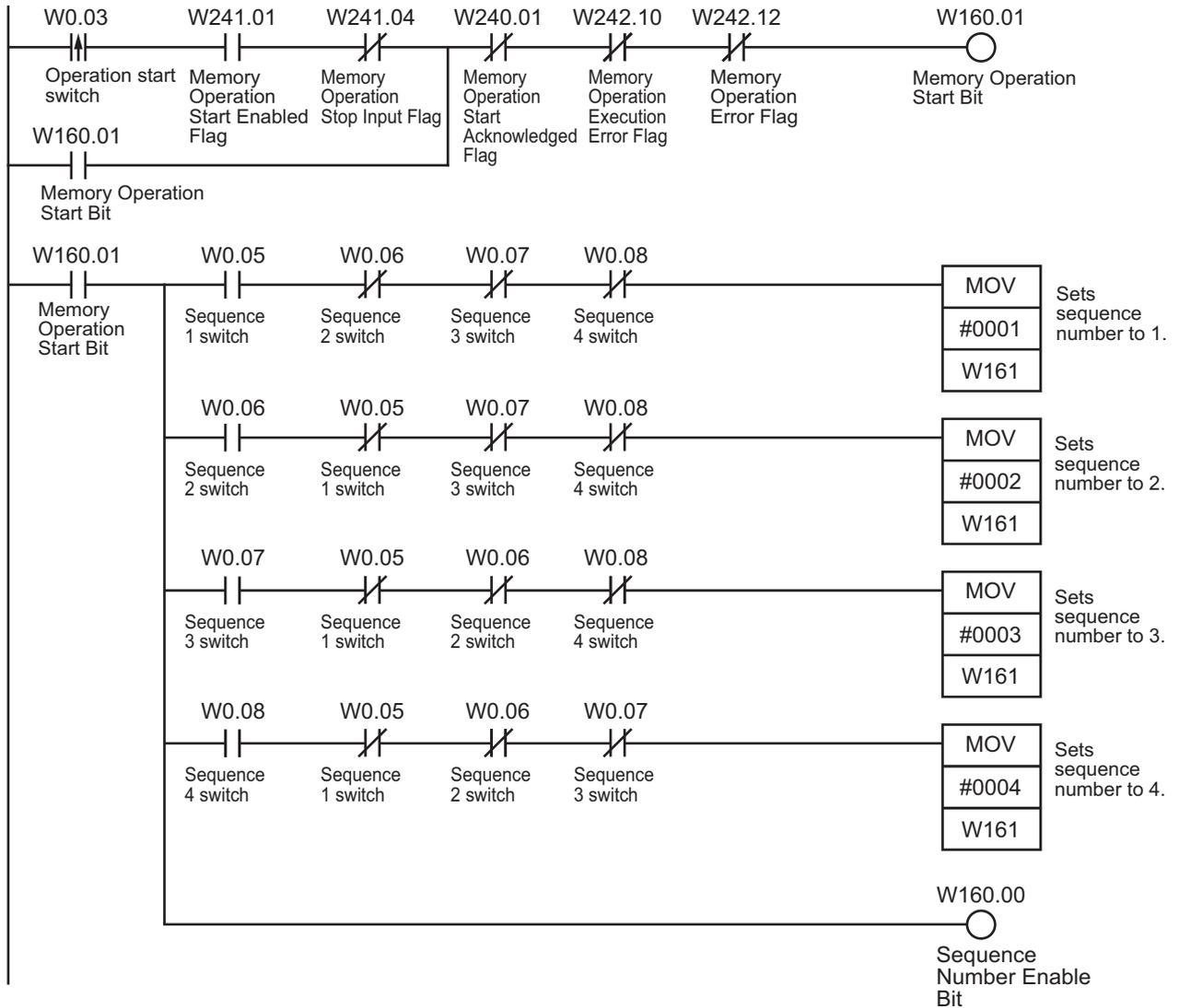
1) Turn ON the setting switch which corresponds to the sequence number for the desired operation angle.
2) The axis executes positioning every time you turn ON the operation start switch.

12

Troubleshooting

This chapter explains the items to check upon occurrence of problems, error diagnosis based on the alarm indication as well as its countermeasures, and error diagnosis based on the operating condition as well as its countermeasures.

12-1 Troubleshooting

This chapter explains remedial actions to take upon encountering problems when you use the PCU for the first time or after start operating the PCU.
For the explanation of each error, refer to "12-2 Remedial Procedure upon Occurrence of Error" onward.

Preliminary Check Items

If you encountered a problem, check the items below and investigate the problem.

No.	Category	Item to check	Confirm
1	Installation condition	Is there dust around the PCU?	
2		Are there conductive foreign matters (metal, carbon, etc.) around the PCU which might enter the unit?	
3		Is the ambient temperature too high (relative to the ambient operating temperature in the specifications)?	
4		Is the ambient area humid (due to moisture content in air, use of water, etc.)?	
5		Does the ambient air contain corrosive gases (acids, salt, sulfur, etc.)?	
6		Are there sources of noise around the PCU (welders, Frequency Inverters, etc.)?	
7	Wiring	Is the power supply line wired in the same duct as the signal line?	
8		Is the PCU grounded properly?	
9		Is there a noise filter in the power supply?	
10	Change	Was any extension work (welding work) done lately?	
11		Was any power supply facility added lately?	
12		Was the system (including its program) modified or added, etc.?	
13	Accident	Was there any lightning strike nearby?	
14		Was there a ground-fault accident or shutdown of the earth leakage breaker?	
15		Was there a power outage?	

Problems and Countermeasures

If you encountered an error which is not explained below, use CX-Programmer to print out the details of the problem, allocated areas and parameters and send the information to OMRON. If your system operates unexpectedly, the transferred parameters and memory operation data may not be saved in the flash memory. Check if the parameters and data are saved in the flash memory.

If your system operates unexpectedly, data or flags may not be exchanged properly between the ladder program and PCU.

Use the data tracing function of CX-Programmer to check if data and flags are exchanged at the correct timings.

No.	Problem	Probable cause	Item to check	Countermeasure	Confirm
1	The RUN LED of the CPU Unit does not turn ON after you turn ON the power supply.	Wrong wiring of the power supply line	Check the wiring of the power supply.	Wire correctly.	
2		Drop in power supply voltage	Check the voltage of the power supply.	Use the correct power supply. Check the power supply capacity.	
3		Faulty power supply	–	Replace the power supply.	
4	Only the RUN LED of the PCU does not turn ON after you turn ON the power supply.	Insufficient power supply capacity	Add up the power supply capacities of the CPU Units which are installed in the same system, as well as all other units, and compare the total power supply capacity against the power supply capacity of the Power Supply Unit. If the total power supply capacity exceeds the capacity of the Power supply Unit, you cannot use your system properly.	Increase the power supply capacity. Change the system configuration so that the power supply capacity is not exceeded.	
5		Failure	–	Perform the actions from "LED Error Indicator" on page 12-11 onward.	
6	Motor does not lock.	The PCU does not output operation commands to the Servo Drive.	Check the wiring of the RUN output signal between the PCU and driver. Check if the ladder program is executing servo lock.	Change the wiring. Correct the ladder program.	
7		Drive setting error	Check the drive settings.	Set the drive correctly.	

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Troubleshooting

No.	Problem	Probable cause	Item to check	Countermeasure	Confirm
8	Motor does not run.	Motor is unlocked.	Refer to No. 7 and 8.	Refer to No. 7 and 8.	
9		The wiring between the PCU and driver is not correct.	Use a tester, etc. to check the wiring. Change the connecting cable.	Wire correctly.	
10		The rotation prohibit input of the Servo Drive is enabled.	Use the Servo Drive software to check the rotation prohibit input.	Cancel the rotation prohibit input of the Servo Drive. Change the setting so that you do not use the rotation prohibit input of the Servo Drive.	
11		Drive alarm	Check for drive alarms.	If an alarm is present, follow the instruction for the applicable alarm.	
12		Mechanical axis is locked.	Check for contact with mechanical limits or dragging-in of mechanical parts.	Manually release the locked mechanical axis.	
13		Faulty PCU	–	Replace the PCU.	
14	Origin Search cannot be performed.	Error or alarm	Check the content of the error or alarm.	If any error or alarm is present, follow the instruction for the applicable error or alarm.	
15		Wrong wiring of the origin proximity input of the PCU	Check if the origin proximity input sensor in the Operating Memory area turns ON/OFF.	Wire correctly.	
16		Incorrect wiring of the origin input to the PCU	Check the wiring of the origin input.	Wire correctly.	
17		The rotation direction and limit input direction is inconsistent.	If the axis moves to the mechanical limit without reversing before the limit, check if the limit input in the Operating Memory area turns ON/OFF.	Wire the limit input correctly.	
18		Wrong wiring of the limit input	Check the wiring of the limit input.	Wire correctly.	
19		Positioning completed does not turn ON.	Check if the Servo Drive gain is too low. Check if the in-position width of the Servo Drive is too narrow.	Increase the Servo Drive gain. Widen the in-position width of the drive.	
20		Excessive Origin Search Approach Speed	Check the Origin Search Approach Speed.	Lower the Origin Search Approach Speed of the PCU.	
21		Parameter is not set correctly.	Check the parameters with CX-Programmer.	Set the parameters correctly, transfer them to the PCU, and write the transferred parameters to the flash memory.	
22		Faulty PCU	–	Replace the PCU.	

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Troubleshooting

No.	Problem	Probable cause	Item to check	Countermeasure	Confirm
23	Origin-searched origin shifts occasionally.	Loose mechanical parts such as couplings	Use a marker pen to mark the motor shafts, couplings and other mechanical connections, to check for shifting.	Securely tighten the connections that shifted.	
24	Origin-searched origin shifts occasionally. (Continued)	No allowance for phase Z No allowance for origin input signal	If the value is close to the setting per Servomotor rotation (number of pulses per encoder rotation) or near zero, a position shift that corresponds to 1 motor rotation occurs during Origin Search due to slight change in the sensor load timing.	Remove the motor coupling and shift the position by around one-quarter of a turn so that the pulses of phase Z allowance become around one half of a Servomotor rotation (number of pulses per encoder rotation), and then perform Origin Search again.	
25	Unstable motor rotation	Wrong wiring of Servomotor power line and encoder line, missing phase, etc.	Check the wiring of the motor power line and encoder line.	Wire correctly.	
26		Misalignment of the coupling that connects the motor shaft and mechanical system Untightened screw Fluctuation of load torque due to pulley and gear meshing	Check the machine. Turn the coupling under no-load (with the mechanical parts after the coupling removed).	Review and adjust the machine.	
27		Insufficient gain adjustment	–	Perform auto-tuning of the Servomotor. Manually adjust the Servomotor gain.	
28		Wrong Servomotor selection (adjustment not possible)	Select a motor again (check the torque and inertia ratio).	Change to an optimal motor.	
29		Damaged Servomotor bearing	Turn OFF the Servo Drive power supply, and also turn ON the brake power supply and release the brake if the motor comes with a brake, and then manually turn the motor output shaft with the motor power line disconnected (because the dynamic brake may be applied).	Replace the Servomotor.	
30		Broken Servomotor winding	Use a tester to check the resistance among U, V and W of the motor power line. If the balance is off, there is a problem.	Replace the Servomotor.	

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Troubleshooting

No.	Problem	Probable cause	Item to check	Countermeasure	Confirm
31	Rotation Direction is reversed.	The Servo Drive is set to the opposite rotation direction.	JOG the machine and if the rotation direction of the Servo Drive is opposite the JOG direction, the rotation direction of the Servo Drive is reversed. Also check for reversed feedback signals (phases A and B) and reverse rotation setting of the parameter.	Set the rotation direction of the Servo Drive correctly.	
32		Reversed forward/reverse direction pulse output signals	Check the wiring of the forward/reverse direction pulse output signals.	Wire correctly.	
33		(Origin Search) Inconsistency between the parameter that sets the origin proximity sensor polarity and the one that sets the origin proximity input polarity (in the PCU).	Check the parameter and sensor polarities again.	Set the correct parameters.	
34		(Origin Search) Wrong wiring of the origin proximity input	Check if the origin proximity input sensor in the Operating area turns ON/OFF.	Wire the origin proximity input correctly.	
35	It cannot be started or positioning completed cannot be output or delayed.	The in-position width of the Servo Drive is narrow, and thus the present position does not enter the in-position width. (Because the current operation does not complete until the present position enters the in-position width, you cannot start the next position.)	–	Widen the in-position width of the Servo Drive.	
36		Wrong wiring of the positioning completed of the Servo Drive	Check if the positioning completed in the Operating area turns ON/OFF.	Wire the positioning completed correctly.	
37		Servo Drive gain is low.	–	Adjust the Servo Drive gain.	

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Troubleshooting

No.	Problem	Probable cause	Item to check	Countermeasure	Confirm
38	It cannot be started or positioning completed cannot be output or delayed. (Continued)	The in-position width is not achieved in a standstill state due to an external force.	Check the error counter with the Servo Drive monitor function to check if the present position is inside the in-position width.	In situations where you stop the axis in such a way that a position inside the in-position width is not achieved, such as in push control, you can use the error counter reset output to forcibly achieve the in-position width. Since the origin will be unconfirmed, however, you must confirm the origin again by Origin Search or present position preset.	
39	Abnormal noise	Mechanical vibration	Check the moving parts of the machine for intrusion of foreign matter, damage, deformation and loosening.	Correct the problem location, if any.	
40		Insufficient adjustment of the Servo Drive gain (high gain)	–	Perform auto-tuning. Manually adjust (lower) the gain.	
41		Wrong motor selection (adjustment not possible)	Select a motor again (check the torque and inertia ratio).	Change to an optimal motor.	
42		Misalignment of the coupling that connects the motor shaft and machine	–	Adjust the motor and machine installation.	
43	Vibration at the same frequency as the commercial frequency	Generation of inductive noise	Check if the drive's control signal line is too long. Check if the control signal line is bundled with the power supply line.	Shorten the control signal line. Isolate the control signal line from the power supply line. Make sure that the control signals are received from a low-impedance power supply.	
44		Grounding of the control signal line is not correct.	Check if the shield of the control signal line is grounded correctly on the drive side (wiring check). Check if the control signal line is contacting the grounding wire.	Wire correctly.	
45		Twisted-pair and shielded cable is not used for connection between the PCU and drive.	Check if the pulse signal line uses a twisted-pair cable and if the entire cable is shielded.	Use a twisted-pair shield cable and wire it according to the wiring example.	

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Troubleshooting

No.	Problem	Probable cause	Item to check	Countermeasure	Confirm
46	Motor shaft shakes.	Insufficient adjustment of the gain (low gain)	–	Perform auto-tuning. Manually adjust (raise) the gain.	
47		Gain cannot be adjusted due to low machine rigidity.	(In particular, this condition occurs on vertical axes, SCARA robots, palletizers and other systems whose axis receives bending or tensional loads.)	Increase the machine rigidity. Readjust the gain.	
48		Mechanical configuration prone to stick slip (highly sticky static friction)	–	Perform auto-tuning. Manually adjust the gain.	
49		Wrong motor selection (adjustment not possible)	Select an appropriate motor (check the torque and inertia ratio).	Change to an optimal motor.	
50		Failure	–	Replace the driver. Replace the motor.	
51	Position shift	Unstable shift amount Malfunction due to noise	–	Use a shielded cable.	
52		The origin position was already shifted before positioning.	Refer to No. 25 and 26.	Refer to No. 25 and 26.	
53		The shield is not grounded at a single point on the Servo Drive side.	Check the ground wiring.	Wire correctly.	
54		The output power supply for the PCU is not isolated from other power supplies.	Check if the output power supply for the PCU is isolated from other power supplies.	Isolate the output power supply for the PCU from other power supplies.	
55				Provide a noise filter on the primary side of the output power supply for the PCU.	
56				Ground the output power supply for the PCU.	
57		Cable between the PCU and driver is long.	–	Keep the cable within 3 m for the open-collector output type and within 10 m for the line-driver output type.	
58		Twisted-pair cable is not used for pulse output.	Check if a twisted-pair cable is used for pulse output.	Use a twisted-pair cable for pulse output.	
59		Cable between the PCU and driver not isolated from other power lines.	Check if the cable between the PCU and driver is isolated from other power lines.	Isolate the cable between the PCU and driver from other power lines.	

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Troubleshooting

No.	Problem	Probable cause	Item to check	Countermeasure	Confirm
60	Position shift (Continued)	Malfunction due to noise from a welder, Frequency Inverters, etc.	Check if a welder, Frequency Inverters or other similar equipment is located nearby.	Isolate from any nearby welder, Frequency Inverters, etc.	
61		Operation command outputs to the driver turn OFF during operation.	Confirm that operation command outputs to the driver do not turn OFF during operation.	Make sure that operation command outputs turn ON at the correct timings.	
62		Mechanical shift	Check if dimensional shifts accumulated (mark the mechanical connections to check for shifting).	Securely tighten the mechanical tightening points.	
63	Pausing and then restarting memory operation results in the operation started from the beginning, not from the paused point.	"Sequence No. Enable" is ON when "Start" is turned ON at the restart.	Check the ladder program or data tracing result.	To continue the operation from the paused point, turn OFF "Sequence No. Enable" when you turn ON "Start" at restart.	

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Troubleshooting

12-2   Remedial Procedure upon Occurrence of Error

The PCU detects errors mainly in the conditions specified below.

▌ Power Supply ON

In the error check which you perform at power supply ON, restart or PCU setup, the PCU checks the items in this order as follows:
⋄ Check the hardware
⋄ Check for establishment of communication with the CPU Unit
⋄ Check the user parameters

Once an error occurs, the error state is held. Check the release method and take an appropriate action.
If multiple errors are present, the PCU detects the next error as soon as you release the present error. Repeat the release operation to release all errors. While an error is present, commands except for data transfer (read, write) and data save become invalid for all axes with the exclusion of some axes.

▌ Command Execution

The PCU checks for data problems, software limits, emergency stop and limit signals, etc., when it executes a command or while it performs a command operation.
If an emergency stop and limit signal error is detected while another error is present, the PCU outputs the emergency stop and limit signal error. Check the release method and take an appropriate action.

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Troubleshooting

Operation item	Operation flow	Refer to
At power supply ON or restart	Power supply ON → When error is detected Check the hardware → When error is detected Establishment of communication with CPU → When error is detected Check the user parameters → When error is detected Check wiring, PCU, and CPU Unit, and make corrections	"12-3 LED Error Indicator" "12-6 Error Code List"
Command Execution	Reception of start command → When error is detected Execution of start command Correction of wiring, data, and ladder program	

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Troubleshooting

12-3 LED Error Indicator

The LED indicators on the front face of the PCU indicate the errors below:
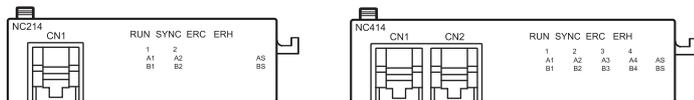
○ : Lit

◎ : Flashing

● : Unlit

− : The axis holds previous state (error handling is not performed; the illumination pattern conforms to the applicable control state at that time)

▲ : The LED of the axis that generated an error flashing (◎), while the LEDs of other axes retain the previous state (−).

LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
●	●	●	●	●	●	●	●	CPU Unit Failure	Power is not supplied properly to the CPU Unit.	Remove the cause of the power failure and then reconnect the power supply.
								System Error	The PCU system is not operating properly.	Reconnect the power supply or restart the PCU. If this error occurs again, replace the PCU. If this error occurs, the PCU cuts off all outputs.
●	●	◎	●	●	●	●	●	Invalid Unit Number Setting	An invalid unit number is set.	Change the unit number to a value inside the settable range, and then reconnect the power supply.
								Duplicate Unit Number Setting	The unit number of the PCU is the same as that of other unit.	Change the unit number, and then reconnect the power supply and create a PLC I/O table.
								PLC Initial Processing Error	The initialization process in the CPU Unit was not successful.	Reconnect the power supply and then create a PLC I/O table.
								Other CPU Errors	A unit number error was detected in the CPU Unit initialization process.	Change the unit number to a value inside the settable range, and then reconnect the power supply.
									The PCU unit number is not registered in the I/O table.	Reconnect the power supply and then create a PLC I/O table.

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Troubleshooting

LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
●	○	○	●	●	●	●	●	PCU Type Error	The PCU is not recognized correctly.	Reconnect the power supply or restart the PCU. If this error occurs again, replace the PCU.
								Out-of-range Unit Number	The PCU unit number is outside the specified range.	Change the unit number to a value inside the settable range, and then reconnect the power supply.
								PLC Initial Processing Error	The initialization process in the CPU Unit was not successful.	Reconnect the power supply or restart the PCU. If this error occurs again, replace the PCU.
●	○	●	●	●	●	●	●	System Software Error	An error in the PCU internal system ROM.	Reconnect the power supply or restart the PCU. If this error occurs again, replace the PCU.
								Memory Error	An error in the PCU internal memory.	
○	●	○	●	●	●	●	●	Synchronous Operation Cycle Invalid	The synchronization control period exceeds the range usable by the PCU.	Set a synchronization cycle time set value within the settable range and then reconnect the power supply.
○	–	○	●	●	●	●	●	Synchronous Time Monitor Timeout	The timing of synchronous control period can not be obtained properly.	Check the installed condition of the PCU and then reconnect the power supply or restart the PCU. If this error occurs again, replace the PCU. If this error occurs, the PCU stops all axes immediately.
○	–	○	–	●	●	●	●	Synchronous Data Receive Error	Data exchange by synchronous data link could not be executed properly.	Check the installed condition of the PCU and synchronous unit control setting, and then execute an error reset. If this error occurs again, replace the PCU. If this error occurs, the PCU decelerates the applicable axis to a stop.
○	–	○	●	–	–	–	–	PLC Watchdog Timer Error	The CPU Unit system is not operating properly.	Reconnect the power supply or restart the PCU. If this error occurs again, replace the PCU. If this error occurs, the PCU cuts off all outputs.
								Bus Error	An error in PLC bus operation.	
○	–	○	–	–	–	–	–	CPU Unit Monitor Error	Processes are not executed properly due to an overload of the CPU Unit.	Check the operating condition of the CPU Unit.
								CPU Unit Stop Error	An error that stops the CPU Unit occurred.	Remove the cause that stopped the CPU Unit. If this error occurs, the PCU cuts off all outputs.

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Troubleshooting

LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	–	–	●	●	●	●	Special IO Unit Memory Error (User Data)	User data could not be saved properly to the nonvolatile memory in the PCU. Or, the saved user data is corrupted.	Transfer and save the data again. While this error is present, you can only execute data transfer and data save. If this error occurs again, replace the PCU. If this error occurs when you turn ON the power supply, all parameters and data in the PCU are reset to their default setting. If this error occurs, the PCU decelerates all axes to a stop.
○	○	●	–	●	●	●	●	Special IO Unit Memory Error (Error Log Data)	The nonvolatile memory that saves the error log of the PCU is abnormal.	Clear the error log of the PCU and then reconnect the power supply or restart the PCU.
								Restore Error	The easy backup function of the CPU Unit could not restore the backup data properly.	The PCU is using the data which was saved before the restore. Execute restore again, or transfer and save the data again. While this error is present, you can only execute data transfer and data save.
○	○	●	–	▲	▲	▲	▲	Emergency Stop Input	An emergency stop signal was input.	Cancel the emergency stop input and then execute an error reset. If the error cannot be reset, check the connection of the emergency stop signal and setting of the emergency stop input logic. If this error occurs, the PCU stops the applicable axis according to the setting of the corresponding axis parameter.
								Forward Direction Limit Error	A forward direction limit signal was input.	Execute an error reset and then perform recovery operation in the reverse direction. If a normal state cannot be recovered, check the connection of the forward direction limit signal and setting of the forward direction limit input logic. If this error occurs, the PCU stops the applicable axis according to the setting of the corresponding axis parameter.

LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	●	–	▲	▲	▲	▲	Reverse Direction Limit Error	A reverse direction limit signal was input.	Execute an error reset and then perform recovery operation in the forward direction. If a normal state cannot be recovered, check the connection of the reverse direction limit signal and setting of the reverse direction limit input logic. If this error occurs, the PCU stops the applicable axis according to the setting of the corresponding axis parameter.
								Drive Alarm Input	A drive alarm input signal was input.	Remove the cause of the drive error and then execute an error reset. If this error occurs, the PCU stops the applicable axis according to the setting of the corresponding axis parameter.
○	○	–	–	▲	▲	▲	▲	External Power Supply Error	The pulse I/O power supply is not supplied.	Confirm that the pulse I/O power supply is supplied, and then execute an error reset. If this error occurs, the PCU immediately stops all axes and switches to the servo unlocked state.
								Duplicate Start	Multiple functions that cannot be executed simultaneously were executed on the same axis.	Check the execution conditions and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								During Servo Unlock	An axis operation command was executed while the servo was unlocked.	Execute an error reset, and issue the axis operation command after the servo is locked.
								During Forward Direction Limit Input	A forward start command was executed when a forward direction limit signal was input.	Execute an error reset and then perform recovery operation in the reverse direction. If this error occurs again, check the connection of the forward direction limit signal, setting of the forward direction limit input logic, and execution condition for start command.

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Troubleshooting

LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	–	–	▲	▲	▲	▲	During Reverse Direction Limit Input	A reverse start command was executed when a reverse direction limit signal was input.	Execute an error reset and then perform recovery operation in the forward direction. If this error occurs again, check the connection of the reverse direction limit signal, setting of the reverse direction limit input logic, and execution condition for start command.
								Command Position Forward Direction Soft Limit Exceeded	The command position of the positioning exceeds the software limit in the forward direction.	Check the command position and software limit setting, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Command Position Reverse Direction Soft Limit Exceeded	The command position of the positioning exceeds the software limit in the reverse direction.	
								Present Position Unknown	Origin Return was executed when the origin was unconfirmed.	Execute an error reset, and execute the command after the origin is confirmed by Origin Search or present position preset.
								Error Counter Reset Error	An axis operation command was executed while an error counter reset signal was output. Or, the error counter was reset during Origin Search.	Check the execution condition for error counter reset, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Override Error	The override is outside the range.	Check the override set value and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Command Present Position Overflow Occurring	The command present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range.	Execute an error reset and then resolve the overflow/underflow state by Origin Search or present position preset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Positioning Time Over	The positioning completed input was not detected within the positioning monitor time.	Check the positioning completed input and then execute an error reset. If this error occurs again, check the connection of the positioning completed signal, input logic, and setting of the positioning monitor time.

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Troubleshooting

LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	–	–	▲	▲	▲	▲	Forward Direction Software Limit Error	The software limit in the forward direction was exceeded.	Check the axis operation command and setting of the forward direction software limit, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Reverse Direction Software Limit Error	The software limit in the reverse direction was exceeded.	Check the axis operation command and setting of the reverse direction software limit, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Position Error Over	The difference between the command present position and present feedback position exceeded the set value.	Remove the cause that generate the error between the command present position and feedback present position, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Speed Error Over	The difference between the present command speed and present feedback speed exceeded the set value.	Remove the cause that generate the error between the present command speed and present feedback speed, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Backlash Compensation Amount Exceeded	The compensation amount exceeded the upper limit that can be output, when the backlash compensation method is "superimpose the compensation amount at start of positioning."	Check the setting of the backlash compensation amount and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Synchronous Feeding Command Present Position Overflow	The synchronous feeding command position data which is given by synchronous data link became outside the upper/lower limits of the usable range.	Check the synchronous feeding command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Command Present Position Overflow	The command present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range when the Position and Speed Error monitor function was enabled.	Execute an error reset and then resolve the overflow/underflow state by Origin Search or present position preset. If this error occurs, the PCU decelerates the applicable axis to a stop.

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Troubleshooting

LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	−	−	▲	▲	▲	▲	Feedback Present Position Overflow	The feedback present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range when the Position and Speed error Monitor function was enabled.	Execute an error reset, and then resolve the overflow/underflow state by feedback present position preset (IOWR). If this error occurs, the PCU decelerates the applicable axis to a stop.
								ABS Encoder Communications Error	When you use an absolute encoder, absolute data could not be read properly upon servo lock.	Execute an error reset and then lock the servo. If this error occurs again, check the connection of the encoder pulse input with the Servo Drive.
								ABS Encoder Data Error	When you use an absolute encoder, invalid absolute data was read upon servo lock.	
								ABS Encoder Present Position Restore Overflow	When you use an absolute encoder, the present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range due to the absolute data which was read upon servo lock.	Execute an error reset and then set up the absolute encoder again and perform origin positioning of PCU.
								Inching Command Position Overflow	The command present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range during inching.	Remove the cause of the command present position overflow/underflow, check the inching width, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								MPG Magnification Invalid	The MPG ratio setting is outside the specified range.	Check the setting of the MPG ratio and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Origin Search Reverse Direction Limit Error	Origin search operation was stopped due to detection of a limit input in the direction opposite the origin input detection direction.	Check the input signal for origin search and origin search setting, and then execute an error reset. If this error occurs, the PCU stops the applicable axis or decelerates to a stop according to the setting of the corresponding axis parameter.
								Origin Search Direction Limit Error	Origin search operation was stopped due to detection of a limit input in the origin input detection direction.	
								Bidirectional Limit Error	Origin search cannot be continued because the limit inputs in both directions were detected.	

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Troubleshooting

LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	–	–	▲	▲	▲	▲	Origin Proximity/ Origin Search Reverse Direction Limit Error	Origin search operation was stopped because the origin proximity input and detection position of the limit input in the direction opposite the origin input detection direction were not appropriate.	Check the origin proximity input and detection position of the limit input in the direction opposite the origin input detection direction, and then execute an error reset. If this error occurs, the PCU stops the applicable axis or decelerates to a stop according to the setting of the corresponding axis parameter.
								Origin Proximity/ Origin Search Direction Limit Error	Origin search operation was stopped because the origin proximity input and detection position of the limit input in the origin input detection direction were not appropriate.	Check the origin proximity input and detection position of the limit input in the origin input detection direction, and then execute an error reset. If this error occurs, the PCU stops the applicable axis or decelerates to a stop according to the setting of the corresponding axis parameter.
								Origin Input/ Origin Search Reverse Direction Limit Error	Origin search operation was stopped because the origin input and detection position of the limit input in the direction opposite the origin input detection direction were not appropriate.	Check the origin input and detection position of the limit input in the direction opposite the origin input detection direction, and then execute an error reset. If this error occurs, the PCU stops the applicable axis or decelerates to a stop according to the setting of the corresponding axis parameter.
								Origin Input/ Origin Search Direction Limit Error	Origin search operation was stopped because the origin input and detection position of the limit input in the origin input detection direction were not appropriate.	Check the origin input and detection position of the limit input in the origin input detection direction, and then execute an error reset. If this error occurs, the PCU stops the applicable axis or decelerates to a stop according to the setting of the corresponding axis parameter.
								Origin Input Mask Amount Invalid	The set value of the origin input mask amount is insufficient for the amount of movement which you need to decelerate from the origin search speed to the origin search approach speed, when the ORIGIN SEARCH OPERATION mode is "Proximity Rev Turn Origin Input Mask Amount".	Check the origin input mask amount, Origin Search Speed and Origin Search Approach Speed, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.

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LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	–	–	▲	▲	▲	▲	No Origin Input	The origin input was not detected during origin search.	Check the connection and setting of the origin input, and then execute an error reset. If this error occurs (upon limit input), the PCU stops the applicable axis according to the setting of the corresponding axis parameter.
								No Origin Proximity Input	The origin proximity input was not detected in an origin search operation that uses the origin proximity input.	Check the connection and setting of the origin proximity input, and then execute an error reset. If this error occurs (upon limit input), the PCU stops the applicable axis according to the setting of the corresponding axis parameter.
								Origin Input Mask Position Overflow	The command present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range due to the movement by the origin input mask amount, when the ORIGIN SEARCH OPERATION mode was "Proximity Rev Turn/Origin Input Mask Amount".	Check the setting of the origin input mask amount and range of the command present positions used, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								ABS Encoder Origin Position Offset Overflow	When you use an absolute encoder, the absolute encoder origin position offset which was calculated upon completion of Origin Search exceeded the setting range.	Set up the absolute encoder again, and then execute an error reset.
								ABS Encoder Origin Position Offset Calculation Not Possible	The absolute encoder origin position offset could not be calculated because the present position of the absolute encoder is unknown. The following are possible causes for the present position of the absolute encoder being unknown. • You did not set [RUN Output Function] under [I/O Function Selection] among the axis parameters to [Use as RUN output] and then execute servo lock. • The present position preset (excluding the origin preset) was executed after servo lock. • The feedback present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range after servo lock. • The axis parameter [Starting Present Position Clear Enable] is set to [Enable].	Check the cause and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.

LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	–	–	▲	▲	▲	▲	Absolute Movement Position Error	The command position of absolute movement is outside the specified range.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Absolute Movement Speed Error	The command speed of absolute movement is outside the specified range.	Check the set value of the command speed and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Absolute Movement Acceleration Time Error	The acceleration time of absolute movement is outside the specified range.	Check the set value of the acceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Absolute Movement Deceleration Time Error	The deceleration time of absolute movement is outside the specified range.	Check the set value of the deceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Absolute Movement Direction Specification Error	The rotational axis direction setting of absolute movement is outside the specified range.	Check the setting of the rotational axis direction, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Rotation Axis Upper Limit Over	The command position of absolute movement for a rotation axis exceeds the rotation axis upper limit.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Absolute Movement Interrupt Feeding Position Error	The command position of absolute movement interrupt feeding is outside the specified range. Or, the command position resulted in 0 movement, and thus the constant-pitch feeding direction was not determined upon interrupt input.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Absolute Movement Interrupt Feeding Input Function Setting Error	Interrupt feeding cannot be executed because latch input is selected for the interrupt input function.	Check the setting of the interrupt input function, and then execute an error reset.
								Absolute Movement Interrupt Feeding with No Interrupt Signal	An interrupt input signal was not detected during interrupt feeding.	Check the connection and setting of the interrupt input, and then execute an error reset.

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LED							Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	–	–	▲	▲	▲	▲	Absolute Movement Interrupt Feeding Feedback Present Position Overflow	The feedback present position upon interrupt input became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range when the feedback present position was selected as the reference position for interrupt constant-pitch feed.	Execute an error reset, and then resolve the overflow/ underflow state by feedback present position preset (IOWR). If this error occurs again, check the unit setting for feedback pulse input and range of feedback present positions to be used. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Relative Movement Position Error	The command position of relative movement is outside the specified range.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Relative Movement Speed Error	The command speed of relative movement is outside the specified range.	Check the set value of the command speed and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Relative Movement Acceleration Time Error	The acceleration time of relative movement is outside the specified range.	Check the set value of the acceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Relative Movement Deceleration Time Error	The deceleration time of relative movement is outside the specified range.	Check the set value of the deceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Relative Movement Interrupt Feeding Position Error	The command position of relative movement interrupt feeding is outside the specified range. Or, the command position resulted in 0 movement, and thus the feeding direction was not determined upon interrupt input.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Relative Movement Interrupt Feeding Input Function Setting Error	Interrupt feeding cannot be executed because latch input is selected for the interrupt input function.	Check the setting of the interrupt input function, and then execute an error reset.
								Relative Movement Interrupt Feeding with No Interrupt Signal	An interrupt input signal was not detected during interrupt feeding.	Check the connection and setting of the interrupt input, and then execute an error reset.

LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	−	−	▲	▲	▲	▲	Relative Movement Interrupt Feeding Feedback Present Position Overflow	The feedback present position upon interrupt input became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range when the feedback present position was selected as the reference position for interrupt feeding.	Execute an error reset, and then resolve the overflow/underflow state by feedback present position preset (IOWR). If this error occurs again, check the unit setting for feedback pulse input and range of feedback present positions to be used. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Speed Control Speed Error	The command speed of speed control is outside the specified range. Or, one of the following operations was executed during speed control interrupt feeding: • The command speed was 0 at the time of interrupt input. • The command speed was changed to 0 during feeding. • The mark of the command speed was changed (reversed) during speed control while waiting for interrupt input.	Check the setting value of the command speed and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Speed Control Acceleration Time Error	The acceleration time of speed control is outside the specified range.	Check the set value of the acceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Speed Control Deceleration Time Error	The deceleration time of speed control is outside the specified range.	Check the set value of the deceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Speed Control Interrupt Feeding Position Error	The command position of speed control interrupt feeding is outside the specified range.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Speed Control Interrupt Feeding Input Function Setting Error	Interrupt feeding cannot be executed because latch input is selected for the interrupt input function.	Check the setting of the interrupt input function, and then execute an error reset.

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LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	−	−	▲	▲	▲	▲	Speed Control Interrupt Feeding Feedback Present Position Overflow	The feedback present position upon interrupt input became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range when the feedback present position was selected as the reference position for interrupt feeding.	Execute an error reset, and then resolve the overflow/ underflow state by feedback present position preset (IOWR). If this error occurs again, check the unit setting for feedback pulse input and range of feedback present positions to be used. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Present Position Preset Error	The command position of present position preset is outside the specified range.	Check the set value of the command position and then execute an error reset.
								High-speed PTP position error	The command position of high-speed PTP start is outside the specified range.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								High-speed PTP Speed Error	The command speed of high-speed PTP start is outside the specified range.	Check the set value of the command speed and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								High-speed PTP Acceleration Time Error	The acceleration time of high-speed PTP start is outside the specified range.	Check the set value of the acceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								High-speed PTP Deceleration Time Error	The deceleration time of high-speed PTP start is outside the specified range.	Check the set value of the deceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								High-speed PTP Direction Specification Error	The rotation axis direction setting of high-speed PTP start is outside the specified range.	Check the setting of the rotational axis direction, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								High-speed PTP Rotation Axis Upper Limit Over	The command position of high-speed PTP start for a rotation axis exceeds the rotation axis upper limit.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
								Synchronous Feeding Command Position Data Setting Invalid	The setting of synchronous feeding command position data is invalid.	Check the setting of synchronous feeding command position data and then execute an error reset.

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LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	–	–	–	–	–	–	Duplicate Start	A memory operation start and a memory operation independent start were executed simultaneously for the same task. Or, a memory operation was started for a task whose configuration axis was busy.	Check the execution conditions and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
								Sequence No Error	The sequence number which you specified by the memory operation command is outside the specified range. Or, sequence data was not yet set for the specified sequence number.	Set a sequence number inside the range or check the setting of the memory operation data for the applicable sequence number, and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
								Configuration Axis Error	A configuration axis in the current memory operation task generated an axis error.	Remove the cause of the error in the applicable axis, and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
								Backlash Output Method Invalid	An attempt was made to execute an operation pattern of circular interpolation or continuous 3 with "perform compensation operation before start of positioning" selected as the backlash compensation method.	Change the backlash output method to "superimpose compensation amount at start of positioning". If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
								Interpolation Movement Amount Overflow	The amount of movement by interpolation operation exceeded the usable range during linear interpolation or circular interpolation command.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
								Error between Axes Over	The error between the specified interpolated axes exceeded the set value during linear interpolation.	Remove the cause of the deviation between the interpolated axes, and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
								Memory Operation Error	The setting of memory operation data is not correct.	Check the setting of the memory operation data for the applicable sequence number, and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.

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LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	○	–	–	–	–	–	–	Memory Operation Condition Data Error	The setting of memory operation condition data is not correct.	Check the setting of the memory operation condition data for the applicable condition number, and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.

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Warning

The warnings are listed below.

LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
◯	–	–	–	–	–	–	–	IORD Busy	IORD cannot be executed because data transfer by the data transfer bit is still in progress. Or, IORD cannot be executed because the OPERATING mode of the PCU is different.	Check the execution condition for IORD.
								IORD Transfer Words Count Invalid	The number of IORD transfer words is outside the specified range.	Check the number of IORD transfer words.
								IORD Control Data Invalid	The IORD control data is outside the specified range. Or, one of the following operations was attempted: • Read the feedback present position of an unused axis • Read unused latch data	Check the control data for IORD.
								IOWR Busy	IOWR cannot be executed because data transfer by the data transfer bit is still in progress. Or, IOWR cannot be executed because the OPERATING mode of the PCU is different.	Check the execution condition for IOWR.
								IOWR Transfer Words Count Invalid	The number of IOWR transfer words is outside the specified range.	Check the number of IOWR transfer words.
								IOWR Control Data Invalid	The IOWR control data is outside the specified range. Or, one of the following operations was attempted: • Feedback present position preset when you use an absolute encoder • Feedback present position preset for an unused axis and Virtual Axis • Feedback present position preset to an axis for which feedback pulse input position management is enabled	Check the control data for IOWR. Or, check the execution condition for feedback present position preset.
								Reflected Data Transfer Error at IOWR Setup	Data write was executed by IOWR to a parameter that becomes valid at power supply ON, restart or setup.	Any data write by IOWR becomes invalid. Check the transfer destination unit address of the IOWR.
								Data Transfer Duplicate Start	Multiple data transfer operations were executed simultaneously.	Check the execution conditions for write, read and save via data transfer bits and data transfer via CX-Programmer.

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LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
○	–	–	–	–	–	–	–	Data Read Transfer Words Count Invalid	The number of transfer words for data read by a data transfer bit is outside the specified range.	Check the number of data transfer words.
								Data Read CPU Side Area Type Invalid	The area type on the CPU side is outside the specified range for data read by a data transfer bit.	Check the setting of the area type on the CPU side.
								Data Read CPU Side Start Word Invalid	The setting of the start word on the CPU side is outside the specified range for data read by a data transfer bit.	Check the setting of the start word on the CPU side.
								Data Read NC Unit Side Area Type Invalid	The setting of the area type on the PCU side is outside the specified range for data read by a data transfer bit.	Check the setting of the area type on the PCU side.
								Data Read NC Unit Side Start Word Invalid	The setting of the start word on the PCU side is outside the specified range for data read by a data transfer bit.	Check the setting of the start word on the PCU side.
								Data Read Timeout	Data read by a data transfer bit was not successful.	Check the operating condition of the CPU Unit, and then execute data read again.
								Data Write Transfer Words Count Invalid	The number of transfer words for data write by a data transfer bit is outside the specified range.	Check the number of data transfer words.
								Data Write CPU Side Area Type Invalid	The setting of the area type on the CPU side is outside the specified range for data write by a data transfer bit.	Check the setting of the area type on the CPU side.
								Data Write CPU Side Start Word Invalid	The setting of the start word on the CPU side is outside the specified range for data write by a data transfer bit.	Check the setting of the start word on the CPU side.
								Data Write NC Unit Side Area Type Invalid	The setting of the area type on the PCU side is outside the specified range for data write by a data transfer bit.	Check the setting of the area type on the PCU side.
								Data Write NC Unit Side Start Word Invalid	The setting of the start word on the PCU side is outside the specified range for data write by a data transfer bit.	Check the setting of the start word on the PCU side.
								Reflected Data Transfer Error at Data Write Setup	Data write was executed by a data transfer bit, in a condition other than during PCU setup, to a parameter that becomes valid at power supply ON, restart or setup.	Any data write not during PCU setup becomes invalid. Check the area type, starting word and execution condition for data write on the PCU.
								Data Write Timeout	Data write by a data transfer bit was not successful.	Check the operating condition of the CPU Unit, and then execute data write again.

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LED								Error name	Cause	Remedy
RUN	ERC	ERH	SYNC	X	Y	Z	U			
◯	–	–	–	–	–	–	–	Data Save Execution Not Available	Data save could not be executed because a simple backup operation was in progress.	Check the execution condition for data save.
								Data Check Warning	The data to write is outside the specified range. Or, the data is not appropriate due to lack of consistency with other parameters.	Set data to write which is inside the specified range.
								Synchronous Data Receive Warning	Data exchange by synchronous data link could not be executed properly.	Check if the PLC is installed correctly.
								Synchronous Processing Time Over	The PCU could not execute processing within the specified synchronous control cycle.	Check the operating condition of the PCU, and revise the synchronous cycle time if necessary.
								Command Present Position Overflow	The command present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range.	Resolve the overflow/underflow state by Origin Search or present position preset.
								Feedback Present Position Overflow	The feedback present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range.	Resolve the overflow/underflow state by feedback present position preset (IOWR).
								Feedback Present Position Preset Warning	The command position for feedback present position preset (data which is set by an IOWR instruction) is outside the specified range.	Check the preset set value relative to the feedback present position.
								Teaching Address No. Invalid	The teaching address number is outside the specified range.	Check the setting of the teaching address number.
								Teaching Execution Not Available	Teaching could not be executed because data save was in progress.	Check the execution conditions for data save and teaching.
								Teaching Position Overflow	The present position of the axis for which teaching was executed became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range.	Resolve the overflow/underflow state of the applicable axis by Origin Search or present position preset.

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12-4 Error Flag Configuration

The PCU has the error flags listed below.
Each error flag indicates an individual error state or an error state of a group of errors, and can be used to identify the location of an error.

Status flags				Details	Notification area
Overall error				This indicates that the PCU generated an error. This flag turns ON upon occurrence of a PCU error, axis error or memory operation error.	PCU Control Input Memory area
	PCU error			This indicates that an error which is common within the entire PCU system is present.	
		Restore error		This turns ON upon occurrence of a restore error.	
		Synchronous data receive error		This turns ON upon occurrence of a synchronous data receive error.	
		Saved data error		This turns ON upon occurrence of Special IO Unit memory error (User Data) or Special IO Unit memory error (Error Log Data).	
		PLC system error		This turns ON when the CPU Unit generates an error.	
	Overall axis error			It indicates that whichever among each axis generated an axis error.	
		Axis error		It indicates that the corresponding axis generated an error.	Axis Status Memory area
			Sensor error	This indicates that an error that relates to an emergency stop, limit input or other external input signal is present.	
			Servo error	This indicates that the Servo Drive notified a drive alarm or other error.	
			Execution error	This indicates that an error that relates to axis operation, such as duplicate starts, is present.	
	Overall memory operation error			This indicates that whichever among each task generated a memory operation error.	PCU Control Input Memory area
		Memory operation error		This indicates that the corresponding task generated a memory operation error.	Memory Operation Status Memory area
			Memory operation execution error	This indicates that an error that relates to memory operation, such as duplicate starts, is present.	

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If the PCU generates an error, execution of functions that relate to axis operation is limited. The table below explains how operations are limited upon occurrence of an error.

Operation	Operation is enabled even after occurrence of an error.	Operation is disabled after occurrence of an error.	Remarks
PCU operation	Error reset Warning reset Data write Data read Save data PCU setup		
Axis operation	Drive alarm reset output Error counter reset output Torque limit output General-purpose output Override valid Deceleration stop Servo unlock Latch completed clear	Servo lock Forward direction JOG/ Inching Reverse direction JOG/ Inching MPG valid Origin Search Origin Return Absolute movement Relative movement Speed control Present position preset Synchronous feeding	Operation is limited after occurrence of a PCU error or axis error.
Memory operation	M code reset Teaching Memory operation stop	Memory operation start Memory operation independent start	Operation is limited after occurrence of a PCU error or memory operation error.

Commands for functions whose operation is disabled after occurrence of an error become invalid unless the error state is reset by an error reset, etc.
In the case of a fatal error that requires restarting of the PCU, all operations are disabled. For details on errors, refer to "Reading Error Codes" on page 12-31.

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12-5 Reading Error Codes

If an error occurs, the error flags in the PCU Control Input Memory area, Axis Status Memory area and Memory Operation Status Memory area turn ON, and a corresponding error code is input to each area. Check this error code and take an appropriate action.
The allocations of error flags and areas in which an error code is input are as follows.

PCU Control Memory Input Area

Name	PCU Control Input Memory area	Bit	Description
PCU Error	n+13	12	1: Error 0:No error
Error Code	n+14	00 to 15	Error code (0000 when normal)

Axis Status Memory Area

Select [C] as the first word in the Axis Status Memory area.

Name	Operating area				Bit	Description
	Axis 1	Axis 2	Axis 3	Axis 4		
Axis error	C+5	C+18	C+31	C+44	12	1: Error 0: No error
Error code	C+7	C+20	C+33	C+46	00 to 15	Error code (0000 when normal)

Memory Operation Status Memory Area

The first word in Memory Operation Status Memory area is [E].

Name	Memory Operation Status Memory area				Bit	Description
	Task 1	Task 2	Task 3	Task 4		
Memory operation error	E+2	E+8	E+14	E+20	12	1: Error 0: No error
Error code	E+3	E+9	E+15	E+21	00 to 15	Error code (0000 when normal)

12-6 Error Code List

When an error occurs, the PCU sets an error flag in the PCU Control Input Memory area, Axis Status Memory area or Memory Operation Status Memory area and also inputs an error code. You can identify the axis that generated the error, and the type of error, from the area in which the error flag was set and the error code which was input.

For the error code (error log code) displayed in the "Confirming error log" on the support software, refer to the error code list in the software help system. The display procedure is as shown below.

♦Click [Help] from the main menu, and click the [Index] tab. Then click [Error code list] under [Troubleshooting].

Data Check at Power Supply ON

The PCU checks for the following errors when the power supply is turned ON.

Category	Item name	Error code	Cause	Release method
Common	Restore Error	0001	The easy backup function of the CPU Unit could not restore the backup data properly.	The PCU is using the data which was saved before the restore. Execute restore again, or transfer and save the data again. While this error is present, you can only execute data transfer and data save.
	Special IO Unit Memory Error (User Data)	0010	User data could not be saved properly to the nonvolatile memory in the PCU. Or, the saved user data is corrupted.	Transfer and save the data again. While this error is present, you can only execute data transfer and data save. If this error occurs again, replace the PCU. If this error occurs when you turn ON the power supply, all parameters and data in the PCU are reset to their default setting. If this error occurs, the PCU decelerates all axes to a stop.
	Special IO Unit Memory Error (Error Log Data)	0011	The nonvolatile memory that saves the error log of the PCU is abnormal.	Clear the error log of the PCU and then reconnect the power supply or restart the PCU.
	Synchronous Operation Cycle Invalid	00F0	The synchronous control cycle exceeds the range usable by the PCU.	Set a synchronous cycle time set value within the settable range and then reconnect the power supply.
	Synchronous Data Receive Error	00F1	Data exchange by synchronous data could not be executed properly.	Check the installed condition of the PCU and inter-unit synchronous control setting, and then execute an error reset. If this error occurs again, replace the PCU. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Synchronous Time Monitor Timeout	00F6	The timing of synchronous control cycle can not be obtained properly.	Check the installed condition of the PCU and then reconnect the power supply or restart the PCU. If this error occurs again, replace the PCU. If this error occurs, the PCU stops all axes immediately.

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Category	Item name	Error code	Cause	Release method
Each task	Memory Operation Error	2XXX	The setting of memory operation data is not correct. The last 3 digits of the error code indicate the sequence number under which the error occurred.	Check the setting of the memory operation data for the applicable sequence number, and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
	Memory Operation Condition Data Error	30XX	The setting of memory operation condition data is not correct. The last 2 digits of the error code indicate the condition number under which the error occurred.	Check the setting of the memory operation condition data for the applicable condition number, and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
Each axis	Forward Direction Limit Error	5008	A forward direction limit signal was input.	Execute an error reset and then perform recovery operation in the reverse direction. If a normal state cannot be recovered, check the connection of the forward direction limit signal and setting of the forward direction limit input logic. If this error occurs, the PCU stops the applicable axis according to the setting of the corresponding axis parameter.
	Reverse Direction Limit Error	5009	A reverse direction limit signal was input.	Execute an error reset and then perform recovery operation in the forward direction. If a normal state cannot be recovered, check the connection of the reverse direction limit signal and setting of the reverse direction limit input logic. If this error occurs, the PCU stops the applicable axis according to the setting of the corresponding axis parameter.
	Emergency Stop Input	500D	An emergency stop signal was input.	Cancel the emergency stop input and then execute an error reset. If the error cannot be reset, check the connection of the emergency stop signal and setting of the emergency stop input logic. If this error occurs, the PCU stops the applicable axis according to the setting of the corresponding axis parameter.
	Drive Alarm Input	500F	A drive alarm input signal was input.	Remove the cause of the drive error and then execute an error reset. If this error occurs, the PCU stops the applicable axis according to the setting of the corresponding axis parameter.
	External Power Supply Error	5100	The pulse I/O power supply is not supplied.	Confirm that the pulse I/O power supply is supplied, and then execute an error reset. If this error occurs, the PCU immediately stops all axes and switches to the servo unlocked state.
	Duplicate Start	6000	Multiple functions that cannot be executed simultaneously were executed on the same axis.	Check the execution conditions and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	During Servo Unlock	6001	An axis operation command was executed while the servo was unlocked.	Execute an error reset, and issue the axis operation command after the servo is locked.

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Troubleshooting

Category	Item name	Error code	Cause	Release method
Each axis	During Forward Direction Limit Input	6002	A forward start command was executed when a forward direction limit signal was input.	Execute an error reset and then perform recovery operation in the reverse direction. If this error occurs again, check the connection of the forward direction limit signal, setting of the forward direction limit input logic, and execution condition for start command.
	During Reverse Direction Limit Input	6003	A reverse start command was executed when a reverse direction limit signal was input.	Execute an error reset and then perform recovery operation in the forward direction. If this error occurs again, check the connection of the reverse direction limit signal, setting of the reverse direction limit input logic, and execution condition for start command.
	Command Position Forward Direction Soft Limit Exceeded	6004	The command position of the positioning exceeds the software limit in the forward direction.	Check the command position and software limit setting, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Command Position Reverse Direction Soft Limit Exceeded	6005	The command position of the positioning exceeds the software limit in the reverse direction.	
	Present Position Unknown	6006	Origin Return was executed when the origin was unconfirmed.	Execute an error reset, and execute the command after the origin is confirmed by Origin Search or present position preset.
	Error Counter Reset Error	6007	An axis operation command was executed while a Error Counter Reset signal was output. Or, the error counter was reset during Origin Search.	Check the execution condition for Error Counter Reset, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Override Error	6008	The override is outside the range.	Check the override set value and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Command Present Position Overflow Occurring	6009	The command present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range.	Execute an error reset and then resolve the overflow/underflow state by Origin Search or present position preset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Positioning Time Over	6020	The positioning completed input was not detected within the positioning monitor time.	Check the positioning completed input and then execute an error reset. If this error occurs again, check the connection of the positioning completed signal, input logic, and setting of the positioning monitor time.
	Forward Direction Software Limit Error	6021	The software limit in the forward direction was exceeded.	Check the axis operation command and setting of the forward direction software limit, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Reverse Direction Software Limit Error	6022	The software limit in the reverse direction was exceeded.	Check the axis operation command and setting of the reverse direction software limit, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.

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Troubleshooting

Category	Item name	Error code	Cause	Release method
Each axis	Position Error Over	6023	The difference between the command present position and present feedback position exceeded the set value.	Remove the cause that generate the error between the command present position and feedback present position, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Speed Error Over	6024	The difference between the present command speed and present feedback speed exceeded the set value.	Remove the cause that generate the error between the present command speed and present feedback speed, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Backlash Compensation Amount Exceeded	6025	The compensation amount exceeded the upper limit that can be output, when the backlash compensation method was superimpose compensation amount at start of positioning.	Check the setting of the backlash compensation amount and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Synchronous Feeding Command Present Position Overflow	6026	The synchronous feeding command position data which is given by synchronous data link became outside the upper/lower limits of the usable range.	Check the synchronous feeding command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Command Present Position Overflow	6027	The command present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range when the Position and Speed Error monitor function was enabled.	Execute an error reset and then resolve the overflow/underflow state by Origin Search or present position preset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Feedback Present Position Overflow	6028	The feedback present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range when the Position and Speed Error monitor function was enabled.	Execute an error reset, and then resolve the overflow/underflow state by feedback present position preset (IOWR). If this error occurs, the PCU decelerates the applicable axis to a stop.
	ABS Encoder Communications Error	6110	When you use an absolute encoder, absolute data could not be read properly upon servo lock. An OMNUC G5-series absolute encoder is connected to the PCU with unit version 1.0.	Execute an error reset and then lock the servo. If this error occurs again, check the connection of the encoder pulse input with the Servo Drive. An OMNUC G5-series absolute encoder is applicable to the PCU Unit version 1.1 or later. Check your PCU unit version.
	ABS Encoder Data Error	6111	When you use an absolute encoder, invalid absolute data was read upon servo lock.	

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Troubleshooting

Category	Item name	Error code	Cause	Release method
Each axis	ABS Encoder Present Position Restore Overflow	6112	When you use an absolute encoder, the present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range due to the absolute data which was read upon servo lock.	Execute an error reset and then set up the absolute encoder again and perform origin positioning of PCU.
	Inching Command Position Overflow	6200	The command present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range during inching.	Remove the cause of the command present position overflow/underflow, check the inching width, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	MPG Magnification Invalid	6300	The MPG magnification setting is outside the specified range.	Check the setting of the MPG magnification and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Origin Search Reverse Direction Limit Error	6400	Origin search operation was stopped due to detection of a limit input in the direction opposite the origin input detection direction.	Check the input signal for origin search and origin search setting, and then execute an error reset. If this error occurs, the PCU stops the applicable axis or decelerates to a stop according to the setting of the corresponding axis parameter.
	Origin Search Direction Limit Error	6401	Origin search operation was stopped due to detection of a limit input in the origin input detection direction.	
	Bidirectional Limit Error	6402	Origin search cannot be continued because the limit inputs in both directions were detected.	
	Origin Proximity/ Origin Search Reverse Direction Limit Error	6403	Origin search operation was stopped because the origin proximity input and detection position of the limit input in the direction opposite the origin input detection direction were not appropriate.	Check the origin proximity input and detection position of the limit input in the direction opposite the origin input detection direction, and then execute an error reset. If this error occurs, the PCU stops the applicable axis or decelerates to a stop according to the setting of the corresponding axis parameter.
	Origin Proximity/ Origin Search Direction Limit Error	6404	Origin search operation was stopped because the origin proximity input and detection position of the limit input in the origin input detection direction were not appropriate.	Check the origin proximity input and detection position of the limit input in the origin input detection direction, and then execute an error reset. If this error occurs, the PCU stops the applicable axis or decelerates to a stop according to the setting of the corresponding axis parameter.
	Origin Input/ Origin Search Reverse Direction Limit Error	6405	Origin search operation was stopped because the origin input and detection position of the limit input in the direction opposite the origin input detection direction were not appropriate.	Check the origin input and detection position of the limit input in the direction opposite the origin input detection direction, and then execute an error reset. If this error occurs, the PCU stops the applicable axis or decelerates to a stop according to the setting of the corresponding axis parameter.

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Troubleshooting

Category	Item name	Error code	Cause	Release method
Each axis	Origin Input/ Origin Search Direction Limit Error	6406	Origin search operation was stopped because the origin input and detection position of the limit input in the origin input detection direction were not appropriate.	Check the origin input and detection position of the limit input in the origin input detection direction, and then execute an error reset. If this error occurs, the PCU stops the applicable axis or decelerates to a stop according to the setting of the corresponding axis parameter.
	Origin Input Mask Amount Invalid	6407	The set value of the origin input mask amount is insufficient for the amount of movement which you need to decelerate from the origin search speed to the origin search approach speed, when the ORIGIN SEARCH OPERATION mode is "Proximity Rev Turn/Origin Input Mask Amount".	Check the origin input mask amount, Origin Search Speed and Origin Search Approach Speed, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	No Origin Input	6420	The origin input was not detected during origin search.	Check the connection and setting of the origin input, and then execute an error reset. If this error occurs (upon limit input), the PCU stops the applicable axis according to the setting of the corresponding axis parameter.
	No Origin Proximity Input	6421	The origin proximity input was not detected in an origin search operation that uses the origin proximity input.	Check the connection and setting of the origin proximity input, and then execute an error reset. If this error occurs (upon limit input), the PCU stops the applicable axis according to the setting of the corresponding axis parameter.
	Origin Input Mask Position Overflow	6422	The command present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range due to the movement by the origin input mask amount, when the ORIGIN SEARCH OPERATION mode was "Proximity Rev Turn/Origin Input Mask Amount".	Check the setting of the origin input mask amount and range of the command present positions used, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	ABS Encoder Origin Position Offset Overflow	6423	When you use an absolute encoder, the absolute encoder origin position offset which was calculated upon completion of Origin Search exceeded the setting range.	Set up the absolute encoder again, and then execute an error reset.

Category	Item name	Error code	Cause	Release method
Each axis	ABS Encoder Origin Position Offset Calculation Not Possible	6424	The absolute encoder origin position offset could not be calculated because the present position of the absolute encoder is unknown. The following are possible causes for the present position of the absolute encoder being unknown. • You did not set [RUN Output Function] under [I/O Function Selection] among the axis parameters to [Use as RUN output] and then execute servo lock. • The present position preset (excluding the origin preset) was executed after servo lock. • The feedback present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range after servo lock. • The axis parameter [Starting Present Position Clear Enable] is set to [Enable].	Check the cause and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Present Position Preset Error	6600	The command position of present position preset is outside the specified range.	Check the set value of the command position and then execute an error reset.
	Absolute Movement Position Error	6700	The command position of absolute movement is outside the specified range.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Absolute Movement Speed Error	6701	The command speed of absolute movement is outside the specified range.	Check the set value of the command speed and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Absolute Movement Acceleration Time Error	6702	The acceleration time of absolute movement is outside the specified range.	Check the set value of the acceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Absolute Movement Deceleration Time Error	6703	The deceleration time of absolute movement is outside the specified range.	Check the set value of the deceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Absolute Movement Direction Specification Error	6704	The rotational axis direction setting of absolute movement is outside the specified range.	Check the setting of the rotational axis direction, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Rotation Axis Upper Limit Over	6705	The command position of absolute movement for a rotation axis exceeds the rotation axis upper limit.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.

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Troubleshooting

Category	Item name	Error code	Cause	Release method
Each axis	Absolute Movement Interrupt Feeding Position Error	6710	The command position of absolute movement interrupt feeding is outside the specified range. Or, the command position resulted in 0 movement, and thus the constant-pitch feeding direction was not determined upon interrupt input.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Absolute Movement Interrupt Feeding Input Function Setting Error	6711	Interrupt feeding cannot be executed because latch input is selected for the interrupt input function.	Check the setting of the interrupt input function, and then execute an error reset.
	Absolute Movement Interrupt Feeding with No Interrupt Signal	6712	An interrupt input signal was not detected during interrupt feeding.	Check the connection and setting of the interrupt input, and then execute an error reset.
	Absolute Movement Interrupt Feeding Feedback Present Position Overflow	6713	The feedback present position upon interrupt input became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range when the feedback present position was selected as the reference position for interrupt feeding.	Execute an error reset, and then resolve the overflow/underflow state by feedback present position preset (IOWR). If this error occurs again, check the unit setting for feedback pulse input and range of feedback present positions to be used. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Relative Movement Position Error	6800	The command position of relative movement is outside the specified range.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Relative Movement Speed Error	6801	The command speed of relative movement is outside the specified range.	Check the set value of the command speed and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Relative Movement Acceleration Time Error	6802	The acceleration time of relative movement is outside the specified range.	Check the set value of the acceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Relative Movement Deceleration Time Error	6803	The deceleration time of relative movement is outside the specified range.	Check the set value of the deceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	Relative Movement Interrupt Feeding Position Error	6810	The command position of relative movement interrupt feeding is outside the specified range. Or, the command position resulted in 0 movement, and thus the constant-pitch feeding direction was not determined upon interrupt input.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.

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Category	Item name	Error code	Cause	Release method
Each axis	Relative Movement Interrupt Feeding Input Function Setting Error	6811	Interrupt feeding cannot be executed because latch input is selected for the interrupt input function.	Check the setting of the interrupt input function, and then execute an error reset.
	Relative Movement Interrupt Feeding with No Interrupt Signal	6812	An interrupt input signal was not detected during interrupt feeding.	Check the connection and setting of the interrupt input, and then execute an error reset.
	Relative Movement Interrupt Feeding Feedback Present Position Overflow	6813	The feedback present position upon interrupt input became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range when the feedback present position was selected as the reference position for interrupt feeding.	Execute an error reset, and then resolve the overflow/underflow state by feedback present position preset (IOWR). If this error occurs again, check the unit setting for feedback pulse input and range of feedback present positions to be used.\nIf this error occurs, the PCU decelerates the applicable axis to a stop.
	Speed Control Speed Error	6901	The command speed of speed control is outside the specified range. Or, one of the following operations was executed during speed control interrupt feeding:\n• The command speed was 0 at the time of interrupt input.\n• The command speed was changed to 0 during constant-pitch feeding.\n• The mark of the command speed was changed (reversed) during speed control while waiting for interrupt input.	Check the setting value of the command speed and then execute an error reset.\nIf this error occurs, the PCU decelerates the applicable axis to a stop.
	Speed Control Acceleration Time Error	6902	The acceleration time of speed control is outside the specified range.	Check the set value of the acceleration time and then execute an error reset.\nIf this error occurs, the PCU decelerates the applicable axis to a stop.
	Speed Control Deceleration Time Error	6903	The deceleration time of speed control is outside the specified range.	Check the set value of the deceleration time and then execute an error reset.\nIf this error occurs, the PCU decelerates the applicable axis to a stop.
	Speed Control Interrupt Feeding Position Error	6910	The command position of speed control interrupt feeding is outside the specified range.	Check the set value of the command position and then execute an error reset.\nIf this error occurs, the PCU decelerates the applicable axis to a stop.
	Speed Control Interrupt Feeding Input Function Setting Error	6911	Interrupt feeding cannot be executed because latch input is selected for the interrupt input function.	Check the setting of the interrupt input function, and then execute an error reset.

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Category	Item name	Error code	Cause	Release method
Each axis	Speed Control Interrupt Feeding Feedback Present Position Overflow	6913	The feedback present position upon interrupt input became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range when the feedback present position was selected as the reference position for interrupt feeding.	Execute an error reset, and then resolve the overflow/underflow state by feedback present position preset (IOWR). If this error occurs again, check the unit setting for feedback pulse input and range of feedback present positions to be used. If this error occurs, the PCU decelerates the applicable axis to a stop.
	High-speed PTP Position Error	6A00	The command position of high-speed PTP start is outside the specified range.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	High-speed PTP Speed Error	6A01	The command speed of high-speed PTP start is outside the specified range.	Check the set value of the command speed and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	High-speed PTP Acceleration Time Error	6A02	The acceleration time of high-speed PTP start is outside the specified range.	Check the set value of the acceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	High-speed PTP Deceleration Time Error	6A03	The deceleration time of high-speed PTP start is outside the specified range.	Check the set value of the deceleration time and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	High-speed PTP Direction Specification Error	6A04	The rotational axis direction setting of high-speed PTP start is outside the specified range.	Check the setting of the rotational axis direction, and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
	High-speed PTP Rotation Axis Upper Limit Over	6A05	The command position of high-speed PTP start for a rotation axis exceeds the rotation axis upper limit.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates the applicable axis to a stop.
Each task	Duplicate Start	6C00	A memory operation start and a memory operation independent start were executed simultaneously for the same task. Or, a memory operation was started for a task whose configuration axis was busy.	Check the execution conditions and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
	Sequence No Error	6C01	The sequence number which you specified by the memory operation command is outside the specified range. Or, sequence data was not yet set for the specified sequence number.	Set a sequence number inside the range or check the setting of the memory operation data for the applicable sequence number, and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
	Configuration Axis Error	6C02	A configuration axis in the current memory operation task generated an axis error.	Remove the cause of the error in the applicable axis, and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.

Category	Item name	Error code	Cause	Release method
Each task	Backlash Output Method Invalid	6C03	An attempt was made to execute an operation pattern of circular interpolation or continuous 3 with perform compensation operation before start of positioning selected as the backlash compensation method.	Change the backlash output method to superimpose compensation amount at start of positioning. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
	Interpolation Movement Amount Overflow	6C04	The amount of movement by interpolation operation exceeded the usable range during linear interpolation or circular interpolation command.	Check the set value of the command position and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
	Error Between Axes Over	6C20	The error between the specified interpolation axes exceeded the set value during linear interpolation.	Remove the cause of the deviation between the interpolation axes, and then execute an error reset. If this error occurs, the PCU decelerates all configuration axes of the applicable task to a stop.
Each axis	Synchronous Feeding Command Position Data Setting Invalid	6E01	The setting of synchronous feeding command position data is invalid.	Check the setting of synchronous feeding command position data and then execute an error reset.

Warning

The warnings are listed below.

Category	Item name	Error code	Cause	Release method
Common	IORD Busy	8110	An attempt was made to execute the IORD instruction when the operation status of the Unit was not normal.	Check the execution condition for IORD.
	IORD Transfer Words Count Invalid	8111	The number of IORD transfer words is outside the specified range.	Check the number of IORD transfer words.
	IORD Control Data Invalid	8112	The IORD control data is outside the specified range. Or, one of the following operations was attempted: • Read the feedback present position of an unused axis • Read unused latch data	Check the control data for IOWR.

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Troubleshooting

Category	Item name	Error code	Cause	Release method
Common	IOWR Busy	8120	• An attempt was made to execute the IOWR instruction when the operation status of the Unit was not normal. • An attempt was made to write data with the IOWR instruction while data was being stored. • An attempt was made to execute a feedback present position preset (IOWR) while the feedback present position was selected for the interrupt feeding reference position and interrupt feeding was being executed. • An attempt was made to execute a feedback present position preset (IOWR) while the feedback present position was selected for the interrupt feeding reference position and the present position latch function was being executed.	Check the execution condition for IOWR.
	IOWR Transfer Words Count Invalid	8121	The number of IOWR transfer words is outside the specified range.	Check the number of IOWR transfer words.
	IOWR Control Data Invalid	8122	The IOWR control data is outside the specified range. Or, one of the following operations was attempted: • Feedback present position preset when you use an absolute encoder • Feedback present position preset for an unused axis and Virtual Axis • Feedback present position preset to an axis for which feedback pulse input position management is enabled	Check the control data for IOWR. Or, check the execution condition for feedback present position preset.
	Reflected Data Transfer Error at IOWR Setup	8126	Data write was executed by IOWR to a parameter that becomes valid at power supply ON, restart or setup.	Any data write by IOWR becomes invalid. Check the transfer destination unit address of the IOWR.
	Data Transfer Duplicate Start	8200	Multiple data transfer operations were executed simultaneously.	Check the execution conditions for write, read and save via data transfer bits and data transfer via CX-Programmer.
	Data Read Transfer Words Count Invalid	8211	The number of transfer words for data read by a data transfer bit is outside the specified range.	Check the number of data transfer words.

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Troubleshooting

Category	Item name	Error code	Cause	Release method
Common	Data Read CPU Side Area Type Invalid	8212	The area type on the CPU side is outside the specified range for data read by a data transfer bit.	Check the setting of the area type on the CPU side.
	Data Read CPU Side Start Word Invalid	8213	The setting of the starting word on the CPU side is outside the specified range for data read by a data transfer bit.	Check the setting of the starting word on the CPU side.
	Data Read NC Unit Side Area Type Invalid	8214	The setting of the area type on the PCU side is outside the specified range for data read by a data transfer bit.	Check the setting of the area type on the PCU side.
	Data Read NC Unit Side Start Word Invalid	8215	The setting of the starting word on the PCU side is outside the specified range for data read by a data transfer bit.	Check the setting of the starting word on the PCU side.
	Data Read Timeout	8217	Data read by a data transfer bit was not successful.	Check the operating condition of the CPU Unit, and then execute data read again.
	Data Write Transfer Words Count Invalid	8221	The number of transfer words for data write by a data transfer bit is outside the specified range.	Check the number of data transfer words.
	Data Write CPU Side Area Type Invalid	8222	The setting of the area type on the CPU side is outside the specified range for data write by a data transfer bit.	Check the setting of the area type on the CPU side.
	Data Write CPU Side Start Word Invalid	8223	The setting of the start word on the CPU side is outside the specified range for data write by a data transfer bit.	Check the setting of the start word on the CPU side.
	Data Write NC Unit Side Area Type Invalid	8224	The setting of the area type on the PCU side is outside the specified range for data write by a data transfer bit.	Check the setting of the area type on the PCU side.
	Data Write NC Unit Side Start Word Invalid	8225	The setting of the starting word on the PCU side is outside the specified range for data write by a data transfer bit.	Check the setting of the starting word on the PCU side.
	Reflected Data Transfer Error at Data Write Setup	8226	Data write was executed by a data transfer bit, in a condition other than during PCU setup, to a parameter that becomes valid at power supply ON, restart or setup.	Any data write not during PCU setup becomes invalid. Check the area type, starting word and execution condition for data write on the PCU.
	Data Write Timeout	8227	Data write by a data transfer bit was not successful.	Check the operating condition of the CPU Unit, and then execute data write again.
	Data Save Execution Not Available	8230	Data save could not be executed because a simple backup operation was in progress.	Check the execution condition for data save.

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Troubleshooting

Category	Item name	Error code	Cause	Release method
Common	Synchronous Data Receive Warning	80F2	Data exchange by synchronous data link could not be executed properly.	Check if the PLC is installed correctly.
	Synchronous Processing Time Over	80F3	The PCU could not execute processing within the specified synchronous control cycle.	Check the operating condition of the PCU, and revise the synchronous cycle time if necessary.
	Data Check Warning	90XX: Common parameter 91XX: Axis parameters 92XX: Task parameter * XX indicates the number of offsets for each parameter (0 to 255).	The data to write is outside the specified range. Or, the data is not appropriate due to lack of consistency with other parameters.	Set data to write which is inside the specified range.
Each axis	Command Present Position Overflow	E027	The command present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range.	Resolve the overflow/underflow state by Origin Search or present position preset.
	Feedback Present Position Overflow	E028	The feedback present position became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range.	Resolve the overflow/underflow state by feedback present position preset (IOWR).
	Feedback Present Position Preset Warning	EA10	The command position for feedback present position preset (data which is set by an IOWR instruction) is outside the specified range.	Check the preset set value relative to the feedback present position.
Each task	Teaching Address No. Invalid	ED00	The teaching address number is outside the specified range.	Check the setting of the teaching address number.
	Teaching Execution Not Available	ED01	Teaching could not be executed because data save was in progress.	Check the execution conditions for data save and teaching.
	Teaching Position Overflow	ED02	The present position of the axis for which teaching was executed became greater than the upper limit (overflow) or smaller than the lower limit (underflow) of the usable range.	Resolve the overflow/underflow state of the applicable axis by Origin Search or present position preset.

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Troubleshooting

12-7 Warnings and Overflows

The PCU notifies the warnings to alert the user on continuation of operation, for the following operations that do not affect axis operation.

- Errors that relate to data transfer
- Present position overflow

This warning is notified according to one of the following statuses depending on the cause of error.

PCU warning:	Warning that relates to data transfer or other control which is common within the PCU
Axis warning:	Command present position overflow, feedback present position overflow or other warning that relates to control of each axis
Memory operation warning:	Warning that relates to teaching operation

If a warning generates, a warning code is output to the error code position in each status area. If an error occurs while a warning is present, the error code overwrites the warning code.

Overflow/Underflow

The command present positions and feedback present positions that are usable with the PCU are from −2,147,483,648 to 2,147,483,647 in pulses.
If the present position goes outside this range during axis operation, the present position update is stopped and the origin becomes unconfirmed. At this time, one of the warnings below generates and the status is notified.

Axis warning

Item name	Warning code
Command Present Position Overflow	E027
Feedback Present Position Overflow	E028

Status

Item name	Description
Command Present Position Overflow	The command present position in pulses became greater than the upper limit (2,147,483,647).
Command Present Position Underflow	The command present position in pulses became smaller than the lower limit (−2,147,483,648).
Feedback Present Position Overflow	The feedback present position in pulses became grater than the upper limit (2,147,483,647).
Feedback Present Position Underflow	The feedback present position in pulses became smaller than the lower limit (−2,147,483,648).

If a command present position overflow/underflow occurs, operations except for JOG in the reverse direction and axis operations for which starting present position clear enable is set cannot be executed, until you resolve the overflow/underflow state.
If you execute any of these operations, command present position overflow error (error code: 6009) occurs.

An error reset or warning reset does not resolve the overflow/underflow state.
To resolve the overflow/underflow state, determine the origin again through present position preset or Origin Search.

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Troubleshooting

12-8 Error Reset

The PCU returns errors which are common within the PCU, as well as errors that generate in each axis or task, to the PCU Operation Input Memory area, Axis Status Memory area and Memory Operation Status Memory area, as error flags and error codes.
These error states are released by an error reset which is executed after the cause of the error is removed. Similarly, warning states are resolved by a warning reset.

First Word in Memory Area

2 types of Operating Memory areas are available: one where the memory area is allocated as the PLC Special I/O Unit Memory area and the other where memory area is set in common parameters.

The Unit Control Memory area is allocated as a Special I/O Unit Memory area.
The first word in the area which is allocated as a Special I/O Unit Memory area is determined by the calculation formula below according to the unit number of the PCU.

First word in Special I/O Unit Memory area (n) $n = 2{,}000 + 10 \times$ unit number

You can select the Manual Operation Command Memory area, Direct Operation Command Memory area, Axis Status Memory area, Memory Operation Command Memory area and Memory Operation Status Memory area from these 5 areas.

Memory Area	Memory Area name	Setting word range
Not set	–	–
[CIO Area]	Normal I/O Memory area	0000 to 0159 words
[WR Area]	Internal Auxiliary Memory area	W000 to W511 words
[HR Area]	Holding Memory area	H000 to H511 words
[DM Area]	DM area	D00000 to D32767 words
[EM Area]	EM area	E00_00000 to E6C_32767 words[*1]

*1. The number of available banks varies depending on the CPU.

Error reset and warning reset signals conform to the allocations in the table below.

Name	PCU Control Input Memory area	Bit	Description
Error Reset	n	00	This resets errors that are common within the PCU at the ON rising.
Warning Reset	n	01	This resets warnings that are common within the PCU at the ON rising.

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Troubleshooting

If you set the first word in the Axis Status area to [C], the allocations in the table below apply.

Name	Operation Memory area				Bit	Description
	Axis 1	Axis 2	Axis 3	Axis 4		
Axis Busy	C+2	C+15	C+28	C+41	00	1: Busy
Sensor Error	C+5	C+18	C+31	C+44	08	This turns ON when an external sensor for the emergency stop input or limit input generates an error.
Servo Error					09	This turns ON when the outside the system notifies a driver alarm input or other error.
Execution Error					10	The Execution Error Flag turns ON when an error occurs, such as a duplicate start error, due to a problem in the execution conditions or command values when a command for axis operation is executed.
Axis Warning					11	This turns ON when a warning occurs.
Axis Error					12	This turns ON when an axis error occurs.

If you set the first word in Memory Operation Status Memory area to [E], the allocations in the table below apply.

Name	Memory Operation Status Memory area				Bit	Description
	Task 1	Task 2	Task 3	Task 4		
Memory Operation Busy	E+1	E+7	E+13	E+19	00	This remains ON while a task configuration axis is busy or task function is in progress.
Memory Operation Execution Error	E+2	E+8	E+14	E+20	10	This turns ON when the task function generates an operation error.
Memory Operation Warning					11	This turns ON when a warning occurs.
Memory Operation Error					12	This turns ON upon occurrence of a memory operation error.

Timing Chart

The timing chart below shows that the emergency stop input turns ON during an absolute movement of axis 1 of a 4-axis PCU.
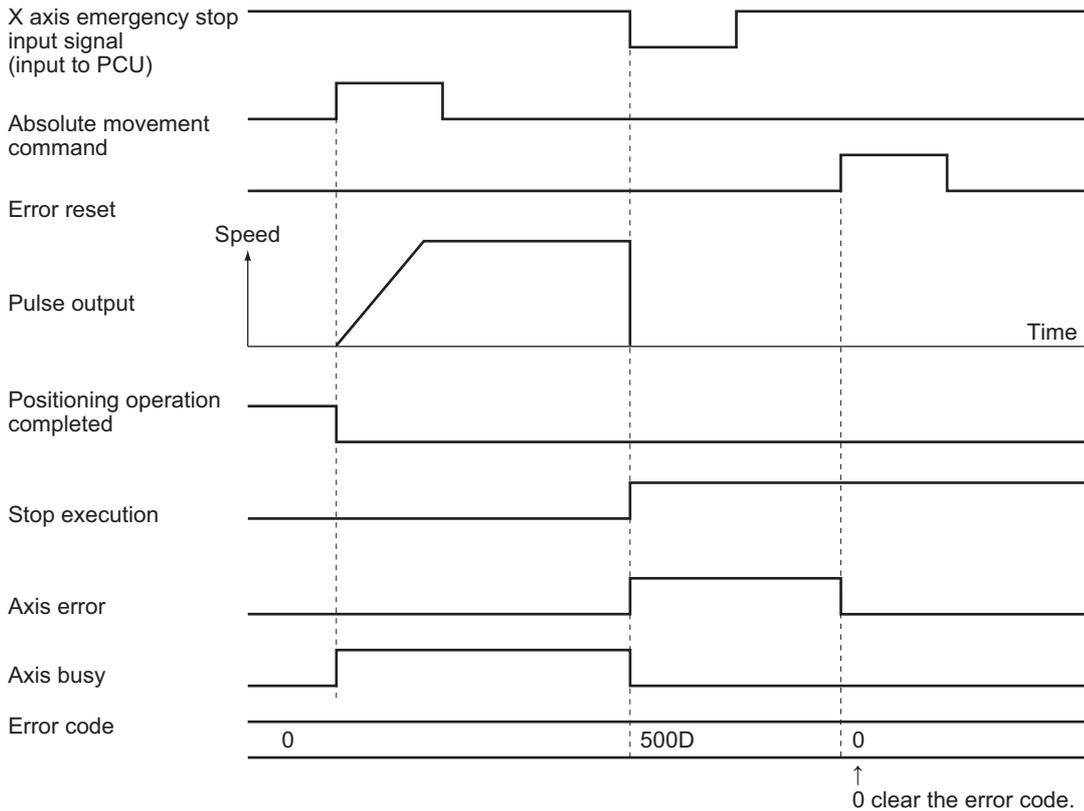
📖 **Reference**

⬧ When [Drive Alarm Reset Output Function] is set to [1: Use as Drive Alarm Reset Output] and [Drive Alarm Input Selection] is set to [1: Detect Drive Alarm Input as an Error] under the [I/O Function Selection] axis parameters, the driver alarm reset output is controlled automatically at the time of the error reset execution.
Under the automatic control of driver alarm reset output, the driver alarm reset output turns ON when the error reset is executed, if the driver alarm input is input. The driver alarm reset output which was output automatically will turn OFF when the driver alarm input is released or the time specified in the axis parameter [Drive Alarm Reset Output Time] elapses, whichever occurs first.

12-9 Error Display at the CPU

The CPU Unit monitors the PCU, which is a Special I/O Unit, for the items below:
- Is the PCU hardware normal?
- Is the unit number inside the setting range?
- Is the unit number duplicated?
- Is refreshing between the CPU Unit and PCU normal?

If an error is detected in the above monitoring, the applicable flag for auxiliary area, among those which are shown below, turns ON in the CPU Unit. (For details on each flag, refer to the Operation Manual for CPU Unit.)
- Special I/O Unit Duplicate unit number flag
- Special I/O Unit Setting error flag
- Special I/O Unit Setting error unit number flag
- Special I/O Unit Error flag
- Special I/O Unit Error unit number flag

To reset the error, perform the applicable action which is explained in "12-3 LED Error Indicator" and "12-6 Error Code List".
If you use one of the restart flags in the table below to restart the PCU (from OFF to ON to OFF), you can turn ON the PCU without reconnecting the PCU power supply.

Restart Flag

Bit number	Function
A50200 to A50215	Restart flag for unit No. 0 to 15
A50300 to A50315	Restart flag for unit No. 16 to 31
A50400 to A50415	Restart flag for unit No. 32 to 47
A50500 to A50515	Restart flag for unit No. 48 to 63
A50600 to A50615	Restart flag for unit No. 64 to 79
A50700 to A50715	Restart flag for unit No. 80 to 95

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Maintenance and Inspection

This chapter explains periodic maintenance and inspection.

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13-1 Items to Inspect

Since the PCU primarily consists of semiconductors, there are few components which have the limited service life. However, their elements may deteriorate depending on the environment and condition in which they are used. You need to inspect the PCU regularly in order to use its functions in its best condition.

The standard inspection period is once every 6 months to a year. However, it's advisable to shorten the inspection interval depending on the operating environment.

If the inspected items are not within the criteria, make necessary corrections to meet the criteria.

Items to Inspect Periodically

No.	Inspection item	Inspection point	Criterion	Remedy
1	I/O power supply	Are the voltage fluctuations within the standards when you measure it with I/O terminals?	24 VDC: 21.6 to 26.4 VDC	Check the power supply between terminals with a tester and change the supplied power amount to meet the criteria.
2	Ambient environment	Is the ambient temperature appropriate? (If you use the PCU in a panel, the ambient temperature in a panel is the ambient temperature to be inspected.)	0 to 55°C	Use a thermometer to measure the PCU ambient temperature, and adjust the ambient environment so that the temperature is within the operating ambient temperature range.
		Is the ambient humidity level (humidity in a panel) appropriate? (If you use the PCU in a panel, the ambient humidity level in a panel is the ambient humidity level to be inspected.)	It must be between 10% and 90% with no dew condensation.	Use a hygrometer to measure the PCU ambient humidity level, and adjust the environment so that the humidity is within the operating ambient humidity range of 10% to 90%. In particular, make sure there is no dew condensation because the temperature can change suddenly.
		Is the PCU subject to direct sunlight?	There must be no direct sunlight.	Shield the PCU from sunlight.
		Is there any accumulation of dirt, dust, saline materials or iron powder on the PCU?	None	Remove any accumulation and shield the PCU.
		Are there any droplets of water, oil, or chemicals on the PCU?	None	Remove any accumulation and shield the PCU.
		Does the environment contain corrosive gas or flammable gas?	None	Check the environment based on the smell or with a gas sensor.
		Is there any direct vibration or impact on the PCU?	It must be within the specification range of vibrations and impacts.	Place cushions, etc. to offset vibrations and impacts.

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No.	Inspection item	Inspection point	Criterion	Remedy
2	Ambient environment	Is there a source of noise nearby?	None	Move the noise source away from the PCU or take shielding measures.
3	Installation and wiring conditions	Is the PCU securely fixed?	There must be no looseness.	Lock the slider firmly.
		Is the connecting cable connector completely inserted and locked?	There must be no looseness.	Completely insert and lock it.
		Are any of the screws for external wiring loose?	There must be no looseness.	Use a Phillips driver to further tighten the screws.
		Is the external wiring cable almost broken?	There must be no apparent abnormality.	Visually check and replace the cable.

Tools required for inspection

Required tools
- Phillips driver
- Tester or digital voltage meter
- Industrial alcohol and all cotton cloth

Measuring equipment, if necessary
- Synchroscope
- Pen-writing oscilloscope
- Thermometer and hygrometer

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Maintenance and Inspection

13-2 Handling Precautions

Be sure to turn OFF the power supply before you replace the PCU.

If you find a faulty PCU and replace it, make sure that there is no problem with the new PCU again.

When you return a faulty PCU for repair, describe the abnormal phenomenon in detail, attach it to the actual PCU, and send it to OMRON branch or sales office that is printed at the end of this manual.

In case of a loose connection problem, saturate a clean all cotton cloth with industrial alcohol to remove any lint, and then install the PCU.

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Maintenance and Inspection

13-3 PCU Replacement Procedures

When you need to replace the PCU due to a failure or other reasons, follow the procedures below.

Backup Procedures (Simple Backup Procedures)

Backup the entire data on the internal flash memory of the PCU to a Memory Card through a simple backup operation. If you need to backup data, take the steps below before you replace the PCU.

1. **Set the DIP switch on the front panel of the CPU Unit as follows, and press and hold down the Memory Card power OFF button for 3 seconds.**

DIP switch on the front panel of the CPU Unit	
SW7	**SW8**
ON	OFF
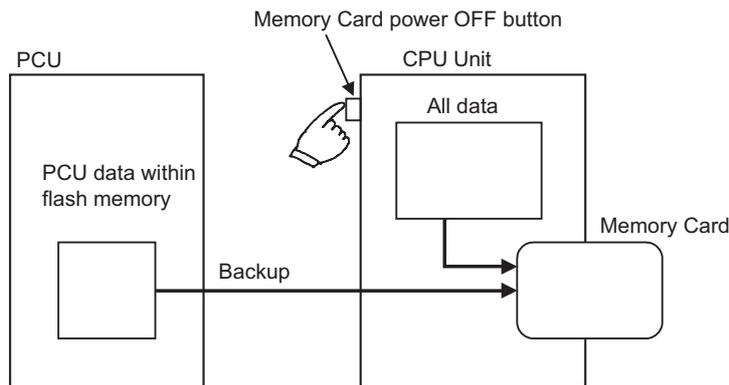
A PCU data file is created and is written to a Memory Card as well as other backup files.

2. **When you press and hold down the Memory Card power OFF button, the MCPWR LED on the front panel of the CPU Unit flashes once and then turns ON when the data write is in progress.**
 It turns OFF after the data write is completed successfully.

Replacement Procedures

(1) **Write down the unit number of the PCU for replacement.**
(2) **Save the parameters and the operating data of the PCU for replacement to an FD or an HD with the CX-Programmer. (Save the parameters and the operating data before the replacement.)**
(3) **Turn OFF the PLC power supply.**
(4) **Write down the wiring condition for the time when you need to wire again. (It is useful to mark the cables with labels and such.)**
(5) **Replace the PCU and wire the cables as they originally were.**
(6) **Set the unit number of the PCU.**

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(7) **Turn ON the PLC power supply.**

(8) **Transfer the saved parameters and the operating data to the PLC with the CX-Programmer.**

(9) **Turn OFF the PLC power supply and turn it back ON again.**

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Appendix

This appendix contains a performance list and describes how this PCU is different from other existing models.

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Appendix-1 Performance List

Power Supply ON Rising Time

The PCU execute the initialization process at power supply ON or restart. The time which takes to recognize a start command is as follows.

Power ON or restart completed

600 to 700 ms[1]
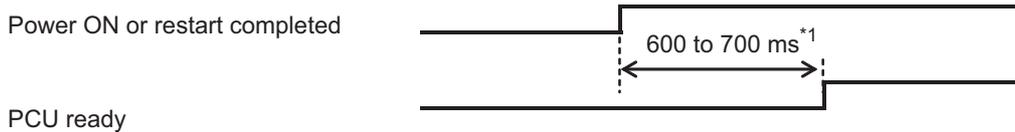
PCU ready

*1. If the CPU has a built-in EtherNet/IP port, the above time increases by approximately 1 second.

The PCU turns OFF the PCU ready during an initialization process after you turn ON the power supply or restart the PCU, and turns ON when the initialization process is completed.

Command Response Time

The time after an axis operation start command is issued until pulses are output varies depending on to the specific command and operating condition of the PCU.
This section shows various command response times of the PCU as reference values based on the equipment configuration below.

CPU Unit   : CJ2H-CPU65

PCU   : Only 1 unit is installed in the CPU Rack

Direct Operation Starting Time

The time between the issuance of a start command of the ladder program and a pulse output is as follows.

Startup items	During normal operation (synchronous unit control disable)		During synchronous unit control (synchronous control cycle: 1 ms)
	Absolute movement, relative movement and speed control bit	High-speed PTP start	
Start axis 1 when all axes are stationary	1 to 2 ms	0.1 ms maximum	1 to 2 ms
Start axis 2 when all axes are stationary	1 to 2 ms	–	1 to 2 ms
Start axis 4 when all axes are stationary	1 to 2 ms	–	1 to 2 ms
Change the target position and speed when the axes are operating (duplicate start)	2 to 3 ms	2 to 3 ms	1 to 2 ms
Start another axis when axes are operating	1 to 2 ms	0.1 ms maximum	1 to 2 ms

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Memory Operation Starting Time

The time between the issuance of a start command of the ladder program and a pulse output (Synchronous unit control disabled) is as follows.

Startup items	Axis 1/task × 4 task	Axis 2/task × 2 tasks	Axis 4/task × 1 task
Start the automatic pattern when all tasks are stationary	1 to 2 ms	1 to 2 ms	1 to 2 ms
Start the linear and circular interpolation continuous-pattern when all tasks are stationary	3 to 4 ms	3 to 4 ms	3 to 4 ms

Interrupt Input Starting Time for Memory Operation

If the memory operation is waiting for starting conditions to be met by an interrupt input, the time between the interrupt input and a pulse output (Synchronous unit control disabled) is as follows.

Startup items	Axis 1/task × 4 task	Axis 2/task × 2 task	Axis 4/task × 1 task
Start the positioning operation (PTP) when all tasks are stationary[1]	0.1 ms maximum	0.1 ms maximum	0.1 ms maximum
Start the linear and circular interpolation pattern when all tasks are stationary	1 to 2 ms	1 to 2 ms	1 to 2 ms

[1].Time at which the first axis is started. If the operation involves multiple axes or tasks, the above time lag occurs in the pulse output of each axis.

External Interrupt Response Time

The response time to an external input, such as a limit input and an interrupt input, is as follows.

Example) If there is an emergency stop input signal
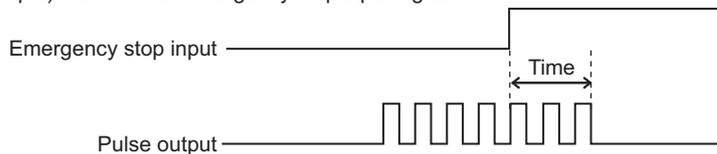
Item	Time
Pulse output stop time when an emergency stop input is input	0.2 to 0.3 ms
Pulse output stop time when a limit input is input	1 ms maximum
Feeding starting time for an interrupt input during an interrupt feeding	0.2 to 0.3 ms

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Speed Resolution

There is a difference in the pulse output that is output by the PCU between the command speed and the actual output frequency as listed below due to the speed resolution.

Command speed [pps]	Actual output frequency [pps]			
	Forward/reverse direction pulse output, and pulse or direction output	Phase difference Quadruple	Phase difference Doubler	Phase difference 1 multiplier
4,000,000	4,166,667	4,166,667	–	–
3,500,000	3,333,333	3,333,333		
3,000,000	3,030,303	3,030,303		
2,500,000	2,564,103	2,564,103		
2,200,000	2,222,222	2,222,222		
2,000,000	1,960,784	1,960,784	2,083,333	
1,900,000	1,851,852	1,851,852	1,851,852	
1,800,000	1,754,386	1,754,386		
:				
1,100,000	1,111,111	1,111,111	1,111,111	–
1,050,000	1,041,667	1,041,667	1,041,667	1,041,667
1,000,000	1,010,101	1,010,101	980,392	
950,000	952,381	952,381	925,926	925,926
900,000	900,901	900,901	877,193	
850,000	854,701	854,701	833,333	833,333
:				
520,000	520,833	520,833	520,833	520,833
510,000	512,821	512,821	505,051	
500,000	497,512	497,512		490,196
490,000	490,196	490,196	490,196	
480,000	483,092	483,092	476,190	
:				
260,000	260,417	260,417	260,417	260,417
255,000	254,453	254,453	256,410	252,525
250,000	250,627	250,627	248,756	
245,000	245,098	245,098	245,098	245,098
240,000	239,808	239,808	241,546	238,095
:				
127,000	127,226	127,226	127,226	126,263
126,000	125,786	125,786	126,263	
125,000	124,844	124,844	125,313	124,378
124,000	123,916	123,916	124,378	
123,000	123,001	123,001	122,549	122,549

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If you use the synchronous unit control function, the speed resolution applies per synchronous control cycle (synchronous cycle time) as follows.
The frequency is such that all pulses are output within a period of 66.7% to 100% of the control period.

Function	Control cycle	Speed resolution per control cycle
During synchronous unit control	Synchronous cycle time	(1/synchronization cycle time) pps

For example, assume that synchronous unit control is performed at a synchronous cycle time of 1 ms.

Control cycle (= synchronous cycle time)   : 1 ms

Speed resolution per control cycle   : 1 kpps

In this case, the pulse outputs which correspond to the command speeds of 750 pps and 1,750 pps become as follows.

750-pps Output
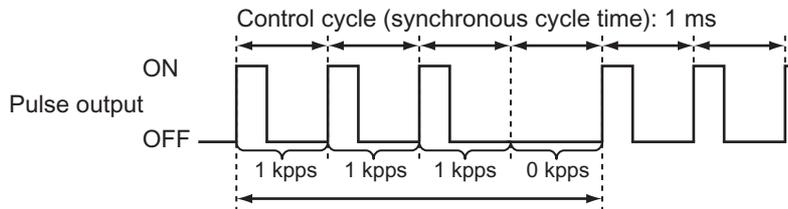
Output is based on a speed resolution of 1 kpps per 1 ms so that an average becomes 750 pps.

1,750-pps Output
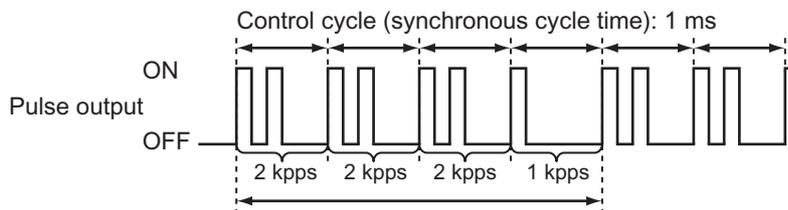
Output is based on a speed resolution of 1 kpps per 1 ms so that an average becomes 1,750 pps.

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Pulse Output Duty

Basically the PCU outputs 50% duty pulses. However, the ON duty becomes 50% or below at lower output frequencies (command speeds), as shown below.

Single-axis Operation

Output duty
[%]

50
40

0   200   Output frequency [pps]
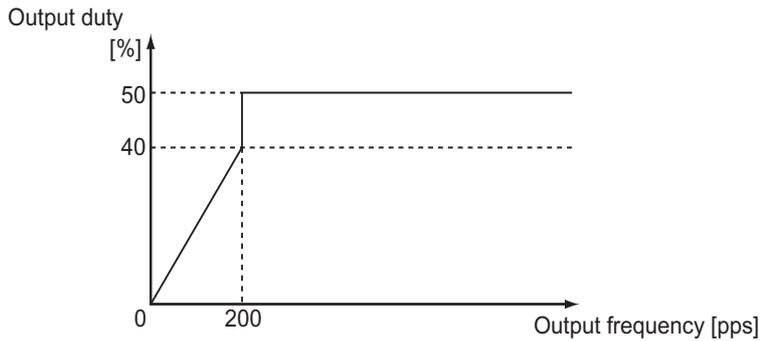
Output frequency: 200 pps or more   : Pulses are output at a duty of 50%.

Output frequency: Less than 200 pps   : Pulse output becomes as follows.

2 ms

ON
Pulse output
OFF

Command cycle (output frequency < 200 pps)

During Linear Interpolation and Circular Interpolation

Output duty
[%]

50

25
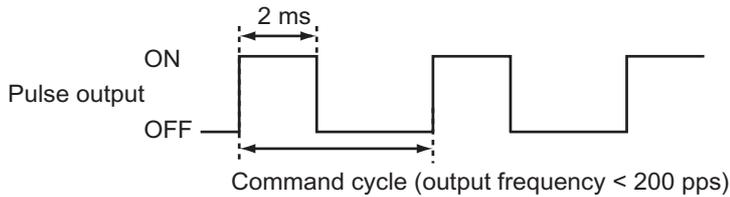
0   500   Output frequency [pps]
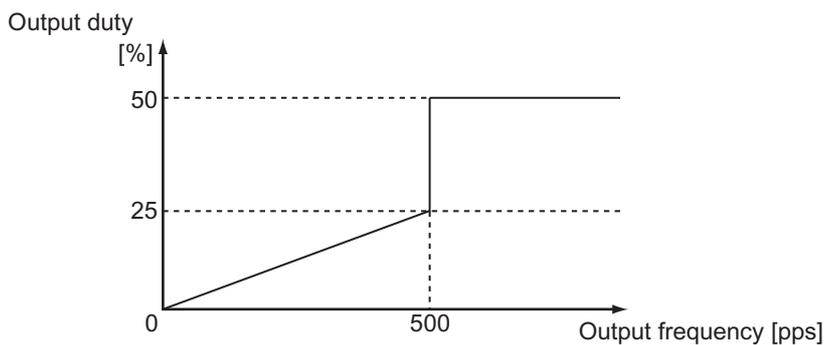
Output frequency: 500 pps or more   : Pulses are output at a duty of 50%.

Output frequency: Less than 500 pps   : Pulse output becomes as follows.

0.5 ms

ON
Pulse output
OFF

Command cycle (output frequency < 500 pps)
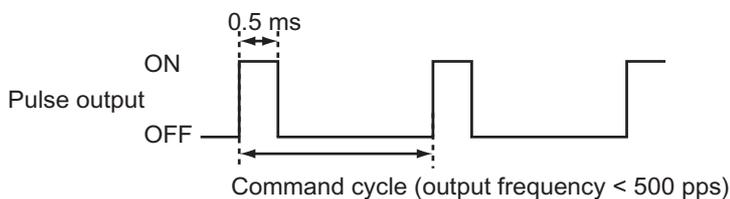
During Synchronous Unit Control

To use the synchronous unit control function, the duty becomes as follows because the frequency must be such that all pulses are output within a period of 66.7% to 100% of the control cycle.

Output Frequency (1/Synchronization Cycle Time) pps or More

Output frequency (1/synchronous cycle time) pps or more : Pulses are output at a duty of 25% to 50%.

[Example] Pulse outputs at 1 kpps, 2 kpps and 4 kpps when the control period (synchronous cycle time) is 1 ms

Output frequency 1 kpps   Output frequency 2 kpps   Output frequency 4 kpps

Control cycle: 1 ms   Control cycle: 1 ms   Control cycle: 1 ms

0.25ms   0.167ms   0.1ms

ON
Pulse output
OFF

The pulse output completes within a period of 66.7% of the control cycle.

The pulse output completes within a period of 80% of the control cycle.
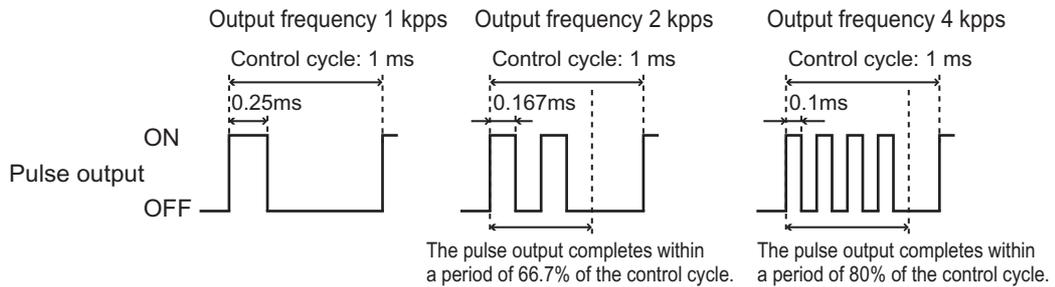
Output Frequency Less Than (1/Synchronization Cycle Time) pps

Output frequency less than (1/synchronous cycle time) pps : Pulse output becomes as follows.

Synchronous cycle time × 0.25

ON
Pulse output
OFF

Command cycle (Output frequency < (1/synchronous cycle time) pps)

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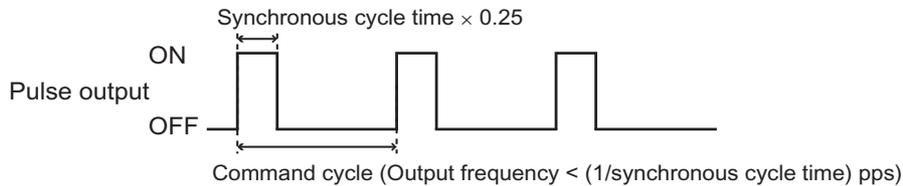
Effect on the Programmable Controller Cycle Time

The cycle time of the PLC increases as follows when 1 PCU is installed.

Item		CJ2H-CPUxx	CJ1H-CPUxxH-R	CJ1H-CPUxxH	CJ1M-CPUxx
Incremental time per installation of 1 additional PCU	When 2 axes and 1 task are in use	0.2 ms	0.2 ms	0.3 ms	0.3 ms
	When 2 axes and 2 task are in use	0.2 ms	0.2 ms	0.3 ms	0.4 ms
	When 4 axes and 1 task are in use	0.3 ms	0.3 ms	0.3 ms	0.4 ms
	When 4 axes and 4 task are in use	0.3 ms	0.4 ms	0.4 ms	0.5 ms

If you transfer the first parameter with an IOWR or IORD instruction, the PLC cycle time increases as follows.

Item	CJ2H-CPUxx	CJ1H-CPUxxH-R	CJ1H-CPUxxH	CJ1M-CPUxx
Incremental time per 1 IOWR instruction (maximum value)	0.1 ms	0.2 ms	0.2 ms	0.3 ms
Incremental time per 1 IORD instruction (maximum value)	0.1 ms	0.1 ms	0.2 ms	0.2 ms

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Pulse Output Time Lag at the Time of Simultaneous Starts

When you issue a start command for multiple axes at the same time from the PLC to the PCU in the same ladder program cycle, the pulse output time lags between the axes become as follows.

Pulse output time lag
2μs or less
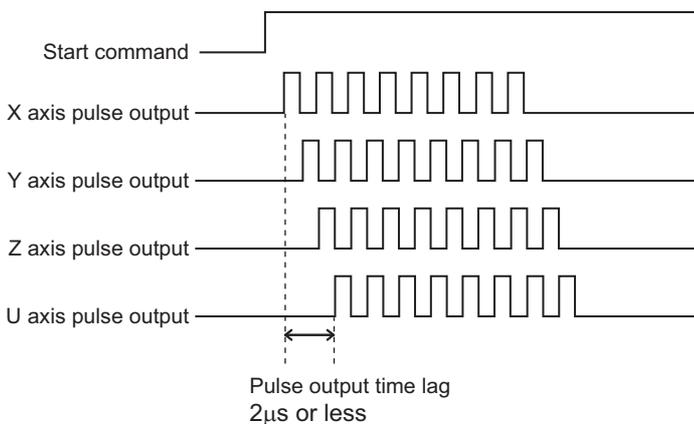
However, if you specify "external interrupt input" for the starting condition of the positioning operation (PTP) which involves multiple axes, a time lag occurs in the pulse output of each axis after the interrupt input, according to the interrupt input start time for memory operation.
For the time lag, refer to "Command Response Time" on page Appendix-1.

Appendix-2 Changes from the Existing PCU

Comparison with Existing Models

The differences between CJ1W-NC2x4/4x4 and CJ1W-NC1x3/2x3/4x3 are as follows.

Functions and performances	CJ1W-NC2x4/4x4	CJ1W-NC1x3/2x3/4x3
Occupied machine number	Mounting is permitted on machines 0 to 94 • 2 or 4-axis PCU: Occupies machine No. 2	Mounting is permitted on machines 0 to 95 • 1 or 2-axis PCU: Occupies machine No. 1 • 4-axis PCU: Occupies machine No. 2
Pulse output method	Open collector output type and line driver output type	Open collector output type and line driver output type
Format of various data between the PLC and the PCU	Binary format (hex) Example) The present position is output to the PLC in a marked 32-bit binary format.	Binary format (hex) Example) The present position is output to the PLC in a marked 32-bit binary format.
Command position range	-2,147,483,648 to 2,147,483,647 pulses	-1,073,741,823 to 1,073,741,823 pulses
Present position range	-2,147,483,648 to 2,147,483,647 pulses	-2,147,483,647 to 2,147,483,647 pulses
Speed command	With position control: 1 to 2,147,483,647 command unit/s With speed control: -2,147,483,648 to 2,147,483,647 command unit/s * You can issue a command within the aforementioned ranges with the maximum of 4 Mpps (line driver) and 500 kpps (open collector).	Set it to 1 to 500,000 pps in units of 1 pps.
Acceleration time	0 to 250,000 ms	0 to 250,000 ms
Deceleration time	0 to 250,000 ms	0 to 250,000 ms

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Functions and performances		CJ1W-NC2x4/4x4	CJ1W-NC1x3/2x3/4x3
Control function	Manual operation	JOG, Inching, Origin Search, Origin Return and MPG	JOG, Origin Search, Origin Return
	Direct operation	Absolute movement, relative movement and speed control (You can specify an interrupt constant-pitch feed for each control.)	Absolute movement, relative movement, speed control and interrupt feeding
	Memory operation	Positioning function: Independent PTP, linear interpolation, circular interpolation, speed control, interrupt feeding End pattern: Individual, automatic or continuous pattern	Positioning function: linear interpolation, interrupt feeding End pattern: Individual, automatic or continuous pattern
	Memory operation data	Set the elements below as a set of memory operation data. • Sequence (such as command and end pattern) • Command position • Command position • Command speed • Acceleration time • Deceleration time • Dwell timer You can set up a maximum of 500×4 tasks as memory operation data.	Set the data below individually. • Sequence data 100 x 4 tasks • Command position data 100/axis • Command speed data100/axis • Acceleration time data 9/axis • Deceleration time data 9/axis • Dwell timer data 19/axis
Override		Set it to 0.01% to 500.00% in units of 0.01%.	Set it to 1% to 999% in units of 1%.
Software limit range		-2,147,483,647 to 2,147,483,646 pulses	-1,073,741,823 to 1,073,741,823 pulses
Zone	Number of settings	3/axis	3/axis
	Setting range	-2,147,483,648 to 2,147,483,647 pulses	-1,073,741,823 to 1,073,741,823 pulses
PLC scan time overrun with an end refresh		0.2 to 0.5 ms or less/unit [1]	0.5 ms or less/1 unit
PLC scan time overrun with an IOWR/IORD instruction		0.1 to 0.3 ms or less/instruction [1]	1 ms or less/instruction
Time between the issuance of a start command from the ladder program and a pulse output		0.1 ms or less (During high-speed PTP start) 1 to 2 ms or less (During direct operation start)	Minimum of 2 ms or less

Functions and performances		CJ1W-NC2x4/4x4	CJ1W-NC1x3/2x3/4x3
Command for operation	Operating area	Use each of the areas below for the functions and the number of axes to be used. ⬧ Unit Common Memory area ⬧ Manual Operation Command Memory area ⬧ Direct Operation Command Memory area ⬧ Axis Status Memory area ⬧ Memory Operation Command Memory area ⬧ Memory Operation Status Memory area	Use these 2 areas. (Fixed size) ⬧ Operation Memory area ⬧ Operation data
	Setting area	Area common to all units: Special I/O Unit Memory area Manual Operation Command Memory area, Direct Operation Command Memory area, Axis Status Memory area, Memory Operation Command Memory area and Memory Operation Status Memory area: You can set each of these in a desired area of CIO, WR, DM and EM.	Operating area: Special I/O Unit Memory area in CIO area Operation data: You can set this up in the special I/O unit area in DM area, a desired DM area and a desired EM area.
External I/O connector		50 pins/2 axes (Servo Drive I/O) 20 pins/2 axes (external control I/O) * Install 2 sets of each of the above for 4-axis PCU.	40 pins/2 axes (Servo Drive I/O and external control I/O) * Install 2 sets of the above for 4-axis PCU.
Software on the computer side		CX-Programmer	CX-Position

*1.The PLC cycle time varies depending on a combined CPU and functions to be used. Refer to "Effect on the Programmable Controller Cycle Time" on page Appendix-7.

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Appendix

Changed Points of Axis Parameters

On some CJ1W-NC2x4/4x4 PCUs, the setting method of the axis parameters may be different compared to the existing CJ1W-NC1x3/2x3/4x3 model.
The axis parameters of CJ1W-NC2x4/4x4 relative to each of the axis parameters of CJ1W-NC1x3/2x3/4x3 are as follows.

CJ1W-NC1x3/2x3/4x3		CJ1W-NC2x4/4x4	
Name	**Configuration and explanation**	**Name**	**Configuration and explanation**
I/O setting	Set the I/O-related items below. • Pulse output selection (CW/CCW output and pulse or direction output) • Limit input, origin proximity input, origin input bit selection (N.C. bit and N.O. bit) • Error counter reset output control when an emergency stop input is input, designation of unconfirmed origin when an emergency stop input and a limit input are input	Pulse output method Pulse output direction	Set the pulse output-related items below. • Pulse output method (phase difference output, forward/reverse direction pulse output, and pulse positive direction output) • Pulse output direction (output the pulse in the forward/reverse direction upon forward direction command.)
		I/O logic selection	Set the I/O-related items below. • Limit input, origin proximity input, origin input, interrupt input, emergency stop input, positioning completed input, drive alarm input bit selection (N.C. bit and N.O. bit)
		Immediate stop input stop method Limit input stop method	Set the items below related to emergency stop input and limit input. • Stop method when an emergency stop input is input (error counter reset output control and RUN output control) • Stop method when a limit input is input (emergency stop/deceleration stop, error counter rest output control, and RUN output control)
Operation mode setting	Set the OPERATING mode of the motor driver to be used and specify the Origin Search method.	Positioning completed input function	Set whether or not to use the positioning completed input in the positioning completed input function setting.
		ORIGIN SEARCH OPERATION Mode Origin Search start direction Origin input detecting direction	Set the items below related to Origin Search. • Origin Search method (operating pattern) • Origin Search start direction • Origin input detection direction
Maximum speed	Specify the maximum speed of each axis.	Maximum speed	Specify the maximum speed of each axis.

CJ1W-NC1x3/2x3/4x3		CJ1W-NC2x4/4x4	
Name	**Configuration and explanation**	**Name**	**Configuration and explanation**
Starting speed	Specify the starting speed of each axis.	Starting speed	Specify the starting speed of each axis.
Origin Search high speed	Specify the origin search high speed of each axis.	Origin Search speed	Specify the Origin Search high speed of each axis.
Origin Search proximity speed	Specify the origin search proximity speed of each axis.	Origin Search approach speed	Specify the origin input detection speed of each axis at Origin Search and after origin proximity is turned ON.
Origin compensation data	Specify the compensation data upon origin input detection in an origin search.	Origin compensation value Origin Search compensation speed	Specify the compensation movement and compensation speed upon origin input detection in an Origin Search.
Backlash compensation data	Specify the backlash compensation data.	Backlash compensation amount	Specify the backlash compensation data.
Backlash compensation speed	Specify the compensation feed speed for a backlash compensation.	Backlash compensation speed	Specify the compensation feed speed for a backlash compensation.
Acceleration/ Deceleration curve, Acceleration/ Deceleration time specification	Specify the acceleration/ deceleration curves (Trapezoid, S-curve). Also, set the acceleration/ deceleration time data to either of the 2 below. • Set it as the time between the starting speed and the maximum speed of each axis. • Set it directly as the time between the present speed and the target speed of each axis.	Acceleration/ Deceleration curve selection Acceleration/ Deceleration time selection	Specify the acceleration/ deceleration curves (trapezoid or S-curve). Also, set the acceleration/ deceleration time data to either of the 2 below. • Set it as the time between the starting speed and the maximum speed of each axis. • Set it directly as the time between the present speed and the target speed of each axis.
Origin Search acceleration time	Specify the time for the axis to reach the maximum speed from the starting speed during an origin search.	Origin Search acceleration time	Specify the time for the axis to reach the maximum speed from the starting speed during an Origin Search.
Origin Search deceleration time	Specify the time for the axis to reach the starting speed from the maximum speed during an origin search.	Origin Search deceleration time	Specify the time for the axis to reach the starting speed from the maximum speed during an origin search.
Positioning monitoring time	Specify the time to monitor the positioning completed from the motor driver when a positioning operation is completed.	Positioning monitoring time	Specify the time to monitor the positioning completed from the motor driver when a positioning operation is completed.
CCW-side limit	Specify the software limit on the CCW-side.	Forward direction software limit	Specify the software limit on the forward direction side.
CW-side limit	Specify the software limit on the CW-side.	Reverse direction software limit	Specify the software limit on the reverse direction side.

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CJ1W-NC1x3/2x3/4x3		CJ1W-NC2x4/4x4	
Name	**Configuration and explanation**	**Name**	**Configuration and explanation**
Start pulse specification	Specify the speed of the first pulse at start.	–	The start pulse specification is not available.

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Appendix

Changed Points of Areas

On some CJ1W-NC2x4/4x4 PCUs, the allocation and some functions of Operating area and the data are different from those of the existing CJ1W-NC1x3/2x3/4x3 model.
The Operating area and the data of CJ1W-NC2x4/4x4 relative to CJ1W-NC1x3/2x3/4x3 are as follows.

Area	I/O	Words NC1x3 X axis	NC2x3 X axis	NC4x3 Y axis	NC4x3 X axis	NC4x3 Y axis	NC4x3 Z axis	NC4x3 U axis	Bit	Group	Name	Function	Area	Words (*) Axis 1	Axis 2	Axis 3	Axis 4	Bit	Name	Remarks (changed points, etc.)
Operating area	Output	n	n	n+2	n	n+2	n+4	n+6	00	Memory operation command	Sequence No. enable	Specify whether to enable/disable the sequence number in the Operating Data area at memory operation start.	Memory Operation Command Memory area	+0	+3	+6	+9	00	Sequence No enable	
									01		Memory operation start	Memory operation starts at the ON rising.						01	Memory operation start	
									02		Memory operation independent start	Memory operation starts at the ON rising. The completion pattern is always independent completion except for bank end.						02	Memory operation independent start	

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CJ1W-NC1x3/2x3/4x3											CJ1W-NC2x4/4x4							
Operating area	Output	n	n	n+2	n	n+2	n+4	n+6			03		Absolute movement	Start direct operation at the ON rising with the position command of the Operating Data Memory area as the absolute position.					00	Absolute movement	
									Direct operation command	04	Relative movement	Start direct operation at the ON rising with the position command of the Operating Data Memory area as the relative position.	Direct Operation Command Memory area	+0	+12	+24	+36	01	Relative movement	
										05	Interrupt feeding	Start interrupt feeding for direct operation at the ON rising.						05	Interrupt feeding specification	Turn ON this area and start the absolute movement, relative movement and speed control to execute an interrupt feeding.
										06	Origin Search	Perform an origin search at the ON rising.	Manual Operation Command Memory area	+0	+2	+4	+6	10	Origin Search	The function name is changed.
										07	Origin Return	Return to origin at the ON rising.						11	Origin Return	The function name is changed.
									Origin fix command	08	Present position preset	Forcibly change the present position to the command position of the Operating Data Memory area at the ON rising to set to the origin confirmation state.	Direct Operation Command Memory area	+0	+12	+24	+36	07	Present position preset	

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		CJ1W-NC1x3/2x3/4x3						CJ1W-NC2x4/4x4		
Operating area / Output	n, n, n+2, n, n+2, n+4, n+6	09	Special function command	JOG (speed feeding)	Perform a JOG feed (speed feed) at ON.	Manual Operation Command Memory area	+0 +2 +4 +6	07	Forward direction JOG	It is changed from JOG + direction designation to forward/ reverse direction JOG bit.
		10		Direction specification	Specify the rotation direction when you perform a JOG and an interrupt feeding.			08	Reverse direction JOG	
		11		Teaching	Perform teaching at the ON rising.	Memory Operation Command Memory area	+0 +3 +6 +9	05	Teaching	
		12		Error reset and of pulse output prohibition release	Reset the error and release the pulse output prohibition status at the ON rising.	Unit Control Memory area	+0	00	Error reset	This is a batch error reset for all PCUs.
		13		Error counter reset output and origin adjustment command output	Turn ON the error counter reset output and origin adjustment command output at ON.	Manual Operation Command Memory area	+0 +2 +4 +6	02	Error counter reset output	
		14		Override valid	Specify whether to enable/disable override.			05	Override valid	
		15		Deceleration stop	Start deceleration stop at the ON rising.			14	Deceleration stop	
	n+1, n+1, n+3, n+1, n+3, n+5, n+7	08		Forced interrupt start	Start forced interrupt sequence during memory operation at the ON rising.	–	– – – –	–		The forced interrupt starting function is not available.
	n+1, n+1, n+1	12	Data transfer command	Write data	Write the data from the PLC to the PCU at the ON rising.	Unit Control Memory area	+0	12	Write data	
		13		Read data	Read the data from the PCU to the PLC at the ON rising.			13	Read data	
		14	Data transfer command	Save data	Save the content of the PCU internal memory to a built-in flash memory at the ON rising.	Unit Control Memory area	+0	14	Save data	

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CJ1W-NC1x3/2x3/4x3						CJ1W-NC2x4/4x4						
Operating area	Input n+2 n+4 n+7 n+8 n+11 n+14 n+17	External I/O status	04	Memory operation waiting	Indicate the status of waiting for memory operation to start.	Memory Operation Status Memory area	+2 +8 +14 +20	00	During memory operation stop	Turn ON when memory operation is not running.
								01	Memory operation waiting	Turn ON during memory operation stop due to reasons other than END completion after memory operation starts.
			05	Positioning completed	Indicate that the operation of the PCU (pulse output) is completed based on the positioning operation command.		+2 +15 +28 +41	13	Positioning completed	OFF of cycle time 1 scan is not held. Confirm that the positioning operation is completed along with the command reception bit.
			06	No origin flag	Indicate that the origin is unconfirmed.	Axis Status Memory area		00	Origin fix	Indicate that the origin is confirmed. (The logic is reversed from that of the existing models.)
			07	Origin stop flag	Indicate that it is stationary at the origin.			01	Origin stop	
			08	Zone 0	Indicate that the present position is within the zone 0 range.		+5 +18 +31 +44	13	Zone 0	
			09	Zone 1	Indicate that the present position is within the zone 1 range.			14	Zone 1	
			10	Zone 2	Indicate that the present position is within the zone 2 range.			15	Zone 2	

											CJ1W-NC1x3/2x3/4x3		CJ1W-NC2x4/4x4						
Operating area	Input	n+2	n+4	n+7	n+8	n+11	n+14	n+17	bit	External I/O status	Flag	Description	Memory area	bit values	bit	Name	Note
			n+4	n+7	n+8	n+11	n+14	n+17	11		Teaching completed	Indicate that the teaching command is completed.	Memory Operation Status Memory area	+1 +7 +13 +19	14	Teaching completed	
									12		Error flag	Indicate that there is an error.	Unit Control Memory area	+13	12	PCU error	
													Axis Status Memory area	+5 +18 +31 +44	12	Axis error	
													Memory Operation Status Memory area	+2 +8 +14 +20	12	Memory operation error	
									13	External I/O status	Busy flag	Indicate that the PCU is processing.	Unit Control Memory area	+12	04	Error resetting	The busy flags common to all PCUs is only for error reset processing. These busy flags do not save the cycle time 1 scan ON. Use it as the response of the PCU to the command from the PLC.
													Axis Status Memory area	+2 +15 +28 +41	00	Axis busy	
													Memory Operation Status Memory area	+1 +7 +13 +19	00	Memory operation busy	
			n+4	–	n+8	–	–	–	14		Data transferring	Indicate that data transfer is in progress.	Unit Control Memory area	+12	00	Data transferring	
			n+4	n+7	n+8	n+11	n+14	n+17	15		Deceleration stop execution	Indicate that the axis operation stopped based on an emergency stop input or a deceleration stop command.	Axis Status Memory area	+2 +15 +28 +41	12	Stop executed	Turn ON for command with axis stop or an axis stop accompanying an error occurrence.

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		CJ1W-NC1x3/2x3/4x3						CJ1W-NC2x4/4x4		
		Word (n+3 / n+5 / n+8 / n+9 / n+12 / n+15 / n+18)	Bit	Group	Signal name	Description	Area	Word (+6 / +19 / +32 / +45)	Bit	Signal name
Operating area – Input		n+3 / n+5 / n+8 / n+9 / n+12 / n+15 / n+18	08	External I/O status	CW limit input	Return the status of I/O signal of each axis. 1: Signal valid 0: Signal invalid Supplemental note: This is different from the electrical ON/OFF statuses.	Axis Status Memory area	+6 / +19 / +32 / +45	08	Forward direction limit input
			09		CCW limit input				09	Reverse direction limit input
			10		Origin proximity input				10	Origin proximity input
			11		Origin input				11	Origin input
			12		Interrupt input				12	Interrupt input
			13		Emergency stop input				13	Emergency stop input
			14		Positioning completed				14	Positioning completed input
			15		Error counter reset output and origin adjustment command output				02	Error counter reset output
Operating area							Unit Control Memory area	+14	–	PCU error code
		n+4 / n+6 / n+9 / n+10 / n+13 / n+16 / n+19	–		Error code	Return an error code.	Axis Status Memory area	+7 / +20 / +33 / +46	–	Error code
							Memory Operation Status Memory area	+3 / +9 / +15 / +21	–	Memory operation error code
Operating area – Output		I / I / I	–		Number of words to be written	Specify the number of words for the data to be written from the PLC to the PCU.		+1	–	Number of data transfer words
		I+1 / I+1 / I+1	–	Operation data for data transfer	Write source area	Specify the area to be arranged for the data to be written from the PLC to the PCU.	Unit Control Memory area	+2	–	CPU data transfer area type
		I+2 / I+2 / I+2	–		Write source words	Specify the first word of the data to be written from the PLC to the PCU.		+3	–	CPU data transfer first word

Operating area		CJ1W-NC1x3/2x3/4x3							CJ1W-NC2x4/4x4						
Output		I+3	I+3	I+3		–	Operation data for data transfer	Write destination address	Specify the address of the PCU to which the data is to be written.	Unit Control Memory area	+4			–	PCU data transfer area type	
											+5			–	PCU data transfer beginning word	
		I+4	I+4	I+4		–		Number of words to be read	Specify the number of words for the data to be read from the PCU to the PLC.		+1			–	Number of data transfer words	
		I+5	I+5	I+5		–		Read source address	Specify the address of the PCU from which the data is to be read.		+4			–	PCU data transfer area type	
											+5			–	PCU data transfer beginning word	
		I+6	I+6	I+6		–		Read destination area	Specify the area to output the data that is read from the PCU to the PLC.		+2			–	CPU data transfer area type	
		I+7	I+7	I+7		–		Read destination words	Specify the first word to output the data that is read from the PCU to the PLC.		+3			–	CPU data transfer first word	
		I+8	I+8	I+20	I+8	I+20	I+32	I+44	–	Operation data for direct operation	Position command	Specify the position for direct operation or present position preset.	Direct Operation Command Memory area	+2	+14	+26	+38	–	Command position	
		I+10	I+10	I+22	I+10	I+22	I+34	I+46	–		Speed command	Specify the target speed of direct operation, JOG and Origin Return.		+4	+16	+28	+40	–	Command speed	Specify the target speed of direct operation. Specify the JOG and Origin Return target speed in the axis parameters.

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Appendix-2 Changes from the Existing PCU

		CJ1W-NC1x3/2x3/4x3											CJ1W-NC2x4/4x4							
Operating area	Output	I+12	I+12	I+24	I+12	I+24	I+36	I+48	−	Operation data for direct operation	Acceleration time	Specify the acceleration time of direct operation, JOG and Origin Return.	Direct Operation Command Memory area	+8	+20	+32	+44	−	Acceleration time	Specify the acceleration time of direct operation. Specify the JOG and Origin Return acceleration time in the axis parameters.
		I+14	I+14	I+26	I+14	I+26	I+38	I+50	−		Deceleration time	Specify the deceleration time of direct operation, JOG and Origin Return.		+10	+22	+34	+46	−	Deceleration time	Specify the deceleration time of direct operation. Specify the JOG and Origin Return deceleration time in the axis parameters.
		I+16	I+16	I+28	I+16	I+28	I+40	I+52	−	For memory operation	Sequence No	Specify the starting sequence number of memory operation.	Memory Operation Command Memory area	+1	+4	+7	+10	−	Sequence No	
		I+17	I+17	I+29	I+17	I+29	I+41	I+53	−	Operation data for special function	Override	Specify the override ratio.	Manual Operation Command Memory area	+1	+3	+5	+7	−	Override	
		I+18	I+18	I+30	I+18	I+30	I+42	I+54	−		Teaching address	Specify the teaching address number.	Memory Operation Command Memory area	+2	+5	+8	+11	−	Teaching address No	
	Input	I+20	I+32	I+36	I+56	I+60	I+64	I+68	−	PCU status	Present position	Return the present position of each axis that is controlled by the PCU.	Axis Status Memory area	+8	+21	+34	+47	−	Command present position	
		I+22	I+34	I+38	I+58	I+62	I+66	I+70	−		Sequence No	Return the executing sequence number during memory operation.	Memory Operation Status Memory area	+4	+10	+16	+22	−	Sequence No in execution	
		I+23	I+35	I+39	I+59	I+63	I+67	I+71	−		Output code	Return the output code during memory operation.		+5	+11	+17	+23	−	M code	This is provided as an M code function.

* The numeric value in the word field for CJ1W-NC2x4/4x4 is the relative words from the beginning word of each area.

Appendix-3 Servo Drive Connecting Cable

CJ1W-NC234/NC434 Cable

G5/G-series Servo Drive Connecting Cable

XW2Z-xxxJ-G1 (for 2 axes) and G9 (for 1 axis)

AWG 18 twisted-pair 1 m
Red: 24 VDC
Black: 24-VDC GND
PCU side
XG4M-5030-T (OMRON)

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 1 and axis 3)
10150-3000PE (3M)

PCU side signal	Pin		Pin	Signal	Description
24-V power supply for output	1		11	BKIR	Brake interlock output
24-V GND for output	3		10	BKIRCOM	
Input common	5		44	+CWLD	Reverse pulse (*1) (line driver input)
Forward direction pulse output (+)	17		45	−CWLD	
Forward direction pulse output (−)	16		46	+CCWLD	forward pulse (*1) (line driver input)
Reverse direction pulse output (+)	19		47	−CCWLD	
Reverse direction pulse output (−)	18		21	+A	Encoder phase A + output
Encoder phase A +	21		22	−A	Encoder phase A − output
Encoder phase A −	20		49	+B	Encoder phase B + output
Encoder phase B +	23		48	−B	Encoder phase B − output
Encoder phase B −	22		23	+Z	Encoder phase Z + output
Encoder phase Z +	25		24	−Z	Encoder phase Z − output
Encoder phase Z −	24		7	+24VIN	+24-V power supply for control
Error counter reset output	15		30	ECRST	Error counter reset input
RUN output	11		29	RUN	Operation command input
General-purpose output	10		26	DFSEL	Vibration filter switch
Alarm reset output	12		31	RESET	Alarm reset
Torque limit output	13		27	TLSEL	Torque limit switch
Positioning completed input	7		39	INP	Positioning completed output 1
			38	INPCOM	
General-purpose input	6		35	READY	Servo ready completed output
			34	REDYCOM	
Alarm input	9		37	ALM	Alarm output
			36	ALMCOM	
SEN output	26		20	SEN	Sensor ON input
Signal ground	27		13	SENGND	
			Shell	FG	Frame ground

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 2 and axis 4)
10150-3000PE (3M)

PCU side signal	Pin		Pin	Signal	Description
24-V power supply for output	2		11	BKIR	Brake interlock output
24-V GND for output	4		10	BKIRCOM	
Input common	50		44	+CWLD	Reverse pulse (*1) (line driver input)
Forward direction pulse output (+)	39		45	−CWLD	
Forward direction pulse output (−)	38		46	+CCWLD	forward pulse (*1) (line driver input)
Reverse direction pulse output (+)	37		47	−CCWLD	
Reverse direction pulse output (−)	36		21	+A	Encoder phase A + output
Encoder phase A +	35		22	−A	Encoder phase A − output
Encoder phase A −	34		49	+B	Encoder phase B + output
Encoder phase B +	33		48	−B	Encoder phase B − output
Encoder phase B −	32		23	+Z	Encoder phase Z + output
Encoder phase Z +	31		24	−Z	Encoder phase Z − output
Encoder phase Z −	30		7	+24VIN	+24-V power supply for control
Error counter reset output	41		30	ECRST	Error counter reset input
RUN output	45		29	RUN	Operation command input
General-purpose output	44		26	DFSEL	Vibration filter switch
Alarm reset output	42		31	RESET	Alarm reset
Torque limit output	43		27	TLSEL	Torque limit switch
Positioning completed input	49		39	INP	Positioning completed output 1
			38	INPCOM	
General-purpose input	48		35	READY	Servo ready completed output
			34	REDYCOM	
Alarm input	47		37	ALM	Alarm output
			36	ALMCOM	
SEN output	29		20	SEN	Sensor ON input
Signal ground	28		13	SENGND	
			Shell	FG	Frame ground

*2

*1. Connect as above because the PCU handles forward direction commands as CW direction and phase A advance pulses (selectable by the pulse output direction selection parameter).
*2. This wiring is not necessary for 1-axis cable.
*3. Use the default settings for the control I/O signals for a G5-series Servo Drive.

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Appendix

W-series Servo Drive Connecting Cable

XW2Z-xxxJ-G2 (for 2 axes) and G10 (for 1 axis)

AWG 18 twisted-pair 1 m
Red: 24 VDC
Black: 24-VDC GND
PCU side
XG4M-5030-T (OMRON)

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 1 and axis 3) 10150-3000PE (3M)

PCU side signal	Pin		Pin	Signal	Servo Drive side description
24-V power supply for output	1		47	+24VIN	+24-V power supply for control
24-V GND for output	3		1	GND	Ground common
Input common	5		27	BKIR	Brake interlock output (*1)
			28	BKIRCOM	
Forward direction pulse output (+)	17		7	+PULS/+CW/+A	Reverse pulse/ feed pulse/phase A (*2)
Forward direction pulse output (−)	16		8	−PULS/−CW/−A	
Reverse direction pulse output (+)	19		11	+SIGN/+CCW/+B	Forward pulse/ direction signal/phase B (*2)
Reverse direction pulse output (−)	18		12	−SIGN/−CCW/−B	
Error counter reset output (with 1.6-kΩ resistance)	14		15	+ECRST	Error counter reset input
			14	−ECRST	
Encoder phase A +	21		33	+A	Encoder phase A + output
Encoder phase A −	20		34	−A	Encoder phase A − output
Encoder phase B +	23		36	+B	Encoder phase B + output
Encoder phase B −	22		35	−B	Encoder phase B − output
Encoder phase Z +	25		19	+Z	Encoder phase Z + output
Encoder phase Z −	24		20	−Z	Encoder phase Z − output
RUN output	11		40	RUN	Operation command input
General-purpose output	10		41	MING	Gain reduction input
Alarm reset output	12		44	RESET	Alarm reset
Torque limit output	13		45	PCL	Forward current limit input
Positioning completed input	7		25	INP1	Positioning completed output 1
			26	INP1COM	
General-purpose input	6		29	READY	Servo ready completed output
			30	REDYCOM	
Alarm input	9		31	ALM	Alarm output
			32	ALMCOM	
SEN output	26		4	SEN	Sensor ON input
Signal ground	27		2	SENGND	
			Shell	FG	Frame ground

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 2 and axis 4) 10150-3000PE (3M)

PCU side signal	Pin		Pin	Signal	Servo Drive side description
24-V power supply for output	2		47	+24VIN	+24-V power supply for control
24-V GND for output	4		1	GND	Ground common
Input common	50		27	BKIR	Brake interlock output (*1)
			28	BKIRCOM	
Forward direction pulse output (+)	39		7	+PULS/+CW/+A	Reverse pulse/ feed pulse/phase A (*2)
Forward direction pulse output (−)	38		8	−PULS/−CW/−A	
Reverse direction pulse output (+)	37		11	+SIGN/+CCW/+B	Forward pulse/ direction signal/phase B (*2)
Reverse direction pulse output (−)	36		12	−SIGN/−CCW/−B	
Error counter reset output (with 1.6-kΩ resistance)	40		15	+ECRST	Error counter reset input
			14	−ECRST	
Encoder phase A +	35		33	+A	Encoder phase A + output
Encoder phase A −	34		34	−A	Encoder phase A − output
Encoder phase B +	33		36	+B	Encoder phase B + output
Encoder phase B −	32		35	−B	Encoder phase B − output
Encoder phase Z +	31		19	+Z	Encoder phase Z + output
Encoder phase Z −	30		20	−Z	Encoder phase Z − output
RUN output	45		40	RUN	Operation command input
General-purpose output	44		41	MING	Gain reduction input
Alarm reset output	42		44	RESET	Alarm reset
Torque limit output	43		45	PCL	Forward current limit input
Positioning completed input	49		25	INP1	Positioning completed output 1
			26	INP1COM	
General-purpose input	48		29	READY	Servo ready completed output
			30	REDYCOM	
Alarm input	47		31	ALM	Alarm output
			32	ALMCOM	
SEN output	29		4	SEN	Sensor ON input
Signal ground	28		2	SENGND	
			Shell	FG	Frame ground

*3

*1. The default setting of the W-series Servo Drive is motor rotation detection output (TGON). Allocate brake interlock output to this pin before using a motor with brakes.

*2. Connect as above because the PCU handles forward direction commands as CW direction and phase A advance pulses (selectable by the pulse output direction selection parameter).

*3. This wiring is not necessary for 1-axis cable.

SMARTSTEP A-series Servo Drive Connecting Cable

XW2Z-xxxJ-G3 (for 2 axes) and G11 (for 1 axis)

AWG 18 twisted-pair 1 m
Red: 24 VDC
Black: 24-VDC GND
PCU side
XG4M-5030-T (OMRON)

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 1 and axis 3)
10136-3000PE (3M)

PCU side	Pin		Servo side	Pin	Signal	Description
24-V power supply for output	1			13	+24VIN	+24-V power supply for control
24-V GND for output	3					
Input common	5			7	BKIR	Brake interlock
Forward direction pulse output (+)	17			1	+CW/+PULS/+A	Reverse pulse/
Forward direction pulse output (–)	16			2	–CW/–PULS/–A	feed pulse/phase A (*1)
Reverse direction pulse output (+)	19			3	+CCW/+SIGN/+B	Forward pulse/
Reverse direction pulse output (–)	18			4	–CCW/–SIGN/–B	direction signal/phase B (*1)
Error counter reset output (with 1.6-kΩ resistance)	14			5	+ECRST	Error counter reset input
				6	–ECRST	
Origin input (24 V)	8			32	Z	Phase-Z output
				33	ZCOM	Phase-Z output ground
RUN output	11			14	RUN	Operation command input
Alarm reset output	12			18	RESET	Alarm reset
Positioning completed input	7			8	INP	Positioning completed output 1
				10	OGND	Output ground common
Alarm input	9			34	ALM	Alarm output
				35	ALMCOM	Alarm output ground
				Shell	FG	Frame ground

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 2 and axis 4)
10136-3000PE (3M)

PCU side	Pin		Servo side	Pin	Signal	Description
24-V power supply for output	2			13	+24VIN	+24-V power supply for control
24-V GND for output	4					
Input common	50			7	BKIR	Brake interlock
Forward direction pulse output (+)	39			1	+CW/+PULS/+A	Reverse pulse/
Forward direction pulse output (–)	38			2	–CW/–PULS/–A	feed pulse/phase A (*1)
Reverse direction pulse output (+)	37			3	+CCW/+SIGN/+B	Forward pulse/
Reverse direction pulse output (–)	36			4	–CCW/–SIGN/–B	direction signal/phase B (*1)
Error counter reset output (with 1.6-kΩ resistance)	40			5	+ECRST	Error counter reset input
				6	–ECRST	
Origin input (24 V)	46			32	Z	Phase-Z output
				33	ZCOM	Phase-Z output ground
RUN output	45			14	RUN	Operation command input
Alarm reset output	42			18	RESET	Alarm reset
Positioning completed input	49			8	INP	Positioning completed output 1
				10	OGND	Output ground common
Alarm input	47			34	ALM	Alarm output
				35	ALMCOM	Alarm output ground
				Shell	FG	Frame ground

*2

*1. Connect as above because the PCU handles forward direction commands as CW direction and phase A advance pulses (selectable by the pulse output direction selection parameter).

*2. This wiring is not necessary for 1-axis cable.

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Appendix

SMARTSTEP2 Series Servo Drive Connecting Cable

XW2Z-xxxJ-G4 (for 2 axes) and G12 (for 1 axis)

*1. Connect as follows because the PCU handles forward direction commands as CW direction and phase A advance pulses (selectable by the pulse output direction selection parameter).

*2. This wiring is not necessary for 1-axis cable.

CJ1W-NC214/NC414 Cable

G5/G-series Servo Drive Connecting Cable

XW2Z-xxxJ-G5 (for 2 axes) and G13 (for 1 axis)

AWG 18 twisted-pair 1 m
Red: 24 VDC
Black: 24-VDC GND
PCU side
XG4M-5030-T (OMRON)

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR

Servo Drive side (for axis 1 and axis 3)
10150-3000PE (3M)

PCU pin	Signal		Servo pin	Signal	Description
1	24-V power supply for output		11	BKIR	Brake interlock output
3	24-V GND for output		10	BKIRCOM	
5	Input common		3	+CW/+PULS/+FA	Reverse pulse/ feed pulse/phase A (*1)
16	Forward direction pulse output (with 1.6-kΩ resistance)		4	−CW/−PULS/−FA	
18	Reverse direction pulse output (with 1.6-kΩ resistance)		5	+CCW/+SIGN/+FB	Forward pulse/ direction signal/phase B (*1)
			6	−CCW/−SIGN/−FB	
21	Encoder phase A +		21	+A	Encoder phase A + output
20	Encoder phase A −		22	−A	Encoder phase A − output
23	Encoder phase B +		49	+B	Encoder phase B + output
22	Encoder phase B −		48	−B	Encoder phase B − output
25	Encoder phase Z +		23	+Z	Encoder phase Z + output
24	Encoder phase Z −		24	−Z	Encoder phase Z − output
			7	+24VIN	+24-V power supply for control
15	Error counter reset output		30	ECRST	Error counter reset input
11	RUN output		29	RUN	Operation command input
10	General-purpose output		26	DFSEL	Vibration filter switch
12	Alarm reset output		31	RESET	Alarm reset
13	Torque limit output		27	TLSEL	Torque limit switch
7	Positioning completed input		39	INP	Positioning completed output 1
			38	INPCOM	
6	General purpose inputs		35	READY	Servo ready completed output
			34	REDYCOM	
9	Alarm input		37	ALM	Alarm output
			36	ALMCOM	
26	SEN output		20	SEN	Sensor ON input
27	Signal ground		13	SENGND	
			Shell	FG	Frame ground

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR

Servo Drive side (for axis 2 and axis 4)
10150-3000PE (3M)

PCU pin	Signal		Servo pin	Signal	Description
2	24-V power supply for output		11	BKIR	Brake interlock output
4	24-V GND for output		10	BKIRCOM	
50	Input common		3	+CW/+PULS/+FA	Reverse pulse/ feed pulse/phase A (*1)
38	Forward direction pulse output (with 1.6-kΩ resistance)		4	−CW/−PULS/−FA	
36	Reverse direction pulse output (with 1.6-kΩ resistance)		5	+CCW/+SIGN/+FB	Forward pulse/ direction signal/phase B (*1)
			6	−CCW/−SIGN/−FB	
35	Encoder phase A +		21	+A	Encoder phase A + output
34	Encoder phase A −		22	−A	Encoder phase A − output
33	Encoder phase B +		49	+B	Encoder phase B + output
32	Encoder phase B −		48	−B	Encoder phase B − output
31	Encoder phase Z +		23	+Z	Encoder phase Z + output
30	Encoder phase Z −		24	−Z	Encoder phase Z − output
			7	+24VIN	+24-V power supply for control
41	Error counter reset output		30	ECRST	Error counter reset input
45	RUN output		29	RUN	Operation command input
44	General-purpose output		26	DFSEL	Vibration filter switch
42	Alarm reset output		31	RESET	Alarm reset
43	Torque limit output		27	TLSEL	Torque limit switch
49	Positioning completed input		39	INP	Positioning completed output 1
			38	INPCOM	
48	General purpose inputs		35	READY	Servo ready completed output
			34	REDYCOM	
47	Alarm input		37	ALM	Alarm output
			36	ALMCOM	
29	SEN output		20	SEN	Sensor ON input
28	Signal ground		13	SENGND	
			Shell	FG	Frame ground

*2

*1. Connect as above because the PCU handles forward direction commands as CW direction and phase A advance pulses (selectable by the pulse output direction selection parameter).
*2. This wiring is not necessary for 1-axis cable.
*3. Use the default settings for the control I/O signals for a G5-series Servo Drive.

A

Appendix

W-series Servo Drive Connecting Cable

XW2Z-xxxJ-G6 (for 2 axes) and G14 (for 1 axis)

AWG 18 twisted-pair 1 m
Red: 24 VDC
Black: 24-VDC GND
PCU side
XG4M-5030-T (OMRON)

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 1 and axis 3) 10150-3000PE (3M)

PCU side signal	Pin	Servo pin	Servo signal	Description
24-V power supply for output	1	47	+24VIN	+24-V power supply for control
24-V GND for output	3	1	GND	Ground common
Input common	5	27	BKIR	Brake interlock output (*1)
		28	BKIRCOM	
Forward direction pulse output (with 1.6-kΩ resistance)	16	7	+PULS/+CW/+A	Reverse pulse/ feed pulse/phase A (*2)
		8	–PULS/–CW/–A	
Reverse direction pulse output (with 1.6-kΩ resistance)	18	11	+SIGN/+CCW/+B	Forward pulse/ direction signal/phase B (*2)
		12	–SIGN/–CCW/–B	
Error counter reset output (with 1.6-kΩ resistance)	14	15	+ECRST	Error counter reset input
		14	–ECRST	
Encoder phase A +	21	33	+A	Encoder phase A + output
Encoder phase A –	20	34	–A	Encoder phase A – output
Encoder phase B +	23	36	+B	Encoder phase B + output
Encoder phase B –	22	35	–B	Encoder phase B – output
Encoder phase Z +	25	19	+Z	Encoder phase Z + output
Encoder phase Z –	24	20	–Z	Encoder phase Z – output
RUN output	11	40	RUN	Operation command input
General-purpose output	10	41	MING	Gain reduction input
Alarm reset output	12	44	RESET	Alarm reset
Torque limit output	13	45	PCL	Forward current limit input
Positioning completed input	7	25	INP1	Positioning completed output 1
		26	INP1COM	
General-purpose input	6	29	READY	Servo ready completed output
		30	REDYCOM	
Alarm input	9	31	ALM	Alarm output
		32	ALMCOM	
SEN output	26	4	SEN	Sensor ON input
Signal ground	27	2	SENGND	
		Shell	FG	Frame ground

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 2 and axis 4) 10150-3000PE (3M)

PCU side signal	Pin	Servo pin	Servo signal	Description
24-V power supply for output	2	47	+24VIN	+24-V power supply for control
24-V GND for output	4	1	GND	Ground common
Input common	50	27	BKIR	Brake interlock output (*1)
		28	BKIRCOM	
Forward direction pulse output (with 1.6-kΩ resistance)	38	7	+PULS/+CW/+A	Reverse pulse/ feed pulse/phase A (*2)
		8	–PULS/–CW/–A	
Reverse direction pulse output (with 1.6-kΩ resistance)	36	11	+SIGN/+CCW/+B	Forward pulse/ direction signal/phase B (*1)
		12	–SIGN/–CCW/–B	
Error counter reset output (with 1.6-kΩ resistance)	40	15	+ECRST	Error counter reset input
		14	–ECRST	
Encoder phase A +	35	33	+A	Encoder phase A + output
Encoder phase A –	34	34	–A	Encoder phase A + output
Encoder phase B +	33	36	+B	Encoder phase B + output
Encoder phase B –	32	35	–B	Encoder phase B – output
Encoder phase Z +	31	19	+Z	Encoder phase Z + output
Encoder phase Z –	30	20	–Z	Encoder phase Z – output
RUN output	45	40	RUN	Operation command input
General-purpose output	44	41	MING	Gain reduction input
Alarm reset output	42	44	RESET	Alarm reset
Torque limit output	43	45	PCL	Forward current limit input
Positioning completed input	49	25	INP1	Positioning completed output 1
		26	INP1COM	
General-purpose input	48	29	READY	Servo ready completed output
		30	REDYCOM	
Alarm input	47	31	ALM	Alarm output
		32	ALMCOM	
SEN output	29	4	SEN	Sensor ON input
Signal ground	28	2	SENGND	
		Shell	FG	Frame ground

*3

*1. The default setting of the W-series Servo Drive is motor rotation detection output (TGON). Allocate brake interlock output to this pin before using a motor with brakes.

*2. Connect as above because the PCU handles forward direction commands as CW direction and phase A advance pulses (selectable by the pulse output direction selection parameter).

*3. This wiring is not necessary for 1-axis cable.

A

Appendix

SMARTSTEP A-series Servo Drive Connecting Cable

XW2Z-xxxJ-G7 (for 2 axes) and G15 (for 1 axis)

AWG 18 twisted-pair 1 m
Red: 24 VDC
Black: 24-VDC GND
PCU side
XG4M-5030-T (OMRON)

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 1 and axis 3)
10136-3000PE (3M)

PCU			Servo Drive		
24-V power supply for output	1		13	+24VIN	+24-V power supply for control
24-V GND for output	3		7	BKIR	Brake interlock
Input common	5		1	+CW/+PULS/+A	Reverse pulse/
Forward direction pulse output (with 1.6-kΩ resistance)	16		2	−CW/−PULS/−A	feed pulse/phase A (*1)
Reverse direction pulse output (with 1.6-kΩ resistance)	18		3	+CCW/+SIGN/+B	Forward pulse/
			4	−CCW/−SIGN/−B	direction signal/phase B (*1)
Error counter reset output (with 1.6-kΩ resistance)	14		5	+ECRST	Error counter reset input
			6	−ECRST	
Origin input (24 V)	8		32	Z	Phase-Z output
			33	ZCOM	Phase-Z output ground
RUN output	11		14	RUN	Operation command input
Alarm reset output	12		18	RESET	Alarm reset
Positioning completed input	7		8	INP	Positioning completed output 1
			10	OGND	Output ground common
Alarm input	9		34	ALM	Alarm output
			35	ALMCOM	Alarm output ground
			Shell	FG	Frame ground

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 2 and axis 4)
10136-3000PE (3M)

PCU			Servo Drive		
24-V power supply for output	2		13	+24VIN	+24-V power supply for control
24-V GND for output	4		7	BKIR	Brake interlock
Input common	50		1	+CW/+PULS/+A	Reverse pulse/
Forward direction pulse output (with 1.6-kΩ resistance)	38		2	−CW/−PULS/−A	feed pulse/phase A (*1)
Reverse direction pulse output (with 1.6-kΩ resistance)	36		3	+CCW/+SIGN/+B	Forward pulse/
			4	−CCW/−SIGN/−B	direction signal/phase B (*1)
Error counter reset output (with 1.6-kΩ resistance)	40		5	+ECRST	Error counter reset input
			6	−ECRST	
Origin input (24 V)	46		32	Z	Phase-Z output
			33	ZCOM	Phase-Z output ground
RUN output	45		14	RUN	Operation command input
Alarm reset output	42		18	RESET	Alarm reset
Positioning completed input	49		8	INP	Positioning completed output 1
			10	OGND	Output ground common
Alarm input	47		34	ALM	Alarm output
			35	ALMCOM	Alarm output ground
			Shell	FG	Frame ground

*2

*1. Connect as above because the PCU handles forward direction commands as CW direction and phase A advance pulses (selectable by the pulse output direction selection parameter).

*2. This wiring is not necessary for 1-axis cable.

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Appendix

SMARTSTEP2 Series Servo Drive Connecting Cable

XW2Z-xxxJ-G8 (for 2 axes) and G16 (for 1 axis)

AWG 18 twisted-pair 1 m
Red: 24 VDC
Black: 24-VDC GND
PCU side
XG4M-5030-T (OMRON)

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 1 and axis 3)
10126-3000PE (3M)

PCU side	Pin		Servo Drive side		
24-V power supply for output	1		11	BKIR	Brake interlock
24-V GND for output	3		22	+CW/+PULS/+FA	Reverse pulse/
Input common	5		23	−CW/−PULS/−FA	feed pulse/phase A (*1)
Forward direction pulse output (with 1.6-kΩ resistance)	16		24	+CCW/+SIGN/+FB	Forward pulse/
Reverse direction pulse output (with 1.6-kΩ resistance)	18		25	−CCW/−SIGN/−FB	direction signal/phase B (*1)
Encoder phase A +	21		15	+A	Encoder phase A + output
Encoder phase A −	20		16	−A	Encoder phase A − output
Encoder phase B +	23		18	+B	Encoder phase B + output
Encoder phase B −	22		17	−B	Encoder phase B − output
Encoder phase Z +	25		19	+Z	Encoder phase Z + output
Encoder phase Z −	24		20	−Z	Encoder phase Z − output
			1	+24VIN	+24-V power supply for control
Error counter reset output	15		4	ECRST	Error counter reset input
RUN output	11		2	RUN	Operation command input
Torque limit output	13		5	TLSEL	Torque limit switch
Alarm reset output	12		3	RESET	Alarm reset
General-purpose output	10		6	GESEL	Electronic gear switch
Positioning completed input	7		10	INP	Positioning completed output 1
			13	OGND	Output ground common
General-purpose input	6		12	WARN	Alarm output
Alarm input	9		9	ALM	Alarm output
			26	FG	Frame ground

AWG 18 twisted-pair 1 m
Blue: BKIRCOM
Black: BKIR
Servo Drive side (for axis 2 and axis 4)
10126-3000PE (3M)

PCU side	Pin		Servo Drive side		
24-V power supply for output	2		11	BKIR	Brake interlock
24-V GND for output	4		22	+CW/+PULS/+FA	Reverse pulse/
Input common	50		23	−CW/−PULS/−FA	feed pulse/phase A (*1)
Forward direction pulse output (with 1.6-kΩ resistance)	38		24	+CCW/+SIGN/+FB	Forward pulse/
Reverse direction pulse output (with 1.6-kΩ resistance)	36		25	−CCW/−SIGN/−FB	direction signal/phase B (*1)
Encoder phase A +	35		15	+A	Encoder phase A + output
Encoder phase A −	34		16	−A	Encoder phase A − output
Encoder phase B +	33		18	+B	Encoder phase B + output
Encoder phase B −	32		17	−B	Encoder phase B − output
Encoder phase Z +	31		19	+Z	Encoder phase Z + output
Encoder phase Z −	30		20	−Z	Encoder phase Z − output
			1	+24VIN	+24-V power supply for control
Error counter reset output	41		4	ECRST	Error counter reset input
RUN output	45		2	RUN	Operation command input
Torque limit output	43		5	TLSEL	Torque limit switch
Alarm reset	42		3	RESET	Alarm reset
General-purpose output	44		6	GESEL	Electronic gear switch
Positioning completed input	49		10	INP	Positioning completed output 1
			13	OGND	Output ground common
General-purpose input	48		12	WARN	Alarm output
Alarm input	47		9	ALM	Alarm output
			26	FG	Frame ground

*2

*1. Connect as follows because the PCU handles forward direction commands as CW direction and phase A advance pulses (selectable by the pulse output direction selection parameter).

*2. This wiring is not necessary for 1-axis cable.

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