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SYSMAC
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# Position Control Units

# OPERATION MANUAL

OMRON

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# CJ1W-NCF71/CS1W-NCF71 Position Control Units

## Operation Manual

*Revised February 2008*

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# 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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No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.



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# About this Manual:

This manual describes the installation and operation of the CJ1W-NCF71 and CS1W-NCF71 Position Control Units and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to install or operate the Position Control Unit. Be sure to read the precautions provided in the following section.

***Precautions*** provides general precautions for using the Position Control Unit, Programmable Controller, and related devices.

***Section 1*** introduces the features of the Position Control Unit, explains the system configuration in which it is used, and also provides information on basic operations, functions and specifications.

***Section 2*** provides an overview of the procedures required to use the Position Control Unit.

***Section 3*** provides information on nomenclature and functions, and describes the procedures required for wiring and installation. Information on the MECHATROLINK-II Application Module is also provided.

***Section 4*** provides an overview of the parameter and data settings used in Position Control Unit operation and provides information on memory allocations.

***Section 5*** explains how to transfer and save parameters and data using the data transfer bits.

***Section 6*** provides an overview of MECHATROLINK communications, and includes information on settings and procedures required to use MECHATROLINK with the Position Control Unit.

***Section 7*** provides an overview of the control system used by the Position Control Unit, including information on the control units, coordinate system, acceleration/deceleration operations, and limit input operations.

***Section 8*** provides information on the various operations used to determine the origin, including origin searches, origin returns, presetting the present position, calculating phase Z margins, and using the absolute encoder.

***Section 9*** provides an overview of direct operation and describes the parameter settings, data settings, and procedures required to perform direct operation. Information on interrupt feeding and torque limits is also provided here.

***Section 10*** describes the servo lock/unlock, jogging, override, torque limits, speed control, torque control, backlash compensation, software limits, and stop functions.

***Section 11*** provides basic program examples and application examples for using the Position Control Unit.

***Section 12*** provides information on troubleshooting errors that may occur, including details on the meaning of indicator displays and error codes, and the procedures required to reset errors in the Unit or axes.

***Section 13*** describes methods for inspecting and maintaining the Position Control Unit and the procedure required to replace a Position Control Unit.

The ***Appendices*** provide information on the performance characteristics, lists of parameters, I/O allocations in the operation areas, lists of error codes, alarm/warning displays, and information required when changing to the CJ1W-NCF71/CS1W-NCF71 from a CJ1W/CS1W-NC113/133/213/233/413/433 Position Control Unit.

> ⚠ **WARNING** Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.



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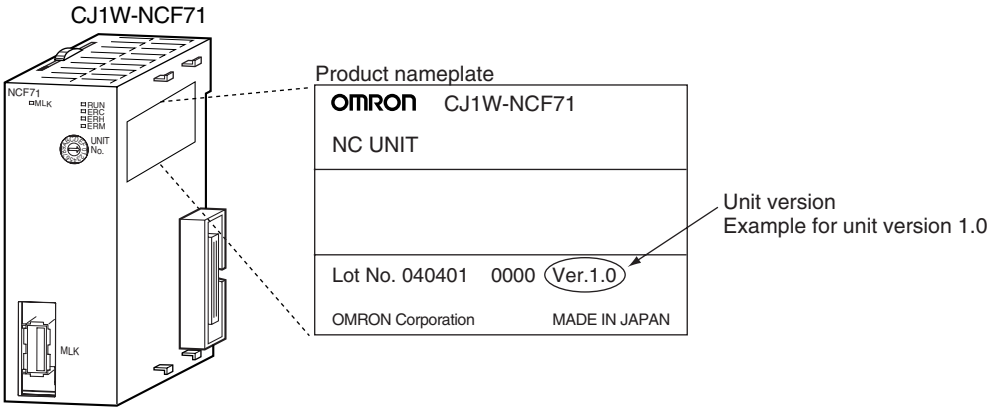
# *Unit Versions of Position Control Units*

## Unit Versions

A “unit version” has been introduced to manage Position Control Units according to differences in functionality accompanying Unit upgrades.

### Notation of Unit Versions on Products

The unit version is given to the right of the lot number on the nameplate of the products for which unit versions are being managed, as shown below.




The unit version of Position Control Units starts with unit version 1.0.

### Confirming Unit Versions with Support Software

CX-Programmer version 4.0 can be used to confirm the unit version using the ***Unit Manufacturing Information***.

In the *IO Table* Window, right-click the Position Control Unit and select ***Unit Manufacturing information.***

The following *Unit Manufacturing information* Dialog Box will be displayed.




The unit version is displayed as *1.0* in the *Unit Version Number* field of the above example. Use the above display to confirm the unit version of the Unit connected online.

### Using Unit Version Label

A unit version label is provided with the Position Control Unit. This label can be attached to the front of the Position Control Unit to differentiate between Position Control Units with different unit versions.



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### Functions Supported According to Position Control Unit Versions

| Model | CJ1W-NCF71/CS1W-NCF71 | | | | | |
|---|---|---|---|---|---|---|
| | Unit Ver. 1.0 | Unit Ver. 1.1 | Unit Ver. 1.2 | Unit Ver. 1.3 | Unit Ver. 2.0 | Unit Ver. 2.1 |
| Linear interpolation | --- | Supported. | Supported. | Supported. | Supported. | Supported. |
| Absolute encoder setup function | --- | --- | Supported. | Supported. | Supported. | Supported. |
| Deviation counter reset | --- | --- | --- | Supported. | Supported. | Supported. |
| Establishing connections even when there are unconnected axes or axes with alarms that cannot be cleared | --- | --- | --- | Supported. | Supported. | Supported. |
| Transferring servo parameters even when there is an axis error | --- | --- | --- | Supported. | Supported. | Supported. |
| Creating servo locks during software limit detection when an absolute encoder is used | --- | --- | --- | Supported. | Supported. | Supported. |
| Driver main circuit OFF error detection only when the servo is locked | --- | --- | --- | Supported. | Supported. | Supported. |
| Using Holding Area address H512 and onwards for function block address allocations | --- | --- | --- | Supported. | Supported. | Supported. |
| Addition of supported models: SMARTSTEP Junior Servo Drivers (R7D-ZN□-ML2) | --- | --- | --- | --- | Supported. | Supported. |
| Addition of rejoin function | --- | --- | --- | --- | Supported. | Supported. |
| Eliminating connection restriction when Servo Driver alarms occur (enabling connection when alarm A.C90 occurs) | --- | --- | --- | --- | Supported. | Supported. |
| Addition of origin search operation modes | --- | --- | --- | --- | Supported. | Supported. |
| Addition of origin search preset function | --- | --- | --- | --- | Supported. | Supported. |
| Faster setting for transfer cycle and communications cycle when setting the absolute encoder PG zero point position offset with an origin search | --- | --- | --- | --- | --- | Supported. |



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### Upgrades Made According to Unit Versions of the Position Control Unit

Unit Version 1.0 to Unit Version 1.1

| Functional upgrade | Unit version 1.0 | Unit version 1.1 |
|---|---|---|
| Addition of linear interpolation function | Linear interpolation cannot be used. | Linear interpolation can be performed for positioning operations combining one or more axes.<br>Linear interpolation can performed for up to four axes each of axes 1 to 4 and axes 5 to 8 for Servo Driver axes connected to the Position Control Unit. (Refer to *9-7 Linear Interpolation*.) |

Unit Version 1.1 to Unit Version 1.2

| Functional upgrade | Unit version 1.1 | Unit version 1.2 |
|---|---|---|
| Addition of setup function for absolute encoders | An absolute encoder must be set up the first time it is used, when the rotation data is initialized to 0, or when the absolute encoder is left for a long period of time without the battery connected.<br>With Position Control Units with unit version 1.1 or earlier, the following operation is used to set up the absolute encoder.<br>• Special software (personal computer monitoring software) must be connected to the Servo Driver to perform the setup operation. | With Position Control Units with unit version 1.2 or later, the following operation can be used to set up the absolute encoder.<br>• Special software (personal computer monitoring software) can be connected to the Servo Driver to perform the setup operation.<br>• When the Position Control Unit is used with a CPU Unit with unit version 3.0 or later, the absolute encoder can be set up from the program by using a function block from the OMRON FB Library.<br>• The absolute encoder can be set up from the CX-Motion-NCF. (Refer to *8-6-4 Absolute Encoder Setup*.) |

Unit Version 1.2 to Unit Version 1.3

| Functional upgrade | Unit version 1.2 | Unit version 1.3 |
|---|---|---|
| Addition of deviation counter reset function | The deviation counter in the Servo Driver cannot be reset from the Position Control Unit during position control operations. | The deviation counter in the Servo Driver can be reset from the Position Control Unit during position control operations.<br>To deviation reset function in the Position Control Unit works by sending a movement command in the opposite direction and of the same size as the current position deviation so that the current command position equals the current feedback position.<br>(Refer to *10-10 DEVIATION COUNTER RESET*.) |



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| Functional upgrade | Unit version 1.2 | Unit version 1.3 |
|---|---|---|
| Establishing connections when there are unconnected axes or axes with alarms that cannot be cleared | If any of the axes registered in the scan list are not connected, have the control power supply interrupted, or have an alarm that can be reset only by cycling the power supply, an MLK initialization error (Unit error code 0020 (hex) will occur after the connections are established and operations using MECHATROLINK communications will not be possible any axes, including those without errors.<br>To start MECHATROLINK communications normally, all errors must be cleared for all axes registered in the scan list before connections can be established. | Axis operations using MECHATROLINK communications are possible for any axes registered in the scan list and for which MECHATROLINK communications have been started (see note) regardless of whether there are Servo Driver alarms.<br>If there are any axes with alarms, they will be indicated by the Error Flags and error code in the Axis Operating Input Memory Areas.<br>If there are alarms in the Servo Driver that can be cleared only by recycling the power, they will be detected as Unit errors (MLK initialization errors) for Units with unit version 1.1 or earlier, but they will be detected in the individual axis areas.<br>**Note** If R88D-WN□-ML2 W-series Servo Drivers (Models with Built-in MECHATROLINK-II Communications) are connected, an encoder communications error (A.C9□) will occur in the Servo Driver and it will not be possible to start MECHATROLINK communications for Units with unit version 1.3 or earlier.<br>(Refer to *6-3-2 MECHATROLINK Communications Status*.) |
| Transferring parameters when there are axis errors | Servo parameters cannot be transferred (i.e., written, read, or saved) for axes with errors. The errors must first be reset to clear the axis error status before Servo parameters can be transferred. | Servo parameters can be transferred (i.e., written, read, or saved) for axes with errors. If the axis error already exists, it will not be overwritten even if an error occurs during parameter transfer.<br>If Servo parameters are written when there is an axis error, be sure to confirm that the parameters were transferred correctly.<br>(Refer to *5-3 Transferring Servo Parameters*.) |
| Locking the servo when a software limit is being detected for a Motor with an absolute encoder | If an attempt is made to lock the Servo when an absolute encoder is used, the software limits are enabled, and the present position is within the software limit area, a software limit error will occur and the Servo lock operation will be canceled.<br>To lock the Servo in the above situation, the software limit must first be disabled. | The Servo can be locked at any position, regardless of the type of encoder and the software limit settings.<br>(Refer to *10-8-4 Software Limit Operation*.) |



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| Functional upgrade | Unit version 1.2 | Unit version 1.3 |
|---|---|---|
| Detecting driver main circuit OFF errors only when the Servo is locked | Servo Driver main circuit OFF errors are detected regardless of whether the Servo is locked for the axis. Once a Servo Driver main circuit OFF error is detected, it will continue to be detected even if the error is reset until the main circuit power supply is restored. | Servo Driver main circuit OFF errors are detected only when the Servo is locked for the axis.<br>The Position Control Unit will automatically unlock the Servo when a Servo Driver main circuit OFF error is detected, allowing the error to be cleared even while the main circuit power supply is interrupted.<br>If an attempt is made to lock the Servo while the main circuit power supply is interrupted, a Servo Driver main circuit OFF error will be detected again.<br>(Refer to *12-4-2 List of Error Codes*.) |
| Allocating holding addresses H512 and higher as function block addresses | The function blocks in the OMRON FB Library for the Position Control Unit cannot be used if H512 (default setting) or higher are allocated for non-holding areas of function block addresses.<br>If H512 or higher are allocated, a function block error will occur when the function block is executed.<br>The CX-Programmer must be used to change the setting to other unused words (e.g., in the DM or EM Area). | The function blocks in the OMRON FB Library for the Position Control Unit can be used if H512 (default setting) or higher are allocated for non-holding areas of function block addresses. |

Unit Version 1.3 to Unit Version 2.0

| Functional upgrade | Unit version 1.3 | Unit version 2.0 |
|---|---|---|
| Addition of applicable models | Applicable Models<br>• R88D-WT□W-series Servo Drivers (with JUSP-NS115 MECHATROLINK-II Application Module mounted)<br>• R88D-WN□-ML2 W-series Servo Drivers (Models with Built-in MECHATROLINK-II Communications) | Applicable Models<br>• R88D-WT□W-series Servo Drivers (with JUSP-NS115 MECHATROLINK-II Application Module mounted)<br>• R88D-WN□-ML2 W-series Servo Drivers (Models with Built-in MECHATROLINK-II Communications)<br>• R7D-ZN□-ML2 SMARTSTEP Junior Servo Driver (Models with Built-in MECHATROLINK-II Communications) |



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<table>
<tr><th>Functional upgrade</th><th>Unit version 1.3</th><th>Unit version 2.0</th></tr>
<tr><td>Addition of rejoin function</td><td>MECHATROLINK communications are started and stopped at the same time for all axes registered in the scan list.</td><td>The following functions are supported in addition to starting and stopping MECHATROLINK communications for all axes at the same time.<br>• Rejoin Function<br>An axis for which communications have been stopped, e.g., due to a communications error, can be restarted without stopping communications for the other axes.<br>(Refer to 6-3-4 Rejoining the Connection.)<br>• Setting the Axes to Be Connected<br>Axes registered in the scan list can be set temporarily so that they are not registered. The axes can be set so that they are temporarily not used without resetting the scan list. Operations can be performed without errors occurring for these axes.<br>(Refer to 6-3-5 Specifying the Axes to Connect.)<br>The Axis Communications Status Flags have also been changed for the above functions. Refer to the note following this table for details.</td></tr>
<tr><td>Eliminating connection restriction when Servo Driver alarms occur (enabling connection when alarm A.C90 occurs)</td><td>If an encoder communications error (A.C90) occurs for a R88D-WN□-ML2 W-series Servo Driver (Model with Built-in MECHATROLINK-II Communications), MECHATROLINK communications cannot be started with that Servo Driver.</td><td>MECHATROLINK communications can be started under the conditions given at the left, and operations, such as transferring Servo Parameters, can be performed.</td></tr>
<tr><td>Addition of origin search operation modes</td><td>Three origin search operation pattern are possible by combining the following settings:<br>• Origin search operations: 3 settings<br>(Reversal modes 1 and 2, and Single-direction mode)<br>• Origin detection method: 1 setting<br>(With origin proximity input signal reversal)</td><td>Eleven origin search operation pattern are possible by combining the following settings:<br>• Origin search operations: 4 settings<br>(Reversal modes 1, 2, and 3, and Single-direction mode)<br>• Origin detection methods: 3 settings (With origin proximity input signal reversal, Without origin proximity input signal reversal, Not use origin proximity input signal)<br><table><tr><th rowspan="2">Origin detection method</th><th colspan="4">Origin search operation</th></tr><tr><th>Reversal mode 1</th><th>Reversal mode 2</th><th>Single-direction mode</th><th>Reversal mode 3</th></tr><tr><td>With origin proximity input signal reversal</td><td>● (See note.)</td><td>●</td><td>●</td><td>○</td></tr><tr><td>Without origin proximity input signal reversal</td><td>○ (See note.)</td><td>○</td><td>○</td><td>○</td></tr><tr><td>Not use origin proximity input signal</td><td>○ (See note.)</td><td>○</td><td>○</td><td></td></tr></table>●: Combinations supported by unit version 1.3 or earlier<br>○: Combinations supported by unit version 2.0 or later<br>**Note:** Origin search operation patterns supported by absolute encoders.<br>(Refer to 8-2-4 Origin Search Operation.)</td></tr>
</table>



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| Functional upgrade | Unit version 1.3 | Unit version 2.0 |
|---|---|---|
| Addition of origin search preset function | The preset function cannot be used during origin searches. | The preset function can be used during origin searches.<br>For any of the origin search operations the present position can be automatically set to any specified value at the end of the origin search. When using reversal mode 1 and an absolute encoder, an offset can also be set for the absolute origin.<br>(Refer to *8-2-6 Origin Search Preset* and *8-6-2 Absolute Encoder Operating Procedure*.) |

**Note** Changes in Axis Communications Status Flags
The conditions for setting and resetting the Axis Communications Status Flags in word n+22 of the Common Operating Memory Area have been changed accompanying the addition of the rejoin function. New conditions are underlined in the following table.

| Functional upgrade | Unit version 1.3 or earlier | Unit version 2.0 or later |
|---|---|---|
| Setting conditions | • The flags will turn ON when connections are made for the axes registered in the scan list and MECHATROLINK communications start. | • The flags will turn ON when connections are made for the axes registered in the scan list and MECHATROLINK communications start.<br>• <u>The flag will turn ON when the rejoin function is used to start MECHATROLINK communications for an axis registered in the scan list.</u> |
| Resetting conditions | • The flags will remain OFF when MECHATROLINK communications cannot be started when connections are made for the axes registered in the scan list.<br>• The flags will turn OFF if MECHATROLINK communications stop because the axis is disconnected.<br>• The flags will turn OFF if a Unit error occurs that requires disconnection. | • The flags will remain OFF when MECHATROLINK communications cannot be started when connections are made for the axes registered in the scan list.<br>• The flags will turn OFF if MECHATROLINK communications stop because the axis is disconnected.<br>• The flags will turn OFF if a Unit error occurs that requires disconnection.<br>• <u>The flags will turn OFF whenever a communications error occurs after MECHATROLINK communications have been started for the axis.</u> |

With unit version 1.3 or earlier, once MECHATROLINK communications have been started by establishing connections, the Axis Communications Status Flags will not change unless communications are disconnected (including Unit errors that required disconnection).

With unit version 2.0 or later, the Axis Communications Status Flags will turn OFF after connections have been established whenever axis operation becomes impossible due to a communications error (synchronous communications alarm or communications alarm).

Unit Version 2.0 to Unit Version 2.1

| Functional upgrade | Unit version 2.0 | Unit version 2.1 |
|---|---|---|
| Faster setting of transfer cycle and communications cycle when setting the absolute encoder PG zero point position offset with an origin search | A longer communications cycle must be set using the settings given in a separate table when the absolute encoder PG zero point position offset is set with an origin search. | The same communications cycle can be set regardless of whether the absolute encoder PG zero point position offset is set with an origin search. |



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# Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

# Warranty and Limitations of Liability

## WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

## LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.



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# Application Considerations

## SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

## PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.



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# Disclaimers

## CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

## DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

## PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

## ERRORS AND OMISSIONS

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.



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# PRECAUTIONS

This section provides general precautions for using the Position Control Unit and related devices.

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


1 Intended Audience . . . . . xxiv
2 General Precautions . . . . . xxiv
3 Safety Precautions . . . . . xxiv
4 Operating Environment Precautions . . . . . xxv
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6-1 Applicable Directives . . . . . xxviii
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# 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 programming and operating the 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 extremely important that a 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** Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in 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.



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- 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. As a countermeasure for 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** Execute online editing 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 safety at the destination node before transferring a program to another node or changing contents of the I/O memory area. Doing either of these without confirming safety may result in injury.

# 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.



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**⚠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. Make 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 PLC System.

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

- 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, Inner Boards, 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 could 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. Not doing so may cause malfunction resulting in serious injury.
- 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.
- For CS-series PLCs, always tighten the mounting screw at the bottom of the PCU to a torque of 0.4 N·m.
- For CJ-series PLCs, lock the sliders securely until they 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.



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- 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.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Disconnect the LG (line ground) terminal and GR (ground) terminal before performing withstand voltage and insulation resistance tests.
- Confirm that set parameters and data operate properly.
- Perform wiring according to specified procedures.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring 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 unexpected operation.
- 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 setting the Startup Mode).
  - Force-setting/force-resetting any bit in memory.
  - Changing the present value of any word or any set value in memory.
- After replacing Units, resume operation only after transferring to the new CPU Unit, Special I/O Units, CPU Bus Units, and externally connected devices the contents of the DM Area, Holding 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.
- 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.
- Never turn OFF the power to the Unit while transferring data.



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# 6 Conformance to EC Directives

## 6-1 Applicable Directives

- EMC Directives

## 6-2 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 the overall machine. 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 on which the OMRON devices are installed. The customer must, therefore, perform the final check 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)

## 6-3 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 is defined as a in-panel device and must be installed within a control panel.
2. Reinforced insulation or double insulation must be used for the DC power supplies used for I/O.
3. PCUs complying with EC directives also meet the common emission standard (EN61000-6-4). The measures required to ensure that the standard is met will vary with the overall configuration of the control panel, the other devices connected to the control panel, wiring, and other conditions. The customer must therefore confirm that EC directives are met for the overall machine or device, particularly for the radiated emission requirement (10 m).

## 6-4 Installation within Control Panels

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.)



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# SECTION 1
# Features and System Configuration

This section introduces the features of the Position Control Unit, explains the system configuration in which it is used, and also provides information on basic operations, functions and specifications.


1-1 Features . . . . . 2
1-2 System Configuration . . . . . 3
1-3 Basic Operations . . . . . 4
1-3-1 Position Control (Direct Operation) . . . . . 4
1-3-2 Speed Control and Torque Control . . . . . 5
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1-4-2 List of Functions and Specifications . . . . . 6
1-5 List of Functions by Purpose . . . . . 8
1-6 Comparison with Existing Models . . . . . 9

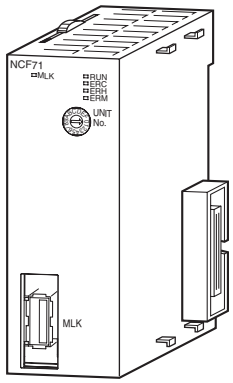



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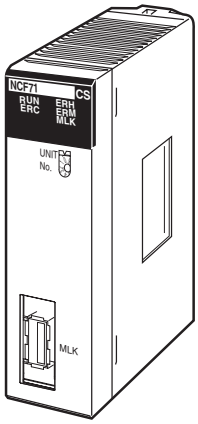
# 1-1 Features

**Position Control Unit**

CJ1W-NCF71




CS1W-NCF71




The Position Control Unit is a CS/CJ-series CPU Bus Unit. The Position Control Unit (PCU) receives commands from the CPU Unit's internal Auxiliary Area and outputs positioning commands to MECHATROLINK-II Servo Drivers.

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**Compatible with the MECHATROLINK-II High-speed Field Network**

A MECHATROLINK-II high-speed (10 Mbps) communications interface is used to control Servo Drivers for up to 16 axes with a single CS/CJ-series Unit. Shielded twisted-pair cables in daisy-chain formation make wiring simple and enable multi-axis systems that require less wiring and are smaller in size.

**High-speed, High-precision Control Using Data Communications**

Optimal motor performance can be achieved by transmitting data using communications between the Programmable Controller (PLC) and Servo Drivers, without having to set an upper limit for the designated speed. High-speed and high-precision position control using high-resolution motors are possible.

**Position Control (Direct Operation)**

Positioning can be performed simply by directly setting the target position and target speed from the CPU Unit. Positioning to either absolute or relative positions is also possible. Interrupt feeding is also supported. With interrupt feeding, positioning is continued for a specified amount after an interrupt input signal is received, and then the axis is stopped.

**Speed Control and Torque Control**

The Servo Driver's speed and torque can be controlled by directly specifying the target speed and torque from the CPU Unit.

**Compatible with Servomotors with Absolute Encoders**

The PCU is compatible with Servomotors that have absolute encoders. Using such Servomotors eliminates the need to repeatedly perform origin searches.

**Transfer Data between Host PLC and Servo Driver**

The Servo Driver's parameters and monitors can be set from the CPU Unit. All the data for the multi-axis system can be centrally controlled from the host PLC. This removes the difficulty in starting up devices or setting data when replacing a Unit.

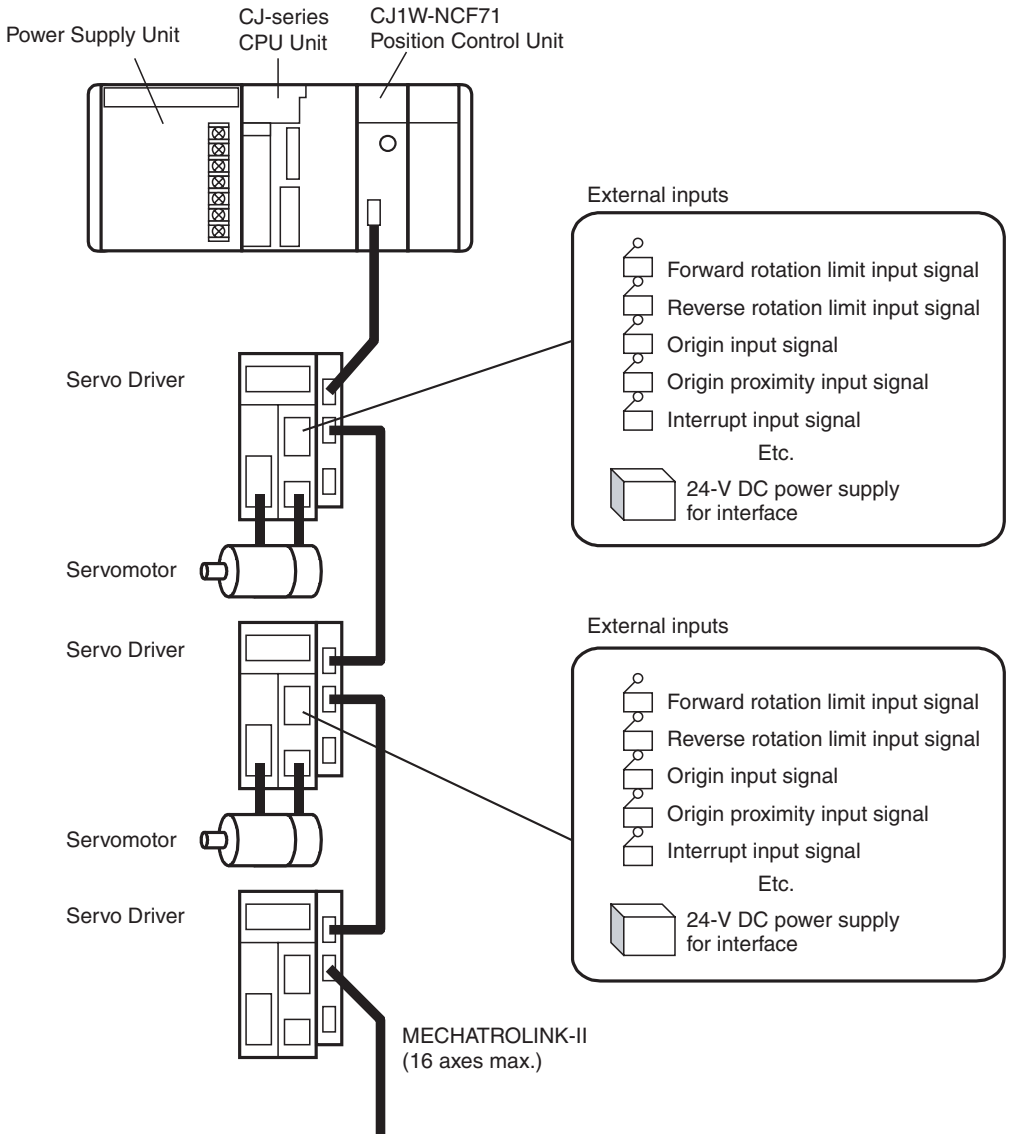


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# 1-2 System Configuration

The PCU receives commands from the CPU Unit's ladder program and control signal status (forward/reverse rotation limit, origin, origin proximity, and interrupt input signals) from devices connected externally to the Servo Driver, and uses them to control Servo Driver positioning.

## System Configuration Example

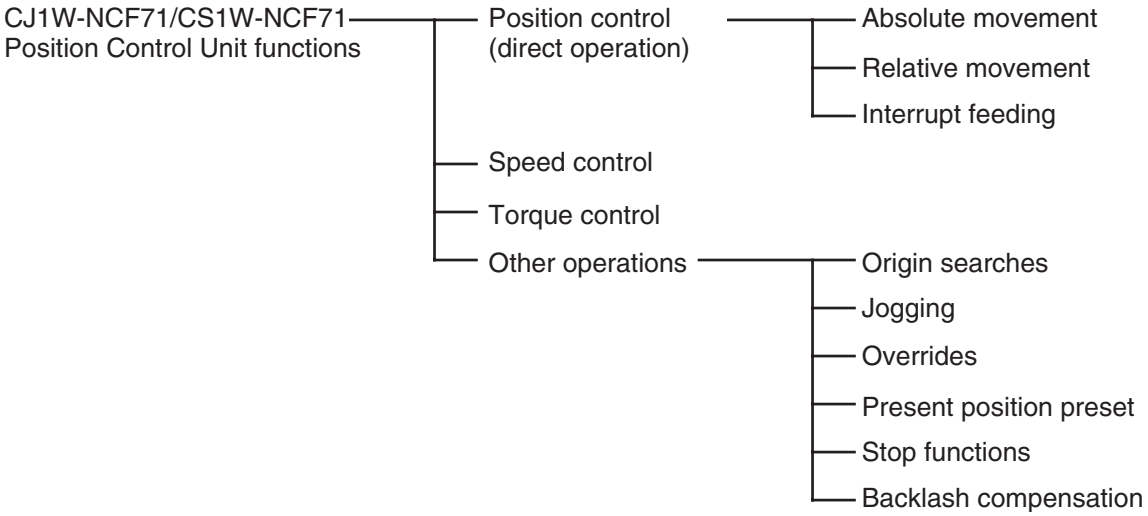





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# 1-3 Basic Operations

The PCU's operations are as follows:

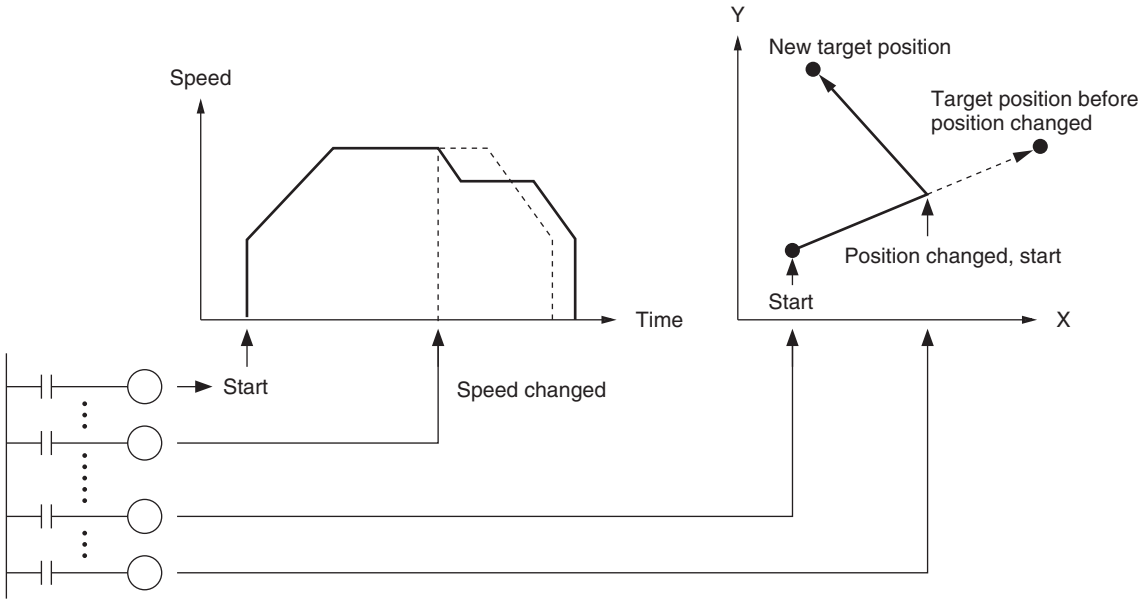



## 1-3-1 Position Control (Direct Operation)

Positioning can be executed either to an absolute position (i.e., to an absolute position from the origin) or to an incremental position (i.e., to a position relative to the present position). Interrupt feeding is also possible, whereby an axis is moved a specified amount when an interrupt input signal is received and then stopped.

**Absolute Movements and Relative Movements**

With absolute and relative movements, position and speed data are set directly from the ladder program in the CPU Unit. Positioning is executed according to operating commands sent to the PCU from the CPU Unit. It is also possible to change the speed or to send commands to move axes to different positions while positioning is being performed.

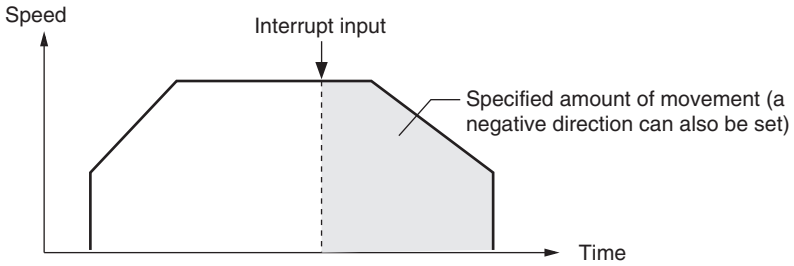





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**Interrupt Feeding**

When an interrupt input signal is received, positioning is continued for the specified amount of movement and then stopped.




**Linear Interpolation**

Linear interpolation can be performed for a combination of axes (Unit Ver. 1.1 or later).

## 1-3-2 Speed Control and Torque Control

Speed command data and torque command data are set from the CPU Unit. Speed control and torque control of the Servomotor are executed by sending operating commands to the PCU from the CPU Unit.

## 1-3-3 Other Operations

**Origin Searches**

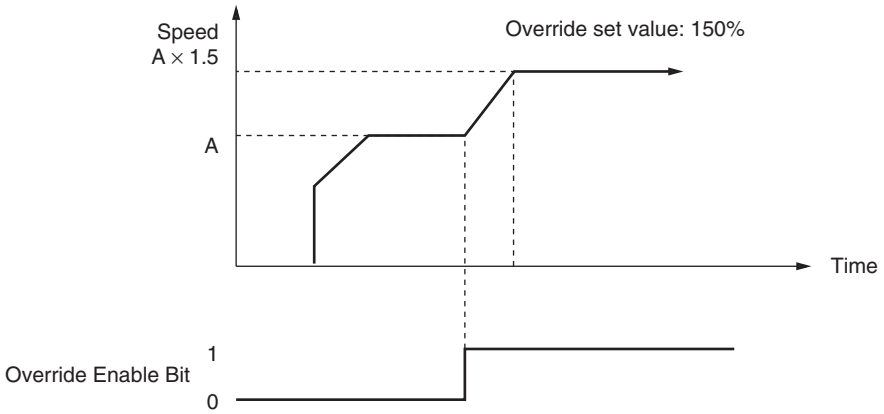
The origin search operations find the origin for a designated axis.

**Jogging**

Jogging moves a specified axis at a designated speed and then stops it.

**Overrides**

When an override is enabled during positioning, the target speed is changed to the override speed.




**Present Position Preset (Changing the Present Position)**

The PRESENT POSITION PRESET command changes the present position to a specified position.

**Stop Functions**

The DECELERATION STOP command decelerates positioning to a stop.

The EMERGENCY STOP command cancels operating commands immediately and stops the axis after moving it for the number of pulses remaining in the Servo Driver's deviation counter.



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# 1-4 List of Functions and Specifications

## 1-4-1 General Specifications

| Item | Specification | |
|---|---|---|
| Model | CJ1W-NCF71 | CS1W-NCF71 |
| Internal current consumption | 360 mA max. at 5 V DC | |
| Dimensions | 31 × 90 × 65 mm (W × H × D) | 130 × 35 × 101 mm (W × H × D) |
| Weight | 95 g max. | 188 g max. |
| Ambient operating temperature | 0 to 55°C | |
| Approved standards | CE, cULus, and C-tick | |

Specifications not listed above conform to general CS/CJ Series specifications.

## 1-4-2 List of Functions and Specifications

| Item | | Specification |
|---|---|---|
| Unit classification | | CPU Bus Unit |
| Applicable PLCs | | CS/CJ Series |
| Possible unit number settings | | 0 to F |
| I/O allocations | Common Operating Memory Area | Words allocated in CPU Bus Unit Area: 25 words (15 output words, 10 input words) |
| | Axis Operating Memory Area | Allocated in one of the following areas (user-specified): CIO, Work, Auxiliary, Holding, DM, or EM Area.<br>Number of words allocated: 50 words (25 output words, 25 input words) × Highest axis No. used |
| Compatible devices | | • OMRON W-series Servo Drivers (equipped with MECHATROLINK-II Application Module or built-in MECHATROLINK-II communications)<br>• OMRON SMARTSTEP Junior Servo Drivers (Built-in MECHATROLINK-II communications)<br>**Note** SMARTSTEP Junior Servo Driver are supported by Position Control Units with unit version 2.0 or later. |
| Control method | | Control commands executed using MECHATROLINK-II synchronous communications. |
| Maximum number of controlled axes | | 16 axes |
| Control units | Position command unit | Command unit: Depends on the Electronic Gear Setting in the Servo Parameters.<br>Default setting: Pulses |
| | Speed command unit for position control | Command units/s |
| | Acceleration/deceleration speeds for position control | 10,000 command units/$s^2$ |
| | Speed command unit for speed control | 0.001% of the motor's momentary maximum rotation speed |
| | Torque command unit for torque control | 0.001% of the motor's momentary maximum torque |



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| Item | | Specification |
|---|---|---|
| Control command range | Position command range | –2,147,483,648 to 2,147,483,647 (command units) |
| | Speed command range for position control | 0 to 2,147,483,647 (command units/s) |
| | Acceleration/deceleration speeds for position control | 1 to 65,535 (10,000 command units/$s^2$) |
| | Speed command range for speed control | –199.999% to 199.999%<br>The upper limit of the speed command range depends on the specifications of the Servo Driver. |
| | Torque command range for torque control | –199.999% to 199.999%<br>The upper limit of the torque command range depends on the specifications of the Servo Driver. |
| Control functions | Servo lock/unlock | Creates (Servo lock) or releases (Servo unlock) the position loop on the PCU. |
| | Position control | Positions to an absolute position or relative position according to the target position and target speed specified from the ladder program. |
| | Origin determination | • Origin search: Establishes the origin using the specified search method.<br>• Present position preset: Changes the present position to a specified position to establish the origin.<br>• Origin return: Returns the axis from any position to the established origin.<br>• Absolute encoder origin: Establishes the origin using a Servomotor that has an absolute encoder, without having to use an origin search. |
| | Jogging | Outputs pulses at a fixed speed in the forward rotation or reverse rotation direction. |
| | Interrupt feeding | Performs positioning by moving the axis a fixed amount when an external interrupt input is received while the axis is moving. |
| | Speed control | Performs speed control by sending a command to the Servo Driver speed loop. |
| | Torque control | Performs torque control by sending a command to the Servo Driver current loop. |
| | Stop functions | • Deceleration stop: Decelerates the moving axis to a stop.<br>• Emergency stop: Positions the moving axis for the number of pulses remaining in the deviation counter and then stops the axis. |
| Auxiliary functions | Acceleration/deceleration curves | Sets one of the following: a trapezoidal (linear) curve, an exponential curve, or an S-curve (moving average). |
| | Torque limit | Restricts the output torque during axis operation. |
| | Override | Multiplies the axis command speed by a specified ratio.<br>Override: 0.01% to 327.67% |
| | Servo parameter transfer | Reads and writes the Servo Driver parameters from the ladder program in the CPU Unit. |
| | Monitoring function | Monitors the control status of the Servo Driver, such as the command coordinate positions, feedback position, current speed, and torque. |
| | Software limits | Limits software operation within the positioning range during position control. |
| | Backlash compensation | Compensates for the amount of play in the mechanical system according to a set value. |
| | Deviation counter reset | The position deviation in the Servo Driver's deviation counter can be reset to 0 (unit version 1.3 or later). |
| External I/O | Position Control Unit | One MECHATROLINK-II interface port |
| | Servo Driver I/O | Forward/reverse rotation limit inputs, origin proximity inputs, external interrupt inputs 1 to 3 (can be used as external origin inputs) |



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| Item | Specification |
|---|---|
| Self-diagnostic functions | Watchdog, flash memory check, memory corruption check |
| Error detection functions | Overtravel, Servo Driver alarm detection, CPU error, MECHATROLINK communications error, Unit setting error |

# 1-5 List of Functions by Purpose

| Purpose | Category | Name | Basic function | Details |
|---|---|---|---|---|
| Establishing the mechanical origin of the machine | Origin determination | Origin search | The motor is operated to established the origin. | *8-2 Origin Search Operation* |
| | | Present position preset | The position where the motor is stopped is set to a specified position to establish the origin. | *8-3 Present Position Preset* |
| | | Origin return | The axis is returned to the established origin. | *8-4 Origin Return* |
| | | Absolute encoder origin | The origin is established using a Servomotor with an absolute encoder, so origin searches are not required at machine startup. | *8-6 Absolute Encoder Origin* |
| Point-to-point (PTP) positioning | Position control | Direct operation (absolute movement or relative movement) | The position and speed are specified to perform positioning using an absolute or relative movement. | *9-4 Using Direct Operation* |
| Changing the target position and speed as required during positioning | | Direct operation: Changing target position or changing target speed | The target position or target speed is changed during positioning with direct operation. | *9-4-3 Changing Target Position*<br>*9-4-4 Changing Target Speed* |
| Performing positioning for a specified distance from an external input point during positioning | | Interrupt feeding | When an interrupt input signal turns ON during positioning with direct operation, operation switches to positioning for a fixed amount. | *9-5 Interrupt Feeding* |
| Performing manual feeding for adjustment or other purpose | | Jogging | The axis is moved at a fixed speed in the forward rotation or reverse rotation direction. | *10-2 Jogging* |
| Reducing shock while device is operating | Auxiliary functions | Acceleration/deceleration curves | Acceleration/deceleration is performed according to the basic trapezoidal curve (linear acceleration/deceleration), an exponential curve, or an S-curve, which greatly helps to reduce mechanical vibration. | *7-4 Acceleration and Deceleration Operations* |
| Temporarily multiplying the machine's operating speed by a constant ratio to perform startup adjustments | | Overrides | The axis command speed is multiplied by a constant ratio. | *10-3 Override* |
| Restricting output torque during control operations such as pushing control | | Torque limit | A constant limit is applied to the output torque of the Servomotor during positioning. | *10-4 Torque Limits* |
| Stopping the device during operation | Stop function | Deceleration stop or emergency stop | The moving axis is decelerated to a stop or the axis is moved for the number of pulses remaining in the deviation counter and then stopped. | *10-9 Stop Functions* |
| Changing the Servo Driver settings from the PLC | Data transfer function | Reading/writing Servo parameters | Servo Driver parameters are read or written from the CPU Unit. | *5-3 Transferring Servo Parameters* |



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| Purpose | Category | Name | Basic function | Details |
|---|---|---|---|---|
| Performing speed feeding in rotary control such as sheet feeding. | Speed control | Speed control | The speed command value is directly specified to control the Servomotor rotation. | *10-5 Speed Control* |
| Changing the output torque sequentially during control operations such as tightening. | Torque control | Torque control | The torque command value is directly specified to control the Servomotor's output torque. | *10-6 Torque Control* |

# 1-6 Comparison with Existing Models

| Functions and performance | CJ1W-NCF71<br>CS1W-NCF71 | CJ1W-NC□13/□33<br>CS1W-NC□13/□33 |
|---|---|---|
| Unit type | CPU Bus Unit | Special I/O Unit |
| Unit number allocation | Unit numbers can be set from 0 to F (CPU Bus Units). | Unit numbers can be set from 0 to 95.<br>• One-axis and two-axis PCUs: One unit number used.<br>• Four-axis PCUs: Two unit numbers used. |
| Control method | Commands are executed using MECHATROLINK-II synchronous communications. | Open-loop control is performed using a pulse train output. |
| Format of data exchanged between PLC and PCU | Binary (hexadecimal)<br>Example: Present position is output to the PLC in 32-bit signed binary format. | Same as CJ1W-NCF71/CS1W-NCF71. |
| Position command range | –2,147,483,648 to 2,147,483,647 (Unit depends on Servo Parameters) | –1,073,741,823 to 1,073,741,823 pulses |
| Present position range | –2,147,483,648~2,147,483,647 (Unit depends on Servo parameters) | –2,147,483,647 to 2,147,483,647 pulses |
| Zone range | No zone functions | –1,073,741,823 to 1,073,741,823 pulses |
| Speed command range | Position control:<br>0 to 2,147,483,647 (command units/s)<br>(Upper limit speed depends on Servo Driver and Servomotor.)<br>Speed control:<br>–199.999% to 199.999%<br>(percentage of Servomotor's momentary maximum rotation speed)<br>The upper limit of the speed command range depends on the specifications of the Servo Driver. | 1 to 500,000 (unit: 1 pps) |
| Torque command range | –199.999% to 199.999%<br>(percentage of Servomotor's momentary maximum torque)<br>The upper limit of the torque command range depends on the specifications of the Servo Driver. | None |
| Overrides | 0.01% to 327.67% in increments of 0.01% | 1% to 999% in increments of 1% |
| Memory operation function | None | Absolute/relative movement, linear interpolation, interrupt feeding, speed control, forced interrupt, and teaching |



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| Functions and performance | CJ1W-NCF71<br>CS1W-NCF71 | CJ1W-NC□13/□33<br>CS1W-NC□13/□33 |
|---|---|---|
| Origin search | Origin search method:<br>• The origin input signal is detected after the origin proximity input signal turns OFF.<br>• The origin input signal is detected after the origin proximity input signal turns ON. (Unit version 2.0 or later)<br>• The origin input signal is detected without using the origin proximity input signal. (Unit version 2.0 or later)<br>Origin compensation: After detecting the origin input signal, positioning is performed for the origin return final travel distance (specified in Servo Parameters). | Origin search methods:<br>• The origin input signal is detected after the origin proximity input signal turns ON.<br>• The origin input signal is detected after the origin proximity input signal turns OFF.<br>• The origin input signal is detected without using the origin proximity input signal.<br>Origin compensation: The axis is moved for the amount specified by the origin compensation data (specified from the Unit) at the proximity speed. |
| Acceleration/deceleration curves | Trapezoidal curve, exponential curve, or S-curve<br>S-curve acceleration/deceleration uses a moving average. | Trapezoidal curve or S-curve<br>S-curve acceleration/deceleration uses a tertiary function. |
| Setting acceleration/deceleration speeds | Accelerations and decelerations are specified in units of 10,000 command units/$s^2$. Servo parameters are set individually for each axis. | The times in milliseconds required to reach the maximum speed from the initial speed and to reach the initial speed from the maximum speed are specified<br>Direct operation: Acceleration/deceleration speeds are specified as operation data from the PLC.<br>Memory operation: Up to 9 acceleration/deceleration speeds per axis are recorded in the Unit. |
| Deviation counter reset | Supported (unit version 1.3 or later). | Supported. |
| Emergency stop | A hardware input contact is not provided on the Position Control Unit.<br>Stopping is possible after moving the number of pulses remaining in the deviation counter by using an allocated operation bit. | The PCU's hardware input contact is used. |
| Data transfer method | Writes/reads using the Data Transfer Bit. | • Data can be read or written using the Data Transfer Bit.<br>• Data can be read or written using the IOWR/IORD instruction. |
| Saving data | Parameters can be saved to the flash memory in the PCU.<br>Servo Parameters are saved in the Servo Driver. | Axis Parameters and Zone Data are saved in the flash memory in the PCU. |
| CPU Unit cycle time extension for END refresh | 1 ms max. per 16 axes (using the CS1/CJ1-H CPU Unit) | 0.5 ms max. per PCU |
| Response time | 4 ms max. (time from when the start commands for the ladder program are sent until the Servo Driver receives the control command when four axes are connected) (See note.) | 4 ms max. (time from when the start commands for the ladder program are sent until the Position Control Unit performs pulse output when all axes of a four-axis Unit are being operated simultaneously) |

**Note** The response time depends on the cycle time of the PLC and the MECHATROLINK communications settings. The time shown in the table is the maximum value obtained when calculated according to specified measurement conditions. For details, refer to *Appendix A Performance Characteristics*.



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# SECTION 2
# Basic Procedures

This section provides an overview of the procedures required to use the Position Control Unit.

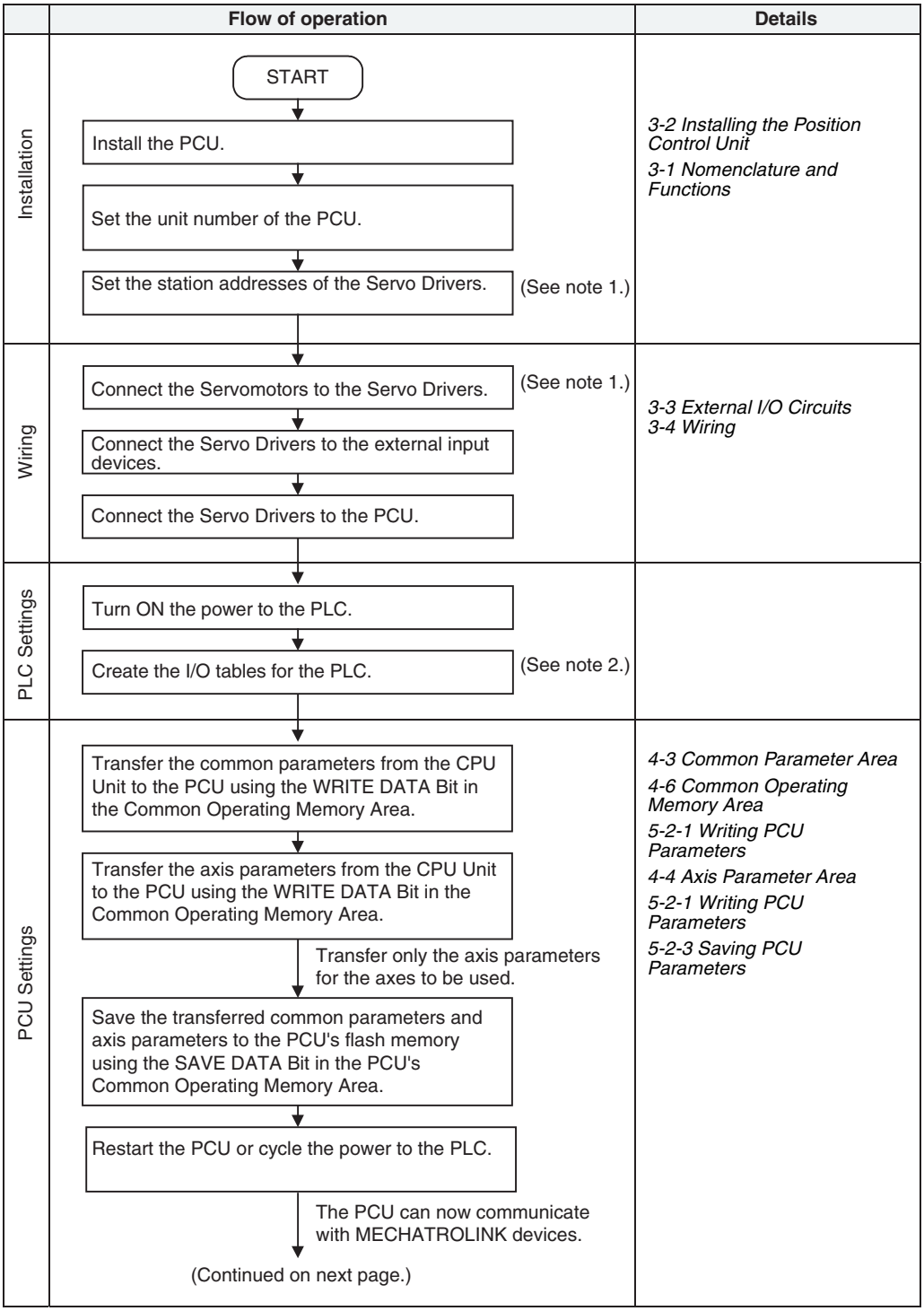

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# 2-1 Basic Flow of Operations

The basic flow of Position Control Unit (PCU) operation is described in this section. The steps from installation through setting the MECHATROLINK devices are required only when installing the devices for the first time. When PCU and MECHATROLINK device settings have been completed, start operation from starting MECHATROLINK communications in the flow of operation.

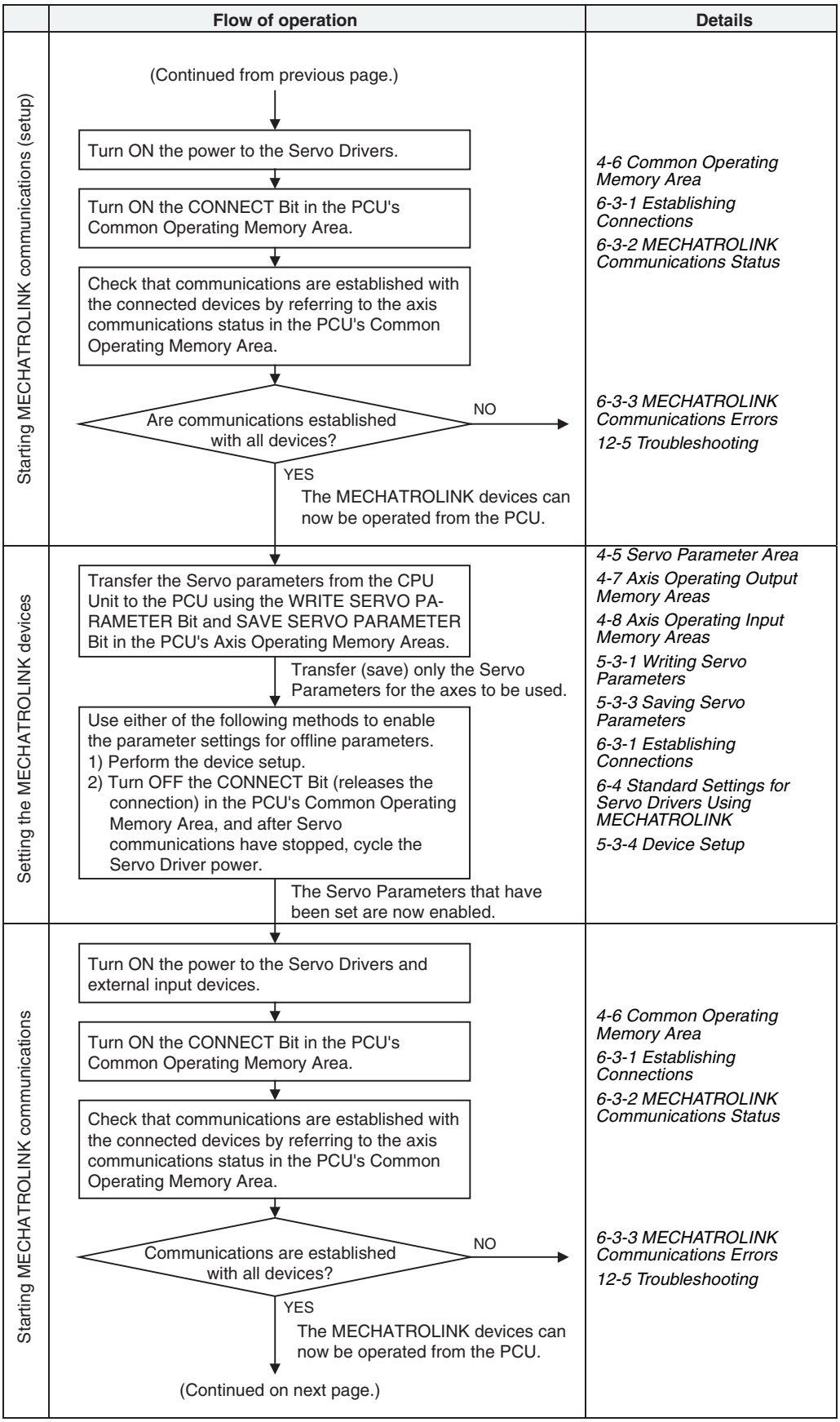



**Note** (1) Perform wiring according to instructions given in the Servomotor and Servo Driver's operation manuals.

(2) Refer to the *CJ Series PLC Operation Manual*.

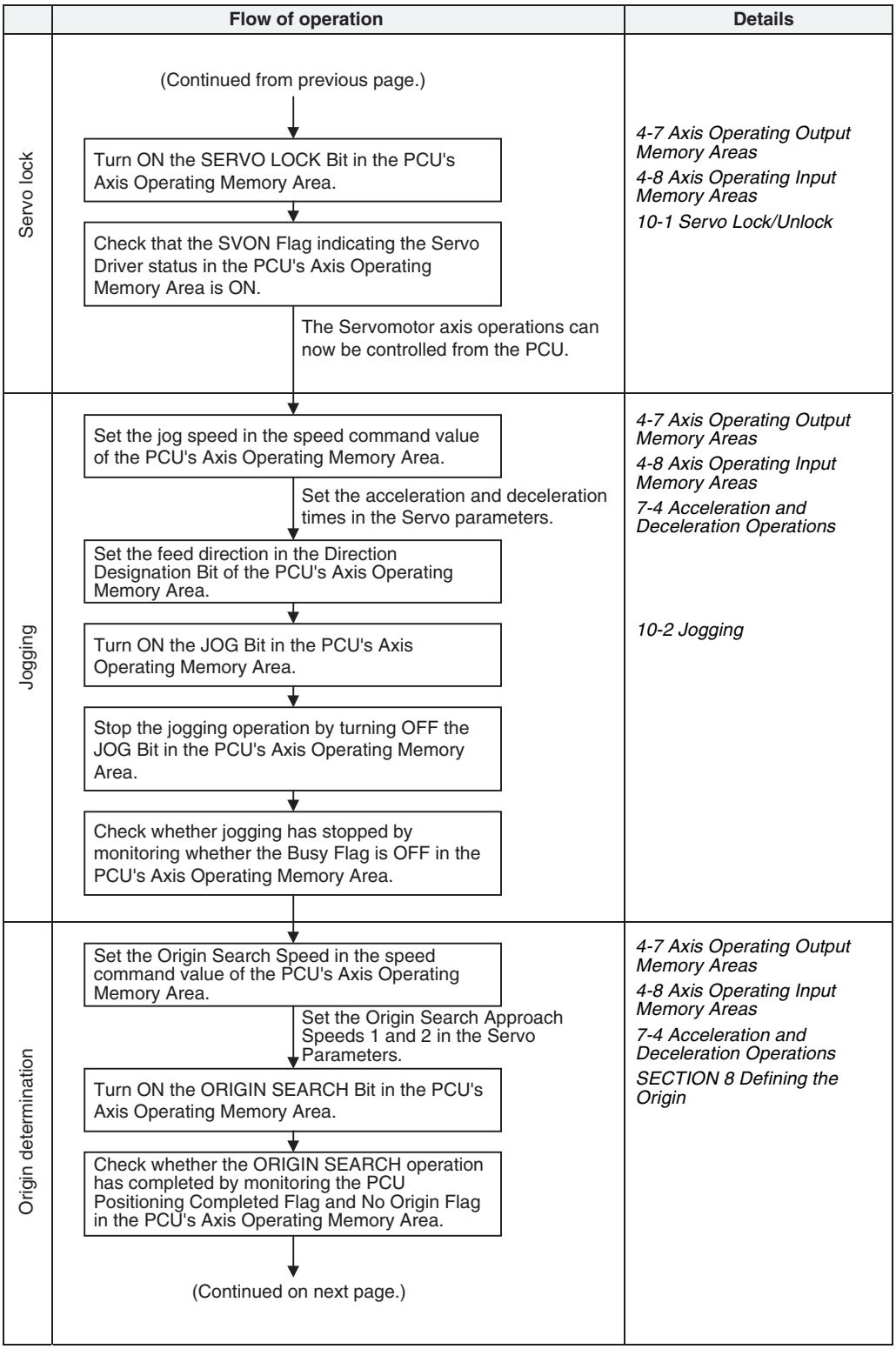


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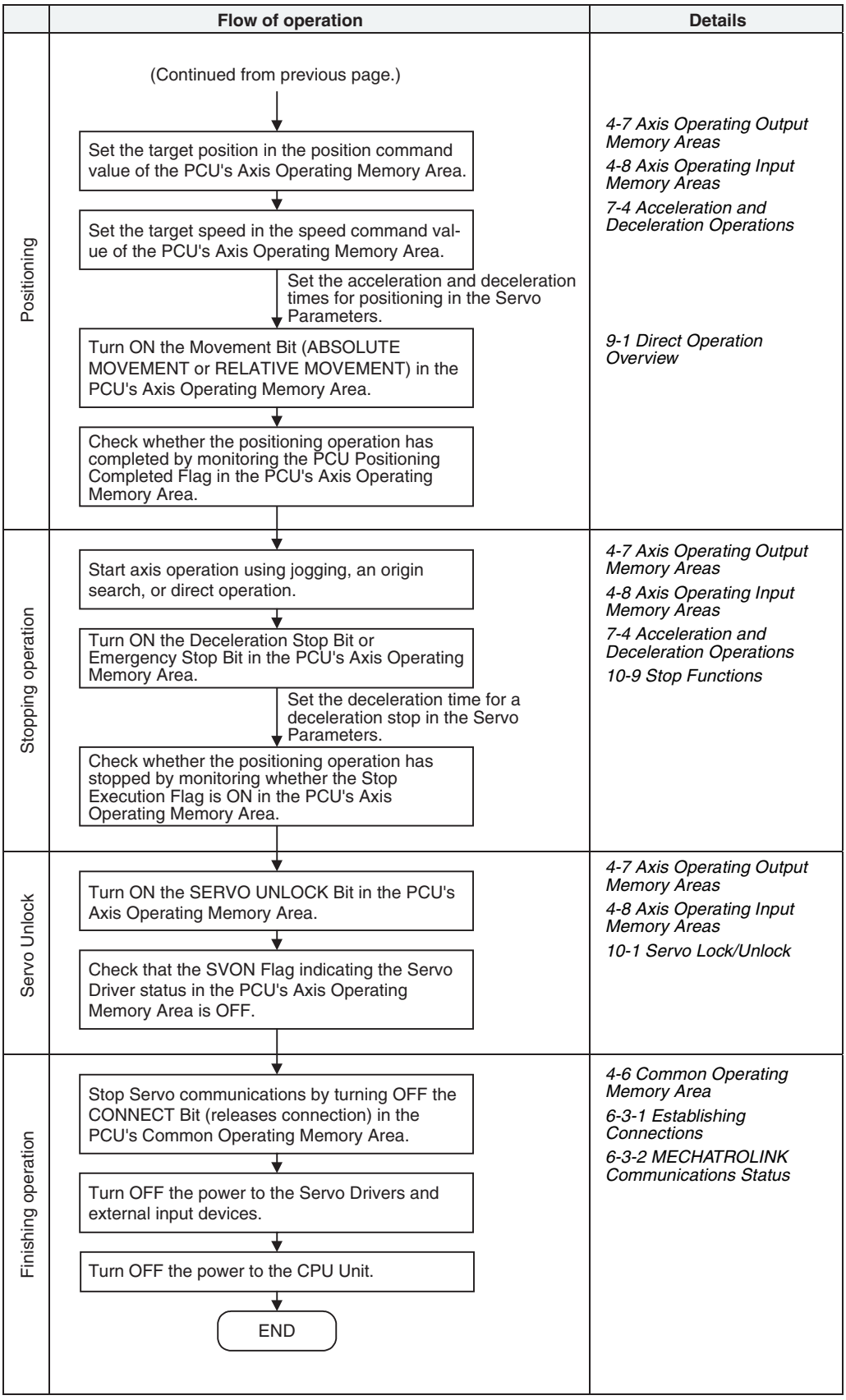



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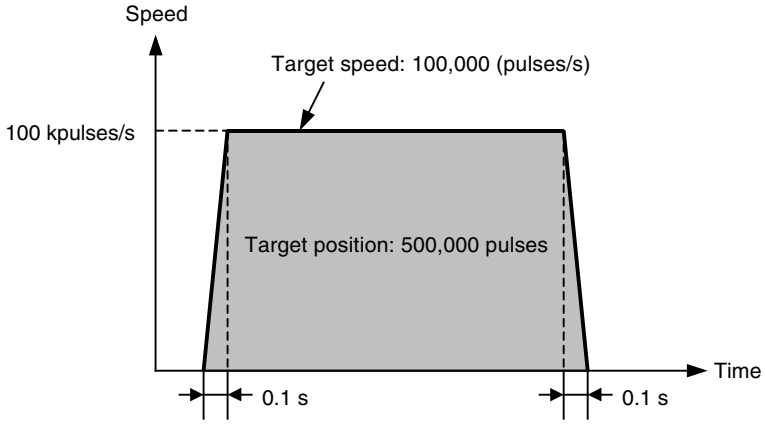
# 2-2 Starting Operation

Examples of operating the Servomotor using RELATIVE MOVEMENT commands for direct operation are provided in this section for first-time users of a PCU.

## 2-2-1 Overview of Operation

The following example is for operating the Servomotor using direct operation under the following operation conditions. An OMRON W-series Servomotor and a Servo Driver with a Yaskawa JUSP-NS115 MECHATROLINK-II Application Module installed is used.

Only the minimum parameters required to operate the Servomotor are set in this example. Default settings are used for the PCU and Servo Driver parameters that are not set.



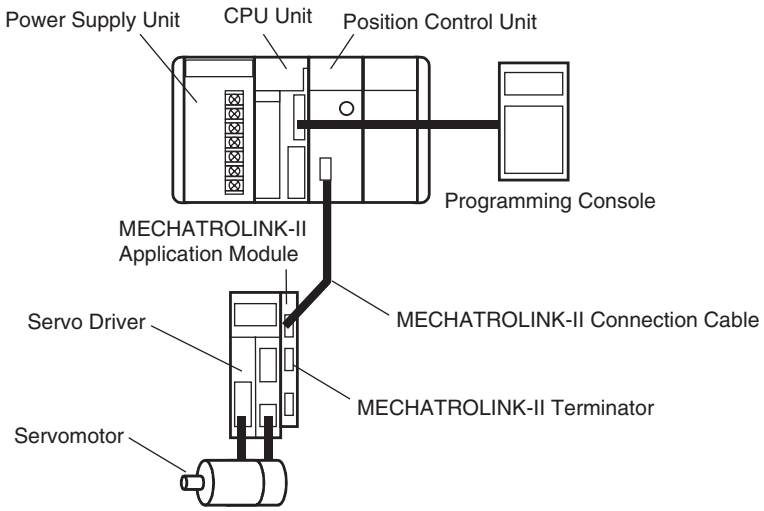

A Programming Console is used in this operation example without using a ladder program and with the PLC in PROGRAM mode to manually perform the settings and execute the start commands that are required to operate the Servomotor. The Programming Console is used to set the required data for direct operation and then turn ON the RELATIVE MOVEMENT Bit to operate the motor.

## 2-2-2 System Configuration and Wiring

The following system configuration is used. In this example, only the motor is operated, without using a mechanical system. The unit number of the PCU is 0, and the station address of the MECHATROLINK-II Application Module is 1.



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The devices used in this configuration diagram example are as follows:

| Device | Model |
|---|---|
| CPU Unit | CJ1H-CPU67H |
| Power Supply Unit | CJ1W-PA202 |
| Position Control Unit | CJ1W-NCF71 |
| Programming Console | C200H-PRO27 |
| Programming Console Connecting Cable | CS1W-CN224 (2 m) |
| Servo Driver | R88D-WT01HL |
| Servomotor | R88M-W10030L |
| Servomotor Encoder Cable | R88A-CRWA003C (3 m) |
| Servomotor Power Cable | R88A-CAWA003S (3 m) |
| MECHATROLINK-II Application Module | JUSP-NS115 (Yaskawa) |
| MECHATROLINK-II Connection Cable | JEPMC-W6003-01 (Yaskawa) (1 m) |
| MECHATROLINK-II Terminator | JEPMC-W6022 (Yaskawa) |

Each of the above devices is in its factory-shipped condition.

## Setting the PCU Unit Number

Set the unit number using the rotary switch on the front of the PCU.

Unit number: 0

## Setting the Station Address of the MECHATROLINK-II Application Module

Set the station address of the MECHATROLINK-II Application Module using the rotary switch (SW1) on the Module. Use the default settings for the DIP switch (SW2).

SW1: 1

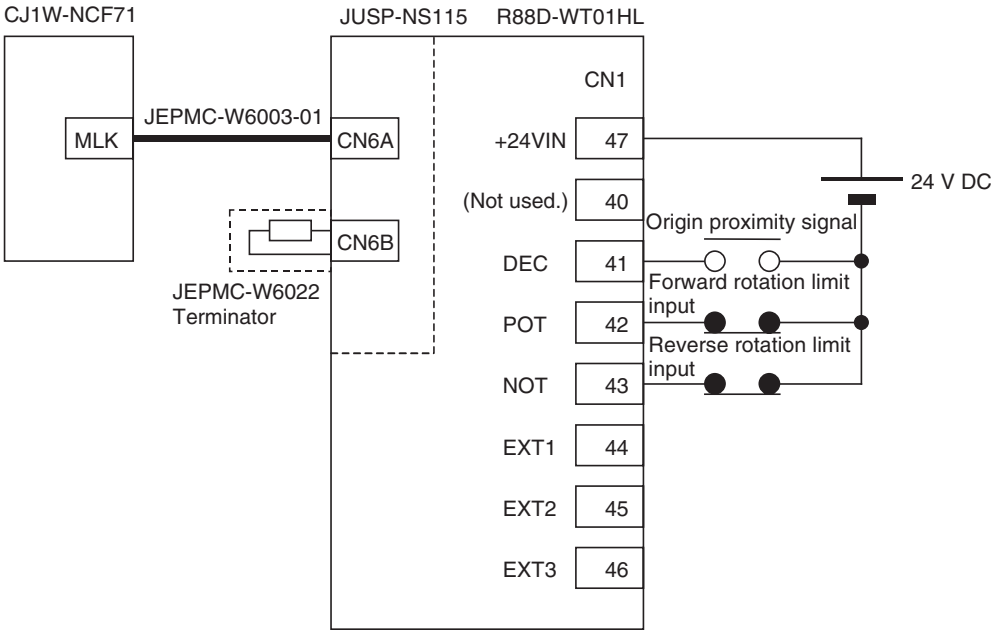
SW2: Default settings (pin 1: ON; pin 2: ON; pin 3: OFF; pin 4: OFF)



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### Wiring

Wire the Units as shown in the following diagram.




The Servo Driver's CN1 input signals depend on the input signal allocations, which are set in this operation example. Of these allocated input signals, the forward drive prohibit input (forward rotation limit input) and reverse drive prohibit input (reverse rotation limit input) are used as N.C. contacts. Therefore, connect them so that they are normally ON. The origin proximity signal and external latch inputs 1 to 3 are not used in this operation example and therefore do not need to be wired.

The above diagram shows the wiring for the PCU, Servo Driver, MECHATROLINK-II Application Module, and external control input signals at the Servo Driver. Refer to each of the CPU Unit and Servo Driver operation manuals for details on wiring the CPU Unit and Servo Driver power supply and connecting the Servo Driver and Servomotor.

## 2-2-3 Setting the PCU

### Creating I/O Tables

Turn ON the power to the PLC and create the I/O tables. Refer to the *CJ Series PLC Operation Manual* for details on creating I/O tables.

### Setting Common Parameters

Set the Common Parameters of the PCU. The minimum required Common Parameters that must be set are as follows:

- Axis Operating Output Memory Area designation
- Axis Operating Input Memory Area designation
- Scan list setting (information registered for axes connected to MECHATROLINK communications)

Common Parameters are transferred to the PCU using the WRITE DATA Bit in the Common Operating Memory Area. D01000 to D01011 are used for data to be transferred.



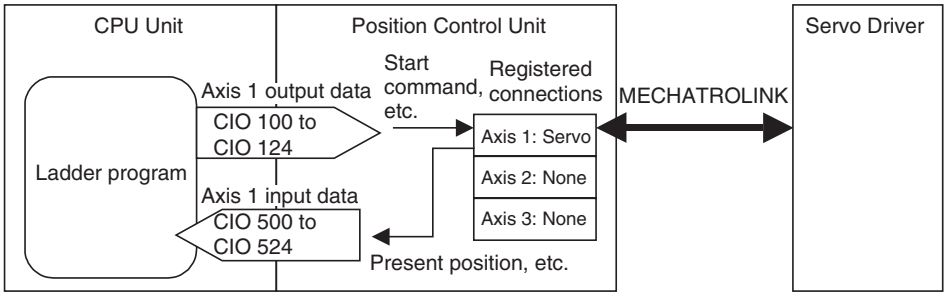
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### Common Parameters Set in the PCU

The following settings are made in D01000 to D01011 as the Common Parameters to be set in the PCU. Refer to the following table for setting details.

| DM word | Set value | Common Parameter | Details |
|---|---|---|---|
| D01000 | 00B0 hex | Axis Operating Output Memory Areas | Set the beginning word of the Axis Operating Output Memory Areas to CIO 100.<br>Axis 1 output words: CIO 100 to CIO 124 |
| D01001 | 0064 hex | Beginning word of Axis Operating Output Memory Areas | |
| D01002 | 00B0 hex | Axis Operating Input Memory Areas | Set the beginning word of the Axis Operating Input Memory Area to CIO 500.<br>Axis 1 input words: CIO 500 to CIO 524 |
| D01003 | 01F4 hex | Beginning word of Axis Operating Input Memory Areas | |
| D01004 | 0040 hex | Scan list setting (axes 1 and 2) | Allocate axis 1 of the PCU to the Servo Driver. |
| D01005 to D01011 | Set all words to 0000 hex. | Scan list setting (axes 3 to 16) | |

The above settings enable the Servo Driver connected to MECHATROLINK to be controlled from the ladder program through the I/O words that are allocated as shown in the following diagram.

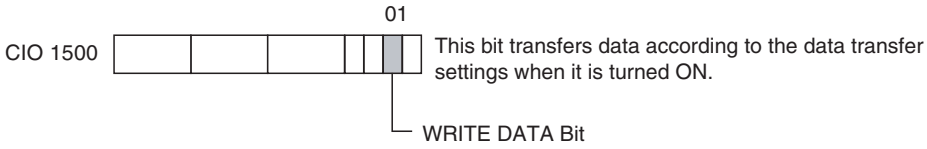



### Writing Common Parameters to the PCU

The Common Parameter settings in D01000 to D01011 are written to the PCU. Make the settings for transferring data to the PCU's Common Operating Memory Area as shown below.

| Word | Set value | Data transfer setting name | Details |
|---|---|---|---|
| CIO 1506 | 000C hex | Number of write words | Number of write words: 0C hex = 12 decimal |
| CIO 1507 | 0082 hex | Write source area | Beginning word of write data: D01000 |
| CIO 1508 | 03E8 hex | Write source word | |
| CIO 1509 | 1838 hex | Write destination address | Write destination address in PCU: 1838 hex = Beginning word of Common Parameter Area |

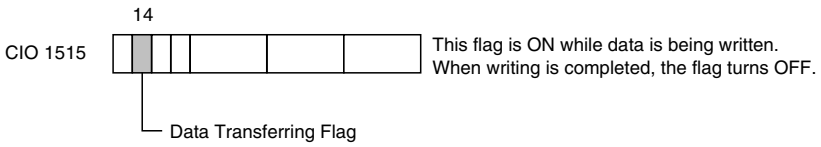
Data is written to the PCU by turning ON the WRITE DATA Bit in the Common Operating Memory Area. For the PCU with unit number 0, the WRITE DATA Bit is allocated in CIO 150001. Turn ON this bit using the Programming Console.



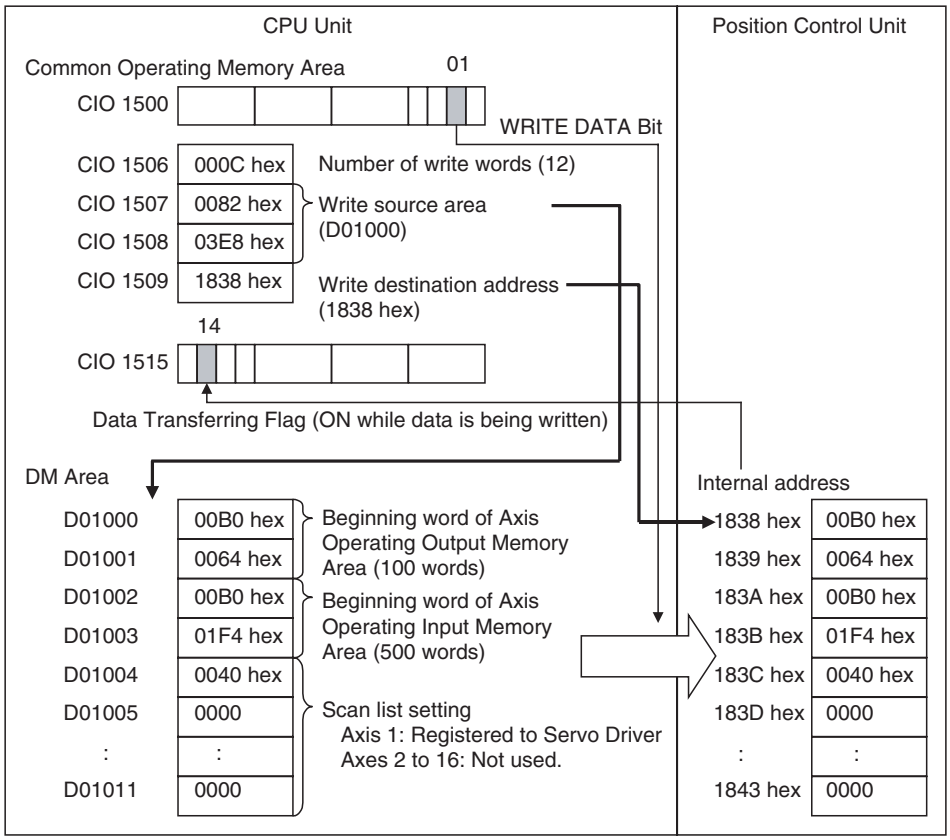



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While data is being written to the PCU, the Data Transferring Flag in the Common Operating Memory Area turns ON. When data has finished being written, the Data Transferring Flag turns OFF. For the PCU with unit number 0, the Data Transferring Flag is allocated in CIO 151514.




The following diagram shows the operation for writing data to the PCU.



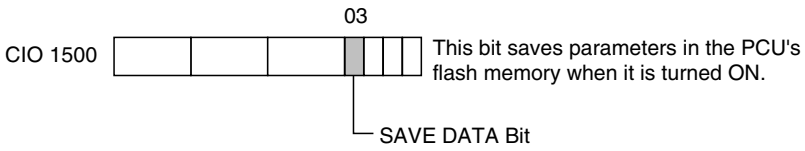

## Setting Axis Parameters

In this operation example, the PCU's default settings are used for each axis parameter, so they do not need to be transferred to the PCU.

## Saving PCU Settings

The Common Parameters are saved in the PCU's flash memory.

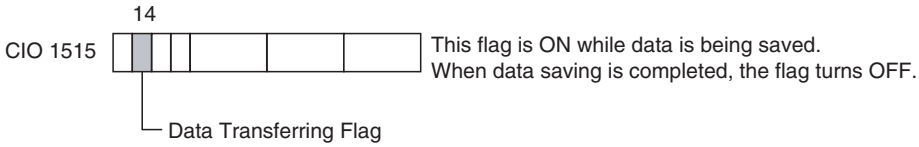
Data is saved to the PCU's flash memory by turning ON the SAVE DATA Bit in the Common Operating Memory Area. For the PCU with unit number 0, the SAVE DATA Bit is allocated in CIO 150003. Turn ON this bit using the Programming Console.




While data is being saved to flash memory, the Data Transferring Flag in the Common Operating Memory Area turns ON. When data has finished being saved, the Data Transferring Flag turns OFF. For the PCU with unit number 0, the Data Transferring Flag is allocated in CIO 151514.



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**Restarting the PCU**

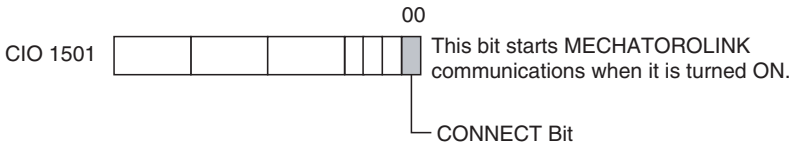
After the PCU settings have been saved, restart the PCU to enable the settings. Either cycle the power to the CPU Unit, or restart the PCU. For the PCU with unit number 0, the Restart Bit is allocated in A50100.

**Note** Do not turn OFF the power to the PLC or restart the PCU while data is being saved to the PCU's flash memory. Doing so may corrupt the PCU's memory. Always make sure that the Data Transferring Flag is OFF before turning OFF the power to the CPU Unit or restarting the PCU.

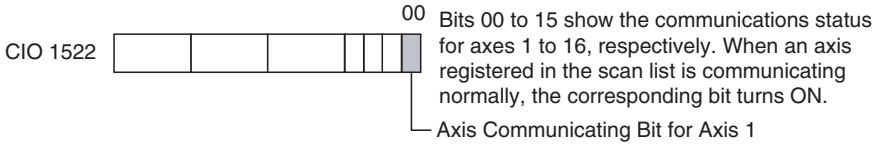
## 2-2-4 Starting MECHATROLINK Communications

Communications are started with the Servo Driver connected to MECHATROLINK based on the Common Parameter settings in the PCU.

MECHATROLINK communications are started by turning ON the CONNECT Bit in the Common Operating Memory Area. For the PCU with unit number 0, the CONNECT Bit is allocated in CIO 150100. Turn ON this bit using the Programming Console.




When connections are established, the PCU starts communications with the MECHATROLINK devices (Servo Drivers) registered in the scan list set in the Common Parameters. When communications with the registered device are normal, the corresponding bits for the axes in the Axis Communications Status of the Common Operating Memory Area are turned ON. For the PCU with unit number 0, the Axis Communications Status is allocated in the bits of CIO 1522.




When communications with the registered devices are not normal, the corresponding bits for the axes in the Axis Communications Status bits of the Common Operating Memory Area are not turned ON and an MLK initialization error (Unit error code 0020 hex) occurs in the PCU. Any axis errors that occur can be checked using the Axis Error Flags and error codes in the Axis Operating Memory Areas.

The Connection Status Flag in the Common Operating Memory Area will turn ON at the start of communications when the CONNECT Bit turns ON, regardless of whether communications with all registered devices are normal.

In this operation example, if MECHATROLINK communications are started normally, the status of each flag is as follows:

Connection status (CIO 151615): 1 (Connection established)

Axis communications status (CIO 1522): 0001 (bit 00 = Communications established with axis 1)



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Unit Error Flag (CIO 151512): 0 (No error)

Unit error code (CIO 1521): 0000 (No error)

Axis Error Flag for axis 1 (CIO 50012): 0 (No error) (See note.)

Axis error code for axis 1 (CIO 504): 0000 (No error) (See note.)

**Note** The Axis Operating Memory Area for axis 1 depends on the Axis Operating Input Memory Area settings in the Common Parameters.

## 2-2-5 Setting Servo Parameters

The Servo Parameters are set in the connected Servo Driver. The following table shows an example of settings for the Servo Driver's external input signal allocations (input signal selection).

| Input terminal (CN1) | Input signal name | Setting | Servo Driver default setting |
|---|---|---|---|
| 40 | --- | Not used | RUN (RUN command input) |
| 41 | DEC | Origin return deceleration limit switch (origin proximity input signal) | MING (gain reduction input) |
| 42 | POT | Forward drive prohibit input (forward rotation limit input signal) | Not allocated. |
| 43 | NOT | Reverse drive prohibit input (reverse rotation limit input signal) | Not allocated. |
| 44 | EXT1 | External latch signal 1 (external interrupt input signal 1) | RESET (alarm reset input) |
| 45 | EXT2 | External latch signal 2 (external interrupt input signal 2) | PCL (forward rotation current limit input) |
| 46 | EXT3 | External latch signal 3 (external interrupt input signal 3) | NCL (reverse rotation current limit input) |

These settings are standard for input signals when an R88D-WT□ Servo Driver and JUSP-NS115 MECHATROLINK-II Application Module are used together.

### Transferring Servo Parameters

Servo Parameters are transferred to the Servo Driver via the PCU using the SAVE SERVO PARAMETER Bits in the PCU's Axis Operating Output Memory Areas. The Servo Parameters are transferred one at a time. The following three parameters must be set as shown below to allocate the above input signals.

| Parameter No. | Parameter name | Set value |
|---|---|---|
| Pn50A | Input signal selection 1 | 2881 |
| Pn50B | Input signal selection 2 | 8883 |
| Pn511 | Input signal selection 5 | 6541 |



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### Preparing Servo Parameters to Be Set in the Servo Driver

The settings for the parameter number, parameter size, and write data are set in the Axis Operating Output Memory Area as Servo Parameters to be set in the Servo Driver. In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Output Memory Area for axis 1 is allocated in CIO 100. Therefore, the setting words for the Servo Parameters for axis 1 are allocated as follows:

| Word | Details |
|---|---|
| CIO 117 | Servo Parameter No. |
| CIO 118 | Parameter size (Unit: bytes) |
| CIO 119 | Write data (rightmost word) |
| CIO 120 | Write data (leftmost word) |

### Writing Servo Parameters to the Servo Driver

The Servo Parameter settings in CIO 117 to CIO 120 are written to the Servo Driver. In this example, to transfer three Servo Parameters, execute the operation to write to the Servo Driver three times.

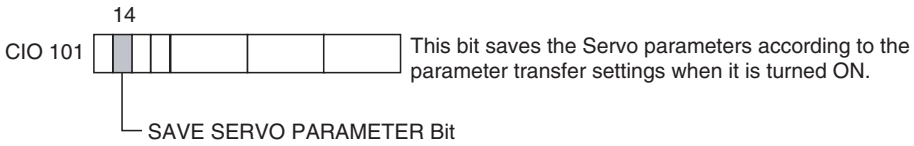
#### Writing the Pn50A Set Value

To write the Pn50A settings, first make the settings for transferring Servo Parameters to the PCU's Axis Operating Output Memory Areas as shown below.

| Word | Set value | Parameter transfer setting | Details |
|---|---|---|---|
| CIO 117 | 050A hex | Servo Parameter No. | Write Servo Parameter No.: Pn50A |
| CIO 118 | 0002 | Parameter size | Write parameter size: 2 (bytes) |
| CIO 119 | 2881 hex | Write data (rightmost word) | Write Servo Parameter set value: 2881 |
| CIO 120 | --- | Write data (leftmost word) | Parameter size is 2 bytes (1 word, so this is not used.) The set value is ignored. |

In this example, to keep the Servo Parameters even if the Servo Driver power is turned OFF, the Servo Parameters are saved in the non-volatile memory (flash memory) in the Servo Driver. Servo Parameters are written from the PCU to the non-volatile memory (flash memory) of the Servo Driver by turning ON the SAVE SERVO PARAMETER Bit in the Axis Operating Output Memory Area.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Output Memory Area for axis 1 is allocated in CIO 100. Therefore, the SAVE SERVO PARAMETER Bit for axis 1 is allocated in CIO 10114. Turn ON this bit using the Programming Console.

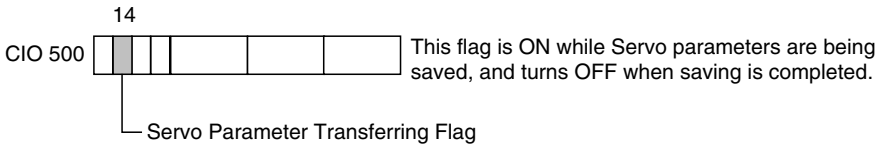



While Servo Parameters are being saved to the Servo Driver, the Servo Parameter Transferring Flag in the Axis Operating Input Memory Area turns ON. When the Servo Parameters have finished being saved, the Servo Parameter Transferring Flag turns OFF.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Input Memory Area for axis 1 is allocated in CIO 500. Therefore, the Servo Parameter Transferring Flag for axis 1 is allocated in CIO 50014.



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The set values for Pn50B and Pn511 are written in the same way, i.e., by changing the details of the Servo Parameters to be transferred and turning ON the WRITE DATA Bit.

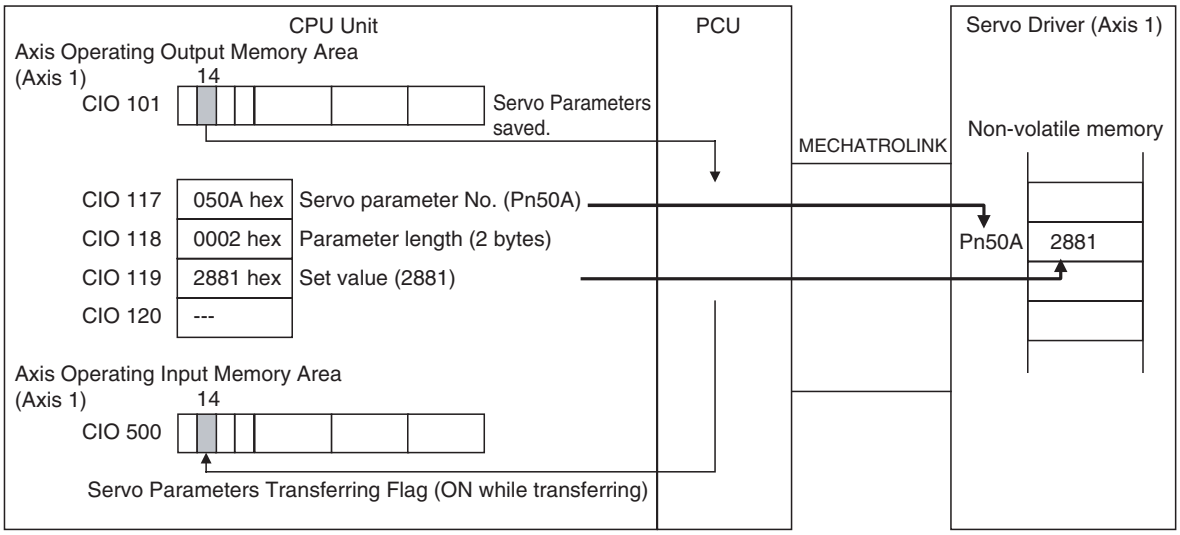
**Writing the Pn50B Set Value**

| Word | Set value | Parameter transfer setting | Details |
|---|---|---|---|
| CIO 117 | 050B hex | Servo Parameter No. | Write Servo Parameter No.: Pn50B |
| CIO 118 | 0002 hex | Parameter size | Write parameter size: 2 (bytes) |
| CIO 119 | 8883 hex | Write data (rightmost word) | Write Servo Parameter setting: 8883 |
| CIO 120 | --- | Write data (leftmost word) | Parameter size is two bytes (one word, so this is not used.) The setting is ignored. |

**Writing the Pn511 Setting**

| Word | Set value | Parameter transfer setting | Details |
|---|---|---|---|
| CIO 117 | 0511 hex | Servo Parameter No. | Write Servo Parameter No.: Pn511 |
| CIO 118 | 0002 hex | Parameter size | Write parameter size: 2 (bytes) |
| CIO 119 | 6541 hex | Write data (rightmost word) | Write Servo Parameter setting: 6541 |
| CIO 120 | --- | Write data (leftmost word) | Parameter size is two bytes (i.e., one word, so this is not used.) The setting is ignored. |

The following diagram shows the operation used to transfer parameters to the Servo Driver.





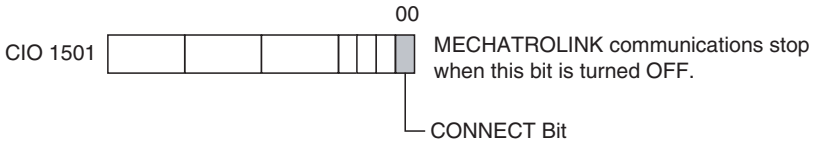

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### Ending MECHATROLINK Communications

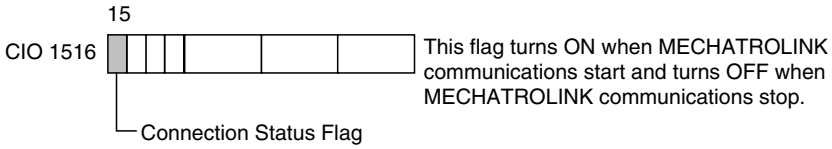
The Servo Parameters written to the Servo Driver consist of online and offline parameters. Online parameters are enabled as soon as they are written, whereas offline parameters are not.

The input signal selection parameters set here are offline parameters that are enabled by cycling the power to the Servo Driver or executing the device setup operation. In this example, the Servo Driver power is cycled. First, stop MECHATROLINK communications before turning OFF the power supply to the Servo Driver.

MECHATROLINK communications are stopped by turning OFF the CONNECT Bit in the Common Operating Memory Area. For the PCU with unit number 0, the CONNECT Bit is allocated in CIO 150100. Use the Programming Console to turn OFF this bit, which was turned ON at the start of MECHATROLINK communications.




When MECHATROLINK communications stop, the Connection Status Flag in the Common Operating Memory Area turns OFF. For the PCU with unit number 0, the Connection Status Flag is allocated in CIO 151615.




### Turning the Servo Driver Power OFF and ON Again

After writing Servo Parameters, and when MECHATROLINK communications have stopped, enable the Servo Parameters by cycling the power to the Servo Driver. This procedure completes settings for the PCU and Servo Driver. Unless changes in installation, wiring, or parameter settings are required, the above operation does not need to be performed a second time.

## 2-2-6 Operating the Servomotor from the PCU

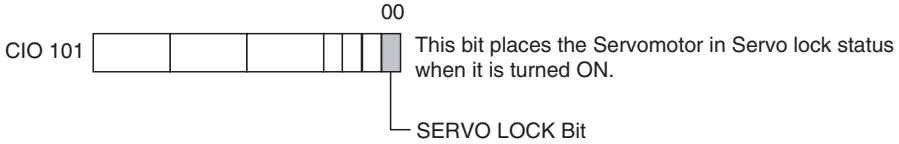
### Starting MECHATROLINK Communications

Perform the operations described in *2-2-4 Starting MECHATROLINK Communications* and then start communications with the Servo Driver connected to MECHATROLINK.

### Servo Lock

The servo lock of the Servomotor connected to MECHATROLINK can be set by turning ON the SERVO LOCK Bit in the Axis Operating Output Memory Area.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Output Memory Area for axis 1 is allocated in CIO 100. Therefore, the SERVO LOCK Bit for axis 1 is allocated in CIO 10100. Turn ON this bit using the Programming Console.

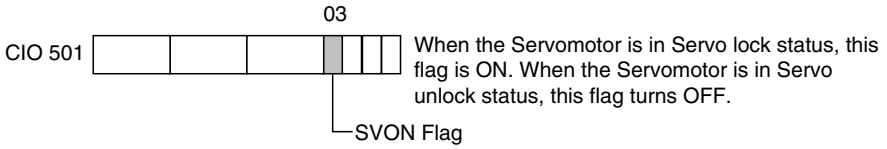





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When the servo lock operation is performed, the Servomotor is placed in servo lock status. The SVON (Servo ON) Flag indicating servo status in the Axis Operating Input Memory Area turns ON when an R88D-WT□ Servo Driver and JUSP-NS115 MECHATROLINK-II Application Module are used together.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Input Memory Area for axis 1 is allocated in CIO 500. Therefore, the SVON Flag for axis 1 is allocated in CIO 50103.




When the servo lock is no longer required, turn OFF the corresponding SERVO LOCK Bit in the Axis Operating Output Memory Area.

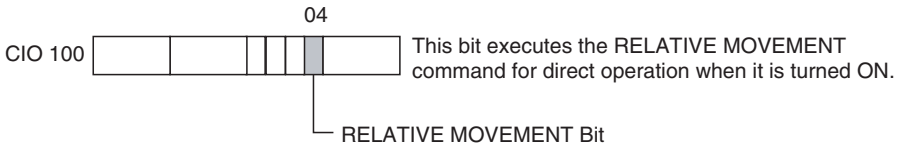
## Positioning Using the Direct Operation RELATIVE MOVEMENT Command

Positioning can be performed for axis 1 using the RELATIVE MOVEMENT command for direct operation. The RELATIVE MOVEMENT command for direct operation sends information on the target position and target speed to the Axis Operating Output Memory Area when the RELATIVE MOVEMENT Bit turns ON.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Output Memory Area for axis 1 is allocated in CIO 100. Therefore, the target position and target speed are set as follows:

| Word | Set value | Parameter transfer setting | Details |
|---|---|---|---|
| CIO 102 | A120 hex | Position command value (rightmost word) | Target position: 0007 A120 hex = 500,000 pulses |
| CIO 103 | 0007 hex | Position command value (leftmost word) | |
| CIO 104 | 86A0 hex | Speed command value (rightmost word) | Target speed: 0001 86A0 hex = 100,000 pulses/s |
| CIO 105 | 0001 hex | Speed command value (leftmost word) | |

The RELATIVE MOVEMENT Bit for axis 1 is allocated in CIO 10004. Therefore, turn this bit ON using the Programming Console.



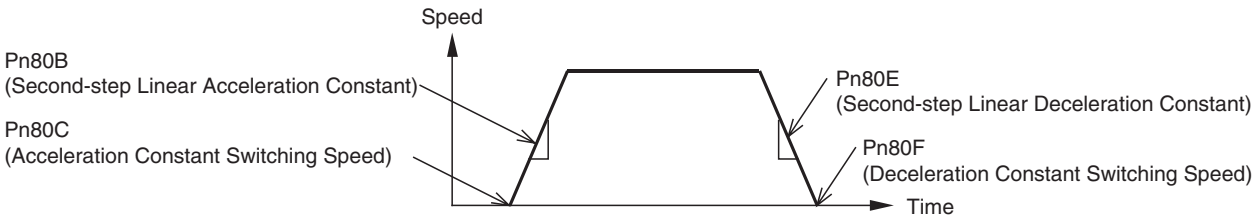



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The Servomotor starts rotating up to the target speed of 100,000 pulses/s and stops at 500,000 pulses. The acceleration/deceleration speed depends on the Servo Parameters set for the Servo Driver. When a W-series Servo Driver and the JUSP-NS115 are used together, the acceleration and deceleration speeds are set in the Servo Parameters as follows:

| Parameter No. | Parameter name | Default | Unit | Setting in this example |
|---|---|---|---|---|
| Pn80A | First-step linear acceleration constant | 100 | 10,000 command units/$s^2$ | Not used. |
| Pn80B | Second-step linear acceleration constant | 100 | 10,000 command units/$s^2$ | 1,000,000 pulses/$s^2$ |
| Pn80C | Acceleration constant switching speed | 0 | 100 command units/s | Default settings used. |
| Pn80D | First-step linear deceleration constant | 100 | 10,000 command units/$s^2$ | Not used. |
| Pn80E | Second-step linear deceleration constant | 100 | 10,000 command units/$s^2$ | 1,000,000 pulses/$s^2$ |
| Pn80F | Deceleration constant switching speed | 0 | 100 command units/s | Default settings used. |

In this operation example, the default settings are used for the acceleration/deceleration constants. With the default settings, the acceleration/deceleration movement uses a linear acceleration/deceleration waveform, and the slope of the acceleration and deceleration is 1,000,000 pulses/$s^2$.The target speed is 100,000 pulses/s, so after starting, the motor accelerates up to the target speed in 0.1 s, and decelerates to a stop from the target speed in 0.1 s.




In this operation example, the acceleration/deceleration constant switching speed is 0. Therefore, from startup, the motor accelerates according to the Second-step Linear Acceleration Constant and decelerates using the Second-step Linear Deceleration Constant until stopping. The First-step Acceleration/Deceleration Constants are not used.

The present position of each axis can be monitored in the Axis Operating Input Memory Areas.

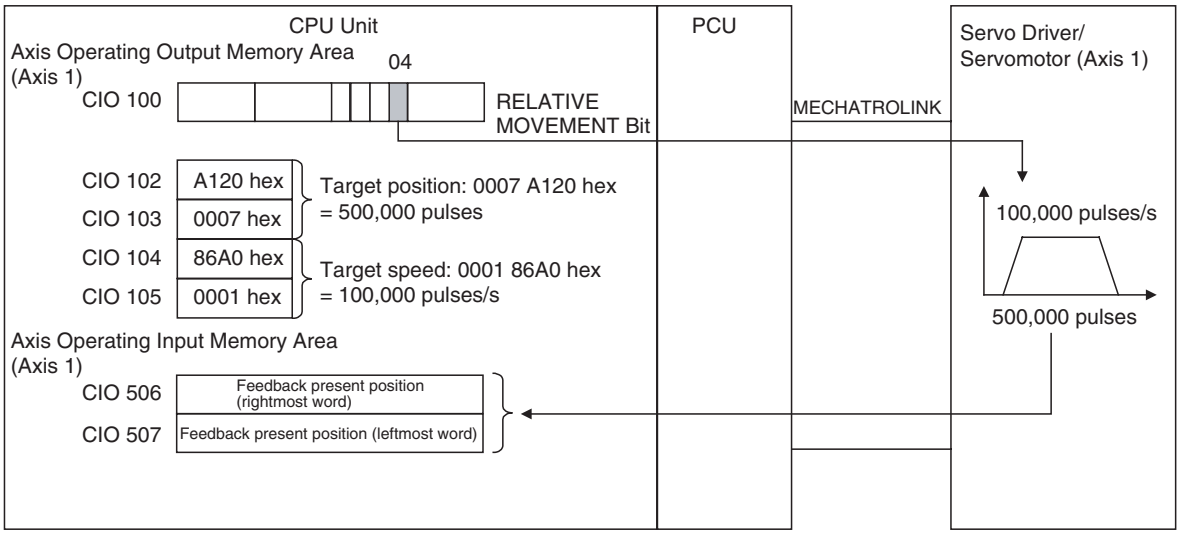
In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Input Memory Area for axis 1 is allocated in CIO 500. Therefore, the present position (feedback present position) for axis 1 is allocated in CIO 506 and CIO 507.

| | |
|---|---|
| CIO 506 | Feedback present position (rightmost word) |
| CIO 507 | Feedback present position (leftmost word) |



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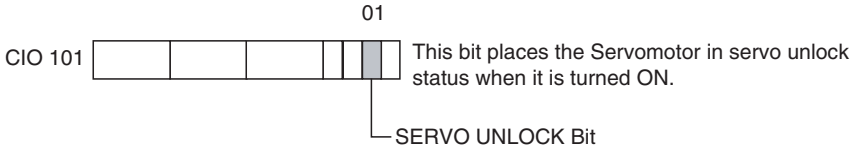
The following diagram shows the operation for the RELATIVE MOVEMENT command.




## Servo Unlock

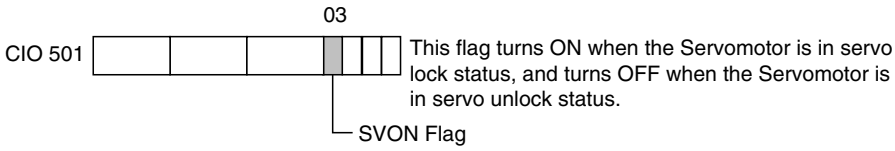
The Servomotor connected to MECHATROLINK can be set to servo unlock status by turning ON the SERVO UNLOCK Bit in the Axis Operating Output Memory Area.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Output Memory Area for axis 1 is allocated in CIO 100. Therefore, the SERVO UNLOCK Bit for axis 1 is allocated in CIO 10101. Turn ON this bit using the Programming Console.




When the servo unlock operation is performed, the Servomotor is placed in servo unlock status. The SVON (Servo ON) Flag indicating servo status in the Axis Operating Memory Areas turns OFF when using an R88D-WT□ Servo Driver with a JUSP-NS115 MECHATROLINK-II Application Module.

In this operation example, the Common Parameters are set so that the beginning word of the Axis Operating Input Memory Area for axis 1 is allocated in CIO 500. Therefore, the SVON Flag for axis 1 is allocated in CIO 50103.




When the servo unlock status is no longer required, turn OFF the corresponding SERVO UNLOCK Bit in the Axis Operating Output Memory Area.

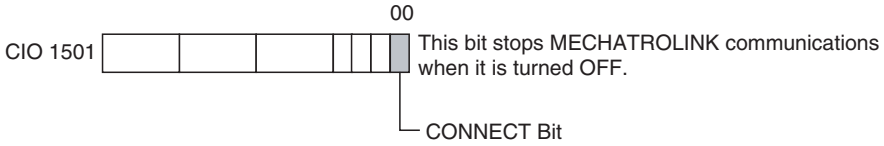
## Stopping MECHATROLINK Communications

Always stop MECHATROLINK communications before turning OFF the power supply to the Servo Driver. MECHATROLINK communications are stopped by turning OFF the CONNECT Bit in the Common Operating Memory Area.

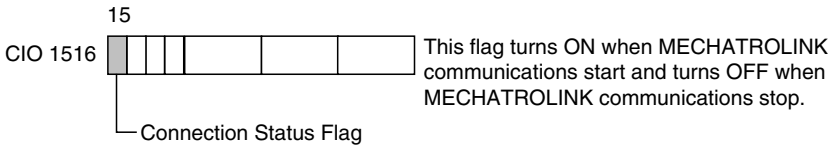
For the PCU with unit number 0, the CONNECT Bit is allocated in CIO 150100. Use the Programming Console to turn OFF this bit, which was turned ON at the start of MECHATROLINK communications.



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When MECHATROLINK communications stop, the Connection Status Flag in the Common Operating Memory Area turns OFF. For the PCU with unit number 0, the Connection Status Flag is allocated in CIO 151615.




This completes the operations example for operating the Servomotor using the RELATIVE MOVEMENT command for direct operation. In this operation example, the commands are sent manually from the Programming Console, but the basic operation flow is the same when sequences are programmed into the ladder program. Other functions are also used in the same way by changing the parameter settings and manipulating bits.



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# SECTION 3
# Installation and Wiring

This section provides information on nomenclature and functions, and describes the procedures required for wiring and installation. Information on the MECHATROLINK-II Application Module is also provided.

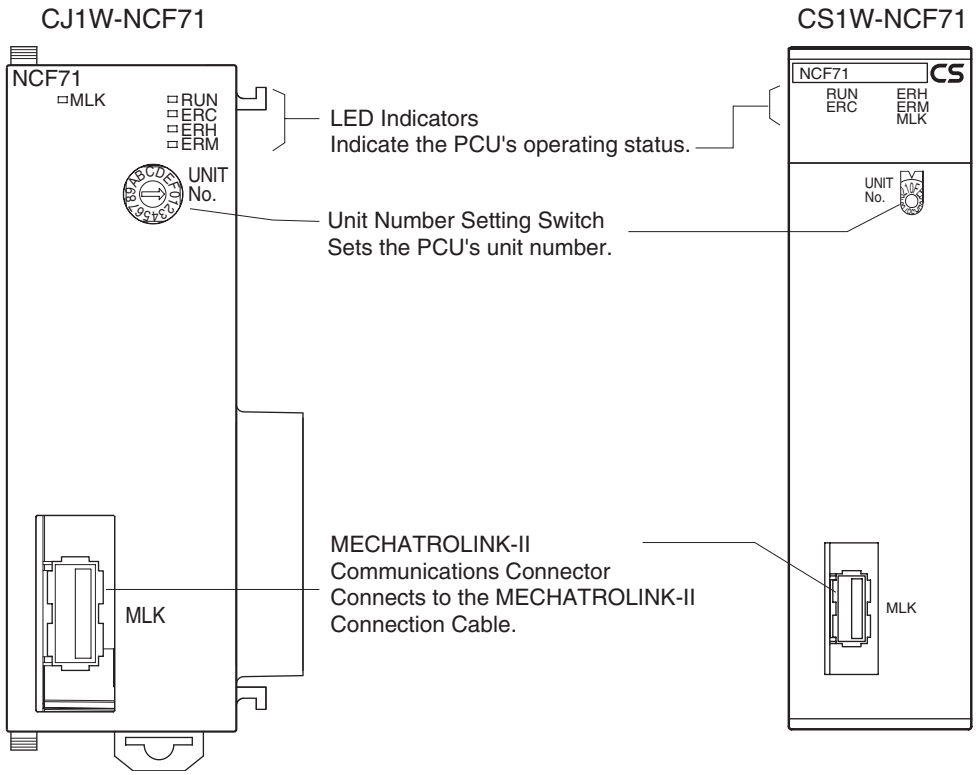

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# 3-1 Nomenclature and Functions

## 3-1-1 Nomenclature




### LED Indicators

| LED | Name | Color | Status | Details |
|---|---|---|---|---|
| RUN | Run | Green | Lit | The PCU is operating normally. |
| | | | Not lit | Other condition |
| ERC | Unit Error | Red | Lit | A fatal error has occurred in the PCU and operation cannot continue. |
| | | | Flashing | A non-fatal error has occurred in the PCU and operation can continue. |
| | | | Not lit | Other condition |
| ERH | CPU Unit Error | Red | Lit | An error has occurred in the PLC. |
| | | | Not lit | Other condition |
| ERM | MECHATROLINK Device Error | Red | Lit | An error has occurred in MECHATROLINK communications. |
| | | | Flashing | An error has occurred in a connected MECHATROLINK device. |
| | | | Not lit | Other condition |
| MLK | MECHATROLINK Communications Status | Yellow | Lit | MECHATROLINK communications in progress |
| | | | Not lit | MECHATROLINK communications stopped |

For details on errors, refer to *SECTION 12 Troubleshooting*.



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**Unit Number Setting Switch (UNIT No.)**

Set the unit number using the rotary switch on the front of the PCU. The PCU's unit number is a CPU Bus Unit unit number.

CJ1W-NCF71 CS1W-NCF71




Setting range: 0 to F (Unit numbers 0 to 15)

**Note** The factory default setting is 0.

The unit number setting determines which words are allocated to the PCU in the CPU Bus Unit Area within the CPU Unit's CIO Area.

The PCU uses this allocated area as the “Common Operating Memory Area.” For details, refer to *4-6 Common Operating Memory Area*.

| Unit number | Allocated words | Unit number | Allocated words |
|---|---|---|---|
| 0 | 1500 to 1524 | 8 | 1700 to 1724 |
| 1 | 1525 to 1549 | 9 | 1725 to 1749 |
| 2 | 1550 to 1574 | 10 | 1750 to 1774 |
| 3 | 1575 to 1599 | 11 | 1775 to 1799 |
| 4 | 1600 to 1624 | 12 | 1800 to 1824 |
| 5 | 1625 to 1649 | 13 | 1825 to 1849 |
| 6 | 1650 to 1674 | 14 | 1850 to 1874 |
| 7 | 1675 to 1699 | 15 | 1875 to 1899 |

**Note** Always turn OFF the power supply before changing the Unit Number Setting Switch's setting.

**MECHATROLINK-II Communications Connector**

This connector connects the PCU with MECHATROLINK devices through the special MECHATROLINK-II Connection Cable.

For details on MECHATROLINK-II Connection Cable models and configuration, refer to *3-4-1 MECHATROLINK-II Communications Wiring*.

## 3-1-2 MECHATROLINK-II Application Module

The following MECHATROLINK-II Application Module must be mounted to a an R88D-WT□ W-series Servo Driver without built-in MECHATROLINK-II communications to enable connection to the PCU through MECHATROLINK-II.

| Name | Model number | Manufacturer |
|---|---|---|
| MECHATROLINK-II Application Module | JUSP-NS115 | Yaskawa Electric Corporation |

When a MECHATROLINK-II Application Module must be mounted to a W-series Servo Driver, use the following device versions.

| Device | Compatible versions |
|---|---|
| W-series Servo Driver | Ver. 39 or later |
| MECHATROLINK-II Application Module | VER. □□□03 or later |

The versions of both the W-series Servo Driver and MECHATROLINK-II Application Module can be found on the nameplate on the side of each device. If an earlier version of the device is used, it will not function properly. Always use products with versions listed in the table above (or later versions).

### Nomenclature

This section provides a basic description of the JUSP-NS115 MECHATROLINK-II Application Module's LED Indicators and Setting Switches.



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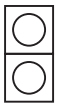
For details, refer to the *JUSP-NS115 MECHATROLINK-II Application Module User's Manual*.

**Note** Refer to the user's manual for the Servo Driver for the nomenclature and functions of Servo Drivers with Built-in MECHATROLINK-II Communications.

- W-series Servo Drivers with Built-in MECHATROLINK-II Communications (R88D-WN□-ML2)
- SMARTSTEP Junior Servo Drivers with Built-in MECHATROLINK-II Communications (R7D-ZN□-ML2)

**LED Indicators**

The LED Indicators show the operating status of the JUSP-NS115.

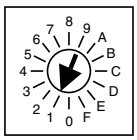



| LED | Name | Color | Status | Details |
|---|---|---|---|---|
| A | Alarm Status | Red | Lit | An alarm occurred in the Servo Driver. (See note 1.) |
| | | | Not lit | Other condition |
| R | MECHATROLINK-II Communications Status | Green | Lit | MECHATROLINK communications in progress |
| | | | Not lit | MECHATROLINK communications stopped |

**Note** The Alarm Status LED will also be lit when MECHATROLINK communications are not established with the PCU.

**Station Address Setting Switch (SW1)**

Set the Servo Driver's station address in conjunction with the MECHATROLINK-II communications setting on pin 3 of the Communications Setting DIP Switch (SW2).



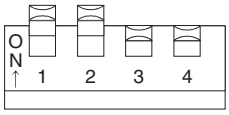

Setting Range: 0 to F (See the following table.)

**Note** The factory default setting is 1.

| Pin 3 of SW2 | SW1 | Station address | Note |
|---|---|---|---|
| OFF | 0 | --- | Cannot be used. Do not set. |
| | 1 to F | 1 to 15 | --- |
| ON | 0 | 16 | --- |
| | 1 to F | --- | Cannot be used when connecting to the PCU. Do not set. |

**Communications Setting DIP Switch (SW2)**

Sets the MECHATROLINK-II communications settings.






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| Pin | Function | Setting | Contents | Default setting | Note |
|---|---|---|---|---|---|
| 1 | Baud rate | OFF | 4 Mbps | ON | Turn ON this pin (10 Mbps) when connecting to the PCU. |
| | | ON | 10 Mbps | | |
| 2 | Transmission bytes | OFF | 17 bytes | ON | Turn ON this pin (32 bytes) when connecting to the PCU. |
| | | ON | 32 bytes (See note.) | | |
| 3 | Station address | OFF | 1 to 15 | OFF | See the explanation of SW1. |
| | | ON | 16 to 30 | | |
| 4 | Reserved by the system. | OFF | --- | OFF | Leave this pin OFF. |

**Note** (1) In some devices, the number of transmission bytes is expressed as "30 bytes," but the meaning is the same as this 32-byte setting.

(2) The MECHATROLINK-II Application Module can be ordered from OMRON with the following model number.

| Name | Yaskawa Electric Co. model number | OMRON model number |
|---|---|---|
| MECHATROLINK-II Application Module | JUSP-NS115 | FNY-NS115 |

# 3-2 Installing the Position Control Unit

## 3-2-1 System Configuration Precautions

- The I/O words allocated to the PCU as a CPU Bus Unit are not determined by the Unit's mounting order, but by the unit number set on the Unit Number Setting Switch on the front of the Unit.
- The PCU can be mounted in either the CPU Rack or an Expansion Rack (only up to 10 Units per Rack for a CJ-series PLC) and up to 16 Units can be controlled by one CPU Unit.
- The CS1W-NCF71 can be mounted to a CS1W-BC□□3 CPU Backplane or a CS1W-BI□□3 Expansion Backplane.

## 3-2-2 Unit Installation

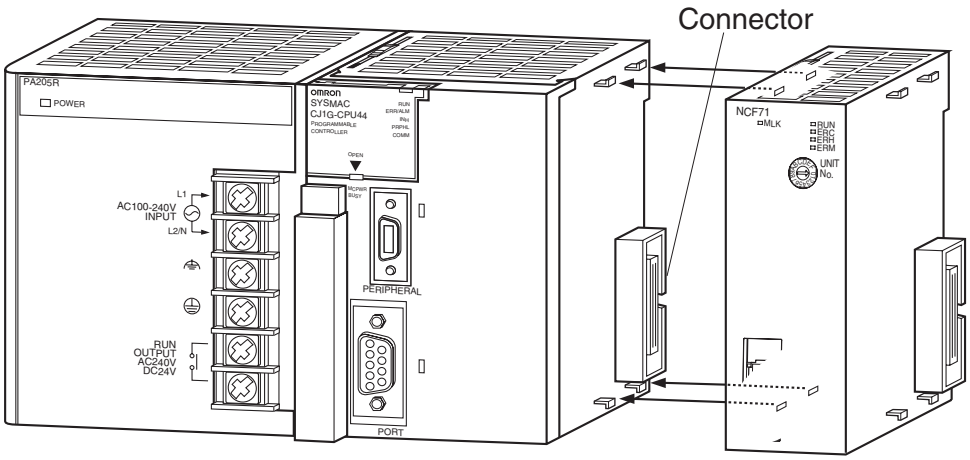
Use the following procedure to install the PCU.

**CJ1W-NCF71**

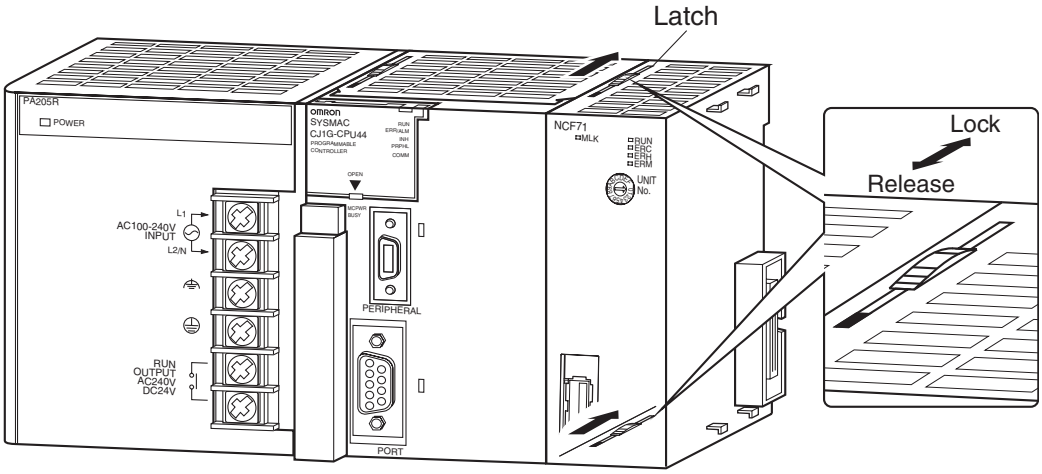
***1,2,3...*** 1. Align the connectors correctly and mount the PCU.



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2. Secure the PCU by sliding the yellow latches on the top and bottom until they click and lock.

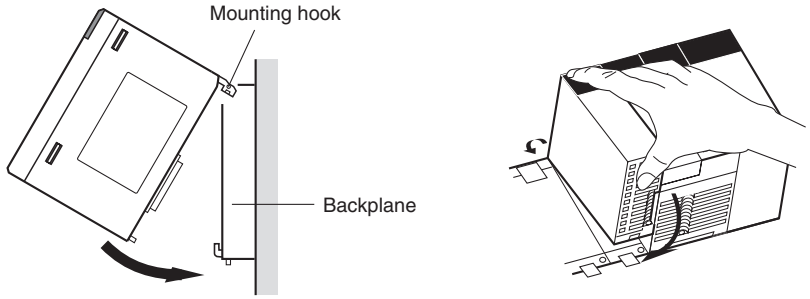



**Note** If the latches are not completely locked, the PCU may not function properly.

To remove the PCU, slide the latches in the “release” direction and remove the PCU.

## CS1W-NCF71

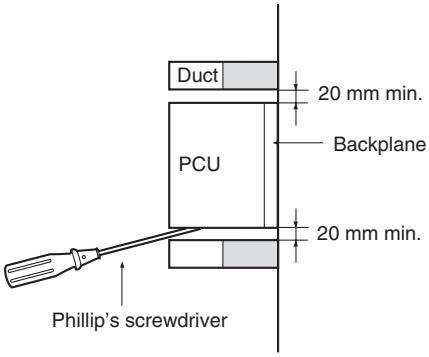
***1,2,3...*** 1. Catch the hook on the top back of the PCU on the Backplane to mount the unit.

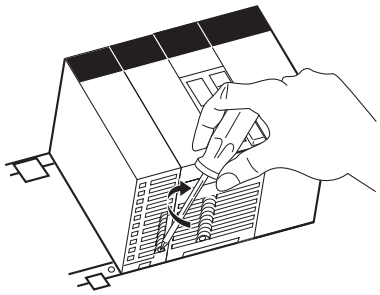





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2. Insert the connector on the back of the CPU properly into the connector on the Backplane.

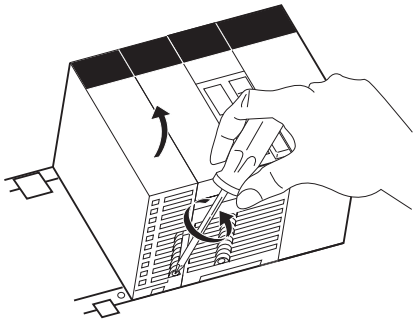


3. Tighten the screw on the bottom of the PCU using a Phillip's screwdriver. When mounting the PCU inside equipment, provide the minimum space indicated in the diagram to enable mounting/dismounting the PCU and to ensure proper ventilation.

**Note** Always tighten the mounting screw on the bottom of the PCU to a torque of 0.4 N·m.

To remove the PCU, loosen the screw at the bottom of the PCU using a Phillip's screwdriver and then lift up on the bottom of the PCU.

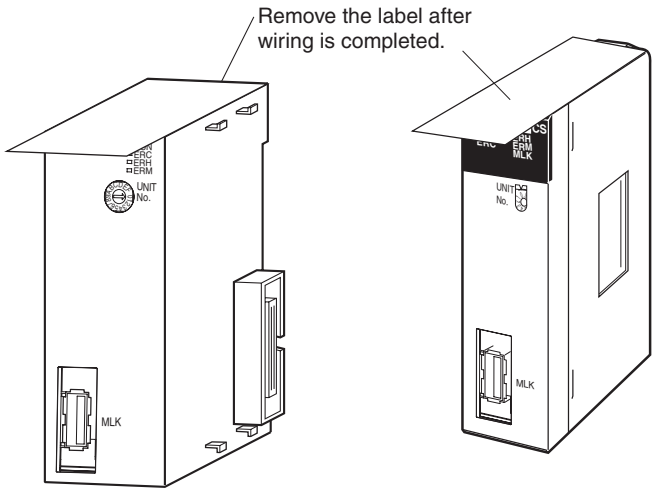


## 3-2-3 Installation Precautions

- Always turn OFF the CPU Unit's power supply before connecting or disconnecting cables or the Unit itself.
- To minimize the effects of noise, place I/O wiring in a separate duct from high-voltage lines and power lines.
- Wire strands may be scattered around during wiring, so leave the protective label on top of the PCU to prevent any wire strands from getting inside the PCU. Once the wiring has been completed, be sure to remove the label to allow ventilation.

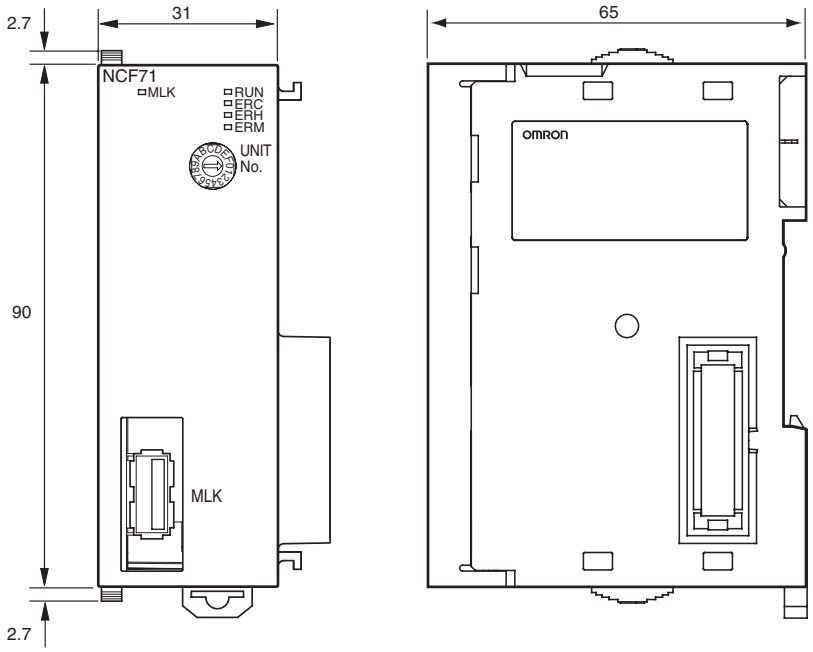


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## 3-2-4 Dimensions

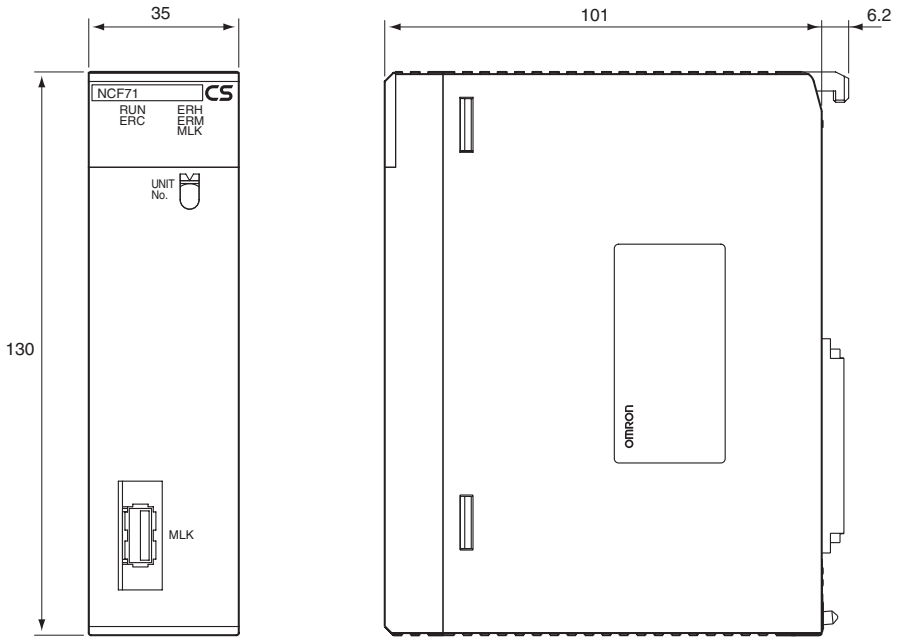
### CJ1W-NCF71



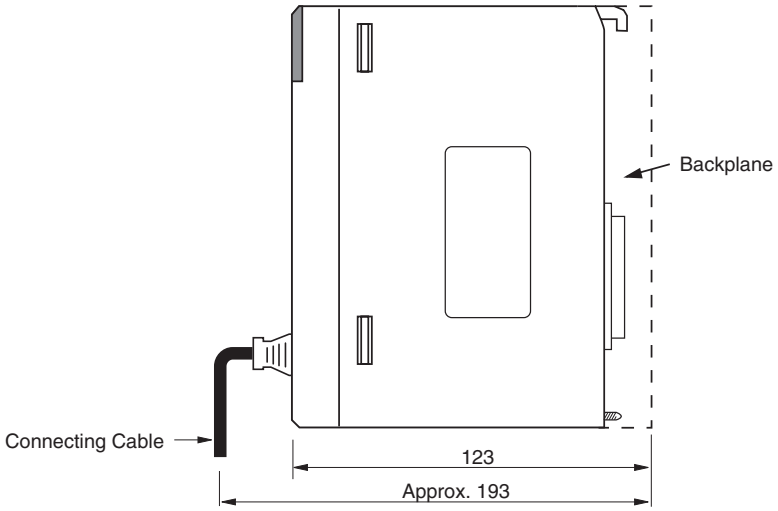



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### CS1W-NCF71




**Dimensions Mounted to Backplane**




# 3-3 External I/O Circuits

This section describes the external I/O that can be used when the PCU is connected to a W-series Servo Driver equipped with MECHATROLINK-II Application Module.

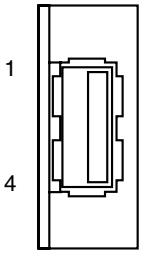
## 3-3-1 PCU I/O Signals

### MECHATROLINK Connector (MLK)

| Connector specifications | Explanation | |
|---|---|---|
| Name | MLK | MECHATROLINK-II connector |
| Connector used | USB connector | DUSB-ARA41-T11 (made by DDK) or equivalent |



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| Connector specifications | Explanation | |
|---|---|---|
| Applicable connector | USB connector | DUSB-APA41-B1-C50 (made by DDK), including shell |
| Pin arrangement |   | |

| Pin | Name | I/O | Description |
|---|---|---|---|
| 1 | (NC) | --- | --- |
| 2 | SRD– | I/O | Send/receive data – |
| 3 | SRD+ | I/O | Send/receive data + |
| 4 | (NC) | --- | --- |
| Shell | Shield | --- | Shield ground |

## 3-3-2 Servo Driver I/O Signals (R88D-WT□ with JUSP-NS115)

This section explains the I/O signals used between the PCU and a W-series Servo Driver equipped with a JUSP-NS115 MECHATROLINK-II Application Module.

Use the *OMNUC W Series User's Manual* together with this manual for information on I/O signals.

### Terminal Arrangement of the Control I/O Connector (CN1)

The following diagram shows the terminal arrangement of the W-series Servo Driver's Control I/O Connector (CN1) when MECHATROLINK is being used with the Servo Driver's standard settings.

This diagram shows only the I/O signals used when connecting to the PCU.

For details on the Servo Driver's standard settings, refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | --- | --- | | | | 26 | INP1COM | Positioning completed output 1 common |
| 2 | --- | --- | | | | 27 | BKIR | Brake interlock output | 28 | BKIRCOM | Brake interlock output common |
| | | | 3 | --- | --- | | | | | | |
| 4 | --- | --- | | | | 29 | READY | Servo ready output | 30 | READYCOM | Servo ready output common |
| | | | 5 | --- | --- | | | | | | |
| 6 | --- | --- | | | | 31 | $\overline{\text{ALM}}$ | Alarm output | 32 | ALMCOM | Alarm output common |
| | | | 7 | --- | --- | | | | | | |
| 8 | --- | --- | | | | 33 | --- | --- | 34 | --- | --- |
| | | | 9 | --- | --- | | | | | | |
| 10 | --- | --- | | | | 35 | --- | --- | 36 | --- | --- |
| | | | 11 | --- | --- | | | | | | |
| 12 | --- | --- | | | | 37 | --- | --- | 38 | --- | --- |
| | | | 13 | --- | --- | | | | | | |
| 14 | --- | --- | | | | 39 | --- | --- | 40 | --- | Unused input |
| | | | 15 | --- | --- | | | | | | |
| 16 | --- | --- | | | | 41 | DEC | Origin return deceleration LS input | 42 | POT | Forward drive prohibit input |
| | | | 17 | --- | --- | | | | | | |
| 18 | --- | --- | | | | 43 | NOT | Reverse drive prohibit input | 44 | EXT1 | External latch 1 input |
| | | | 19 | --- | --- | | | | | | |
| 20 | --- | --- | | | | 45 | EXT2 | External latch 2 input | 46 | EXT3 | External latch 3 input |
| | | | 21 | BAT | Backup battery + input | | | | | | |
| 22 | BATGND | Backup battery – input | | | | 47 | +24VIN | +24 VDC control power supply input | 48 | --- | --- |
| | | | 23 | --- | --- | | | | | | |
| 24 | --- | --- | | | | 49 | --- | --- | 50 | --- | --- |
| | | | 25 | INP1 | Positioning completed output 1 | | | | | | |



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**Note** (1) Do not connect wiring to unused pins.

(2) Connect the control I/O signal cable's shield wire to the connector shell. The connector on the Servo Driver side is connected to the FG (frame ground).

**CN1 Connector (50 Pin)**

| | | |
|---|---|---|
| Receptacle on Servo Driver Side | 10250-52A2JL | (Sumitomo 3M) |
| Soldered Plug on Cable Side | 10150-3000VE | (Sumitomo 3M) |
| Case on Cable Side | 10350-52A0-008 | (Sumitomo 3M) |

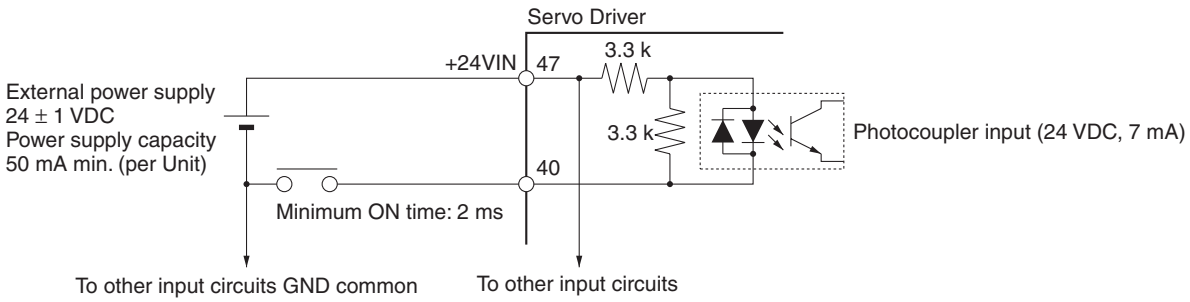
## Control I/O Signals

The following tables show the names and functions of the Servo Driver's control I/O signals.

### Control Input Signals

| Pin no. | Signal | Name | Function/Interface | Control mode |
|---|---|---|---|---|
| 40 | --- | Not used. | This control input signal is not used with the standard settings. | --- |
| 41 | DEC | Origin return deceleration LS | Used as the origin proximity input signal during the origin search operation.<br>With the standard settings, the signal is enabled when ON. | Position |
| 42 | POT | Forward drive prohibit input (Positive overtravel) | Used as the forward limit input.<br>With the standard settings, the input is normally closed and operates as follows:<br>OFF: Drive prohibited ON: Drive allowed | All modes |
| 43 | NOT | Reverse drive prohibit input (Negative overtravel) | Used as the reverse limit input.<br>With the standard settings, the input is normally closed and operates as follows<br>OFF: Drive prohibited ON: Drive allowed | All modes |
| 44 | EXT1 | External latch 1 input | Input signal used for external interrupts.<br>Used as an external interrupt input signal during interrupt feeding or an external origin input signal during an origin search.<br>With the standard settings, the signal is enabled when ON. | Position |
| 45 | EXT2 | External latch 2 input | | |
| 46 | EXT3 | External latch 3 input | | |
| 47 | +24VIN | +24 VDC control power supply | This is the input terminal for the +24 VDC control input power supply. | All modes |

### Control Input Circuit




- Signal levels ON: Min. voltage (+24VIN – 11 V)
  OFF: Max. voltage (+24VIN – 1 V)

**Note** (1) If the limit input signals (Servo Driver's forward drive prohibited signal and reverse drive prohibited signal) are not allocated, the Servo Driver will not stop the Servomotor when the signal is input, and the PCU will also be unable to detect limit inputs as errors. When using a PCU, always allocate the Servo Driver's forward drive prohibited signal and reverse drive prohibited signal to enable use of the limit input signals. (Refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.)



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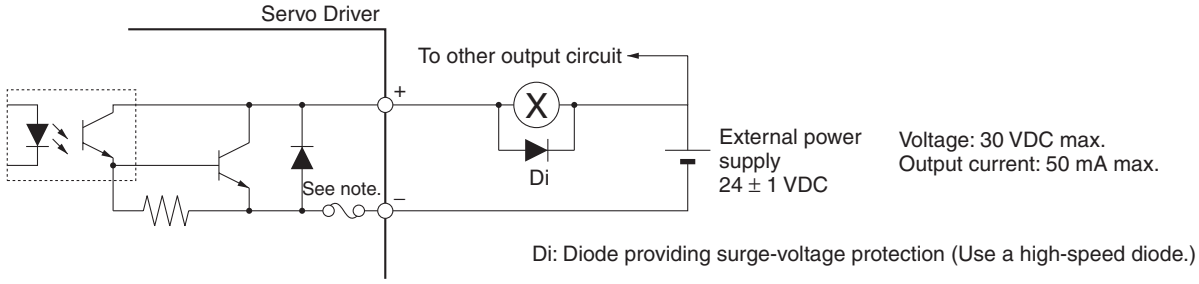
(2) The signal width of the limit input signals (forward drive prohibited signal and reverse drive prohibited signal) and origin proximity input signal (origin return deceleration LS) must be longer than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU will be unable to detect the input signal.

(3) When selecting a sensor for the origin proximity input signal (origin return deceleration LS), use a sensor such as a Photoelectric Sensor, which does not have chattering, because the origin signal is detected after the input goes from ON to OFF during the origin search. If a switch with contacts is used, the origin position may shift due to the switch contact's chattering.

**Control Output Signals**

| Pin no. | Signal | Name | Function/Interface | Control mode |
|---|---|---|---|---|
| 25 | INP1 | Positioning completed output 1 | The position deviation is less than positioning completion range 1 (Pn500). (This signal is always OFF in control modes other than position control mode.) | Position |
| 26 | INP1COM | | | |
| 27 | BKIR | Brake interlock output | This is the holding brake timing signal that is output according to the settings in parameters Pn506, Pn507, and Pn508. | All modes |
| 28 | BKIRCOM | | | |
| 29 | READY | Servo ready output | Turned ON if there are no errors after the control and main circuit power supplies are turned ON. | All modes |
| 30 | READYCOM | | | |
| 31 | $\overline{\text{ALM}}$ | Alarm output | This output turns OFF when there is a Servo Driver alarm. | All modes |
| 32 | ALMCOM | | | |
| Shell | FG | Frame ground | Use this terminal to connect the cable's shield and FG wire. | All modes |

**Control Output Circuit**




**Note** The circuit is equipped with an auto-resetting circuit breaker to protect the output. Even if an overcurrent trips the breaker, the breaker will reset automatically after a certain time elapses with no current. (Ver. 37 and later Servo Drivers are equipped with the auto-resetting circuit breakers.)

## 3-3-3 Servo Driver I/O Signals (R88D-WN□-ML2 with MECHATROLINK-II Built-in Communications)

This section explains the I/O signals used between the PCU and a W-series Servo Driver equipped with built-in MECHATROLINK-II communications.

Use the *OMNUC W Series User's Manual* (Cat. No. I544) together with this manual for information on I/O signals.

### Terminal Arrangement of the Control I/O Connector (CN1)

When using W-series Servo Drivers equipped with built-in MECHATROLINK-II communications, the default control I/O signal allocations are the standard Servo Driver settings for using MECHATROLINK.



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The following diagram shows the terminal arrangement of the W-series Servo Driver's Control I/O Connector (CN1) when MECHATROLINK is being used with the Servo Driver's default settings.

This diagram shows only the I/O signals used when connecting to the PCU.

For details on the Servo Driver's standard settings, refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BKIR (SO1+) | Brake interlock output | 2 | BKIRCOM (SO1–) | Brake interlock output common | 14 | BAT | Backup battery + input | 15 | BATGND | Backup battery – input |
| 3 | $\overline{\text{ALM}}$ | Alarm output | 4 | ALMCOM | Alarm output common | 16 | --- | --- | 17 | --- | --- |
| 5 | --- | --- | 6 | +24VIN | 24-VDC control power supply | 18 | --- | --- | 19 | --- | --- |
| 7 | POT | Forward drive prohibited | 8 | NOT | Reverse drive prohibited | 20 | --- | --- | 21 | --- | --- |
| 9 | DEC | Origin return deceleration limit switch | 10 | EXT1 | External latch 1 input | 22 | --- | --- | 23 | SO2+ | Unused output |
| 11 | EXT2 | External latch 2 input | 12 | EXT3 | External latch 3 input | 24 | SO2– | Unused output | 25 | SO3+ | Unused output |
| 13 | --- | Unused input | | | | 26 | SO3– | Unused output | | | |

**Note**

(1) Do not connect wiring to unused pins.

(2) Connect the control I/O signal cable's shield wire to the connector shell. The connector on the Servo Driver side is connected to the FG (frame ground).

**CN1 Connectors (26 Pin)**

| | | |
|---|---|---|
| Receptacle on Servo Driver Side | 10226-52A2JL | (Sumitomo 3M) |
| Soldered Plug on Cable Side | 10126-3000VE | (Sumitomo 3M) |
| Case on Cable Side | 10326-52A0-008 | (Sumitomo 3M) |

## Control I/O Signals

The following tables show the names and functions of the Servo Driver's control I/O signals.

### Control Input Signals

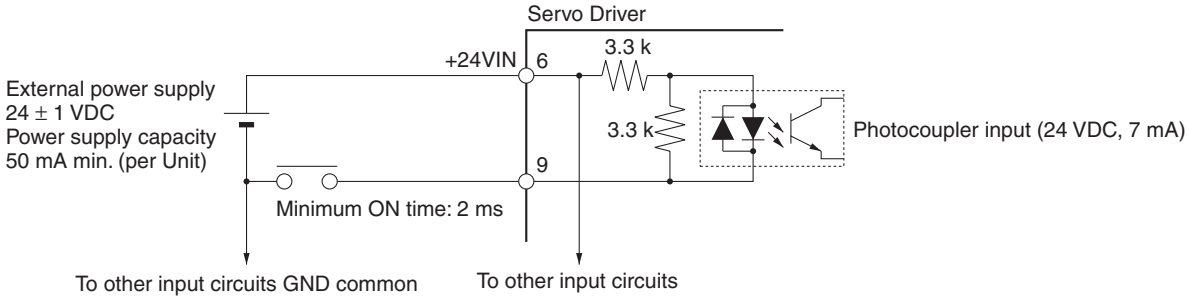
| Pin No. | Symbol | Name | Function/Interface | Control mode |
|---|---|---|---|---|
| 6 | +24VIN | +24 VDC control power supply | This is the input terminal for the +24 VDC control input power supply. | All modes |
| 7 | POT | Forward drive prohibited | Used as the forward limit input.<br>With the standard settings, the input is normally closed and operates as follows:<br>OFF: Drive prohibited ON: Drive allowed | All modes |
| 8 | NOT | Reverse drive prohibited | Used as the reverse limit input.<br>With the standard settings, the input is normally closed and operates as follows<br>OFF: Drive prohibited ON: Drive allowed | All modes |
| 9 | DEC | Origin return deceleration limit switch | Used as the origin proximity input signal during the origin search operation.<br>With the standard settings, the signal is enabled when ON. | Position |



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| Pin No. | Symbol | Name | Function/Interface | Control mode |
|---|---|---|---|---|
| 10 | EXT1 | External latch 1 input | Input signal used for external interrupts. | Position |
| 11 | EXT2 | External latch 2 input | Used as an external interrupt input signal during interrupt feeding or an external origin input signal during an origin search. | |
| 12 | EXT3 | External latch 3 input | With the standard settings, the signal is enabled when ON. | |
| 13 | --- | Not used. | This control input signal is not used with the standard settings. | --- |

### Control Input Circuit




• Signal levels ON: Min. voltage (+24VIN – 11 V)
OFF: Max. voltage (+24VIN – 1 V)

**Note**

(1) If the limit input signals (Servo Driver's forward drive prohibited signal and reverse drive prohibited signal) are not allocated, the Servo Driver will not stop the Servomotor when the signal is input, and the PCU will also be unable to detect limit inputs as errors. When using a PCU, always allocate the Servo Driver's forward drive prohibited signal and reverse drive prohibited signal to enable use of the limit input signals. (Refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.)

(2) The signal width of the limit input signals (forward drive prohibited signal and reverse drive prohibited signal) and origin proximity input signal (origin return deceleration limit switch) must be longer than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU will be unable to detect the input signal.

(3) When selecting a sensor for the origin proximity input signal (origin return deceleration limit switch), use a sensor such as a Photoelectric Sensor, which does not have chattering, because the origin signal is detected after the input goes from ON to OFF during the origin search. If a switch with contacts is used, the origin position may shift due to the switch contact's chattering.

### Control Output Signals

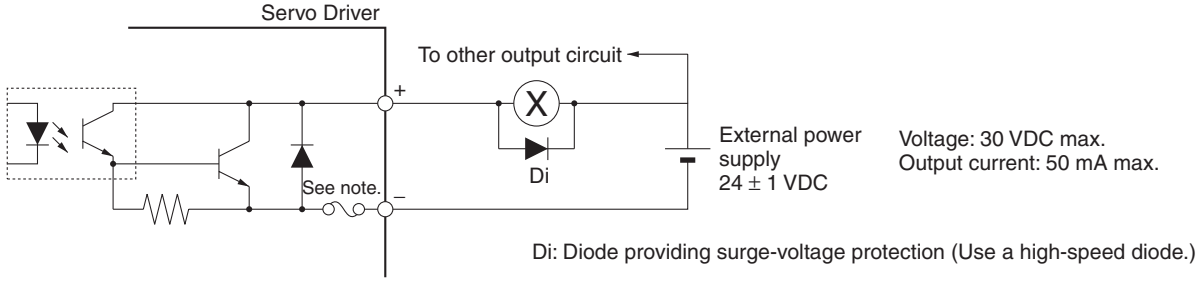
| Pin No. | Symbol | Name | Function/Interface | Control mode |
|---|---|---|---|---|
| 1 | BKIR (SO1+) | Brake interlock output | This is the holding brake timing signal that is output according to the settings in parameters Pn506, Pn507, and Pn508. | All modes |
| 2 | BKIRCOM (SO1–) | | | |
| 3 | $\overline{\text{ALM}}$ | Alarm output | This output turns OFF when there is a Servo Driver alarm. | All modes |
| 4 | ALMCOM | | | |



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| Pin No. | Symbol | Name | Function/Interface | Control mode |
|---|---|---|---|---|
| 23 | SO2+ | General-purpose output | These control input signals are not used with the standard settings. | All modes |
| 24 | SO2− | | | |
| 25 | SO3+ | | | |
| 26 | SO3− | | | |
| Shell | FG | Frame ground | Use this terminal to connect the cable's shield and FG wire. | All modes |

**Control Output Circuit**




**Note** The circuit is equipped with an auto-resetting circuit breaker to protect the output. Even if an overcurrent trips the breaker, the breaker will reset automatically after a certain time elapses with no current.

## 3-3-4 Servo Driver I/O Signals (R7D-ZN□-ML2 with Built-in MECHATROLINK-II Communications)

This section describes the standard I/O signals used with a Position Control Unit when using a SMARTSTEP Junior Servo Driver with Built-in MECHATROLINK-II Communications.

Refer also to the *SMARTSTEP Junior Servo Driver with MECHATROLINK-II Communications User's Manual* (Cat. No. I554).

### Terminal Arrangement of Control I/O Connector (CN1)

The default control I/O signal allocations for a SMARTSTEP Junior Servo Driver with MECHATROLINK-II Communications are set to the standard Servo Driver settings for using MECHATROLINK. The default pin arrangement of the control I/O connector (CN1) on the Servo Driver are shown below.

Only the I/O signals that are connected to the Position Control Unit are shown. Refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK* for the standard Servo Driver settings for using MECHATROLINK.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | EXT1 | External latch signal 1 input | | | | 8 | --- | --- |
| 2 | DEC | Origin proximity input | | | | 9 | --- | --- | | | |
| 4 | POT | Forward drive inhibit input | 3 | NOT | Reverse drive inhibit input | 11 | --- | --- | 10 | --- | --- |
| 6 | STOP | Emergency stop input | 5 | +24VIN | +24 VDC control power supply input | 13 | BKIR | Brake interlock output | 12 | $\overline{\text{ALM}}$ | Alarm output |
| | | | 7 | 0GND | Output ground common | | | | 14 | --- | --- |

**Note** (1) Do not connect unused pins.



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(2) Connect the shield in the control I/O signal cable to the connector hood. At the Servo Driver connector, connect it to the FG (Frame ground).

**CN1 Connector (14P)**

Receptacle on Servo Driver: 10214-52A2JL(Sumitomo 3M)
Soldered Plug on Cable: 10114-3000VE (Sumitomo 3M)
Case on Cable: 10314-52A0-008 (Sumitomo 3M)

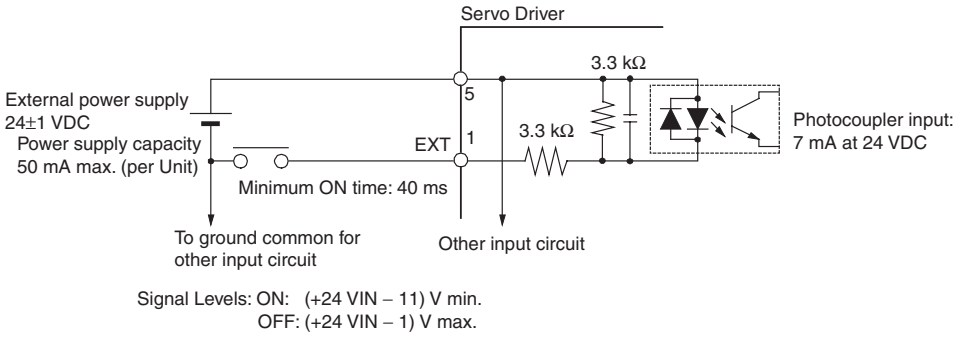
## Control I/O Signals

The names and functions of Servo Driver control I/O signals are given in the following table.

### Control Input Signals

| Pin No. | Signal | Name | Function/interface | Control mode |
|---|---|---|---|---|
| 1 | EXT1 | External latch signal 1 input | An external interrupt input signal.<br>Use as an external interrupt signal for interrupt feeding or as external origin input signal for origin searches. The signal is valid when ON. | Position |
| 2 | DEC | Origin proximity input | The origin proximity input signal for origin searches.<br>The signal is valid when ON. | All modes |
| 3 | NOT | Reverse drive inhibit input | The limit input in the reverse direction. This input operates as follows (i.e., like a NC contact):<br>OFF: Drive prohibited, ON: Drive enabled | All modes |
| 4 | POT | Forward drive inhibit input | The limit input in the forward direction. This input operates as follows (i.e., like a NC contact):<br>OFF: Drive prohibited, ON: Drive enabled | All modes |
| 5 | +24VIN | +24-V power supply input for control DC | The +24 VDC input terminal for the control input power supply. | All modes |
| 6 | STOP | Emergency stop input | An external input signal used to stop power supply to the motor.<br>This input is used when an error occurs to unlock the Servo from a host controller.<br>This input operates as follows (i.e., like a NC contact):<br>OFF: Power to motor stopped (Servo cannot be locked).<br>ON: Power can be supplied to motor (Servo can be locked). | All modes |

### Control Input Circuits




Signal Levels: ON: (+24 VIN – 11) V min.
OFF: (+24 VIN – 1) V max.



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**Note**

(1) If the limit input signals (Servo Driver's forward drive inhibit signal and reverse drive inhibit signal) are not allocated, the Servo Driver will not stop the Servomotor when the signal is input, and the PCU will also be unable to detect limit inputs as errors. When using a PCU, always allocate the Servo Driver's forward drive inhibit signal and reverse drive inhibit signal to enable use of the limit input signals. (Refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.)

(2) The signal width of the limit input signals (forward drive inhibit signal and reverse drive inhibit signal) and origin proximity input signal must be longer than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU will be unable to detect the input signal.

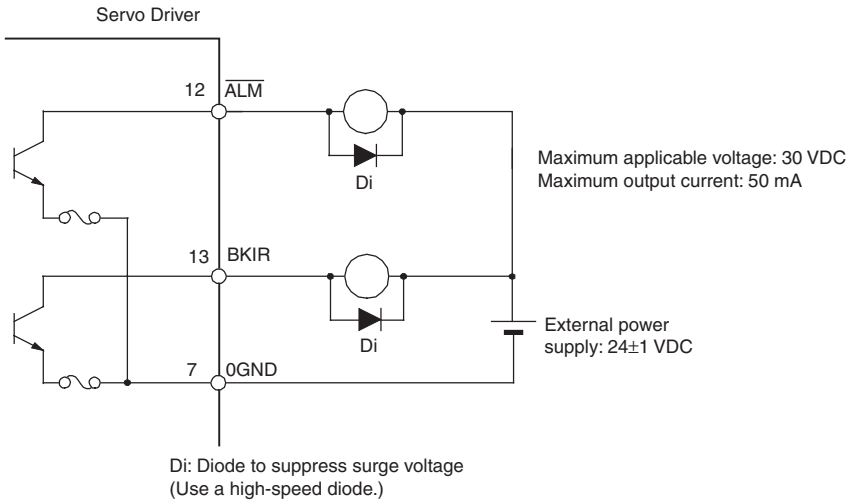
(3) When selecting a sensor for the origin proximity input signal, use a sensor such as a Photoelectric Sensor, which does not have chattering, because the origin signal is detected after the input goes from ON to OFF during the origin search. If a switch with contacts is used, the origin position may shift due to the switch contact's chattering.

(4) The SMARTSTEP Junior Servo Driver's emergency stop input stops the Servomotor using software processing. If required for system safety, add a safety circuit in an external circuit.

### Control Output Signals

| Pin No. | Signal | Name | Function/interface | Control mode |
|---|---|---|---|---|
| 7 | 0GND | Output ground common | The ground common for control output signals. | All modes |
| 12 | $\overline{\text{ALM}}$ | Alarm output | Turns OFF when an alarm occurs in the Servo Driver. | All modes |
| 13 | BKIR | Brake interlock output | Output as a timing signal for a holding brake when the Servo is locked or unlocked. | All modes |
| Shell | FG | Frame ground | The connection point for the cable shield and FG line. | All modes |

### Control Input Circuits




**Note** The circuit is equipped with an auto-resetting circuit breaker to protect the output. Even if an overcurrent trips the breaker, the breaker will reset automatically after a certain time elapses with no current.



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# 3-4 Wiring

This section provides examples of the connections between the PCU and Servo Driver as well as the Servo Driver's control I/O connections.

## 3-4-1 MECHATROLINK-II Communications Wiring

Use the special MECHATROLINK-II Connection Cable to connect the PCU and Servo Driver (MECHATROLINK-II Application Module).

**Connection Cable**

Use the following cables (made by Yaskawa Electric) to connect MECHATROLINK-II devices.

| Name | Model number | Cable length | Manufacturer |
|---|---|---|---|
| MECHATROLINK-II Connection Cable (USB connectors and ferrite cores on both ends) | JEPMC-W6003-A5 | 0.5 m | Yaskawa Electric Corporation |
| | JEPMC-W6003-01 | 1.0 m | |
| | JEPMC-W6003-03 | 3.0 m | |
| | JEPMC-W6003-05 | 5.0 m | |
| | JEPMC-W6003-10 | 10 m | |
| | JEPMC-W6003-20 | 20 m | |
| | JEPMC-W6003-30 | 30 m | |

**Terminators**

Make sure to connect the following Terminator at the end of the MECHATROLINK-II communications line.

| Name | Model number | Manufacturer |
|---|---|---|
| MECHATROLINK-II Terminator | JEPMC-W6022 | Yaskawa Electric Corporation |

**Note** MECHATROLINK-II Connection Cables and Terminators can be ordered from OMRON with the following model numbers.

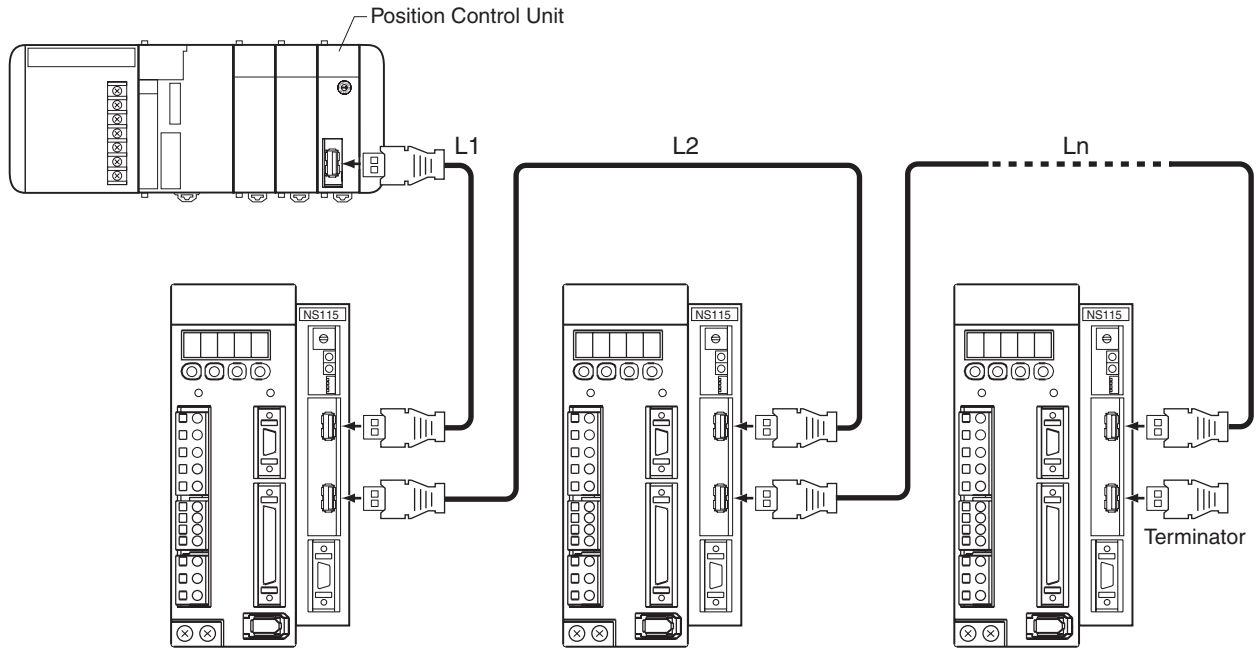
| Name | Yaskawa Electric Co. model number | OMRON model number |
|---|---|---|
| MECHATROLINK-II Connection Cable (USB connectors and ferrite cores on both ends) | JEPMC-W6003-A5 | FNY-W6003-A5 |
| | JEPMC-W6003-01 | FNY-W6003-01 |
| | JEPMC-W6003-03 | FNY-W6003-03 |
| | JEPMC-W6003-05 | FNY-W6003-05 |
| | JEPMC-W6003-10 | FNY-W6003-10 |
| | JEPMC-W6003-20 | FNY-W6003-20 |
| | JEPMC-W6003-30 | FNY-W6003-30 |
| MECHATROLINK-II Terminator | JEPMC-W6022 | FNY-W6022 |



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## MECHATROLINK-II Communications Connections

The following example shows a PCU connected with several Servo Drivers with the MECHATROLINK-II Connection Cables.




**Note** The maximum total length of the Connection Cables (L1 + L2 + ... + Ln) is 50 m when using fewer than 16 axes or 30 m when using 16 axes.

### MECHATROLINK-II Connection Cable Length

The maximum total length of the Connection Cables depends on the number of MECHATROLINK devices (Servo Drivers) being connected, as shown in the following table.

| Number of MECHATROLINK devices | Minimum cable length between devices | Maximum total cable length |
|---|---|---|
| 15 or fewer | 0.5 m min. | 50 m max. |
| 16 | 0.5 m min. | 30 m max. |

**Note** Always turn OFF the power supply to the PCU and Servo Drivers before connecting or disconnecting MECHATROLINK-II Connection Cables or the Terminator.



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## 3-4-2 Wiring the Servo Driver I/O Signals

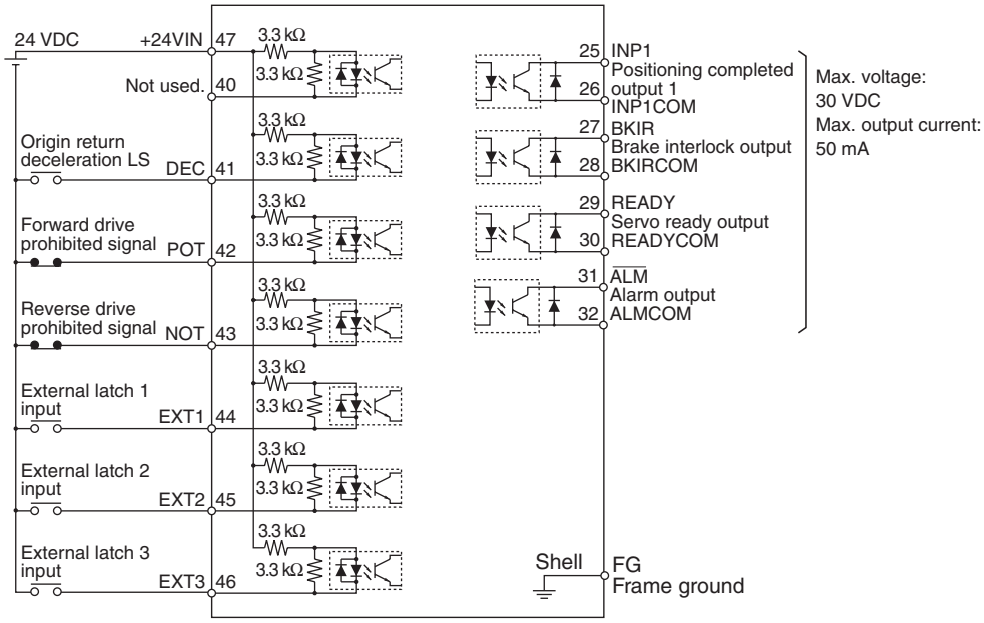
The following example shows a Servo Driver's control I/O signal connections when a Position Control Unit is connected to a W-series Servo Driver or SMARTSTEP Junior Servo Driver.

For details on connecting the Servo Driver to the power supply or Servomotor, refer to the Servo Driver operation manual.

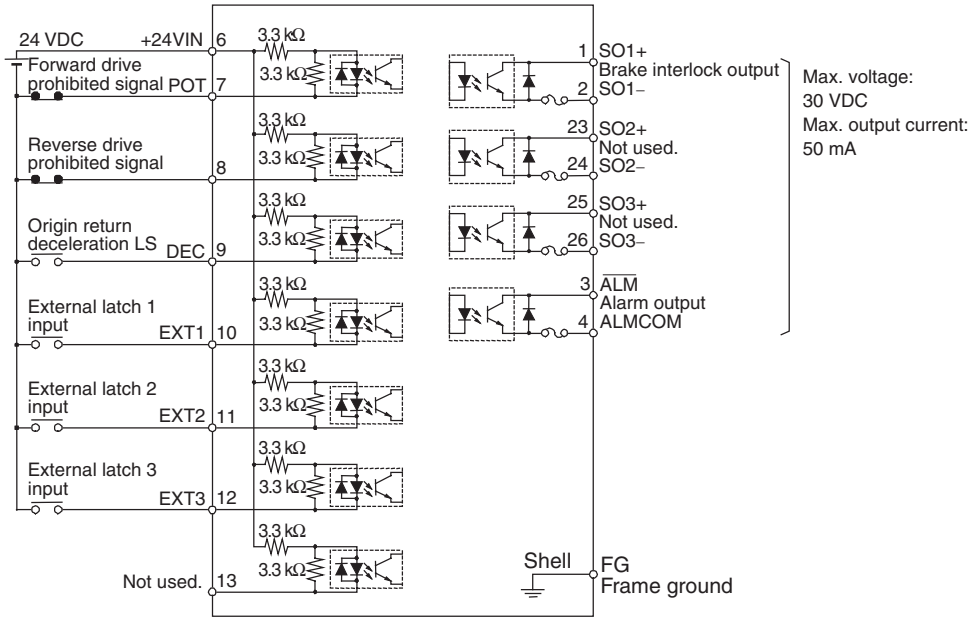
### Control I/O Connector (CN1) Connection Example

**R88D-WT□ with JUSP-NS115**

The following example shows the connections when the standard I/O signal settings are being used.



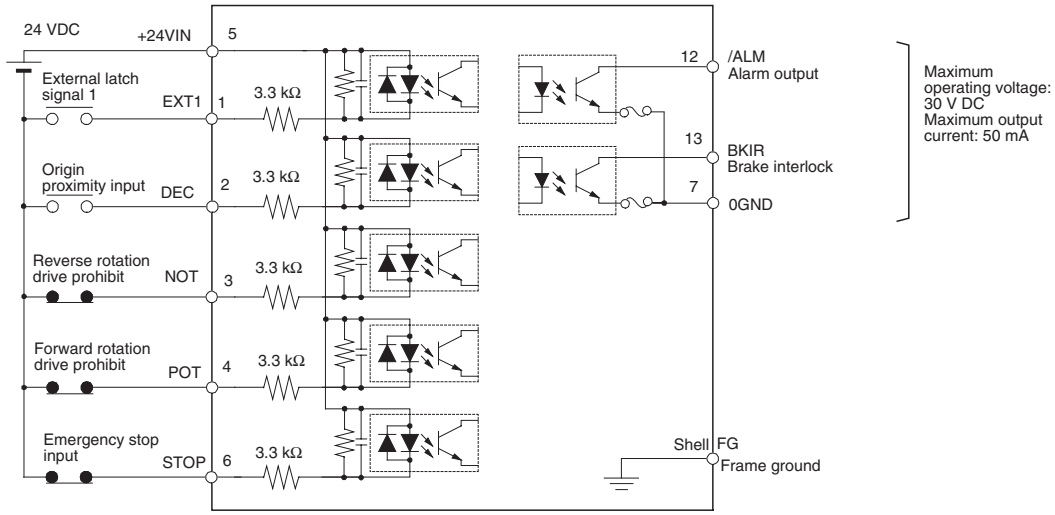

**R88D-WN□-ML2 Equipped with Built-in MECHATROLINK-II Communications**






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### R7D-ZN□-ML2 Equipped with Built-in MECHATROLINK-II Communications




**Note** When a Servo Driver is controlled through MECHATROLINK-II communications, software processes are used to stop the Servomotor when the corresponding PCU control signal is received, the Servo Driver's drive prohibited input signal is received, or an error occurs. Use an external fail-safe circuit (outside of the Servo Driver), such as a circuit that disconnects the Servo Driver's main power supply, to stop the system in an emergency.

## Components Provided to Wire Control I/O Signals

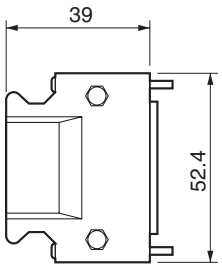
The following components are provided to wire the Control I/O Connector (CN1) on a W-series or SMARTSTEP Junior Servo Driver.

### Control I/O Connector (R88A-CNU11C)

This connector connects to the W-series Servo Driver's Control I/O Connector (CN1).

Use this connector when making your own control cable.

**Dimensions**




Connector Plug model
10150-3000VE (Sumitomo 3M)
Connector Case model
10350-52A0-008 (Sumitomo 3M)

### Control I/O Connector (R88A-CNW01C)

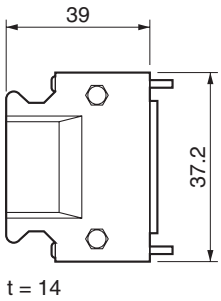
This connector connects to the R88D-WN□-ML2 W-series Servo Driver's Control I/O Connector (CN1).

Use this connector when making your own control cable.



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### Dimensions

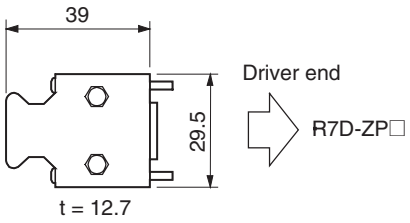



Connector plug: 10126-3000VE (Sumitomo 3M)
Connector case: 10326-52A0-008 (Sumitomo 3M)

**Control I/O Connector (R7A-CNA01R)**

This connector connects to the R7D-ZN□-ML2 SMARTSTEP Junior Servo Driver's Control I/O Connector (CN1).

Use this connector when making your own control cable.



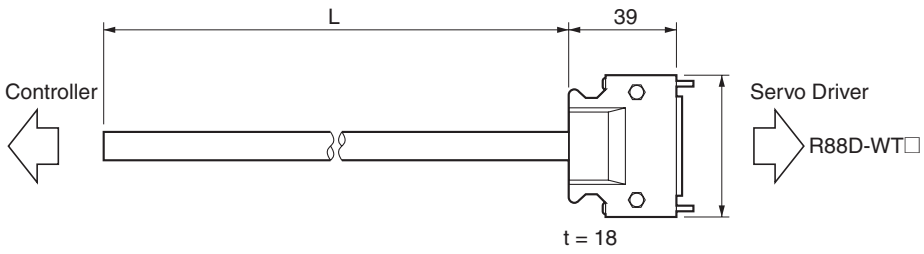

**General-purpose Control Cable (R88A-CPW□S)**

This cable has a connector already attached, which connects to the R88D-WT□ W-series Servo Driver's Control I/O Connector (CN1). There is no connector attached to the other end of the cable. Attach an appropriate connector to connect the desired I/O device in order to use the cable.

### Standard Cables

| Model | Length (L) | Sheath diameter | Approx. weight |
|---|---|---|---|
| R88A-CPW001S | 1 m | 12.8-mm dia. | 0.3 kg |
| R88A-CPW002S | 2 m | | 0.6 kg |

### Connection Configuration and Dimensions




### Wiring

| No. | Wire/Marking colors | Signal |
|---|---|---|
| 1 | Yellow/Black (– – –) | --- |
| 2 | Pink/Black (– – – –) | --- |
| 3 | Yellow/Red (– – – – –) | --- |
| 4 | Pink/Red (– – – –) | --- |
| 5 | Orange/Red (–) | --- |
| 6 | Orange/Black (–) | --- |
| 7 | Gray/Red (–) | --- |

| No. | Wire/Marking colors | Signal |
|---|---|---|
| 27 | White/Red (– –) | BKIR |
| 28 | White/Black (– –) | BKIRCOM |
| 29 | Yellow/Red (– –) | READY |
| 30 | Yellow/Black (– –) | READYCOM |
| 31 | Pink/Red (– –) | --- |
| 32 | Pink/Black (– –) | --- |
| 33 | Orange/Red (– – –) | --- |



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| No. | Wire/Marking colors | Signal |
|---|---|---|
| 8 | Gray/Black (–) | --- |
| 9 | White/Red (–) | --- |
| 10 | White/Black (–) | --- |
| 11 | Yellow/Red (–) | --- |
| 12 | Yellow/Black (–) | --- |
| 13 | Yellow/Black (– – – – –) | --- |
| 14 | Pink/Black (–) | --- |
| 15 | Pink/Red (–) | --- |
| 16 | Orange/Red (– – – – –) | --- |
| 17 | Orange/Black (– – – – –) | --- |
| 18 | Pink/Red (– – – – –) | --- |
| 19 | Gray/Red (– –) | --- |
| 20 | Gray/Black (– –) | --- |
| 21 | Gray/Red (– – – – –) | --- |
| 22 | Gray/Black (– – – – –) | --- |
| 23 | White/Red (– – – – –) | --- |
| 24 | White/Black (– – – – –) | --- |
| 25 | Orange/Red (– –) | INP1 |
| 26 | Orange/Black (– –) | INP1COM |

| No. | Wire/Marking colors | Signal |
|---|---|---|
| 34 | Orange/Black (– – –) | --- |
| 35 | Gray/Black (– – –) | --- |
| 36 | Gray/Red (– – –) | --- |
| 37 | White/Red (– – –) | --- |
| 38 | White/Black (– – –) | --- |
| 39 | Yellow/Red (– – –) | --- |
| 40 | Pink/Red (– – –) | (Not used.) |
| 41 | Pink/Black (– – –) | DEC |
| 42 | Orange/Red (– – – –) | POT |
| 43 | Orange/Black (– – – –) | NOT |
| 44 | Gray/Black (– – – –) | EXT1 |
| 45 | White/Red (– – – –) | EXT2 |
| 46 | White/Black (– – – –) | EXT3 |
| 47 | Gray/Red (– – – –) | +24VIN |
| 48 | Yellow/Red (– – – –) | --- |
| 49 | Yellow/Black (– – – –) | --- |
| 50 | Pink/Black (– – – – –) | --- |
| Shell | --- | FG |

Connector Plug model: 10150-3000VE (Sumitomo 3M)
Connector Case model: 10350-52A0-008 (Sumitomo 3M)
Cable: 24 AWG, 25 wire, UL20276

**Note**

(1) Wires with the same wire color and number of marks make up a twisted pair.
For example, the Orange/Red (–) and Orange/Black (–) wires make up a twisted pair.

(2) The I/O signals listed in the table above are applicable only when connecting to the PCU. Do not wire any unused signals.

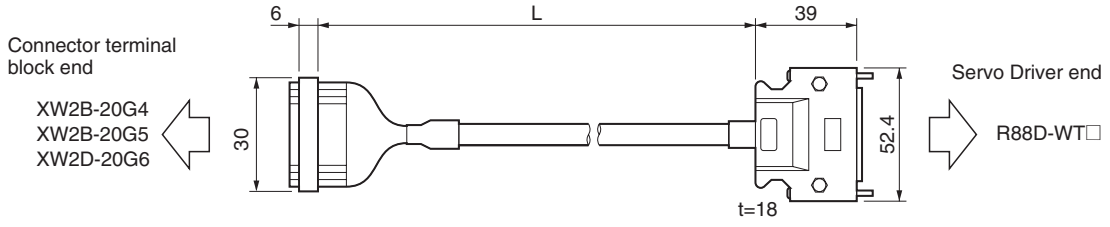
### Connector Terminal Block Cables (XW2Z-□J-B15)

This cable connects to the R88D-WT□ W-series Servo Driver's connector terminal block.

#### Standard Cables

| Model | Length (L) | Approx. weight |
|---|---|---|
| XW2Z-100J-B15 | 1 m | 0.1 kg |
| XW2Z-200J-B15 | 2 m | 0.2 kg |

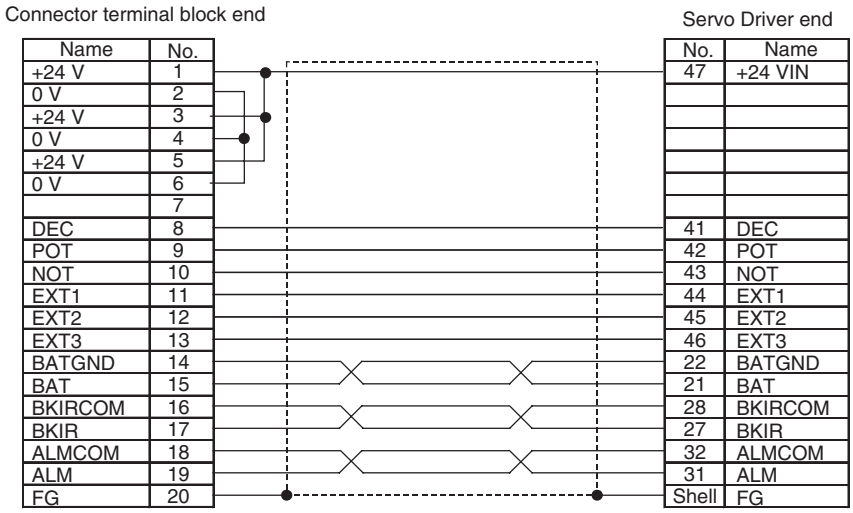
#### Connection Configuration and Dimensions






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### Wiring




Connector on Servo Driver End

Connector Plug: 10150-300VE (Sumitomo 3M)

Connector Case: 10350-52A0-008 (Sumitomo 3M)

Connector on Connector Terminal Block End

Connector Socket: XG4M-2030 (OMRON)

Strain Relief: XG4T-2004 (OMRON)

Cable: AWG28 × 3P + AWG28 × 7C UL2464

**Note** Signal names for the connector on the Servo Driver end are for standard I/O allocations.

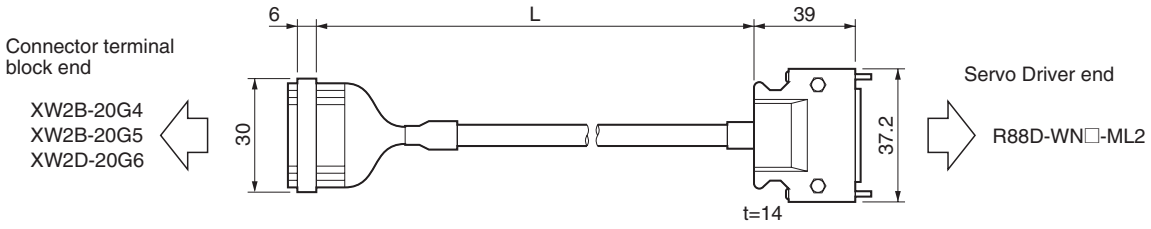
**Connector Terminal Block Cables (XW2Z-□J-B16)**

This cable connects to the R88D-WN□-ML2 W-series Servo Driver's connector terminal block.

### Standard Cables

| Model | Length (L) | Approx. weight |
|---|---|---|
| XW2Z-100J-B16 | 1 m | 0.1 kg |
| XW2Z-200J-B16 | 2 m | 0.2 kg |

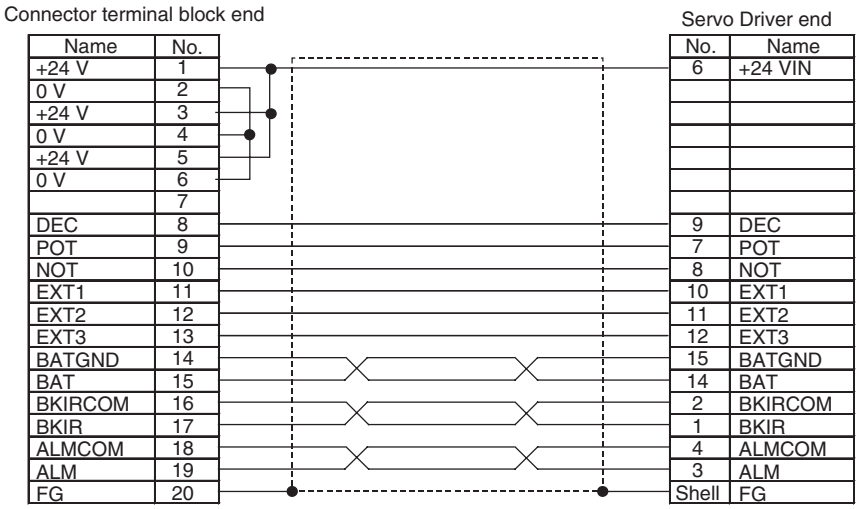
### Connection Configuration and Dimensions






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### Wiring




Connector on Servo Driver End

Connector Plug: 10126-300VE (Sumitomo 3M)
Connector Case: 10326-52A0-008 (Sumitomo 3M)

Connector on Connector Terminal Block End

Connector Socket: XG4M-2030 (OMRON)
Strain Relief: XG4T-2004 (OMRON)

Cable: AWG28 × 3P + AWG28 × 7C UL2464

**Note** Signal names for the connector on the Servo Driver end are for standard I/O allocations.

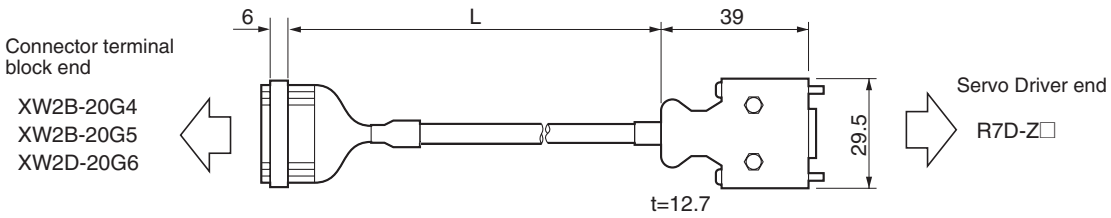
**Connector Terminal Block Cable (XW2Z-□J-B19)**

This is the Cable for the Connector Terminal Block for the Servo Driver's control I/O connector (CN1).

### Standard Cables

| Model | Length (L) | Outer diameter of cable | Approx. weight |
|---|---|---|---|
| XW2Z-100J-B19 | 1 m | 8 dia. | 0.1 kg |
| XW2Z-200J-B19 | 2 m | | 0.2 kg |

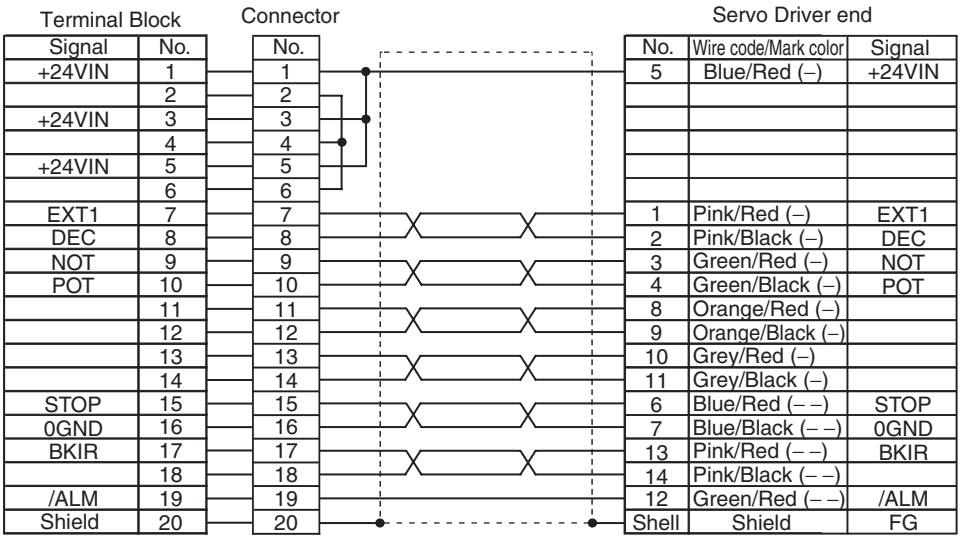
### Connection Configuration and Dimensions






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**Wiring**




Connector at Connector Terminal Block
Connector Socket: XG4M-2030
Strain Relief: XG4T-5004

Cable: AWG28-10P UL20276

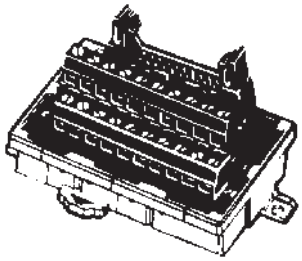
Connector at Servo Driver
Connector Plug: 10114-3000PE (Sumitomo 3M)
Connector Case: 10314-52A0-008 (Sumitomo 3M)

**Connector-Terminal Conversion Units**

Connector-Terminal Conversion Units can be combined with Connector Terminal Block Cables (XW2Z-□J-B15/B16) to convert the control I/O signals of a W-series Servo Driver (CN1) to a terminal block.

**XW2B-20G4**

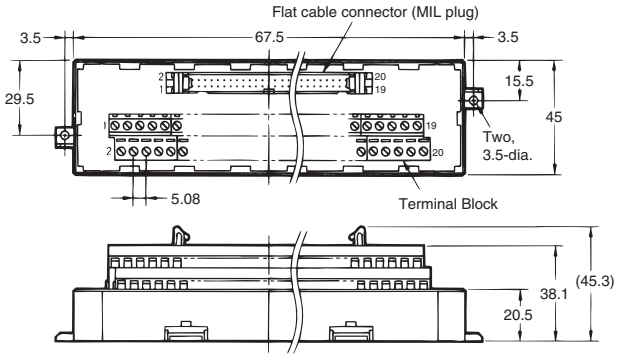
The XW2B-20G4 is an M3 Screw Terminal Block.





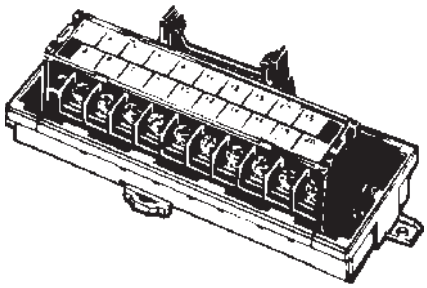
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**Dimensions**

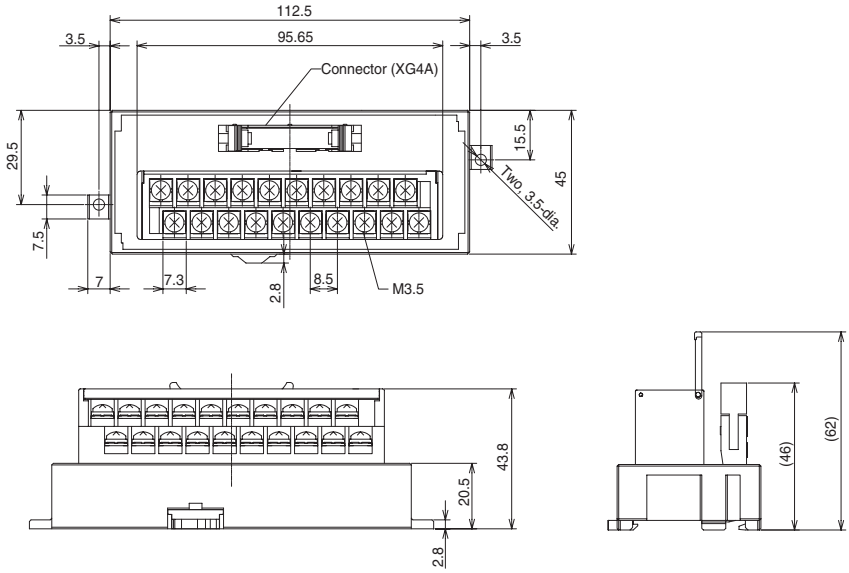



**XW2B-20G5**

The XW2B-20G5 is an M3.5 Screw Terminal Block.



**Dimensions**

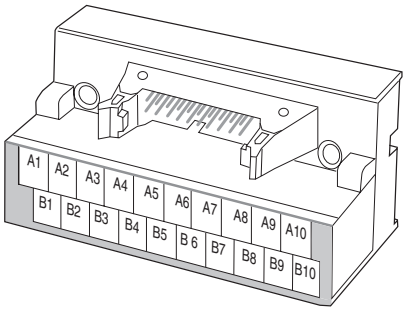




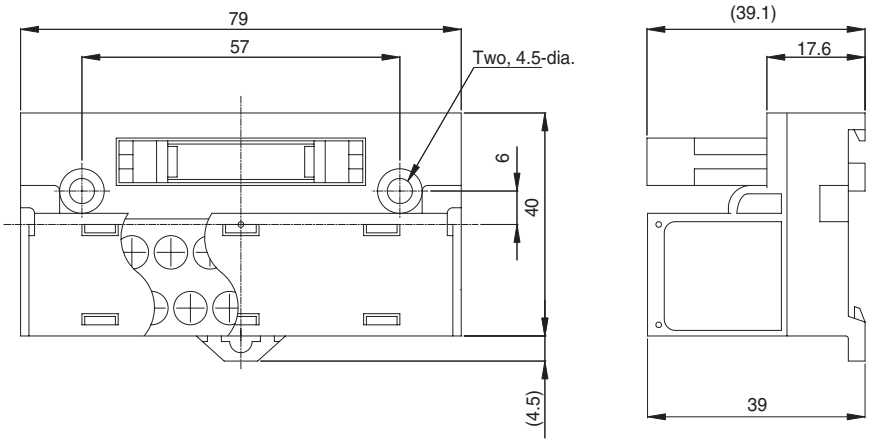

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**XW2D-20G6**

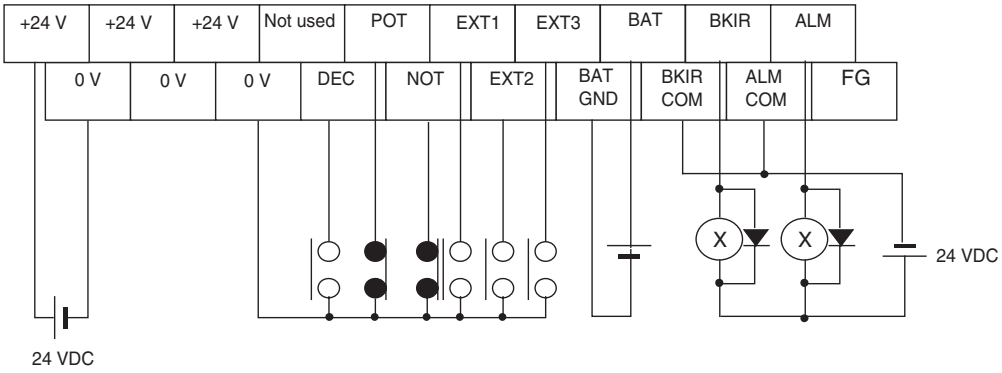
The XW2D-20G6 is an M3 Screw Terminal Block.




**Dimensions**




**Terminal Block Wiring Example (Same for All Models; with Standard Settings for I/O Allocations)**




**Note**

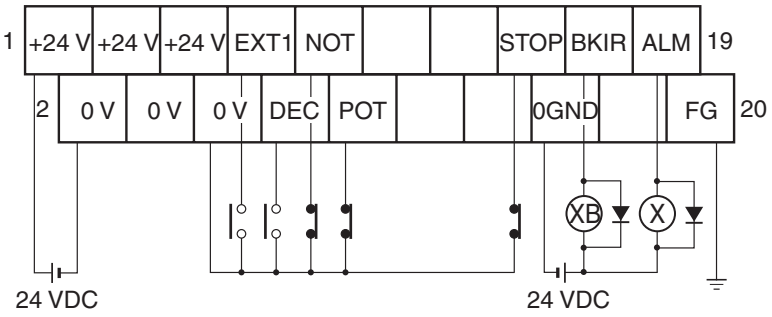
(1) Absolute Encoder Backup Battery: 2.8 to 4.5 V
When using a motor with an absolute encoder, connect a backup battery to one of the following: The Servo Driver for the R88D-WT□, the battery cable for the R88D-WN□-ML2, or the Connector Terminal Block.

(2) Do not connect anything to unused terminals.



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**Terminal Block Wiring Example (XW2B-20G4, XW2B-20G5, and XW2D-20G6)**




**Note** (1) Use a maximum of 300 mA total for the 24-VDC inputs.
(2) Do not use inputs other than sensor inputs.

**Terminal Block Signal Names**

Terminal Block

| Signal | No. |
|---|---|
| +24VIN | 1 |
| | 2 |
| +24VIN | 3 |
| | 4 |
| +24VIN | 5 |
| | 6 |
| EXT1 | 7 |
| DEC | 8 |
| NOT | 9 |
| POT | 10 |
| | 11 |
| | 12 |
| | 13 |
| | 14 |
| STOP | 15 |
| 0GND | 16 |
| BKIR | 17 |
| | 18 |
| /ALM | 19 |
| Shield | 20 |

## Wiring Precautions

The electronic control devices may malfunction due to noise from nearby power supply lines, external loads, or other sources.

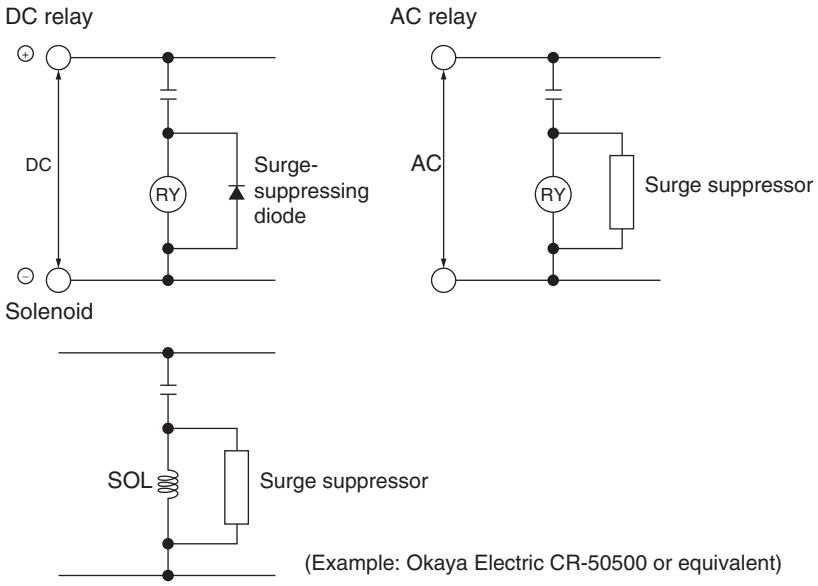
Malfunctions caused by noise can be troublesome because it can be difficult to recreate the situation and to identify the noise source.

Use the following methods to eliminate malfunctions due to noise and improve the system's reliability.

- When selecting wiring components, use wires or cables that meet or exceed the specifications listed in the Servo Driver User's Manual.
- Wire the control lines (communications lines, external I/O signal lines, etc.) separately from the power lines (AC power supply lines and motor power lines). Do not wire these lines together in the same duct or bundle them together.
- Use shielded cables for the control lines.
- Use the specified special cables to connect the PCU and Servo Drivers.
- Always connect surge suppressors to nearby inductive loads (relays or solenoids).



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**Note** Connect surge-suppressing diodes or surge suppressors close to relays. Use surge-suppressing diodes with a dielectric strength of at least 5 times the circuit voltage.

- Noise may be transferred through the power line if there is nearby equipment that generates high-frequency noise or the power supply is shared with equipment such as an electric welder or electric discharge equipment. In this case, insert a noise filter in the power supply input line.
- Connect to a ground of 100 Ω or less and use the thickest possible wire, greater than 1.25 $mm^2$.
- Twisted-pair cable is recommended for power lines.



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# SECTION 4
# Data Areas

This section provides an overview of the parameter and data settings used in Position Control Unit operation and provides information on memory allocations.

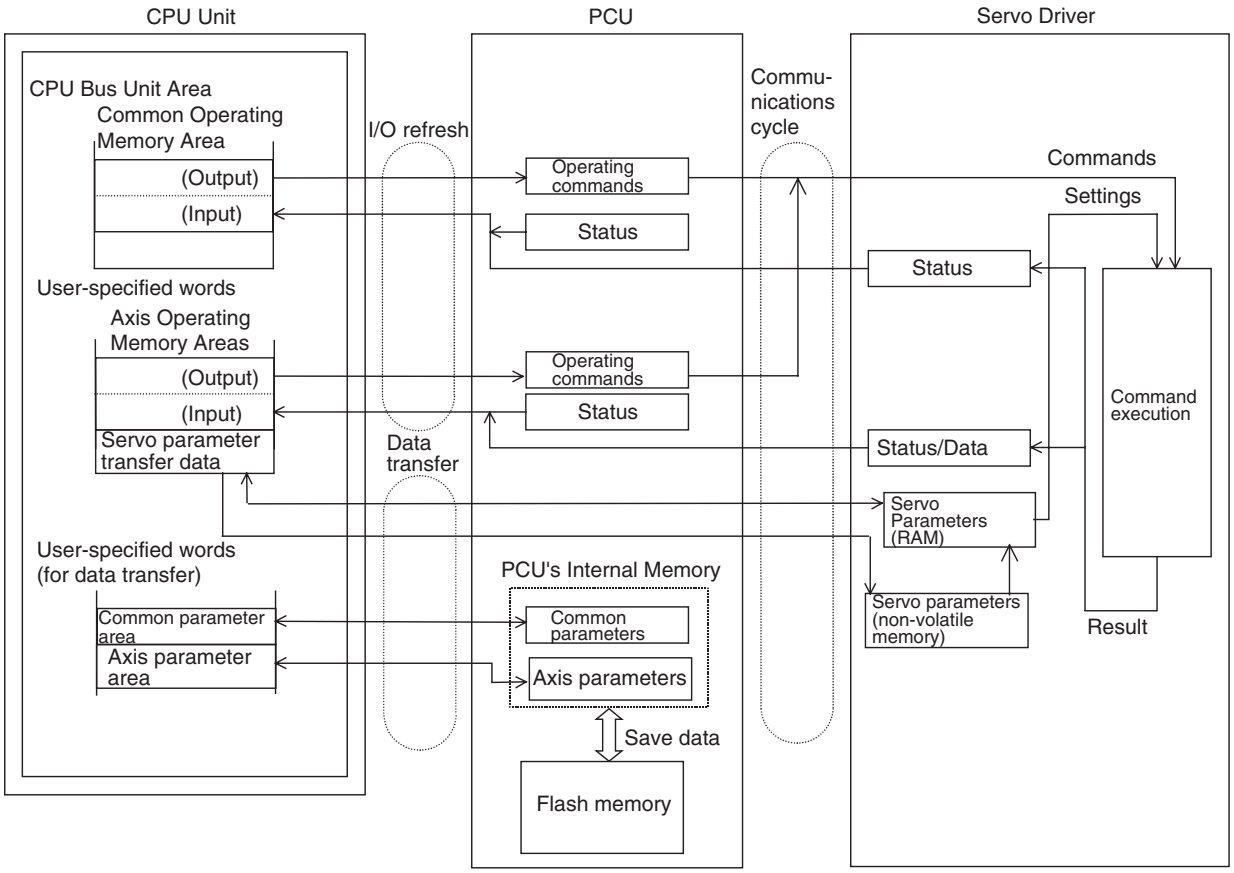

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# 4-1 Overall Structure

The PCU is used by exchanging data with the CPU Unit as shown in the following diagram.






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The data handled by the PCU can be classified into the following six types.

| Data name | Contents | Setting area | Enable timing |
|---|---|---|---|
| Common Parameter Area | This area contains the parameters for basic setting of PCU operation, such as allocation of the Axis Operating Memory Areas and MECHATROLINK communications.<br>The common parameters must be set to use the PCU. | PCU's internal memory (The parameter settings can be saved in the PCU's flash memory.) | The settings saved in the PCU are enabled when read to the PCU internal memory at power ON or restart. |
| Axis Parameter Areas | These areas contain the parameters for axis control settings, such as the origin input signal selection and origin search method. | PCU's internal memory (The parameter settings can be saved in the PCU's flash memory.) | The settings saved in the PCU are read to the PCU internal memory at power ON or restart.<br>When the settings are written, they are refreshed immediately and are enabled after they have been written. |
| Servo Parameter Area | These parameters are for setting Servo Driver operation. | Servo Driver's internal memory (The parameter settings can be saved in the Servo Driver's internal non-volatile memory.) | Online Servo Parameters are enabled as soon as they are written, and offline Servo parameters are enabled after the Servo Driver power is turned OFF and ON again, or after executing DEVICE SETUP. |
| Common Operating Memory Area | This area is for settings for common PCU operations, such as communications control and transferring common parameters. The status of these operations is also input to this area. | CPU Unit's CPU Bus Unit Area | Data is updated with every I/O refresh of the CPU Unit.<br>The set data is enabled and used with the startup of each operation. |
| Axis Operating Output Memory Areas | These areas are for settings and operations of axis operation, such as positioning/speed commands and operating commands for direct operation, origin search, and jogging. | CPU Unit's memory area set in the common parameters. | Data is updated with every I/O refresh of the CPU Unit.<br>The set data is enabled and used with the startup of each operation. |
| Axis Operating Input Memory Areas | These areas are used to input status information for axis operations, such as present position and axis operation status. | CPU Unit's memory area set in the common parameters. | Data is updated with every I/O refresh of the CPU Unit. |

Using these data/parameter settings, the PCU executes operation (1) using the operation settings specified in the common parameters, axis parameters, and Servo parameters (2) based on operating commands received from the Axis Operating Memory Areas.

The common parameters, axis parameters, and certain Servo parameters are the basic settings for the PCU and the axes to be controlled. Therefore, these settings must be set when using the PCU. Make the settings for other data/parameters according to the kind of operation required.



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## PCU Setting Procedure

| Step | | | Operation | Result |
|---|---|---|---|---|
| 1 | | Set unit number. | Set the unit number on the unit number setting switch and turn ON the power to the PCU. | The Common Operating Memory Area starts from the beginning word obtained using the following equation: n = CIO 1500 + (unit No. × 25) |
| 2 | | Set common parameters. | Write the common parameters to the PCU and save them in the internal flash memory using the WRITE DATA and SAVE DATA Bits in the Common Operating Memory Area.<br>After saving the common parameters, restart the PCU or cycle the power to enable the parameters. | The axes being used (scan list) and MECHATROLINK communications settings are determined. The Axis Operating Output/Input Memory Areas for the axes to be used are allocated. |
| 3 | | Set axis parameters. | Write the axis parameters to the PCU and save them in the internal flash memory using the WRITE DATA and SAVE DATA Bits in the Common Operating Memory Area. (These parameters are set at the same time as the common parameters.) | The settings of the origin search operation and other parameters for the axes to be used are determined. |
| 4 | | Start MECHATROLINK communications. | Start MECHATROLINK communications using the CONNECT Bit in the Common Operating Memory Area. | When MECHATROLINK communications start, the axes are operated according to the bits in the Axis Operating Output Memory Areas and the status of the axes can be monitored using the bits in the Axis Operating Input Memory Areas. Subsequent operations are performed with MECHATROLINK communications in progress. |
| MECHATROLINK communications in progress | 5 | Set Servo parameters. | Write the Servo parameters using the WRITE SERVO PARAMETER Bit and SAVE SERVO PARAMETER Bit in the Axis Operating Output Memory Areas.<br>Read the Servo parameters using the READ SERVO PARAMETER Bit in the Axis Operating Input Memory Areas. | The settings for each axis or each Servo Parameter are transferred. The transferred online parameters are enabled when writing is completed, and transferred offline parameters are enabled when the Servo Driver power is cycled or DEVICE SETUP is executed. |
| | 6 | Operate axes. | Start operating axes using the bits in the Axis Operating Output Memory Areas.<br>Monitor the status of axes using the Axis Operating Input Memory Areas. | Commands are executed and status information is obtained when the PLC's I/O is refreshed. |



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# 4-2 Data Areas

The following tables provide the bit/word addresses for the parameters and data handled by the PCU. For further details, refer to the relevant sections.

Only the Servo parameters for applicable models are listed here. For details on Servo parameters, refer to the operation manual for the model being used.

## Common Parameter Area

| PCU's internal address | Name | Bits | | | |
|---|---|---|---|---|---|
| | | 15 to 12 | 11 to 08 | 07 to 04 | 03 to 00 |
| 1838 hex | Area allocations | Axis Operating Output Memory Area designation | | | |
| 1839 hex | | Beginning word of Axis Operating Output Memory Area | | | |
| 183A hex | | Axis Operating Input Memory Area designation | | | |
| 183B hex | | Beginning word of Axis Operating Input Memory Area | | | |
| 183C hex | Scan list | Axis 2 allocation | | Axis 1 allocation | |
| 183D hex | | Axis 4 allocation | | Axis 3 allocation | |
| 183E hex | | Axis 6 allocation | | Axis 5 allocation | |
| 183F hex | | Axis 8 allocation | | Axis 7 allocation | |
| 1840 hex | | Axis 10 allocation | | Axis 9 allocation | |
| 1841 hex | | Axis 12 allocation | | Axis 11 allocation | |
| 1842 hex | | Axis 14 allocation | | Axis 13 allocation | |
| 1843 hex | | Axis 16 allocation | | Axis 15 allocation | |
| 1844 hex to 1855 hex | Reserved by the system. | Set to 0000. | | | |
| 1856 hex | MECHATROLINK communications setting | Transfer cycle | | Communications cycle | |
| 1857 hex | | 00 (fixed) | | C2 master connection | Number of communications retries |
| 1858 hex to 185F hex | Reserved by the system. | Set to 0000. | | | |

## Axis Parameter Area

| PCU's internal address | Name | | Bits | | | |
|---|---|---|---|---|---|---|
| | | | 15 to 12 | 11 to 08 | 07 to 04 | 03 to 00 |
| 1860 hex | Axis 1 | Input signal selection | Origin input signal selection | | Interrupt input signal selection | |
| 1861 hex | | Operation mode selection | Origin search direction<br>Origin search preset | Origin detection method | Origin search operation | 0 (fixed) |
| 1862 hex | | | 0 (fixed) | 0 (fixed) | 0 (fixed) | Encoder type |
| 1863 hex to 1873 hex | | Reserved by the system. | Set to 0000. | | | |
| 1874 hex | Axis 2 | Input signal selection | Origin input signal selection | | Interrupt input signal selection | |
| 1875 hex | | Operation mode selection | Origin search direction<br>Origin search preset | Origin detection method | Origin search operation | 0 (fixed) |
| 1876 hex | | | 0 (fixed) | 0 (fixed) | 0 (fixed) | Encoder type |
| 1877 hex to 1887 hex | | Reserved by the system. | Set to 0000. | | | |
| 1888 hex to 189B hex | Axis 3 | Same as above | Same as above | | | |



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| PCU's internal address | Name | | Bits | | | |
|---|---|---|---|---|---|---|
| | | | 15 to 12 | 11 to 08 | 07 to 04 | 03 to 00 |
| 189C hex to 18AF hex | Axis 4 | Same as above | Same as above | | | |
| 18B0 hex to 18C3 hex | Axis 5 | Same as above | Same as above | | | |
| 18C4 hex to 18D7 hex | Axis 6 | Same as above | Same as above | | | |
| 18D8 hex to 18EB hex | Axis 7 | Same as above | Same as above | | | |
| 18EC hex to 18FF hex | Axis 8 | Same as above | Same as above | | | |
| 1900 hex to 1913 hex | Axis 9 | Same as above | Same as above | | | |
| 1914 hex to 1927 hex | Axis 10 | Same as above | Same as above | | | |
| 1928 hex to 193B hex | Axis 11 | Same as above | Same as above | | | |
| 193C hex to 194F hex | Axis 12 | Same as above | Same as above | | | |
| 1950 hex to 1963 hex | Axis 13 | Same as above | Same as above | | | |
| 1964 hex to 1977 hex | Axis 14 | Same as above | Same as above | | | |
| 1978 hex to 198B hex | Axis 15 | Same as above | Same as above | | | |
| 198C hex | Axis 16 | Input signal selection | Origin input signal selection | | Interrupt input signal selection | |
| 198D hex | | Operation mode selection | Origin search direction<br>Origin search preset | Origin detection method | Origin search operation | 0 (fixed) |
| 198E hex | | | 0 (fixed) | 0 (fixed) | 0 (fixed) | Encoder type |
| 198F hex to 199F hex | | Reserved by the system. | Set to 0000. | | | |

## Servo Parameter Area

The following table provides information on the parameters for the main functions of the PCU that are described in this manual when using an R88D-WT□ OMRON W-series Servo Driver together with a JUSP-NS115 MECHATROLINK-II Application Module or an R88D-WN□-ML2 W-series Servo Driver with built-in MECHATROLINK-II communications. A list of other parameters and SMARTSTEP Junior Servo Driver parameters are provided in *4-5 Servo Parameter Area*. For further details on each of the parameters, refer to the operation manuals for OMRON W-series Servo Drivers, SMARTSTEP Junior Servo Drivers, and Yaskawa JUSP-NS115 MECHATROLINK-II Application Modules.

The default settings for parameters Pn000 to Pn601 in the parameter tables for the R88D-WT□ W-series Servo Driver used with the JUSP-NS115 are automatically set to the default parameter settings used when the JUSP-NS115 MECHATROLINK-II Application Module is mounted to a W-series Servo Driver. Parameters from Pn800 onwards are enabled when the JUSP-NS115 is installed. The parameter names and default settings used for these parameters follow those specified in the JUSP-NS115 operation manual.

For details on information provided in the Enable Setting and Details columns, refer to *4-5 Servo Parameter Area*.



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## Function Selection Parameters

### ■ R88D-WT□ and R88D-WN□-ML2

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn001 | Function selection application switch 1 | 2 | 0 | Select stop if an alarm occurs when Servomotor is OFF | 0 | Servomotor stopped by dynamic brake. | 2 | --- | --- | Offline | --- |
| | | | | | 1 | Dynamic brake OFF after Servomotor stopped. | | --- | --- | | |
| | | | | | 2 | Servomotor stopped with free run. | | --- | --- | | |
| | | | 1 | Select stop when prohibited drive is input | 0 | Stop according to Pn001.0 settings (release Servomotor after stopping) | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Stop Servomotor using torque set in Pn406, and lock Servomotor after stopping. | | --- | --- | | |
| | | | | | 2 | Stop Servomotor using torque set in Pn406, and release Servomotor after stopping. | | --- | --- | | |
| | | | 2 | Select AC/DC power input | --- | --- | 0 | --- | --- | Offline | --- |
| | | | 3 | Select warning code output | --- | --- | 1 | --- | --- | Offline | --- |
| Pn002 | Function selection application switch 2 | 2 | 0 | Torque command input change (during speed control) | 0 | Option command values not used. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Option command value 1 used as the torque limit input. | | | | | |
| | | | | | 2 | Option command value 1 used as the torque feed forward input. | | | | | |
| | | | | | 3 | Option command values 1 and 2 used as the torque limit input according to the forward/reverse rotation current limit setting. | | | | | |
| | | | 1 | Speed command input change (during torque control) | 0 | Option command value not used. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Option command value 1 used as speed limit input. | | | | | |
| | | | 2 | Operation switch when using absolute encoder | 0 | Use as absolute encoder. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Use as incremental encoder. | | | | | |
| | | | 3 | Fully-closed encoder usage method | --- | --- | 0 | --- | --- | Offline | --- |

## Position Control Parameters

### ■ R88D-WT□

| Parameter No. | Parameter name | Parameter size | Explanation | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn202 | Electronic gear ratio G1 (numerator) | 2 | Set the pulse rate for the command pulses and Servomotor travel distance.<br>0.01 ≤ G1/G2 ≤ 100 | 4 | --- | 1 to 65535 | Offline | --- |
| Pn203 | Electronic gear ratio G2 (denominator) | 2 | | 1 | --- | 1 to 65535 | Offline | --- |



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■ **R88D-WN□-ML2**

| Parameter No. | Parameter name | Parameter size | Explanation | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn20E | Electronic gear ratio G1 (numerator) | 4 | Sets the pulse rate for the command pulses and Servomotor movement distance.<br>0.01 ≤ G1/G2 ≤ 1000 | 4 | --- | 1 to 1073741824 | Offline | --- |
| Pn210 | Electronic gear ratio G2 (denominator) | 4 | | 1 | --- | 1 to 1073741824 | Offline | --- |

## Speed Control Parameters

■ **R88D-WT□ and R88D-WN□-ML2**

| Parameter No. | Parameter name | Parameter size | Explanation | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn305 | Soft start acceleration time | 2 | Sets acceleration time during speed control soft start. | 0 | ms | 0 to 10000 | Online | --- |
| Pn306 | Soft start deceleration time | 2 | Sets deceleration time during speed control soft start. | 0 | ms | 0 to 10000 | Online | --- |

## Torque Control (Torque Limit) Parameters

■ **R88D-WT□ and R88D-WN□-ML2**

| Parameter No. | Parameter name | Parameter size | Explanation | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn402 | Forward torque limit | 2 | Forward rotation output torque limit (rated torque ratio). | 350 | % | 0 to 800 | Online | --- |
| Pn403 | Reverse torque limit | 2 | Reverse rotation output torque limit (rated torque ratio). | 350 | % | 0 to 800 | Online | --- |
| Pn404 | Forward rotation external current limit | 2 | Output torque limit during input of forward rotation current limit (rated torque ratio). | 100 | % | 0 to 800 | Online | --- |
| Pn405 | Reverse rotation external current limit | 2 | Output torque limit during input of reverse rotation current limit (rated torque ratio). | 100 | % | 0 to 800 | Online | --- |
| Pn406 | Emergency stop torque | 2 | Deceleration torque when an error occurs (rated torque ratio). | 350 | % | 0 to 800 | Online | --- |
| Pn407 | Speed limit | 2 | Sets the speed limit in torque control mode. | 3000 | r/min | 0 to 10000 | Online | --- |

## I/O and Status Parameters

■ **R88D-WT□**

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn500 | Positioning completion range 1 | 2 | Sets the range of positioning completed. | | | | 3 | Command unit | 0 to 250 | Online | --- |
| Pn502 | Rotation speed for motor rotation detection | 2 | Sets the rotation speed for the Servomotor rotation detection output (TGON). | | | | 20 | r/min | 1 to 10000 | Online | --- |
| Pn503 | Speed conformity signal output width | 2 | Sets the allowable fluctuation range (rotation speed) for the Speed Conformity Flag. | | | | 10 | r/min | 0 to 100 | Online | --- |
| Pn504 | Positioning completion range 2 | 2 | Sets the proximity range for the Positioning Proximity Flag. | | | | 3 | Command unit | 1 to 250 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50A | Input signal selection 1 | 2 | 0 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | Fixed setting: 1 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 3 | POT (forward drive prohibited input) signal Input terminal allocation | 0 | Allocated to CN1, pin 40: Valid for low input | 8 | --- | --- | Offline | Standard setting: 2 |
| | | | | | 1 | Allocated to CN1, pin 41: Valid for low input | | | | | |
| | | | | | 2 | Allocated to CN1, pin 42: Valid for low input | | | | | |
| | | | | | 3 | Allocated to CN1, pin 43: Valid for low input | | | | | |
| | | | | | 4 | Allocated to CN1, pin 44: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 45: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 46: Valid for low input | | | | | |
| | | | | | 7 | Always valid. | | | | | |
| | | | | | 8 | Always invalid. | | | | | |
| | | | | | 9 | Allocated to CN1, pin 40: Valid for high input | | | | | |
| | | | | | A | Allocated to CN1, pin 41: Valid for high input | | | | | |
| | | | | | B | Allocated to CN1, pin 42: Valid for high input | | | | | |
| | | | | | C | Allocated to CN1, pin 43: Valid for high input | | | | | |
| | | | | | D | Allocated to CN1, pin 44: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 45: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 46: Valid for high input | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50B | Input signal selection 2 | 2 | 0 | NOT (reverse drive prohibited) signal input terminal allocation | 0 to F | Same as Pn50A.3 | 8 | --- | --- | Offline | Standard setting: 3 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 2 | PCL (forward rotation current limit) signal input terminal allocation | 0 to F | Same as Pn50A.3 | 5 | --- | --- | Offline | Fixed setting: 8 |
| | | | 3 | NCL (reverse rotation current limit) signal input terminal allocation | 0 to F | Same as Pn50A.3 | 6 | --- | --- | Offline | Fixed setting: 8 |
| Pn50E | Output signal selection 1 | 2 | 0 | INP1 (positioning completed 1) signal output terminal allocation | 0 | Not used. | 1 | --- | --- | Offline | Standard setting: 1 |
| | | | | | 1 | Allocated to CN1, pins 25, 26 | | | | | |
| | | | | | 2 | Allocated to CN1, pins 27, 28 | | | | | |
| | | | | | 3 | Allocated to CN1, pins 29, 30 | | | | | |
| | | | 1 | VCMP (speed conformity) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 1 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | TGON (Servomotor rotation detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 2 | --- | --- | Offline | Standard setting: 0 |
| | | | 3 | READY (Servomotor warmup complete) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 3 | --- | --- | Offline | Standard setting: 3 |
| Pn50F | Output signal selection 2 | 2 | 0 | CLIMT (current limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 1 | VLIMT (speed limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | BKIR (brake interlock) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 2 |
| | | | 3 | WARN (warning) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn510 | Output signal selection 3 | 2 | 0 | INP2 (positioning completed 2) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn511 | Input signal selection 5 | 2 | 0 | DEC (origin return deceleration limit switch) signal input terminal allocation | 0 to F | Same as Pn50A.3 | 8 | --- | --- | Offline | Standard setting: 1 |
| | | | 1 | EXT1 (external latch 1 input) signal input terminal allocation | 0 to F | Same as Pn50A.3 (0 to 3 and 9 to C are always disabled.) | 8 | --- | --- | Offline | Standard setting: 4 |
| | | | 2 | EXT2 (external latch 2 input) signal input terminal allocation | 0 to F | Same as Pn50A.3 (0 to 3 and 9 to C are always disabled.) | 8 | --- | --- | Offline | Standard setting: 5 |
| | | | 3 | EXT3 (external latch 3 input) signal input terminal allocation | 0 to F | Same as Pn50A.3 (0 to 3 and 9 to C are always disabled.) | 8 | --- | --- | Offline | Standard setting: 6 |

■ **R88D-WN□-ML2**

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn502 | Rotation speed for motor rotation detection | 2 | Sets the number of rotations for the Servomotor rotation detection output (TGON). | | | | 20 | r/min | 1 to 10000 | Online | --- |
| Pn503 | Speed conformity signal output width | 2 | Sets the allowable fluctuation (number of rotations) for the speed conformity output (VCMP). | | | | 10 | r/min | 0 to 100 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50A | Input signal selections 1 | 2 | 0 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | Fixed setting: 1 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 3 | POT (forward drive prohibited input) signal Input terminal allocation | 0 | Allocated to CN1, pin 13: Valid for low input | 1 | --- | --- | Offline | Standard setting: 1 |
| | | | | | 1 | Allocated to CN1, pin 7: Valid for low input | | | | | |
| | | | | | 2 | Allocated to CN1, pin 8: Valid for low input | | | | | |
| | | | | | 3 | Allocated to CN1, pin 9: Valid for low input | | | | | |
| | | | | | 4 | Allocated to CN1, pin 10: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 11: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 12: Valid for low input | | | | | |
| | | | | | 7 | Always enabled. | | | | | |
| | | | | | 8 | Always disabled. | | | | | |
| | | | | | 9 | Allocated to CN1, pin 13: Valid for high input | | | | | |
| | | | | | A | Allocated to CN1, pin 7: Valid for high input | | | | | |
| | | | | | B | Allocated to CN1, pin 8: Valid for high input | | | | | |
| | | | | | C | Allocated to CN1, pin 9: Valid for high input | | | | | |
| | | | | | D | Allocated to CN1, pin 10: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 11: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 12: Valid for high input | | | | | |
| Pn50B | Input signal selections 2 | 2 | 0 | NOT (reverse drive prohibited input) signal Input terminal allocation | 0 to F | Same as Pn50A.3. | 2 | --- | --- | Offline | Standard setting: 2 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50E | Output signal selections 1 | 2 | 0 | INP1 (positioning completed 1) signal output terminal allocation | 0 | Not used. | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | | | 1 | Allocated to CN1 pins 1, 2 | | | | | |
| | | | | | 2 | Allocated to CN1 pins 23, 24 | | | | | |
| | | | | | 3 | Allocated to CN1 pins 25, 26 | | | | | |
| | | | 1 | VCMP (speed conformity) signal output terminal allocation | 0 to 3 | Same as Pn50E.0. | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | TGON (servomotor rotation detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0. | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 3 | READY (servo ready) signal output terminal allocation | 0 to 3 | Same as Pn50E.0. | 0 | --- | --- | Offline | Standard setting: 0 |
| Pn50F | Output signal selections 2 | 2 | 0 | CLIMT (current limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0. | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 1 | VLIMT (speed limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0. | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | BKIR (brake interlock) signal output terminal allocation | 0 to 3 | Same as Pn50E.0. | 1 | --- | --- | Offline | Standard setting: 1 |
| | | | 3 | WARN (warning) signal output terminal allocation | 0 to 3 | Same as Pn50E.0. | 0 | --- | --- | Offline | Standard setting: 0 |
| Pn510 | Output signal selections 3 | 2 | 0 | INP2 (positioning completed 2) signal output terminal allocation | 0 to 3 | Same as Pn50E.0. | 0 | --- | --- | Offline | --- |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn511 | Input signal selections 5 | 2 | 0 | DEC signal input terminal allocation | 0 to F | Same as Pn50A.3. | 3 | --- | --- | Offline | Standard setting: 3 |
| | | | 1 | EXT1 signal input terminal allocation | 0 to F | Same as Pn50A.3. (0 to 3 and 9 to C are always disabled.) | 4 | --- | --- | Offline | Standard setting: 4 |
| | | | 2 | EXT2 signal input terminal allocation | 0 to F | Same as Pn50A.3. (0 to 3 and 9 to C are always disabled.) | 5 | --- | --- | Offline | Standard setting: 5 |
| | | | 3 | EXT3 signal input terminal allocation | 0 to F | Same as Pn50A.3. (0 to 3 and 9 to C are always disabled.) | 6 | --- | --- | Offline | Standard setting: 6 |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn522 | Positioning completed range 1 | 4 | Setting range for positioning completed range | | | | 3 | Command unit | 0 to 1,073,741,824 | Online | --- |
| Pn524 | Positioning completed range 2 | 4 | Setting for proximity range for the Positioning Proximity Flag. | | | | 3 | Command unit | 1 to 1,073,741,824 | Online | --- |



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### Control Function Parameters

■ **R88D-WT□ and R88D-WN□-ML2)**

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn800 | Communications control | 2 | 0 | MECHATROLINK-II communications check mask | 0 | Detects both communications errors (A.E6) and synchronization errors (A.E5). | 0 | --- | --- | Online | Always set to 0. |
| | | | | | 1 | Ignores communications errors (A.E6). | | | | | |
| | | | | | 2 | Ignores synchronization errors (A.E5). | | | | | |
| | | | | | 3 | Ignores both communications errors (A.E6) and synchronization errors (A.E5). | | | | | |
| | | | 1 | Warning check mask | 0 | Detects parameter setting warnings (A.94), MECHATROLINK command warnings (A.95), and communications errors (A.96). | 4 | --- | --- | Online | Always set to 4 or 0. |
| | | | | | 1 | Ignores parameter setting warnings (A.94). | | | | | |
| | | | | | 2 | Ignores MECHATROLINK-II command warnings (A.95). | | | | | |
| | | | | | 3 | Ignores both parameter setting warnings (A.94) and MECHATROLINK-II command warnings (A.95). | | | | | |
| | | | | | 4 | Ignores communications errors (A.96). | | | | | |
| | | | | | 5 | Ignores both parameter setting warnings (A.94) and communications errors (A.96). | | | | | |
| | | | | | 6 | Ignores both MECHATROLINK-II command warnings (A.95) and communications errors (A.96). | | | | | |
| | | | | | 7 | Ignores parameter setting warnings (A.94), MECHATROLINK-II command warnings (A.95), and communications errors (A.96). | | | | | |
| | | | 2 | Communications error count at single transmission | --- | --- | 0 | --- | --- | Online | --- |
| | | | 3 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn801 | Function selection application (software limits) | 2 | 0 | Software limit function | 0 | Software limit enabled. | (See note.) | --- | --- | Online | --- |
| | | | | | 1 | Forward software limit disabled. | | | | | |
| | | | | | 2 | Reverse software limit disabled. | | | | | |
| | | | | | 3 | Software limit disabled in both directions. | | | | | |
| | | | 1 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Software limit check using references | 0 | No software limit check using references. | 0 | --- | --- | Online | Always set to 0. |
| | | | | | 1 | Software limit check using references. | | | | | |
| | | | 3 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |

**Note** R88D-WT□ with JUSP-NS115: 0
R88D-WN□-ML2: 3

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn803 | Zero point width | 2 | Sets the detection range for the Origin Stop Flag. | 10 | Command unit | 0 to 250 | Online | --- |
| Pn804 | Forward software limit | 4 | Sets the forward software limit. | 819,191,808 | Command unit | –1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn806 | Reverse software limit | 4 | Sets the reverse software limit. | –819,191,808 | Command unit | –1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn808 | Absolute encoder zero point position offset | 4 | Sets the offset for the mechanical origin from the absolute encoder's absolute value data. | 0 | Command unit | –1,073,741,823 to 1,073,741,823 | Offline | --- |
| Pn80A | First-step linear acceleration constant | 2 | Sets the first-step acceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80B | Second-step linear acceleration constant | 2 | Sets the second-step acceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80C | Acceleration constant switching speed | 2 | Sets the speed for switching between first-step and second-step acceleration for the acceleration/deceleration curve used in position control. | 0 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn80D | First-step linear deceleration constant | 2 | Sets the first-step deceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80E | Second-step linear deceleration constant | 2 | Sets the second-step deceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80F | Deceleration constant switching speed | 2 | Sets the speed for switching between first-step and second-step deceleration for the acceleration/deceleration curve used in position control. | 0 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn810 | Exponential acceleration/ deceleration bias | 2 | Sets the exponential acceleration/deceleration bias speed for the acceleration/deceleration curve used in position control. | 0 | Command units/s | 0 to 32767 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn811 | Exponential acceleration/ deceleration time constant | 2 | Sets exponential acceleration/deceleration time constant for the acceleration/deceleration curve used in position control. | 0 | ×0.1 ms | 0 to 5100 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn812 | Movement average time | 2 | Sets the S-curve acceleration/deceleration moving average time for the acceleration/deceleration curve used in position control. | 0 | ×0.1 ms | 0 to 5100 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn814 | Final travel distance for external positioning | 4 | Sets the final travel distance for external positioning when performing interrupt feeding using direct operation. | 100 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn816 | Zero point return mode setting | 2 | 0 | Zero point return direction | 0 | Forward | 0 | --- | --- | Online | Set the same direction as the origin search direction set in the Axis Parameters.<br>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| | | | | | 1 | Reverse | | | | | |
| | | | 1 to 3 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn817 | Zero point return approach speed 1 | 2 | Sets the origin (zero point) input signal search speed used after the origin proximity signal has been detected in an origin search. | | | | 50 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn818 | Zero point return approach speed 2 | 2 | Sets the origin (zero point) return final travel distance positioning speed used after the origin input signal has been detected in an origin search. | | | | 5 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn819 | Final travel distance to return to zero point | 4 | Sets the amount of compensation positioning used after the origin input signal has been detected in an origin search. | | | | 100 | Command unit | –1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |

**Note** The parameters for backlash compensation are different for the R88D-WT□ and R88D-WN□-ML2.

■ **R88D-WT□**

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn81B | Backlash compensation amount | 2 | Sets the amount of backlash compensation. | | | | 0 | ×0.1 command unit | –32,768 to 32,767 | Online | --- |
| Pn81D | Compensation function selection | 2 | 0 | Backlash compensation selection | 0 | Compensates in forward direction. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Compensates in reverse direction. | | | | | |
| | | | 1 to 3 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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■ **R88D-WN□-ML2**

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn207 | Position control settings 2 | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 2 | Backlash compensation selection | 0 | Disabled | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Compensates to forward rotation side. | | | | | |
| | | | | | 2 | Compensates to reverse rotation side. | | | | | |
| | | | 3 | INP 1 output timing | --- | --- | 0 | --- | --- | Offline | --- |
| Pn214 | Backlash compensation amount | 2 | Mechanical system backlash amount (the mechanical gap between the drive shaft and the shaft being driven) | | | | 0 | Command unit | –32767 to 32767 | Online | --- |
| Pn215 | Backlash compensation time constant | 2 | Sets the backlash compensation time constant. | | | | 0 | × 0.01 ms | 0 to 65535 | Online | --- |

## Common Operating Memory Area

Beginning word of Common Operating Memory Area: n = CIO 1500 + (unit number × 25)

| Word | Name | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
| n | Not used (reserved by the system). | | | | | | | | | | | | SAVE DATA | READ DATA | WRITE DATA | UNIT ERROR RESET |
| n+1 | REJOIN (See note.) | Not used (reserved by the system). | | | | | | | READ BACK-UP DATA | WRITE BACK-UP DATA | Reserved by the system. | | | | | CONNECT |
| n+2 | Axes to connect (See note.) | | | | | | | | | | | | | | | |
| n+3 to n+5 | Not used (reserved by the system). | | | | | | | | | | | | | | | |
| n+6 | Number of write words | | | | | | | | | | | | | | | |
| n+7 | Write source area | | | | | | | | | | | | | | | |
| n+8 | Write source word | | | | | | | | | | | | | | | |
| n+9 | Write destination address | | | | | | | | | | | | | | | |
| n+10 | Number of read words | | | | | | | | | | | | | | | |
| n+11 | Read source address | | | | | | | | | | | | | | | |
| n+12 | Read destination area | | | | | | | | | | | | | | | |
| n+13 | Read destination word | | | | | | | | | | | | | | | |
| n+14 | Not used (reserved by the system). | | | | | | | | | | | | | | | |
| n+15 | Not used (reserved by the system). | Data Transferring Flag | Not used (reserved by the system). | Unit Error Flag | Not used (reserved by the system). | | | | | | | | | | | |
| n+16 | Connection Status Flag | Unit Busy Flag | Not used (reserved by the system). | Memory Card transfer error | Reserved by the system. | | | | | | | | | | | |
| n+17 to n+20 | Reserved by the system. | | | | | | | | | | | | | | | |
| n+21 | Unit error code | | | | | | | | | | | | | | | |



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| Word | Name | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
| n+22 | Axis communications status | | | | | | | | | | | | | | | |
| n+23<br>n+24 | Not used (reserved by the system). | | | | | | | | | | | | | | | |

**Note** The REJOIN Bit and the Axes to Connect parameter are supported for unit version 2.0 or later. The allocated bit and word are not used for earlier unit versions.

## Axis Operating Output Memory Areas

Beginning Word of Axis Operating Output Memory Areas:
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

| Word | Name | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
| a | DECELERATION STOP | Override Enable Bit | DEVIATION COUNTER RESET (See note 4.) | ERROR RESET | Not used (reserved by the system). | Direction designation | JOG | PRESENT POSITION PRESET | ORIGIN RETURN | ORIGIN SEARCH | INTERRUPT FEEDING | RELATIVE MOVEMENT | ABSOLUTE MOVEMENT | Not used (reserved by the system). | LINEAR INTERPOLATION START (See note 1.) | LINEAR INTERPOLATION SETTING (See note 1.) |
| a+1 | EMERGENCY STOP | SAVE SERVO PARAMETER | READ SERVO PARAMETER | WRITE SERVO PARAMETER | DEVICE SETUP | Not used (reserved by the system). | | | | | | | TORQUE CONTROL | SPEED CONTROL | SERVO UNLOCK | SERVO LOCK |
| a+2 | Position command value | | | | | | | | | | | | | | | |
| a+3 | | | | | | | | | | | | | | | | |
| a+4 | Speed command value (for position control) | | | | | | | | | | | | | | | |
| a+5 | | | | | | | | | | | | | | | | |
| a+6 | Speed command value (for speed control) | | | | | | | | | | | | | | | |
| a+7 | | | | | | | | | | | | | | | | |
| a+8 | Torque command value | | | | | | | | | | | | | | | |
| a+9 | | | | | | | | | | | | | | | | |
| a+10 | Option command value 1 | | | | | | | | | | | | | | | |
| a+11 | | | | | | | | | | | | | | | | |
| a+12 | Option command value 2 | | | | | | | | | | | | | | | |
| a+13 | | | | | | | | | | | | | | | | |
| a+14 | Override | | | | | | | | | | | | | | | |
| a+15 | Not used (reserved by the system). | | | | | | | | Monitor 2 type | | | | Monitor 1 type | | | |
| a+16 | Reverse rotation current limit | Forward rotation current limit | Reserved by the system. | | | | | | | | | S-curve designation | Exponential curve designation | Reserved by the system. | | |
| a+17 | Servo Parameter No. | | | | | | | | | | | | | | | |
| a+18 | Parameter size | | | | | | | | | | | | | | | |
| a+19 | Write data (Servo Parameters) | | | | | | | | | | | | | | | |
| a+20 | | | | | | | | | | | | | | | | |
| a+21 | Not used (reserved by the system). | | | | | | | | Interpolation axis designation (See note 3.) | | | | Interpolation axis designation (See note 2.) | | | |
| a+22 | Not used (reserved by the system). | | | | | | | | Interpolation position designation (See note 3.) | | | | Interpolation position designation (See note 2.) | | | |
| a+23 | Interpolation speed command value (See note 1.) | | | | | | | | | | | | | | | |
| a+24 | | | | | | | | | | | | | | | | |

**Note**

(1) Allocated in Axis Operating Output Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(2) Allocated in Axis Operating Output Memory Area for axis 1 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.



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(3) Allocated in Axis Operating Output Memory Area for axis 5 for Position Control Unit version 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(4) The DEVIATION COUNTER RESET can be used with unit version 1.3 or later. This bit is not used for earlier unit versions.

## Axis Operating Input Memory Areas

Beginning Word of Axis Operating Input Memory Areas:
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

| Word | Name | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
| b | Axis Control Status Flags | | | | | | | | | | | | | | | |
| | Stop Execution Flag | Servo Parameters Transferring Flag | Busy Flag | Error Flag | Warning Flag | Not used (reserved by the system). | | | Origin Stop Flag | No Origin Flag | PCU Positioning Completed Flag | Not used (reserved by the system). | | | | Receiving Command Flag |
| b+1 | Servo Status Flags (status particular to Servo Driver) | | | | | | | | | | | | | | | |
| | Reserved by the system. | | Reverse Software Limit Flag | Forward Software Limit Flag | Positioning Proximity Flag/ Speed Limit Status Flag | Reserved by the system. | Torque Limit Status Flag | Distribution Completed Flag/ Zero Speed Flag | Position Completed Flag/ Speed Conformity Flag | Reserved by the system. | | Main Power ON Flag | Servo ON Flag | Reserved by the system. | | |
| b+2 | Reserved by the system. | | | | | | | | | | | | | | | |
| b+3 | External I/O Status Bits | | | | | | | | | | | | | | | |
| | Reserved by the system. | | | | | Emergency stop input (See note 2.) | Brake output | External latch signal 3 input | External latch signal 2 input | External latch signal 1 input | Encoder Phase Z input | Encoder Phase B input | Encoder Phase A input | Origin proximity input signal | Reverse rotation limit input | Forward rotation limit input |
| b+4 | Axis error code | | | | | | | | | | | | | | | |
| b+5 | Not used (reserved by the system). | | | | | | | | Monitor 2 type | | | | Monitor 1 type | | | |
| b+6 | Feedback present position | | | | | | | | | | | | | | | |
| b+7 | | | | | | | | | | | | | | | | |
| b+8 | Command present position | | | | | | | | | | | | | | | |
| b+9 | | | | | | | | | | | | | | | | |
| b+10 | Monitor 1 | | | | | | | | | | | | | | | |
| b+11 | | | | | | | | | | | | | | | | |
| b+12 | Monitor 2 | | | | | | | | | | | | | | | |
| b+13 | | | | | | | | | | | | | | | | |
| b+14 | Read data (Servo Parameters) | | | | | | | | | | | | | | | |
| b+15 | | | | | | | | | | | | | | | | |
| b+16 to b+23 | Not used (reserved by the system). | | | | | | | | | | | | | | | |
| b+24 | Not used (reserved by the system). | | Linear interpolation executing (See note 1.) | Not used (reserved by the system). | | | | | | | | | | | | Linear interpolation setting completed (See note 1.) |

**Note**

(1) Allocated in Axis Operating Input Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(2) The emergency stop input status is input only for SMARTSTEP Junior Servo Drivers. This status is not used (reserved by the system) by W-series Servo Drivers.



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# 4-3 Common Parameter Area

Common Parameters are used for basic settings for operating the PCU, such as allocation of the Axis Operating Memory Areas and settings for MECHATROLINK communications. The common parameters must be set when using the PCU.

## 4-3-1 Common Parameters Overview

Common Parameters are transferred to the PCU's internal memory using the data transfer command and saved in the PCU's flash memory using the SAVE DATA command. After setting and saving the Common Parameters, either cycle the power to the CPU Unit, or restart the PCU. This operation will enable the set parameters. The Common Parameter Area is used to set the following information.

| PCU's address | Contents | | Setting |
|---|---|---|---|
| | Bits 08 to 15 | Bits 00 to 07 | |
| 1838 hex | Axis Operating Output Memory Area designation | | Specifies the area allocated for the Axis Operating Output Memory Areas.<br>0000 hex: No setting 00B0 hex: CIO Area<br>00B1 hex: Work Area 00B2 hex: Holding Area<br>00B3 hex: Auxiliary Area 0082 hex: DM Area<br>0050 to 0059, 005A, 005B, 005C hex: EM Area (5□: □ = EM Bank No.) |
| 1839 hex | Beginning word of Axis Operating Output Memory Areas | | Specifies the beginning word of the Axis Operating Output Memory Areas.<br>The beginning word of the Operating Output Memory Area for Axis 1 is determined by the Axis Operating Output Memory Area designation and the word determined using this parameter. Each Axis is allocated 25 words in sequence from this word. |
| 183A hex | Axis Operating Input Memory Area designation | | Specifies the allocated area and beginning word for the Axis Operating Input Memory Areas.<br>The setting method is the same as for the Axis Operating Output Memory Areas. |
| 183B hex | Beginning word of Axis Operating Input Memory Areas | | |
| 183C hex to 1843 hex | Scan list | | Sets the axis allocations for axes 1 to 16 with 8 bytes per axis, as follows:<br>00 hex: Axis not used (default setting)<br>40 hex: Allocates axis to the Servo Driver. |
| 1856 hex | Transfer cycle | Communications cycle | Transfer cycle:<br>00 hex: 1 ms (default setting)<br>01 hex: 1 ms 02 hex: 2 ms 03 hex: 3 ms<br>04 hex: 4 ms 05 hex: 5 ms 06 hex: 6 ms<br>07 hex: 7 ms 08 hex: 8 ms A2 hex: 0.25 ms<br>A5 hex: 0.5 ms<br>Communications cycle:<br>Sets a multiplier used to obtain integer multiples of the transfer cycle.<br>Set value: 00 to 20 hex<br>The default setting 00 is the same as when the cycle is set to 3.<br>Set as follows:<br>Transfer cycle x communications cycle (multiplier) ≤ 32 ms |



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| PCU's address | Contents | | | Setting |
|---|---|---|---|---|
| | Bits 08 to 15 | Bits 00 to 07 | | |
| 1857 hex | 00 (fixed) | 07 to 04 | 03 to 00 | C2 master connection:<br>0: No C2 master (default setting)<br>1: C2 master connected<br>Number of communications retries:<br>Set value: 0 to 7, F<br>The default setting 0 is the same as when the number of retries is set to 1. |
| | | C2 master connection | Number of communications retries | |

## 4-3-2 Common Parameter Details

The data set in the Common Parameter Area is as follows:

| Unit address | Name | Enable timing |
|---|---|---|
| 1838 hex | Axis Operating Output Memory Area designation | At powerup or restart. |
| 1839 hex | Beginning word of Axis Operating Output Memory Areas | |
| 183A hex | Axis Operating Input Memory Area designation | |
| 183B hex | Beginning word of Axis Operating Input Memory Areas | |

| Data configuration | 15 08 07 00 | Data setting range | Default |
|---|---|---|---|
| 1838 hex | Axis Operating Output Memory Area designation | 00B0 to 00B3, 0082, 0050 to 005C hex | 0000 |
| 1839 hex | Beginning word of Axis Operating Output Memory Areas | 0000 to 7FFF hex | 0000 |
| 183A hex | Axis Operating Input Memory Area designation | 00B0 to 00B3, 0082, 0050 to 005C hex | 0000 |
| 183B hex | Beginning word of Axis Operating Input Memory Areas | 0000 to 7FFF hex | 0000 |

**Data Details**

**Axis Operating Output Memory Area Designation**

Specifies the words allocated for the Axis Operating Output Memory Areas.

0000 hex: No setting (default setting)
00B0 hex: CIO Area
00B1 hex: Work Area
00B2 hex: Holding Area
00B3 hex: Auxiliary Area
0082 hex: DM Area
0050 to 0059, 005A, 005B, 005C hex:
EM Area (005□ hex: □ = EM Bank No.)

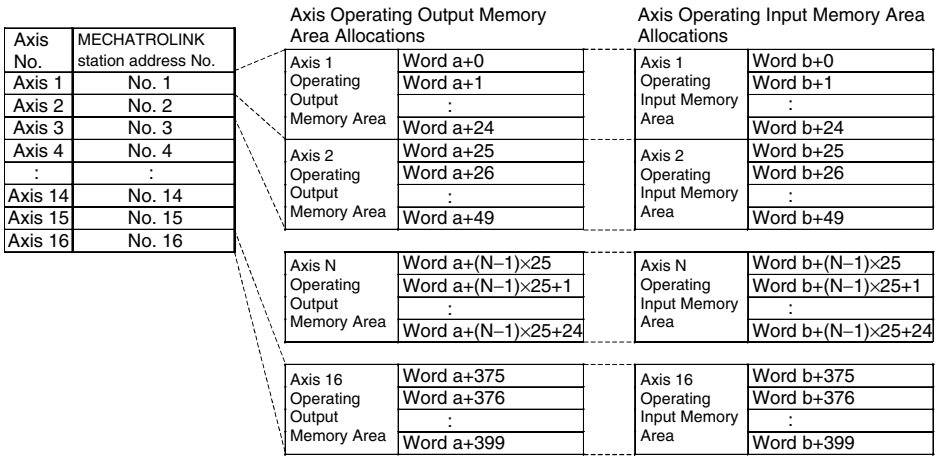
**Beginning Word of Axis Operating Output Memory Areas**

Specifies the beginning word of the Axis Operating Output Memory Areas.

The Axis Operating Output Memory Area designation and the word determined using this parameter are used as the beginning word of the Operating Output Memory Area for Axis 1. Each axis is allocated 25 words in sequence up to the highest axis number registered in the scan list.



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a: Beginning word of Axis Operating Output Memory Areas specified in Common Parameters.
b: Beginning word of Axis Operating Input Memory Areas specified in Common Parameters.

**Axis Operating Input Memory Area Designation:**

Specifies the words allocated for the Axis Operating Input Memory Areas.

The setting method is the same as for the Axis Operating Output Memory Areas.

**Beginning Word of Axis Operating Input Memory Areas:**

Specifies the beginning word of the Axis Operating Input Memory Areas.

The setting method is the same as for the Axis Operating Output Memory Areas.

**Note**

(1) Set the beginning word of the Axis Operating Output Memory Areas and Axis Operating Input Memory Areas in the Common Parameters so that the words allocated to each area do not exceed the upper limit of the range for each of the CPU Unit's I/O memory areas.
CPU Unit I/O Memory Areas
CIO Area: CIO 0000 to CIO 6143
Work Area: W000 to W511
Holding Area: H000 to H511
Auxiliary Area: A000 to A959
DM Area: D00000 to D32767
EM Area: E□_00000 to E□_32767 (□ = EM Bank No.)
The maximum set value for the beginning word of the Axis Operating Output/Input Memory Area is calculated as follows:
Maximum number of words in each area − Highest axis No. registered in scan list × 25 + 1

(2) If the setting exceeds the range of the I/O memory area, an Initialization Common Parameter Check Error (Unit error code 0028) will occur when the PCU power is turned ON or the Unit is restarted.
Example:
Beginning word of the Axis Operating Output Memory Area: CIO 6100
Connected axes: 2 min.
Axis 1: Output Area: CIO 6100 to CIO 6124
Axis 2: Output Area: CIO 6125 to CIO 6149
The highest word in the CIO Area is CIO 6143. Therefore, an error will occur.

(3) If the ranges set for the Axis Operating Output Memory Area and Axis Operating Input Memory Area overlap, an Initialization Common Parameter

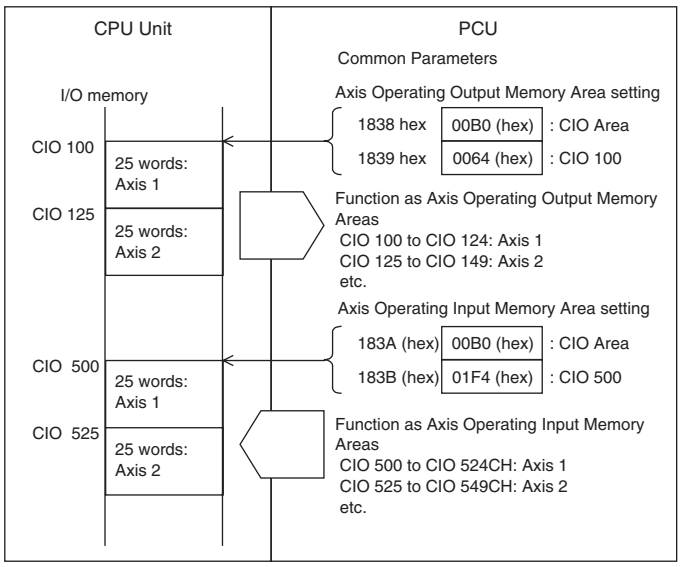


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Check Error (Unit error code 0028) will occur when the PCU power is turned ON or the Unit is restarted.

(4) Do not set the bank number of the EM Area that is being saved to file memory in the CPU Unit. When the EM Area for the bank saved to file memory has been specified, the information in the Operating Data Area will not be reflected, resulting in a malfunction. If multiple PCUs are mounted to a single PLC, make sure that the Operating Data Areas do not overlap. The PCU will not detect an error if the Operating Data Areas overlap, which may result in a malfunction.

**Setting Example**




**Details**

Refer to *6-2-2 Scan List and PCU Area Allocations*.

| Unit address | Name | Enable timing |
|---|---|---|
| 183C hex to 1843 hex | Scan list | At powerup or restart. |

| Data configuration | 15 08 07 00 | Data setting range | Default |
|---|---|---|---|
| 183C hex | Axis 2 allocation / Axis 1 allocation | 00 or 40 | 0000 |
| 183D hex | Axis 4 allocation / Axis 3 allocation | 00 or 40 | 0000 |
| 183E hex | Axis 6 allocation / Axis 5 allocation | 00 or 40 | 0000 |
| 183F hex | Axis 8 allocation / Axis 7 allocation | 00 or 40 | 0000 |
| 1840 hex | Axis 10 allocation / Axis 9 allocation | 00 or 40 | 0000 |
| 1841 hex | Axis 12 allocation / Axis 11 allocation | 00 or 40 | 0000 |
| 1842 hex | Axis 14 allocation / Axis 13 allocation | 00 or 40 | 0000 |
| 1843 hex | Axis 16 allocation / Axis 15 allocation | 00 or 40 | 0000 |



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**Data Details**

Set the allocations for the MECHATROLINK devices connected to the PCU.

Make the following settings using eight bits per axis for axes 1 to 16.
00 hex: Axis not used (no allocation).
40 hex: Axis allocated to the Servo Driver.

**Setting Example**

In this example, axes 1 to 3, axis 5, and axis 8 are allocated to the Servo Driver. (The axis number corresponds to the station number for the MECHATROLINK device.)

183C hex: 4040 hex
183D hex: 0040 hex
183E hex: 0040 hex
183F hex: 4000 hex
1840 to 1843 hex: 0000 hex

**Details**

Refer to *6-2-1 Scan List*.

| Unit address | Name | Enable timing |
|---|---|---|
| 1856 hex to 1857 hex | MECHATROLINK communications setting | At Powerup or restart |

| Data configuration | 15 08 07 04 03 00 | Data setting range | Default |
|---|---|---|---|
| 1856 hex | Transfer cycle \| Communications cycle | Transfer cycle: 00 to 08, A2, A5<br>Communications cycle: 00 to 20 hex | 0000 |
| 1857 hex | 00 (fixed) \| C2 master connection \| No. of communications retries | C2 master connection: 0, 1<br>No. of communications retries: 0 to 7, F | 0000 |

**Data Details**

This parameter is used to make the settings for MECHATROLINK communications. For details on settings, refer to *6-2-3 MECHATROLINK Communications Settings*.

**Transfer Cycle**

This parameter is used to set the cycle for sending and receiving data with MECHATROLINK communications.

00: 1 ms (default setting)

| | |
|---|---|
| 01: 1 ms | 05: 5 ms |
| 02: 2 ms | 06: 6 ms |
| 03: 3 ms | 07: 7 ms |
| 04: 4 ms | 08: 8 ms |
| A2 hex: 0.25 ms | A5 hex: 0.5 ms |

**Communications Cycle**

This parameter sets the cycle for refreshing data in the PCU and MECHATROLINK device. The communications cycle is set in the Common Parameters by setting the factor used to obtain integer multiples of the transfer cycle.

Set value: 00 to 20 hex

The default setting 00 is the same as when the cycle is set to 3. The communications cycle, however, is set as follows:
Transfer cycle × communications cycle (multiplier) ≤ 32 ms



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**Number of Communications Retries**

This parameter is used to set the maximum number of stations that will perform communications retries when sending/receiving data between the PCU and MECHATROLINK devices.

Set value: 0 to 7, F

The default setting 0 is the same as when the number of retries is set to 1. When F is specified, the number of retires is 0 (no retries).

**C2 Master Connection**

This parameter is used to set whether a separate communications master is connected to the PCU for MECHATROLINK system support. This parameter will be used for connecting future system support devices. Do not change the default setting of 0 (no C2 master).

0: No C2 master (default setting)
1: C2 master connected

**Setting Example**

Default Settings

1856 hex: 0000 hex
1857 hex: 0000 hex

The MECHATROLINK communications settings are as follows:

Transfer cycle: 1.0 ms
Communications cycle: × 3 (1.0 ms × 3 = 3.0 ms)
Number of communications retries: 1
There is no C2 master.

**Details**

Refer to *6-2-3 MECHATROLINK Communications Settings*.

# 4-4 Axis Parameter Area

The Axis Parameter Area is used to make settings for axis control, such as origin input signal selection and origin search method. The axis parameters for the axes to be used must be set.

## 4-4-1 Axis Parameters Overview

Axis Parameters are transferred to the PCU's internal memory using the data transfer command and saved in the PCU's flash memory using the SAVE DATA command. Turn ON the power to the CPU Unit again, or restart the PCU to read the Axis Parameters saved in flash memory to the PCU's internal memory.

The Axis Parameters can be changed at any time by sending the WRITE DATA command to the PCU. The changed parameters are enabled as soon as the data has been written without any errors. The addresses in the PCU's internal memory allocated for Axis Parameters are determined by the axis number of each axis using the following equation.

Beginning word of Axis Parameter Area for Axis N: d = 1860 hex + (N–1) × 14 hex (N = 1 to 16)

The following table lists the beginning word of each Axis Parameter Area.

| Axis No. | Beginning word d | Axis No. | Beginning word d | Axis No. | Beginning word d | Axis No. | Beginning word d |
|---|---|---|---|---|---|---|---|
| Axis 1 | 1860 hex | Axis 5 | 18B0 hex | Axis 9 | 1900 hex | Axis 13 | 1950 hex |
| Axis 2 | 1874 hex | Axis 6 | 18C4 hex | Axis 10 | 1914 hex | Axis 14 | 1964 hex |
| Axis 3 | 1888 hex | Axis 7 | 18D8 hex | Axis 11 | 1928 hex | Axis 15 | 1978 hex |
| Axis 4 | 189C hex | Axis 8 | 18EC hex | Axis 12 | 193C hex | Axis 16 | 198C hex |



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| PCU's address | Contents | | | | | | Setting |
|---|---|---|---|---|---|---|---|
| | 15 to 14 | 13 | 12 | 11 to 08 | 07 to 04 | 03 to 00 | |
| d | Origin input signal selection | | | | Interrupt input signal selection | | Select the origin input signal and interrupt input signal.<br>00: Phase Z (default setting)<br>01: External latch signal 1 input<br>02: External latch signal 2 input<br>03: External latch signal 3 input |
| d+1 | 0 (fixed) | Origin search preset | Origin search direction | Origin detection method | Origin search operation | 0 (fixed) | Set the origin search operation.<br>Origin search direction<br>0: Reversal mode 1 (default setting)<br>1: Reverse mode 2<br>2: Single-direction mode<br>3: Reversal mode 3 (See note.)<br>Origin detection method (See note.)<br>0: With origin proximity input signal reversal (default setting)<br>1: Without origin proximity input signal reversal<br>2: Not use origin proximity input signal<br>Origin search direction<br>0: Forward (default setting)<br>1: Reverse<br>Origin search preset (See note.)<br>0: Not Set (default setting)<br>1: Set |
| d+2 | 0 (fixed) | | | 0 (fixed) | 0 (fixed) | Encoder type | 0: Incremental encoder (default setting)<br>1: Absolute encoder |

**Note** The reversal mode 3 setting for the origin search operation, the origin detection method, and the origin search preset can be used only with Position Control Units with unit version 2.0 or later. They cannot be used with Position Control Units with unit version 1.3 or earlier.

For details on transferring data, refer to *SECTION 5 Transferring and Saving Data*.

## 4-4-2 Axis Parameter Details

The data set in the Axis Parameter Area is as follows:
d = 1860 hex + (Axis No. −1) × 14 hex

| Unit address | Name | Enable timing |
|---|---|---|
| d | Input signal selection | After completion of data writing |

| Data configuration | 15 08 07 00 | Data setting range | Default |
|---|---|---|---|
| d | Origin input signal selection \| Interrupt input signal selection | Origin input signal selection: 00 to 03<br>Interrupt input signal selection: 00 to 03 | 0000 |

**Data Details**

**Origin Input Signal Selection**

Use this parameter to select the origin input signal to be used with origin search.

00: Phase Z
01: External latch signal 1 input
02: External latch signal 2 input
03: External latch signal 3 input



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**Interrupt Input Signal Selection**

Select the interrupt input signal used for interrupt feeding.

00: Phase Z
01: External latch signal 1 input
02: External latch signal 2 input
03: External latch signal 3 input

**Note**

(1) When 01, 02, or 03 (external latch signals 1 to 3) is selected in the origin input signal selection/interrupt input signal selection, the external latch signal to be used must be allocated in the Servo Driver's external input allocations. (Refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.)

(2) When using a SMARTSTEP Junior Servo Driver, only 00 (phase Z) and 01 (external latch signal 1) can be used for the origin input signal selection and interrupt input signal selection. Do not select any other input signals.

**Setting Example**

In this example, the origin search is performed using the Servomotor's phase Z as the origin input, and external latch signal 2 as the interrupt input signal for interrupt feeding.

Beginning word of Axis Parameter Area for axis 4:
d = 1860 hex + (4 − 1) × 14 hex = 189C hex
189C hex: 0002 hex = Origin input signal selection: Phase Z (00 hex); Interrupt input signal selection: External latch signal 2 (02 hex)

**Details**

Refer to *8-2 Origin Search Operation*, and *9-5 Interrupt Feeding*.

d = 1860 hex + (Axis No. −1) × 14 hex

| Unit address | Name | Enable timing |
|---|---|---|
| d+1, d+2 | Operation mode selection | After completion of data writing |

| Data configuration | 15 12 11 08 07 04 03 00 | Data setting range | Default |
|---|---|---|---|
| d+1 | 0 (fixed) \| Origin search method \| Origin search operation \| 0 (fixed)<br>Bit 12: Origin search direction<br>Bit 13: Origin search preset | Origin search operation: 0 to 3<br>Origin detection method: 0 to 2<br>Origin search direction: 0, 1<br>Origin search preset : 0, 1 | 0000 |
| d+2 | 00 (fixed) \| 0 (fixed) \| Encoder type | Encoder type: 0, 1 | 0000 |

**Data Details**

Use there parameters to make the operation mode settings (origin search operation mode) for each axis of the PCU. The bits specified as “0/00 (fixed)” are reserved by the system in the PCU and must always be set to 0. For details on settings, refer to *8-2-3 Data Settings Required for Origin Search*, and *8-6-3 PCU Data Settings for Using Absolute Encoders*.

**Origin Search Operation**

Select the origin search operation pattern. For details on operation patterns, refer to *8-2-4 Origin Search Operation*.



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0: Reversal mode 1
1: Reversal mode 2
2: Single-direction mode
3: Reversal mode 3 (unit version 2.0 or later)

**Origin Detection Method (Unit Version 2.0 or Later)**

Select the origin detection method. For details on operation patterns, refer to *8-2-4 Origin Search Operation*.

0: With origin proximity input signal reversal
1: Without origin proximity input signal reversal
2: Not use origin proximity input signal

**Origin Search Direction**

This parameter sets the origin search direction to match the Zero Point Return Direction setting (Pn816) in the Servo Parameters. This parameter and Servo Parameter Pn816 must be set to the same value. For details on origin search operations, refer to *8-2-4 Origin Search Operation*.

0: Forward direction
1: Reverse direction

**Origin Search Preset (Unit Version 2.0 or Later)**

The present position can be automatically set to a preset value when the origin search has been completed normally. Refer to *8-2-6 Origin Search Preset* for details on the origin search preset.

0: Present position not set to preset value at completion of origin search
1: Present position set to preset value at completion of origin search

**Encoder Type**

Use this parameter to select incremental encoder or absolute encoder as the encoder for the Servomotor. Set the encoder type according to the functions of the Servomotor and Servo Driver being used, as follows.

0: Incremental encoder
1: Absolute encoder

**Setting Example**

In this example, an incremental encoder is used with axis 5, and origin search is set to reverse direction in single-direction mode.

18B1 hex: 1020 hex
18B2 hex: 0000 hex

**Details**

- *8-2-3 Data Settings Required for Origin Search*
- *8-2-4 Origin Search Operation*
- *8-2-6 Origin Search Preset*.
- *8-6-3 PCU Data Settings for Using Absolute Encoders*

# 4-5 Servo Parameter Area

The Servo Parameters listed here can be used when the Position Control Unit is used with an OMRON W-series Servo Driver (R88D-WT□) with a Yaskawa MECHATROLINK-II Application Module (JUSP-NS115), with a W-series Servo Driver with Built-in MECHATROLINK-II Communications (R88D-WN□-ML2), or with a SMARTSTEP Junior Servo Driver with Built-in MECHATROLINK-II Communications (R7D-ZN□-ML2).

For further details on each of the parameters, refer to the operation manuals for OMRON W-series Servo Drivers, SMARTSTEP Junior Servo Driver, and Yaskawa JUSP-NS115 MECHATROLINK-II Application Modules.



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The default settings for parameters Pn000 to Pn601 in the parameter tables for the R88D-WT□ W-series Servo Driver used with the JUSP-NS115 are automatically set to the default parameter settings for when the JUSP-NS115 MECHATROLINK-II Application Module is mounted to a W-series Servo Driver. Parameters from Pn800 onwards are enabled when the JUSP-NS115 is installed. The parameter names and default settings for these parameters follow those specified by the JUSP-NS115 operation manual.

The timing for Servo Parameters to be enabled are classified into the following two types.

Online (online parameters): Changed settings are enabled immediately after Servo Parameters have been written.

Offline (offline parameters): Changed settings are enabled when the Servo Driver power is cycled or DEVICE SETUP is executed.

The *Details* column indicates whether the following conditions apply to the corresponding parameter.

- Online parameters that can be changed when the axis is stopped (Busy Flag = 0) only.
- Parameters are automatically set when a JUSP-NS115 MECHATROLINK-II Application Module is installed. Parameters that are used with fixed set values are indicated in the *Details* column as “fixed” with the set value.
- Parameters with standard set values when using MECHATROLINK are indicated in the *Details* column as “standard” with the set value.
  The standard settings are basic settings required when using the PCU. This manual describes operations assuming standard settings are being used.

For details on fixed and standard settings, refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.

**Note** Make sure that the equipment will not be adversely affected before changing the Servo Parameters (WRITE SERVO PARAMETER, SAVE SERVO PARAMETER). Refer to the Servo Driver's operation manual and always check the effect of changing the settings before changing the Servo Parameters.



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## 4-5-1 R88D-WT□ W-series Servo Drivers Equipped with JUSP-NS115

### Function Selection Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn000 | Function selection basic switch | 2 | 0 | Reverse rotation | 0 | CCW direction is taken for positive command. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | CW direction is taken for positive command. | | | | | |
| | | | 1 | Not used. | 1 | The setting is disabled. (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 2 | Unit No. setting | 0 to F | Servo Driver communications unit number setting when using personal computer monitoring software | 0 | --- | --- | Offline | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn001 | Function selection application switch 1 | 2 | 0 | Select stop if an alarm occurs when Servomotor is OFF | 0 | Servomotor stopped by dynamic brake. | 2 | --- | --- | Offline | --- |
| | | | | | 1 | Servomotor stopped by dynamic brake. Dynamic brake released after stopping. | | | | | |
| | | | | | 2 | Servomotor stopped with free run. | | | | | |
| | | | 1 | Select stop when prohibited drive is input | 0 | Stop according to Pn001.0 settings (release Servomotor after stopping). | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Stop Servomotor using torque set in Pn406, and lock Servomotor after stopping. | | | | | |
| | | | | | 2 | Stop Servomotor using torque set in Pn406, and release Servomotor after stopping. | | | | | |
| | | | 2 | Select AC/DC power input | 0 | AC power supply: AC power supplied from L1, L2, (L3) terminals | 0 | --- | --- | Offline | --- |
| | | | | | 1 | DC power supply: DC power supplied from +1, – terminals | | | | | |
| | | | 3 | Select warning code output | 0 | Alarm code only output from ALO1, ALO2, ALO3 | 1 | --- | --- | Offline | --- |
| | | | | | 1 | Alarm code and warning code both output from ALO1, ALO2, ALO3 | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn002 | Function selection application switch 2 | 2 | 0 | Torque command input change (during speed control) | 0 | Option command value not used. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Option command value 1 used as torque limit input. | | | | | |
| | | | | | 2 | Option command value 1 used as the torque feed forward input. | | | | | |
| | | | | | 3 | Option command values 1 and 2 used as torque limit inputs according to the forward/reverse rotation current limit setting. | | | | | |
| | | | 1 | Speed command input change (during torque control) | 0 | Option command value not used. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Option command value 1 used as speed limit input. | | | | | |
| | | | 2 | Operation switch when using absolute encoder | 0 | Use as absolute encoder. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Use as incremental encoder. | | | | | |
| | | | 3 | Fully-closed encoder usage method | 0 | Fully-closed encoder is not used. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Fully-closed encoder is used without phase Z. | | | | | |
| | | | | | 2 | Fully-closed encoder is used with phase Z. | | | | | |
| | | | | | 3 | Fully-closed encoder is used in Reverse Rotation Mode without phase Z. | | | | | |
| | | | | | 4 | Fully-closed encoder is used in Reverse Rotation Mode with phase Z. | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn003 | Function selection application switch 3 | 2 | 0 | Analog monitor 1 (AM) allocation | 0 | Servomotor rotation speed: 1 V/1,000 r/min | 2 | --- | --- | Online | --- |
| | | | | | 1 | Speed command: 1 V/1,000 r/min | | | | | |
| | | | | | 2 | Torque command: 1 V/100% | | | | | |
| | | | | | 3 | Position deviation: 0.05 V/1 command unit | | | | | |
| | | | | | 4 | Position deviation: 0.05 V/100 command units | | | | | |
| | | | | | 5 | Command pulse frequency: 1 V/1,000 r/min | | | | | |
| | | | | | 6 | Servomotor rotation speed: 1 V/250 r/min | | | | | |
| | | | | | 7 | Servomotor rotation speed: 1 V/125 r/min | | | | | |
| | | | | | 8 to F | Not used. | | | | | |
| | | | 1 | Analog monitor 2 (NM) allocation | 0 to F | Same as Pn003.0 | 0 | --- | --- | Online | --- |
| | | | 2 to 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn004 | Not used. | --- | --- | --- | --- | (Do not change the setting.) | 0200 | --- | --- | --- | Fixed setting: 0200 |
| Pn005 | Not used. | --- | --- | --- | --- | (Do not change the setting.) | 0000 | --- | --- | --- | --- |

## Servo Gain Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn100 | Speed loop gain | 2 | Adjusts speed loop responsiveness. | | | | 80 | Hz | 1 to 2000 | Online | --- |
| Pn101 | Speed loop integration constant | 2 | Speed loop integral time constant | | | | 2000 | ×0.01 ms | 15 to 51200 | Online | --- |
| Pn102 | Position loop gain | 2 | Adjusts position loop responsiveness. | | | | 40 | 1/s | 1 to 2000 | Online | --- |
| Pn103 | Inertia ratio | 2 | Sets using the ratio between the machine system inertia and the Servomotor rotor inertia. | | | | 300 | % | 0 to 20000 | Online | --- |
| Pn104 | Speed loop gain 2 | 2 | Adjusts speed loop responsiveness (enabled by automatic gain switching input). | | | | 80 | Hz | 1 to 2000 | Online | --- |
| Pn105 | Speed loop integration constant 2 | 2 | Speed loop integral time constant (enabled by automatic gain switching input) | | | | 2000 | ×0.01 ms | 15 to 51200 | Online | --- |
| Pn106 | Position loop gain 2 | 2 | Adjusts position loop responsiveness (enabled by automatic gain switching input). | | | | 40 | 1/s | 1 to 2000 | Online | --- |
| Pn107 | Bias rotational speed | 2 | Sets position control bias. | | | | 0 | r/min | 0 to 450 | Online | --- |
| Pn108 | Bias addition band | 2 | Sets the position control bias operation start using deviation counter pulse width. | | | | 7 | Command unit | 0 to 250 | Online | --- |
| Pn109 | Feed-forward amount | 2 | Position control feed-forward compensation value | | | | 0 | % | 0 to 100 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn10A | Feed-forward command filter | 2 | Sets position control feed-forward command filter. | | | | 0 | ×0.01 ms | 0 to 6400 | Online | --- |
| Pn10B | Speed control setting | 2 | 0 | P control switching conditions | 0 | Sets internal torque command value conditions (Pn10C). | 4 | --- | --- | Online | --- |
| | | | | | 1 | Sets speed command value conditions (Pn10D). | | | | | |
| | | | | | 2 | Sets acceleration command value conditions (Pn10E). | | | | | |
| | | | | | 3 | Sets deviation pulse value conditions (Pn10F). | | | | | |
| | | | | | 4 | No P control switching function | | | | | |
| | | | 1 | Speed control loop switching | 0 | PI control | 0 | --- | --- | Offline | --- |
| | | | | | 1 | IP control | | | | | |
| | | | 2 | Automatic gain switching | 0 | Automatic gain switching disabled | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Gain switching using position commands | | | | | |
| | | | | | 2 | Gain switching using position deviation | | | | | |
| | | | | | 3 | Gain switching using position commands and position deviation | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn10C | P control switching (torque command) | 2 | Sets level of torque command to switch from PI control to P control. | | | | 200 | % | 0 to 800 | Online | --- |
| Pn10D | P control switching (speed command) | 2 | Sets level of speed command to switch from PI control to P control. | | | | 0 | r/min | 0 to 10000 | Online | --- |
| Pn10E | P control switching (acceleration command) | 2 | Sets level of acceleration command to switch from PI control to P control. | | | | 0 | 10 r/min/s | 0 to 3000 | Online | --- |
| Pn10F | P control switching (deviation pulse) | 2 | Sets level of deviation pulses to switch from PI control to P control. | | | | 10 | Command unit | 0 to 10000 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn110 | Online autotuning setting | 2 | 0 | Select online autotuning | 0 | Autotunes initial operations only after power is turned ON. | 2 | --- | --- | Offline | --- |
| | | | | | 1 | Always autotunes. | | | | | |
| | | | | | 2 | No autotuning | | | | | |
| | | | 1 | Select speed feedback compensation function | 0 | ON | 1 | --- | --- | Online | --- |
| | | | | | 1 | OFF | | | | | |
| | | | 2 | Select adhesive friction compensation function | 0 | Friction compensation: OFF | 0 | --- | --- | Online | --- |
| | | | | | 1 | Friction compensation: Rated torque ratio small | | | | | |
| | | | | | 2 | Friction compensation: Rated torque ratio large | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn111 | Speed feedback compensation gain | 2 | Adjusts speed loop feedback gain. | | | | 100 | % | 1 to 500 | Online | --- |
| Pn112 to Pn123 | Not used. | --- | (Do not change the setting.) | | | | --- | --- | --- | --- | --- |
| Pn124 | Automatic gain switching timer | 2 | Sets the switching delay after conditions have been met, when the automatic gain switching function is used. (Pn10B.2 = 1 to 3). | | | | 100 | ms | 1 to 10000 | Online | --- |
| Pn125 | Automatic gain switching width (amount of position deviation) | 2 | Sets the position deviation used as the switching condition when the automatic gain switching function by position deviation (Pn10B.2 = 2, 3) is used. | | | | 7 | Command unit | 1 to 250 | Online | --- |

## Position Control Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn200 | Position control setting 1 | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | Fixed setting: 1 |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn201 | Encoder divider rate | 2 | Sets the number of output pulses from the Servo Driver. | | | | 1000 | Pulses /rotation | 16 to 16384 | Offline | --- |
| Pn202 | Electronic gear ratio G1 (numerator) | 2 | Sets the pulse rate for the command pulses and Servomotor travel distance. $0.01 \leq G1/G2 \leq 100$ | | | | 4 | --- | 1 to 65535 | Offline | --- |
| Pn203 | Electronic gear ratio G2 (denominator) | 2 | | | | | 1 | --- | 1 to 65535 | Offline | --- |
| Pn204 | Not used. | --- | (Do not change the setting.) | | | | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn205 | Absolute encoder multi-turn limit setting | 2 | Sets the limit to the rotation speed when using a Servomotor with an absolute encoder. | | | | 65535 | Rotations | 0 to 65535 | Offline | --- |
| Pn206 | Number of fully-closed encoder pulses | 2 | Sets the number of fully-closed encoder pulses for each motor rotation. | | | | 16384 | Pulses /rotation | 513 to 32768 | Offline | --- |
| Pn207 | Position control setting 2 | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | Fixed setting: 1 |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn208 | Not used. | --- | (Do not change the setting.) | | | | 0 | --- | --- | --- | --- |
| Pn212 | Not used. | --- | (Do not change the setting.) | | | | 2048 | --- | --- | --- | --- |
| Pn217 | Not used. | --- | (Do not change the setting.) | | | | 1 | --- | --- | --- | --- |
| Pn218 | Position control setting 3 | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 1 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |

## Speed Control Parameters

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn300 | Not used. | --- | (Do not change the setting.) | 1000 | --- | --- | --- | --- |
| Pn301 | Not used. | --- | (Do not change the setting.) | 100 | --- | --- | --- | --- |
| Pn302 | Not used. | --- | (Do not change the setting.) | 200 | --- | --- | --- | --- |
| Pn303 | Not used. | --- | (Do not change the setting.) | 300 | --- | --- | --- | --- |
| Pn304 | Jog speed | 2 | Sets the rotation speed used during jog operation (executed from the Servo Driver's Parameter Unit). | 500 | r/min | 0 to 10000 | Online | --- |
| Pn305 | Soft start acceleration time | 2 | Sets acceleration time during speed control soft start. | 0 | ms | 0 to 10000 | Online | --- |
| Pn306 | Soft start deceleration time | 2 | Sets deceleration time during speed control soft start. | 0 | ms | 0 to 10000 | Online | --- |
| Pn307 | Not used. | --- | (Do not change the setting.) | 40 | --- | --- | --- | --- |
| Pn308 | Speed feedback filter time constant | 2 | Sets filter time constant for speed feedback. | 0 | ×0.01 ms | 0 to 65535 | Online | --- |
| Pn309 | Not used. | --- | (Do not change the setting.) | 60 | --- | --- | --- | --- |

## Torque Control (Torque Limit) Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn400 | Not used. | --- | (Do not change the setting.) | | | | 30 | --- | --- | --- | --- |
| Pn401 | Torque command filter time constant | 2 | Sets the filter time constant for the internal torque command. | | | | 40 | ×0.01 ms | 0 to 65535 | Online | --- |
| Pn402 | Forward torque limit | 2 | Forward rotation output torque limit (rated torque ratio). | | | | 350 | % | 0 to 800 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn403 | Reverse torque limit | 2 | Reverse rotation output torque limit (rated torque ratio). | | | | 350 | % | 0 to 800 | Online | --- |
| Pn404 | Forward rotation external current limit | 2 | Output torque limit during input of forward rotation current limit (rated torque ratio). | | | | 100 | % | 0 to 800 | Online | --- |
| Pn405 | Reverse rotation external current limit | 2 | Output torque limit during input of reverse rotation current limit (rated torque ratio). | | | | 100 | % | 0 to 800 | Online | --- |
| Pn406 | Emergency stop torque | 2 | Deceleration torque when an error occurs (rated torque ratio). | | | | 350 | % | 0 to 800 | Online | --- |
| Pn407 | Speed limit | 2 | Sets the speed limit in torque control mode. | | | | 3000 | r/min | 0 to 10000 | Online | --- |
| Pn408 | Torque command setting | 2 | 0 | Selects notch filter 1 function | 0 | Notch filter 1 not used. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Notch filter 1 used for torque commands. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Selects notch filter 2 function | 0 | Notch filter 2 not used. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Notch filter 2 used for torque commands. | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn409 | Notch filter 1 frequency | 2 | Sets notch filter 1 frequency for torque command. | | | | 2000 | Hz | 50 to 2000 | Online | --- |
| Pn40A | Notch filter 1 Q value | 2 | Sets Q value of notch filter 1. | | | | 70 | ×0.01 | 50 to 400 | Online | --- |
| Pn40B | Notch filter 2 frequency | 2 | Sets notch filter 2 frequency for torque command. | | | | 2000 | Hz | 50 to 2000 | Online | --- |
| Pn40C | Notch filter 2 Q value | 2 | Sets Q value of notch filter 2. | | | | 70 | ×0.01 | 50 to 400 | Online | --- |

## I/O and Status Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn500 | Positioning completion range 1 | 2 | Sets the width of the positioning completed range. | | | | 3 | Command unit | 0 to 250 | Online | --- |
| Pn501 | Not used. | --- | (Do not change the setting.) | | | | 10 | --- | --- | --- | --- |
| Pn502 | Rotation speed for motor rotation detection | 2 | Sets the number of rotations for detecting the Zero Speed Flag. | | | | 20 | r/min | 1 to 10000 | Online | --- |
| Pn503 | Speed conformity signal output width | 2 | Sets the allowable fluctuation range (rotation speed) for the Speed Conformity Flag. | | | | 10 | r/min | 0 to 100 | Online | --- |
| Pn504 | Positioning completion range 2 | 2 | Sets the proximity range for the Positioning Proximity Flag. | | | | 3 | Command unit | 1 to 250 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn505 | Deviation counter overflow level | 2 | Sets the detection level for the deviation counter over alarm. | | | | 1024 | ×256 pulses | 1 to 32767 | Online | --- |
| Pn506 | Brake timing 1 | 2 | Sets the delay from the brake command to the Servomotor turning OFF. | | | | 0 | ×10 ms | 0 to 50 | Online | --- |
| Pn507 | Brake command speed | 2 | Sets the rotation speed for outputting the brake command. | | | | 100 | r/min | 0 to 10000 | Online | --- |
| Pn508 | Brake timing 2 | 2 | Sets the delay from the Servomotor turning OFF to the brake command output. | | | | 50 | ×10 ms | 10 to 100 | Online | --- |
| Pn509 | Momentary hold time | 2 | Sets the time during which alarm detection is disabled when a power failure occurs. | | | | 20 | ms | 20 to 1000 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50A | Input signal selection 1 | 2 | 0 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | Fixed setting: 1 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 3 | POT (forward drive prohibited input) signal input terminal allocation | 0 | Allocated to CN1, pin 40: Valid for low input | 8 | --- | --- | Offline | Standard setting: 2 |
| | | | | | 1 | Allocated to CN1, pin 41: Valid for low input | | | | | |
| | | | | | 2 | Allocated to CN1, pin 42: Valid for low input | | | | | |
| | | | | | 3 | Allocated to CN1, pin 43: Valid for low input | | | | | |
| | | | | | 4 | Allocated to CN1, pin 44: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 45: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 46: Valid for low input | | | | | |
| | | | | | 7 | Always valid. | | | | | |
| | | | | | 8 | Always invalid. | | | | | |
| | | | | | 9 | Allocated to CN1, pin 40: Valid for high input | | | | | |
| | | | | | A | Allocated to CN1, pin 41: Valid for high input | | | | | |
| | | | | | B | Allocated to CN1, pin 42: Valid for high input | | | | | |
| | | | | | C | Allocated to CN1, pin 43: Valid for high input | | | | | |
| | | | | | D | Allocated to CN1, pin 44: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 45: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 46: Valid for high input | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50B | Input signal selection 2 | 2 | 0 | NOT (reverse drive prohibited input) signal input terminal allocation | 0 to F | Same as Pn50A.3 | 8 | --- | --- | Offline | Standard setting: 3 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 2 | PCL (forward rotation current limit) signal input terminal allocation | 0 to F | Same as Pn50A.3 | 5 | --- | --- | Offline | Standard setting: 8 |
| | | | 3 | NCL (reverse rotation current limit) signal input terminal allocation | 0 to F | Same as Pn50A.3 | 6 | --- | --- | Offline | Standard setting: 8 |
| Pn50C | Input signal selection 3 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| Pn50D | Input signal selection 4 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| Pn50E | Output signal selection 1 | 2 | 0 | INP1 (positioning completed 1) signal output terminal allocation | 0 | Not used. | 1 | --- | --- | Offline | Standard setting: 1 |
| | | | | | 1 | Allocated to CN1, pins 25, 26 | | | | | |
| | | | | | 2 | Allocated to CN1, pins 27, 28 | | | | | |
| | | | | | 3 | Allocated to CN1, pins 29, 30 | | | | | |
| | | | 1 | VCMP (speed conformity) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 1 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | TGON (Servomotor rotation detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 2 | --- | --- | Offline | Standard setting: 0 |
| | | | 3 | READY (Servomotor warmup complete) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 3 | --- | --- | Offline | Standard setting: 3 |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50F | Output signal selection 2 | 2 | 0 | CLIMT (current limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 1 | VLIMT (speed limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | BKIR (brake interlock) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 2 |
| | | | 3 | WARN (warning) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| Pn510 | Output signal selection 3 | 2 | 0 | INP2 (positioning completed 2) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn511 | Input signal selection 5 | 2 | 0 | DEC signal input terminal allocation | 0 | Allocated to CN1, pin 40: Valid for low input | 8 | --- | --- | Offline | Standard setting: 1 |
| | | | | | 1 | Allocated to CN1, pin 41: Valid for low input | | | | | |
| | | | | | 2 | Allocated to CN1, pin 42: Valid for low input | | | | | |
| | | | | | 3 | Allocated to CN1, pin 43: Valid for low input | | | | | |
| | | | | | 4 | Allocated to CN1, pin 44: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 45: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 46: Valid for low input | | | | | |
| | | | | | 7 | Always enabled. | | | | | |
| | | | | | 8 | Always disabled. | | | | | |
| | | | | | 9 | Allocated to CN1, pin 40: Valid for high input | | | | | |
| | | | | | A | Allocated to CN1, pin 41: Valid for high input | | | | | |
| | | | | | B | Allocated to CN1, pin 42: Valid for high input | | | | | |
| | | | | | C | Allocated to CN1, pin 43: Valid for high input | | | | | |
| | | | | | D | Allocated to CN1, pin 44: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 45: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 46: Valid for high input | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn511 | Input signal selection 5 | 2 | 1 | EXT1 signal input terminal allocation | 0 to 3 | Always disabled. | 8 | --- | --- | Offline | Standard setting: 4 |
| | | | | | 4 | Allocated to CN1, pin 44: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 45: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 46: Valid for low input | | | | | |
| | | | | | 7 | Always enabled. | | | | | |
| | | | | | 8 | Always disabled. | | | | | |
| | | | | | 9 to C | Always disabled. | | | | | |
| | | | | | D | Allocated to CN1, pin 44: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 45: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 46: Valid for high input | | | | | |
| | | | 2 | EXT2 signal input terminal allocation | 0 to F | Same as Pn511.1 | 8 | --- | --- | Offline | Standard setting: 5 |
| | | | 3 | EXT3 signal input terminal allocation | 0 to F | Same as Pn511.1 | 8 | --- | --- | Offline | Standard setting: 6 |
| Pn512 | Output signal reverse | 2 | 0 | Output signal reverse for CN1 pins 25, 26 | 0 | Not reversed. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Reversed. | | | | | |
| | | | 1 | Output signal reverse for CN1 pins 27, 28 | 0, 1 | Same as above | 0 | --- | --- | Offline | --- |
| | | | 2 | Output signal reverse for CN1 pins 29, 30 | 0, 1 | Same as above | 0 | --- | --- | Offline | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn513 | Input signal selection 6 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn51A | Motor-load deviation over level | 2 | Sets the allowable range for the number of pulses for fully-closed encoders and semi-closed encoders. | | | | 0 | Pulse | 0 to 32767 | Online | --- |
| Pn51B | Not used. | --- | (Do not change the setting.) | | | | 100 | --- | --- | --- | --- |
| Pn51C | Not used. | --- | (Do not change the setting.) | | | | 450 | --- | --- | --- | --- |
| Pn51E | Deviation counter overflow warning level | 2 | Sets the detection level for the deviation counter overflow warning. | | | | 0 | % | 0 to 100 | Online | --- |



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### Other Parameters

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn600 | Regeneration resistor capacity | 2 | Setting for the regeneration resistance load ratio monitoring calculations. | 0 | ×10 W | From 0 (Varies by Unit.) | Online | --- |
| Pn601 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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### Control Function Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn800 | Communications control | 2 | 0 | MECHATROLINK-II communications check mask | 0 | Detects both communications errors (A.E6) and synchronization errors (A.E5). | 0 | --- | --- | Online | Always set to 0. |
| | | | | | 1 | Ignores communications errors (A.E6). | | | | | |
| | | | | | 2 | Ignores synchronization errors (A.E5). | | | | | |
| | | | | | 3 | Ignores both communications errors (A.E6) and synchronization errors (A.E5). | | | | | |
| | | | 1 | Warning check mask | 0 | Detects parameter setting warnings (A.94), MECHATROLINK command warnings (A.95), and communications errors (A.96). | 4 | --- | --- | Online | Always set to 4 or 0. |
| | | | | | 1 | Ignores parameters setting warnings (A.94). | | | | | |
| | | | | | 2 | Ignores MECHATROLINK-II command warnings (A.95). | | | | | |
| | | | | | 3 | Ignores both parameter setting warnings (A.94) and MECHATROLINK-II command warnings (A.95). | | | | | |
| | | | | | 4 | Ignores communications errors (A.96). | | | | | |
| | | | | | 5 | Ignores both parameter setting warnings (A.94) and communications errors (A.96). | | | | | |
| | | | | | 6 | Ignores both MECHATROLINK-II command warnings (A.95) and communications errors (A.96). | | | | | |
| | | | | | 7 | Ignores parameter setting warnings (A.94), MECHATROLINK-II command warnings (A.95), and communications errors (A.96). | | | | | |
| | | | 2 | Communications error count at single transmission | 0 to F | Detects a communications error (A.E6) when the number of errors specified by the set value + 2 have occurred continuously. | 0 | --- | --- | Online | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn801 | Function selection application (software limits) | 2 | 0 | Software limit function | 0 | Software limit enabled. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Forward software limit disabled. | | | | | |
| | | | | | 2 | Reverse software limit disabled. | | | | | |
| | | | | | 3 | Software limit disabled in both directions. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Software limit check using references | 0 | No software limit check using references. | 0 | --- | --- | Online | Always set to 0. |
| | | | | | 1 | Software limit check using references. | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn802 | Not used. | --- | (Do not change the setting.) | 0000 | --- | --- | --- | --- |
| Pn803 | Zero point width | 2 | Sets the detection range for the Origin Stop Flag. | 10 | Command unit | 0 to 250 | Online | --- |
| Pn804 | Forward software limit | 4 | Sets the forward software limit. | 819,191,808 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn806 | Reverse software limit | 4 | Sets the reverse software limit. | −819,191,808 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn808 | Absolute encoder zero point position offset | 4 | Sets the offset for the mechanical origin from the absolute encoder's absolute value data. | 0 | Command unit | −1,073,741,823 to 1,073,741,823 | Offline | --- |
| Pn80A | First-step linear acceleration constant | 2 | Sets the first-step acceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80B | Second-step linear acceleration constant | 2 | Sets the second-step acceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80C | Acceleration constant switching speed | 2 | Sets the speed for switching between first-step and second-step acceleration for the acceleration/deceleration curve used in position control. | 0 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn80D | First-step linear deceleration constant | 2 | Sets the first-step deceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80E | Second-step linear deceleration constant | 2 | Sets the second-step deceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80F | Deceleration constant switching speed | 2 | Sets the speed for switching between first-step and second-step deceleration for the acceleration/deceleration curve used in position control. | 0 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn810 | Exponential acceleration/ deceleration bias | 2 | Sets the exponential acceleration/deceleration bias speed for the acceleration/deceleration curve used in position control. | 0 | Command units/s | 0 to 32767 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn811 | Exponential acceleration/ deceleration time constant | 2 | Sets exponential acceleration/deceleration time constant for the acceleration/deceleration curve used in position control. | 0 | ×0.1 ms | 0 to 5100 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn812 | Movement average time | 2 | Sets the average movement time for when S-curve acceleration/ deceleration is used, and an average movement filter is used for the position command filter. | 0 | ×0.1 ms | 0 to 5100 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn813 | Not used. | --- | (Do not change the setting.) | 0010 | --- | --- | --- | --- |
| Pn814 | Final travel distance for external positioning | 4 | Sets the final travel distance for external positioning when executing INTERRUPT FEEDING using direct operation. | 100 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn816 | Zero point return mode setting | 2 | 0 | Zero point return direction | 0 | Forward | 0 | --- | --- | Online | Set the same direction as the origin search direction set in the Axis Parameters. Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| | | | | | 1 | Reverse | | | | | |
| | | | 1 to 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn817 | Zero point return approach speed 1 | 2 | Sets the origin (zero point) input signal search speed used after the origin proximity signal has been detected in an origin search. | | | | 50 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn818 | Zero point return approach speed 2 | 2 | Sets the origin (zero point) return final travel distance positioning speed used after the origin input signal has been detected in an origin search. | | | | 5 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn819 | Final travel distance to return to zero point | 4 | Sets the amount of compensation positioning used after the origin input signal has been detected in an origin search. | | | | 100 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn81B | Backlash compensation amount | 2 | Sets the amount of backlash compensation. | | | | 0 | × 0.1 command unit | −32,768 to 32,767 | Online | --- |
| Pn81C | Not used. | --- | (Do not change the setting.) | | | | 0000 | --- | --- | --- | --- |
| Pn81D | Compensation function selection | 2 | 0 | Backlash compensation selection | 0 | Compensates in forward direction. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Compensates in reverse direction. | | | | | |
| | | | 1 to 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn81E to Pn823 | Not used. | --- | (Do not change the setting.) | | | | 0000 | --- | --- | --- | --- |



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## 4-5-2 R88D-WN□-ML2 W-series Servo Driver with Built-in MECHATROLINK-II Communications

### Function Selection Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn000 | Function selection basic switches | 2 | 0 | Reverse rotation | 0 | CCW direction is taken for positive command | 0 | --- | --- | Offline | --- |
| | | | | | 1 | CW direction is taken for positive command | | | | | |
| | | | | | 2 to 3 | Not used. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Unit No. setting | 0 to F | Servo Driver communications unit number setting (necessary for multiple Servo Driver connections when using personal computer monitoring software) | 0 | --- | --- | Offline | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn001 | Function selection application switches 1 | 2 | 0 | Stop selection if an alarm occurs when Servomotor is OFF | 0 | Servomotor stopped by dynamic brake. | 2 | --- | --- | Offline | --- |
| | | | | | 1 | Dynamic brake OFF after Servomotor stopped | | | | | |
| | | | | | 2 | Servomotor stopped with free run | | | | | |
| | | | 1 | Stop selection when drive prohibited is input | 0 | Stop according to Pn001.0 setting (release Servomotor after stopping) | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Stop Servomotor using torque set in Pn406, and lock Servomotor after stopping | | | | | |
| | | | | | 2 | Stop Servomotor using torque set in Pn406, and release Servomotor after stopping | | | | | |
| | | | 2 | AC/DC power input selection | 0 | AC power supply: AC power supplied from L1, L2, (L3) terminals | 0 | --- | --- | Offline | --- |
| | | | | | 1 | DC power supply: DC power from +, – (2) terminals | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn002 | Function selection application switches 2 | 2 | 0 | Torque command input change (during speed control) | 0 | Do not use option command value. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Use option command value 1 as the torque limit value. | | | | | |
| | | | | | 2 | Use option command value 1 as the torque feed forward command value. | | | | | |
| | | | | | 3 | Use option command value 1 or 2 as the torque limit value, according to the forward and reverse torque limits that are specified. | | | | | |
| | | | 1 | Speed command input change (during torque control) | 0 | Do not use option command value. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Use option command value 1 as the speed limit value. | | | | | |
| | | | 2 | Operation switch when using absolute encoder | 0 | Use as absolute encoder. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Use as incremental encoder. | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn004 | Function selection application switches 4 | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 2 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn006 | Function selection application switches 6 | 2 | 0 to 1 | Analog monitor 1 (AM) signal selection | 00 | Servomotor rotation speed: 1 V/1000 r/min | 02 | --- | --- | Online | --- |
| | | | | | 01 | Speed command: 1 V/1000 r/min | | | | | |
| | | | | | 02 | Torque command: gravity compensation torque (Pn422) (1 V per 100%) | | | | | |
| | | | | | 03 | Position deviation: 0.05 V/1 command unit | | | | | |
| | | | | | 04 | Position amplifier deviation (after electronic gear) (0.05 V per encoder pulse unit) | | | | | |
| | | | | | 05 | Position command speed (1 V/1,000 r/min) | | | | | |
| | | | | | 06 | Not used. | | | | | |
| | | | | | 07 | Not used. | | | | | |
| | | | | | 08 | Positioning completed command (Positioning completed: 5 V; positioning not completed: 0 V | | | | | |
| | | | | | 09 | Speed feed forward (1 V/1,000 r/min) | | | | | |
| | | | | | 0A | Torque feed forward (1 V per 100%) | | | | | |
| | | | | | 0B to 1F | Not used. | | | | | |
| | | | 2 | Analog monitor 1 signal multiplier selection | 0 | 1x | 0 | --- | --- | Online | --- |
| | | | | | 1 | 10x | | | | | |
| | | | | | 2 | 100x | | | | | |
| | | | | | 3 | 1/10x | | | | | |
| | | | | | 4 | 1/100x | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn007 | Function selection application switches 7 | 2 | 0 to 1 | Analog monitor 2 (NM) signal selection | 00 | Servomotor rotation speed: 1V/1000 r/min | 00 | --- | --- | Online | --- |
| | | | | | 01 | Speed command: 1 V/1000 r/min | | | | | |
| | | | | | 02 | Torque command: gravity compensation torque (Pn422) (1 V per 100%) | | | | | |
| | | | | | 03 | Position deviation: 0.05 V/1 command unit | | | | | |
| | | | | | 04 | Position amplifier deviation (after electronic gear) (0.05 V per encoder pulse unit) | | | | | |
| | | | | | 05 | Position command speed (1 V/1,000 r/min) | | | | | |
| | | | | | 06 | Not used. | | | | | |
| | | | | | 07 | Not used. | | | | | |
| | | | | | 08 | Positioning completed command (Positioning completed: 5 V; positioning not completed: 0 V | | | | | |
| | | | | | 09 | Speed feed forward (1 V/1,000 r/min) | | | | | |
| | | | | | 0A | Torque feed forward (1 V per 100%) | | | | | |
| | | | | | 0B to 1F | Not used. | | | | | |
| | | | 2 | Analog monitor 2 signal multiplier selection | 0 | 1x | 0 | --- | --- | Online | --- |
| | | | | | 1 | 10x | | | | | |
| | | | | | 2 | 100x | | | | | |
| | | | | | 3 | 1/10x | | | | | |
| | | | | | 4 | 1/100x | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn008 | Function selection application switches 8 | 2 | 0 | Lowered battery voltage alarm/warning selection | 0 | Regard battery voltage drop as alarm (A.830). | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Regard battery voltage drop as warning (A.930). | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Warning detection selection | 0 | Warnings detected. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Warnings not detected. | | | | | |
| | | | 3 | Not used. | 4 | (Do not change the setting.) | 4 | --- | --- | --- | --- |



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### Servo Gain Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn100 | Speed loop gain | 2 | Adjusts speed loop response. | | | | 800 | × 0.1 Hz | 10 to 20000 | Online | --- |
| Pn101 | Speed loop integration constant | 2 | Speed loop integral time constant | | | | 2000 | ×0.01 ms | 15 to 51200 | Online | --- |
| Pn102 | Position loop gain | 2 | Adjusts position loop response. | | | | 400 | × 0.1/s | 10 to 20000 | Online | --- |
| Pn103 | Inertia ratio | 2 | Set using the ratio between the machine system inertia and the Servomotor rotor inertia. | | | | 300 | % | 0 to 20000 | Online | --- |
| Pn104 | Speed loop gain 2 | 2 | Adjusts speed loop response (enabled by automatic gain switching input). | | | | 800 | × 0.1 Hz | 10 to 20000 | Online | --- |
| Pn105 | Speed loop integration constant 2 | 2 | Speed loop integral time constant (enabled by automatic gain switching input). | | | | 2000 | ×0.01 ms | 15 to 51200 | Online | --- |
| Pn106 | Position loop gain 2 | 2 | Adjusts position loop response (enabled by automatic gain switching input). | | | | 400 | × 0.1/s | 10 to 20000 | Online | --- |
| Pn107 | Bias rotational speed | 2 | Sets position control bias. | | | | 0 | r/min | 0 to 450 | Online | --- |
| Pn108 | Bias addition band | 2 | Sets the position control bias operation start using deviation counter pulse width. | | | | 7 | Command unit | 0 to 250 | Online | --- |
| Pn109 | Feed-forward amount | 2 | Position control feed-forward compensation value | | | | 0 | % | 0 to 100 | Online | --- |
| Pn10A | Feed-forward command filter | 2 | Sets position control feed-forward command filter. | | | | 0 | ×0.01 ms | 0 to 6400 | Online | --- |
| Pn10B | Speed control setting | 2 | 0 | P control switching conditions | 0 | Sets internal torque command value conditions (Pn10C). | 4 | --- | --- | Online | --- |
| | | | | | 1 | Sets speed command value conditions (Pn10d). | | | | | |
| | | | | | 2 | Sets acceleration command value conditions (Pn10E). | | | | | |
| | | | | | 3 | Sets deviation pulse value conditions (Pn10F). | | | | | |
| | | | | | 4 | No P control switching function | | | | | |
| | | | 1 | Speed control loop switching | 0 | PI control | 0 | --- | --- | Offline | --- |
| | | | | | 1 | IP control | | | | | |
| | | | | | 2 to 3 | Not used. | | | | | |
| | | | 2 | Position loop control method | 0 | Standard position control | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Less deviation control | | | | | |
| | | | | | 2 to 3 | Not used. | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn10C | P control switching (torque command) | 2 | Sets level of torque command to switch from PI control to P control. | | | | 200 | % | 0 to 800 | Online | --- |
| Pn10D | P control switching (speed command) | 2 | Sets level of speed command to switch from PI control to P control. | | | | 0 | r/min | 0 to 10000 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn10E | P control switching (acceleration command) | 2 | Sets level of acceleration command to switch from PI control to P control. | | | | 0 | r/min/s | 0 to 30000 | Online | --- |
| Pn10F | P control switching (deviation pulse) | 2 | Sets level of deviation pulses to switch from PI control to P control. | | | | 10 | Command unit | 0 to 10000 | Online | --- |
| Pn110 | Normal autotuning switches | 2 | 0 | Not used. | 2 | (Do not change the setting.) | 2 | --- | --- | Offline | --- |
| | | | 1 | Speed feedback compensation function selection | 0 | ON | 1 | --- | --- | Online | --- |
| | | | | | 1 | OFF | | | | | |
| | | | | | 2 to 3 | Not used. | | | | | |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn111 | Speed feedback compensating gain | 2 | Adjusts speed loop feedback gain. | | | | 100 | % | 1 to 500 | Online | --- |
| Pn119 | Not used. | --- | (Do not change the setting.) | | | | 500 | --- | --- | --- | --- |
| Pn11A | Not used. | --- | (Do not change the setting.) | | | | 1000 | --- | --- | --- | --- |
| Pn11E | Not used. | --- | (Do not change the setting.) | | | | 1000 | --- | --- | --- | --- |
| Pn11F | Position integral time constant | 2 | Position loop integral time constant | | | | 0 | × 0.1 ms | 0 to 50000 | Online | --- |
| Pn12B | Not used. | --- | (Do not change the setting.) | | | | 400 | --- | --- | --- | --- |
| Pn12C | Not used. | --- | (Do not change the setting.) | | | | 2000 | --- | --- | --- | --- |
| Pn12D | Not used. | --- | (Do not change the setting.) | | | | 400 | --- | --- | --- | --- |
| Pn12E | Not used. | --- | (Do not change the setting.) | | | | 400 | --- | --- | --- | --- |
| Pn12F | Not used. | --- | (Do not change the setting.) | | | | 2000 | --- | --- | --- | --- |
| Pn130 | Not used. | --- | (Do not change the setting.) | | | | 400 | --- | --- | --- | --- |
| Pn131 | Gain switching time 1 | 2 | Switching time from No. 1 gain to No. 2 gain | | | | 0 | ms | 0 to 65535 | Online | --- |
| Pn132 | Gain switching time 2 | 2 | Switching time from No. 2 gain to No. 1 gain | | | | 0 | ms | 0 to 65535 | Online | --- |
| Pn135 | Gain switching waiting time 1 | 2 | The time from when gain switching condition A is satisfied until switching from the No. 1 gain to the No. 2 gain begins. | | | | 0 | ms | 0 to 65535 | Online | --- |
| Pn136 | Gain switching waiting time 2 | 2 | The time from when gain switching condition B is satisfied until switching from the No. 2 gain to the No. 1 gain begins. | | | | 0 | ms | 0 to 65535 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn139 | Automatic gain changeover related switches 1 | 2 | 0 | Gain switching selection switch | 0 | Manual gain switching (automatic gain switching not used) | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Automatic switching pattern 1 Automatic switching from No. 1 gain to No. 2 gain when gain switching condition A is satisfied. Automatic switching from No. 2 gain to No. 1 gain when gain switching condition B is satisfied. | | | | | |
| | | | | | 2 to 4 | Not used. | | | | | |
| | | | 1 | Gain switching condition A | 0 | Positioning completed output 1 (INP1) ON | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Positioning completed output 1 (INP1) OFF | | | | | |
| | | | | | 2 | Positioning completed output 2 (INP2) ON | | | | | |
| | | | | | 3 | Positioning completed output 2 (INP2) OFF | | | | | |
| | | | | | 4 | The position command filter output is 0, and also the position command input is 0. | | | | | |
| | | | | | 5 | The position command input is not 0. | | | | | |
| | | | 2 | Gain switching condition B | 0 to 5 | Same as Pn139.1 | 0 | --- | --- | Offline | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn144 | Not used. | --- | (Do not change the setting.) | | | | 1000 | --- | --- | --- | --- |
| Pn150 | Predictive control selection switches | 2 | 0 | Predictive control selection | 0 | Predictive control not used. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Predictive control used. | | | | | |
| | | | | | 2 | Not used. | | | | | |
| | | | 1 | Predictive control type | 0 | Predictive control for tracking | 1 | --- | --- | Offline | --- |
| | | | | | 1 | Predictive control for positioning | | | | | |
| | | | 2 | Not used. | 2 | (Do not change the setting.) | 2 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn151 | Predictive control acceleration/deceleration gain | 2 | Adjusts acceleration and deceleration response for predictive control. | | | | 100 | % | 0 to 300 | Online | --- |
| Pn152 | Predictive control weighting ratio | 2 | Adjusts position deviation for predictive control. | | | | 100 | % | 0 to 300 | Online | --- |
| Pn1A0 | Servo rigidity | 2 | Adjusts the Servo rigidity for the No. 1 gain. | | | | 60 | % | 1 to 500 | Online | --- |
| Pn1A1 | Servo rigidity 2 | 2 | Adjusts the Servo rigidity for the No. 2 gain. | | | | 60 | % | 1 to 500 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn1A2 | Speed feedback filter time constant | 2 | Sets the filter time constant for No. 1 gain speed feedback. | | | | 72 | × 0.01 ms | 30 to 3200 | Online | --- |
| Pn1A3 | Speed feedback filter time constant 2 | 2 | Sets the filter time constant for No. 2 gain speed feedback. | | | | 72 | × 0.01 ms | 30 to 3200 | Online | --- |
| Pn1A4 | Torque command filter time constant 2 | 2 | Sets the filter time constant for the torque command. | | | | 36 | × 0.01 ms | 0 to 2500 | Online | --- |
| Pn1A7 | Utility control switches | 2 | 0 | Integral compensation processing | 0 | Integral compensation processing not executed. | 1 | --- | --- | Online | --- |
| | | | | | 1 | Integral compensation processing executed. | | | | | |
| | | | | | 2 | Integral compensation is executed for No. 1 gain and not for No. 2 gain for less-deviation gain switching. | | | | | |
| | | | | | 3 | Integral compensation is executed for No. 2 gain and not for No. 1 gain for less-deviation gain switching. | | | | | |
| | | | 1 | Not used. | 2 | (Do not change the setting.) | 2 | --- | --- | --- | --- |
| | | | 2 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 3 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| Pn1A9 | Utility integral gain | 2 | Adjusts the auxiliary integral responsive. | | | | 37 | Hz | 0 to 500 | Online | --- |
| Pn1AA | Position proportional gain | 2 | Adjusts the position proportional responsive. | | | | 60 | Hz | 0 to 500 | Online | --- |
| Pn1AB | Speed integral gain | 2 | Adjusts the speed integral responsive. | | | | 0 | Hz | 0 to 500 | Online | --- |
| Pn1AC | Speed proportional gain | 2 | Adjusts the speed proportional responsive. | | | | 120 | Hz | 0 to 2000 | Online | --- |
| Pn1B5 | Not used. | --- | (Do not change the setting.) | | | | 150 | --- | --- | --- | --- |

### Position Control Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn200 | Not used. | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn205 | Absolute encoder multi-turn limit setting | 2 | Sets the multi-turn limit for when a Servomotor with an absolute encoder is used. | | | | 65535 | Rotation | 0 to 65535 | Offline | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn207 | Position control settings 2 | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 2 | Backlash compensation selection | 0 | Disabled | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Compensates to forward rotation side. | | | | | |
| | | | | | 2 | Compensates to reverse rotation side. | | | | | |
| | | | 3 | INP 1 output timing | 0 | When the position deviation is below the INP1 range (Pn522). | 0 | --- | --- | Offline | --- |
| | | | | | 1 | When the position deviation is below the INP1 range (Pn522) and also the command after the position command filter is 0. | | | | | |
| | | | | | 2 | When the absolute value for the position deviation is below the INP1 range (Pn522) and also the position command input is 0. | | | | | |
| Pn209 | Not used. | --- | (Do not change the setting.) | | | | 0 | --- | --- | --- | --- |
| Pn20A | Not used. | --- | (Do not change the setting.) | | | | 32768 | --- | --- | --- | --- |
| Pn20E | Electronic gear ratio G1 (numerator) | 4 | Sets the pulse rate for the command pulses and Servomotor movement distance.<br>0.001 ≤ G1/G2 ≤ 1000 | | | | 4 | --- | 1 to 1073741824 | Offline | --- |
| Pn210 | Electronic gear ratio G2 (denominator) | 4 | | | | | 1 | --- | 1 to 1073741824 | Offline | --- |
| Pn212 | Encoder divider rate | 4 | Sets the number of output pulses per Servomotor rotation. | | | | 1000 | Pulses /rotation | 16 to 1073741824 | Offline | --- |
| Pn214 | Backlash compensation amount | 2 | Sets mechanical system backlash amount (the mechanical gap between the drive shaft and the shaft being driven) | | | | 0 | Command unit | –32767 to 32767 | Online | --- |
| Pn215 | Backlash compensation time constant | 2 | Sets the backlash compensation time constant. | | | | 0 | × 0.01 ms | 0 to 65535 | Online | --- |
| Pn216 | Not used. | --- | (Do not change the setting.) | | | | 0 | --- | --- | --- | --- |
| Pn217 | Not used. | --- | (Do not change the setting.) | | | | 0 | --- | --- | --- | --- |
| Pn281 | Not used. | --- | (Do not change the setting.) | | | | 20 | --- | --- | --- | --- |

## Speed Control Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn300 | Not used. | --- | (Do not change the setting.) | | | | 600 | --- | --- | --- | --- |
| Pn301 | Not used. | --- | (Do not change the setting.) | | | | 100 | --- | --- | --- | --- |
| Pn302 | Not used. | --- | (Do not change the setting.) | | | | 200 | --- | --- | --- | --- |
| Pn303 | Not used. | --- | (Do not change the setting.) | | | | 300 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn304 | Jog speed | 2 | Sets rotation speed during jog operation (using Servo Driver's personal computer monitoring software) | | | | 500 | r/min | 0 to 10000 | Online | --- |
| Pn305 | Soft start acceleration time | 2 | Sets acceleration time during speed control soft start. | | | | 0 | ms | 0 to 10000 | Online | --- |
| Pn306 | Soft start deceleration time | 2 | Sets deceleration time during speed control soft start. | | | | 0 | ms | 0 to 10000 | Online | --- |
| Pn307 | Not used. | --- | (Do not change the setting.) | | | | 40 | --- | --- | --- | --- |
| Pn308 | Speed feedback filter time constant | 2 | Sets constant during filter of speed feedback. | | | | 0 | × 0.01 ms | 0 to 65535 | Online | --- |
| Pn310 | Vibration detection switches | 2 | 0 | Vibration detection selection | 0 | Vibration detection not used. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Gives warning (A.911) when vibration is detected. | | | | | |
| | | | | | 2 | Gives warning (A.520) when vibration is detected. | | | | | |
| | | | 1 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn311 | Vibration detection sensitivity | 2 | Sets the vibration detection sensitivity. | | | | 100 | % | 50 to 500 | Online | --- |
| Pn312 | Vibration detection level | 2 | Sets the vibration detection level | | | | 50 | r/min | 0 to 500 | Online | --- |

### Torque Control (Torque Limit) Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn400 | Not used. | --- | (Do not change the setting.) | | | | 30 | --- | --- | --- | --- |
| Pn401 | 1st step 1st torque command filter time constant | 2 | Sets the filter time constant for internal torque commands. | | | | 40 | ×0.01 ms | 0 to 65535 | Online | --- |
| Pn402 | Forward torque limit | 2 | Forward rotation output torque limit (rated torque ratio). | | | | 350 | % | 0 to 800 | Online | --- |
| Pn403 | Reverse torque limit | 2 | Reverse rotation output torque limit (rated torque ratio). | | | | 350 | % | 0 to 800 | Online | --- |
| Pn404 | Forward rotation external current limit | 2 | Output torque limit during input of forward rotation current limit (rated torque ratio) | | | | 100 | % | 0 to 800 | Online | --- |
| Pn405 | Reverse rotation external current limit | 2 | Output torque limit during input of reverse rotation current limit (rated torque ratio) | | | | 100 | % | 0 to 800 | Online | --- |
| Pn406 | Emergency stop torque | 2 | Deceleration torque when an error occurs (rated torque ratio) | | | | 350 | % | 0 to 800 | Online | --- |
| Pn407 | Speed limit | 2 | Sets the speed limit in torque control mode. | | | | 3000 | r/min | 0 to 10000 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn408 | Torque command setting | 2 | 0 | Selects notch filter 1 function. | 0 | Notch filter 1 not used. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Notch filter 1 used for torque commands. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Selects notch filter 2 function. | 0 | Notch filter 2 not used. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Notch filter 2 used for torque commands. | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn409 | Notch filter 1 frequency | 2 | Sets notch filter 1 frequency for torque command. | | | | 2000 | Hz | 50 to 2000 | Online | --- |
| Pn40A | Notch filter 1 Q value | 2 | Sets Q value of notch filter 1. | | | | 70 | ×0.01 | 50 to 1000 | Online | --- |
| Pn40C | Notch filter 2 frequency | 2 | Sets the notch filter 2 frequency for torque commands. | | | | 2000 | Hz | 50 to 2000 | Online | --- |
| Pn40D | Notch filter 2 Q value | 2 | Sets Q value of notch filter 2. | | | | 70 | ×0.01 | 50 to 1000 | Online | --- |
| Pn40F | 2nd step 2nd torque command filter frequency | 2 | Sets the filter frequency for internal torque commands. | | | | 2000 | Hz | 100 to 2000 | Online | --- |
| Pn410 | 2nd step 2nd torque command filter Q value | 2 | Sets the torque command filter Q value. | | | | 70 | ×0.01 | 50 to 1000 | Online | --- |
| Pn411 | 3rd step torque command filter time constant | 2 | Sets the filter time constant for internal torque commands. | | | | 0 | μs | 0 to 65535 | Online | --- |
| Pn412 | 1st step 2nd torque command filter time constant | 2 | Sets the filter time constant for No. 2 gain internal torque commands. | | | | 100 | × 0.01 ms | 0 to 65535 | Online | --- |
| Pn413 | Not used. | --- | (Do not change the setting.) | | | | 100 | --- | --- | --- | --- |
| Pn414 | Not used. | --- | (Do not change the setting.) | | | | 100 | --- | --- | --- | --- |
| Pn420 | Damping for vibration suppression on stopping | 2 | Sets the vibration suppression value while stopped. | | | | 100 | % | 10 to 100 | Online | --- |
| Pn421 | Vibration suppression starting time | 2 | Sets the time from when the position command becomes 0 until damping for vibration suppression on stopping begins. | | | | 1000 | ms | 0 to 65535 | Online | --- |
| Pn422 | Gravity compensation torque | 2 | Sets the gravity compensation torque. | | | | 0 | ×0.01 % | –20000 to 20000 | Online | --- |
| Pn456 | Sweep torque command amplitude | 2 | Sets the sweep torque command amplitude. | | | | 15 | % | 1 to 800 | Online | --- |



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### I/O and Status Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn501 | Not used. | --- | (Do not change the setting.) | | | | 10 | --- | --- | --- | --- |
| Pn502 | Rotation speed for motor rotation detection | 2 | Sets the number of rotations for the Servomotor rotation detection output (TGON). | | | | 20 | r/min | 1 to 10000 | Online | --- |
| Pn503 | Speed conformity signal output width | 2 | Sets the allowable fluctuation (number of rotations) for the speed conformity output (VCMP). | | | | 10 | r/min | 0 to 100 | Online | --- |
| Pn506 | Brake timing 1 | 2 | Sets the delay from the brake command to the Servomotor turning OFF. | | | | 0 | ×10 ms | 0 to 50 | Online | --- |
| Pn507 | Brake command speed | 2 | Sets the number of rotations for outputting the brake command. | | | | 100 | r/min | 0 to 10000 | Online | --- |
| Pn508 | Brake timing 2 | 2 | Sets the delay time from the Servomotor turning OFF to the brake command output. | | | | 50 | ×10 ms | 10 to 100 | Online | --- |
| Pn509 | Momentary hold time | 2 | Sets the time during which alarm detection is disabled when a power failure occurs. | | | | 20 | ms | 20 to 1000 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50A | Input signal selections 1 | 2 | 0 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | POT (forward drive prohibited input) signal Input terminal allocation | 0 | Allocated to CN1, pin 13: Valid for low input | 1 | --- | --- | Offline | Standard setting: 1 |
| | | | | | 1 | Allocated to CN1, pin 7: Valid for low input | | | | | |
| | | | | | 2 | Allocated to CN1, pin 8: Valid for low input | | | | | |
| | | | | | 3 | Allocated to CN1, pin 9: Valid for low input | | | | | |
| | | | | | 4 | Allocated to CN1, pin 10: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 11: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 12: Valid for low input | | | | | |
| | | | | | 7 | Always enabled. | | | | | |
| | | | | | 8 | Always disabled. | | | | | |
| | | | | | 9 | Allocated to CN1, pin 13: Valid for high input | | | | | |
| | | | | | A | Allocated to CN1, pin 7: Valid for high input | | | | | |
| | | | | | B | Allocated to CN1, pin 8: Valid for high input | | | | | |
| | | | | | C | Allocated to CN1, pin 9: Valid for high input | | | | | |
| | | | | | D | Allocated to CN1, pin 10: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 11: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 12: Valid for high input | | | | | |
| Pn50B | Input signal selections 2 | 2 | 0 | NOT (reverse drive prohibited input) signal Input terminal allocation | 0 to F | Same as Pn50A.3 | 2 | --- | --- | Offline | Standard setting: 2 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50C | Input signal selections 3 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| Pn50D | Input signal selections 4 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| Pn50E | Output signal selections 1 | 2 | 0 | INP1 (positioning completed 1) signal output terminal allocation | 0 | Not used. | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | | | 1 | Allocated to CN1 pins 1, 2 | | | | | |
| | | | | | 2 | Allocated to CN1 pins 23, 24 | | | | | |
| | | | | | 3 | Allocated to CN1 pins 25, 26 | | | | | |
| | | | 1 | VCMP (speed conformity) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | TGON (servomotor rotation detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 3 | READY (servo ready) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| Pn50F | Output signal selections 2 | 2 | 0 | CLIMT (current limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 1 | VLIMT (speed limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | BKIR (brake interlock) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 1 |
| | | | 3 | WARN (warning) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn510 | Output signal selections 3 | 2 | 0 | INP2 (positioning completed 2) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn511 | Input signal selections 5 | 2 | 0 | DEC signal input terminal allocation | 0 | Allocated to CN1, pin 13: Valid for low input | 3 | --- | --- | Offline | Standard setting: 3 |
| | | | | | 1 | Allocated to CN1, pin 7: Valid for low input | | | | | |
| | | | | | 2 | Allocated to CN1, pin 8: Valid for low input | | | | | |
| | | | | | 3 | Allocated to CN1, pin 9: Valid for low input | | | | | |
| | | | | | 4 | Allocated to CN1, pin 10: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 11: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 12: Valid for low input | | | | | |
| | | | | | 7 | Always enabled. | | | | | |
| | | | | | 8 | Always disabled. | | | | | |
| | | | | | 9 | Allocated to CN1, pin 13: Valid for high input | | | | | |
| | | | | | A | Allocated to CN1, pin 7: Valid for high input | | | | | |
| | | | | | B | Allocated to CN1, pin 8: Valid for high input | | | | | |
| | | | | | C | Allocated to CN1, pin 9: Valid for high input | | | | | |
| | | | | | D | Allocated to CN1, pin 10: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 11: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 12: Valid for high input | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn511 | Input signal selections 5 | 2 | 1 | EXT1 signal input terminal allocation | 0 to 3 | Always disabled. | 4 | --- | --- | Offline | Standard setting: 4 |
| | | | | | 4 | Allocated to CN1, pin 10: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 11: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 12: Valid for low input | | | | | |
| | | | | | 7 | Always enabled. | | | | | |
| | | | | | 8 | Always disabled. | | | | | |
| | | | | | 9 to C | Always disabled. | | | | | |
| | | | | | D | Allocated to CN1, pin 10: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 11: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 12: Valid for high input | | | | | |
| | | | 2 | EXT2 signal input terminal allocation | 0 to F | Same as Pn511.1 | 5 | --- | --- | Offline | Standard setting: 5 |
| | | | 3 | EXT3 signal input terminal allocation | 0 to F | Same as Pn511.1 | 6 | --- | --- | Offline | Standard setting: 6 |
| Pn512 | Output signal reverse | 2 | 0 | Output signal reverse for CN1 pins 1, 2 | 0 | Not reversed. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Reversed. | | | | | |
| | | | 1 | Output signal reverse for CN1 pins 23, 24 | 0, 1 | Same as above | 0 | --- | --- | Offline | --- |
| | | | 2 | Output signal reverse for CN1 pins 25, 26 | 0, 1 | Same as above | 0 | --- | --- | Offline | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn513 | Not used. | --- | (Do not change the setting.) | | | | 0321 | --- | --- | --- | --- |
| Pn515 | Not used. | --- | (Do not change the setting.) | | | | 8888 | --- | --- | --- | --- |
| Pn51B | Not used. | --- | (Do not change the setting.) | | | | 1000 | --- | --- | --- | --- |
| Pn51E | Deviation counter overflow warning level | 2 | Sets the detection level for the deviation counter overflow warning. | | | | 100 | % | 10 to 100 | Online | --- |
| Pn520 | Deviation counter overflow level | 4 | Sets the deviation counter overflow alarm detection level. | | | | 262144 | Command unit | 1 to 1073741823 | Online | --- |
| Pn522 | Positioning completed range 1 | 4 | Setting range for positioning completed range 1 (INP1) | | | | 3 | Command unit | 0 to 1073741824 | Online | --- |
| Pn524 | Positioning completed range 2 | 4 | Setting range for positioning completed range 2 (INP2) | | | | 3 | Command unit | 1 to 1073741824 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn526 | Deviation counter overflow level at Servo-ON | 4 | Sets the deviation counter overflow alarm detection level for Servo ON. | | | | 262144 | Command unit | 1 to 1073741823 | Online | --- |
| Pn528 | Deviation counter overflow warning level at Servo-ON | 2 | Sets the deviation counter overflow warning detection level for Servo ON. | | | | 100 | % | 10 to 100 | Online | --- |
| Pn529 | Speed limit level at Servo-ON | 2 | Sets the speed limit for when the Servo turns ON with position deviation accumulated. | | | | 10000 | r/min | 0 to 10000 | Online | --- |
| Pn52A | Not used. | --- | (Do not change the setting.) | | | | 20 | --- | --- | --- | --- |
| Pn52F | Not used. | --- | (Do not change the setting.) | | | | FFF | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn530 | Program JOG operation related switches | 2 | 0 | Program JOG operating pattern | 0 | (Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536 | 0 | --- | --- | Online | --- |
| | | | | | 1 | (Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536 | | | | | |
| | | | | | 2 | Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536 (Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536 | | | | | |
| | | | | | 3 | (Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536 (Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536 | | | | | |
| | | | | | 4 | (Waiting time Pn535 → Forward movement Pn531 → Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536 | | | | | |
| | | | | | 5 | (Waiting time Pn535 → Reverse movement Pn531 → Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536 | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn531 | Program JOG movement distance | 4 | Sets the program JOG movement distance. | | | | 32768 | Command unit | 1 to 1073741824 | Online | --- |
| Pn533 | Program JOG movement speed | 2 | Sets the program JOG operation movement speed. | | | | 500 | r/min | 1 to 10000 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn534 | Program JOG acceleration/deceleration time | 2 | Sets the acceleration/deceleration time for program JOG operation. | | | | 100 | ms | 2 to 10000 | Online | --- |
| Pn535 | Program JOG waiting time | 2 | Sets the delay time from the program JOG operation start input until operation starts. | | | | 100 | ms | 0 to 10000 | Online | --- |
| Pn536 | Number of program JOG movements | 2 | Sets the number of repetitions of the program JOG operations. | | | | 1 | Times | 1 to 1000 | Online | --- |
| Pn540 | Gain limit | 2 | Sets the gain limit. | | | | 2000 | × 0.1 Hz | 10 to 2000 | Online | --- |
| Pn550 | Analog monitor 1 offset voltage | 2 | Sets the analog monitor 1 offset voltage. | | | | 0 | × 0.1 V | –10000 to 10000 | Online | --- |
| Pn551 | Analog monitor 2 offset voltage | 2 | Sets the analog monitor 2 offset voltage. | | | | 0 | × 0.1 V | –10000 to 10000 | Online | --- |

### Other Parameters

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn600 | Regeneration resistor capacity | 2 | Setting for regeneration resistance load ratio monitoring calculations | 0 | ×10 W | 0 to (varies by model) | Online | --- |



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### Control Function Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn800 | Communications control | 2 | 0 | MECHATROLINK communications check mask | 0 | Detects both communications errors (A.E6□) and synchronization errors (A.E5□). | 0 | --- | --- | Online | Always set to 0. |
| | | | | | 1 | Ignores communications errors (A.E6□). | | | | | |
| | | | | | 2 | Ignores synchronization errors (A.E5□). | | | | | |
| | | | | | 3 | Ignores communications errors (A.E6□) and synchronization errors (A.E5□). | | | | | |
| | | | 1 | Warning check mask | 0 | Detects all parameter setting warnings (A.94□), MECHATROLINK command warnings (A.95□), and communications errors (A.96□). | 4 | --- | --- | Online | Always set to 4 or 0. |
| | | | | | 1 | Ignores parameter setting warning (A. 94□). | | | | | |
| | | | | | 2 | Ignores command warning (A.95□). | | | | | |
| | | | | | 3 | Ignores A.94□ and A.95□. | | | | | |
| | | | | | 4 | Ignores communications warning (A.96□). | | | | | |
| | | | | | 5 | Ignore A.94□ and A.96□. | | | | | |
| | | | | | 6 | Ignores A.95□ and A.96□. | | | | | |
| | | | | | 7 | Ignores A.94□, A.95□ and A.96□. | | | | | |
| | | | 2 | Communications error count at single transmission | 0 to F | Detects communications errors (A.E60) if they occur consecutively for the set value plus two times. | 0 | --- | --- | Online | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn801 | Function selection application 6 (software LS) | 2 | 0 | Software limit function | 0 | Software limit enabled. | 3 | --- | --- | Online | --- |
| | | | | | 1 | Forward software limit disabled. | | | | | |
| | | | | | 2 | Reverse software limit disabled. | | | | | |
| | | | | | 3 | Forward/reverse software limits disabled. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Software limit check using reference | 0 | No software limit check using reference | 0 | --- | --- | Online | Always set to 0. |
| | | | | | 1 | Software limit check using reference | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn802 | Not used. | --- | (Do not change the setting.) | 0000 | --- | --- | --- | --- |
| Pn803 | Zero point width | 2 | Sets the origin position detection range. | 10 | Command unit | 0 to 250 | Online | --- |
| Pn804 | Forward software limit | 4 | Sets the software limit for the positive direction. | 819,191,808 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn806 | Reverse software limit | 4 | Sets the software limit for the negative direction. | −819,191,808 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn808 | Absolute encoder zero point position offset | 4 | Sets the encoder position and machine coordinate system offsets for when an absolute encoder is used. | 0 | Command unit | −1,073,741,823 to 1,073,741,823 | Offline | --- |
| Pn80A | First step linear acceleration constant | 2 | Sets the step 1 acceleration for when two-step acceleration is used. | 100 | ×10,000 command units/s$^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80B | Second step linear acceleration constant | 2 | Sets the step 2 acceleration for when two-step acceleration is executed, or the one-step acceleration constant for when one-step acceleration is executed. | 100 | ×10,000 command units/s$^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80C | Acceleration constant switching speed | 2 | Sets the switching speed for the step 1 and step 2 acceleration when two-step acceleration is executed. | 0 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn80D | First step linear deceleration constant | 2 | Sets the step 1 deceleration for when two-step deceleration is used. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80E | Second step linear deceleration constant | 2 | Sets the step 2 deceleration for when two-step deceleration is executed, or the one-step deceleration constant for when one-step deceleration is executed. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80F | Deceleration constant switching speed | 2 | Sets the switching speed for the step 1 and step 2 deceleration when two-step deceleration is executed. | 0 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn810 | Exponential acceleration/ deceleration bias | 2 | Sets the bias for when an exponential filter is used for the position command filter. | 0 | Command units/s | 0 to 32767 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn811 | Exponential acceleration/ deceleration time constant | 2 | Sets the time constant for when an exponential filter is used for the position command filter. | 0 | ×0.1 ms | 0 to 5100 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn812 | Moving average time | 2 | Sets the average movement time for when S-curve acceleration/ deceleration is used, and an average movement filter is used for the position command filter. | 0 | ×0.1 ms | 0 to 5100 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn813 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn814 | Final travel distance for external positioning | 4 | Sets the distance from the external signal input position when external positioning is executed. | 100 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn816 | Zero point return mode settings | 2 | 0 | Zero point return direction | 0 | Forward direction | 0 | --- | --- | Online | Set the same direction as the origin search direction set in the Axis Parameters.<br>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| | | | | | 1 | Reverse direction | | | | | |
| | | | 1 to 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn817 | Zero point return approach speed 1 | 2 | Sets the origin search speed after the deceleration limit switch signal turns ON. | | | | 50 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn818 | Zero point return approach speed 2 | 2 | Sets the origin search speed after the deceleration limit switch signal turns ON. | | | | 5 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn819 | Final travel distance to return to zero point | 4 | Sets the distance from the latch signal input position to the origin, for when origin search is executed. | | | | 100 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn81B to Pn825 | Not used. | --- | (Do not change the setting.) | | | | 0000 | --- | --- | --- | --- |
| Pn900 to Pn910 | Not used. | --- | (Do not change the setting.) | | | | --- | --- | --- | --- | --- |
| Pn920 to Pn95F | Not used. | --- | (Do not change the setting.) | | | | ---- | --- | --- | --- | --- |



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## 4-5-3 SMARTSTEP Junior Servo Driver with Built-in MECHATROLINK-II Communications (R7D-ZN□-ML2)

### ■ Function Selection Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn000 | Function selection basic switch | 2 | 0 | Reverse rotation | 0 | CCW direction is taken for positive command. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | CW direction is taken for positive command. | | | | | |
| | | | | | 2 to 3 | Not used. | | | | | |
| | | | 1 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn00A | Command filter setting | 2 | Set the command filter constant.<br>When using this parameter, turn ON bit 4 on SW2 on the SMARTSTEP Junior Servo Driver. | | | | 0000 | --- | 0000 to 000F | Online | --- |

### ■ Position Control Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn20E | Electronic gear ratio G1 (numerator) | 4 | Set the pulse rate for the command pulses and Servomotor travel distance.<br>0.01≤G1/G2≤100 | | | | 1 | --- | 1 to 1073741824 | Offline | --- |
| Pn210 | Electronic gear ratio G2 (denominator) | 4 | | | | | 1 | --- | 1 to 1073741824 | Offline | --- |

### ■ I/O and Status Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50A | Input signal selection 1 | 2 | 0 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | Offline | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | POT (forward drive prohibited input) signal Input terminal allocation | 2 | Allocated to CN1, pin 4: Valid for low input | 2 | --- | --- | Offline | Standard setting: 2 |
| | | | | | 8 | Always invalid. | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50B | Input signal selection 2 | 2 | 0 | NOT (reverse drive prohibited input) signal input terminal allocation | 3 | Allocated to CN1, pin 3: Valid for low input | 3 | --- | --- | Offline | Standard setting: 3 |
| | | | | | 8 | Always invalid. | | | | | |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| Pn515 | Input signal selection 7 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | STOP (emergency stop input) | 4 | Allocated to CN1, pin 6: Valid for low input | 4 | --- | --- | Offline | Standard setting: 4 |
| | | | | | | Always invalid. | | | | | |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| Pn522 | Positioning completion width 1 | 4 | Setting range for positioning completed range | | | | 10 | Command unit | 0 to 1,073,741,824 | Online | --- |
| Pn524 | Positioning completion width 2 | 4 | Setting for proximity range for the Positioning Proximity Flag. | | | | 100 | Command unit | 1 to 1,073,741,824 | Online | --- |



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## ■ Control Function Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn800 | Communications control | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 1 | Warning check mask | 0 | Detects parameter setting warnings (A.94), command warnings (A.95), and communications errors (A.96). | 4 | --- | --- | Online | Always set to 4 or 0. |
| | | | | | 1 | Ignores parameters setting warnings (A.94). | | | | | |
| | | | | | 2 | Ignores command warnings (A.95). | | | | | |
| | | | | | 3 | Ignores both parameter setting warnings (A.94) and command warnings (A.95). | | | | | |
| | | | | | 4 | Ignores communications errors (A.96). | | | | | |
| | | | | | 5 | Ignores both parameter setting warnings (A.94) and communications errors (A.96). | | | | | |
| | | | | | 6 | Ignores both command warnings (A.95) and communications errors (A.96). | | | | | |
| | | | | | 7 | Ignores parameter setting warnings (A.94), command warnings (A.95), and communications errors (A.96). | | | | | |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn801 | Function selection application 6 (software limits) | 2 | 0 | Software limit function | 0 | Software limit enabled. | 3 | --- | --- | Online | --- |
| | | | | | 1 | Forward software limit disabled. | | | | | |
| | | | | | 2 | Reverse software limit disabled. | | | | | |
| | | | | | 3 | Software limit disabled in both directions. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| PN803 | Zero point width | 2 | Sets the detection range for the Origin Stop Flag. | | | | 10 | Command unit | 0 to 250 | Online | --- |
| Pn804 | Forward software limit | 4 | Sets the forward software limit. | | | | 1073741823 | Command unit | −1073741823 to 1073741823 | Online | --- |
| Pn806 | Reverse software limit | 4 | Sets the reverse software limit. | | | | −1073741823 | Command unit | −1073741823 to 1073741823 | Online | --- |
| Pn80B | Linear acceleration constant | 2 | Sets the acceleration speed for the acceleration/deceleration curve used in position control. | | | | 100 | ×10,000 command units/s$^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80E | Linear deceleration constant | 2 | Sets the deceleration speed for the acceleration/deceleration curve used in position control. | | | | 100 | ×10,000 command units/s$^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn814 | Final travel distance for external positioning | 4 | Sets the final travel distance for external positioning when executing INTERRUPT FEEDING using direct operation. | | | | 100 | Command unit | −1073741823 to 1073741823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn816 | Zero point return mode setting | 2 | 0 | Zero point return direction | 0 | Forward | 0 | --- | --- | Online | Set the same direction as the origin search direction set in the Axis Parameters. Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| | | | | | 1 | Reverse | | | | | |
| | | | 1 to 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn817 | Zero point return approach speed 1 | 2 | Sets the origin (zero point) input signal search speed used after the origin proximity signal has been detected in an origin search. | | | | 50 | ×100 command units/$s^2$ | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn818 | Zero point return approach speed 2 | 2 | Sets the origin (zero point) return final travel distance positioning speed used after the origin input signal has been detected in an origin search. | | | | 5 | ×100 command units/$s^2$ | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn819 | Final travel distance to return to zero point | 4 | Sets the amount of compensation positioning used after the origin input signal has been detected in an origin search. | | | | 100 | Command unit | −1073741823 to 1073741823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn820 to Pn823 | Not used. | -- | (Do not change the setting.) | | | | 0000 | --- | --- | --- | --- |

# 4-6 Common Operating Memory Area

The Common Operating Memory Area is allocated to outputs used for common PCU operations and settings, such as communications control and transferring common parameters, and inputs used for monitoring the status of these operations.

## 4-6-1 Common Operating Memory Area Overview

The area allocated as the Common Operating Memory Area is contained in the CPU Bus Unit Area within the CPU Unit's CIO Area. The beginning word of the Common Operating Memory Area is determined by the unit number set for the PCU using the following equation.

Beginning word of Common Operating Memory Area: n = CIO 1500 + (unit number × 25)

| Unit number | Allocated words | Unit number | Allocated words |
|---|---|---|---|
| 0 | CIO 1500 to CIO 1524 | 8 | CIO 1700 to CIO 1724 |
| 1 | CIO 1525 to CIO 1549 | 9 | CIO 1725 to CIO 1749 |



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| Unit number | Allocated words | Unit number | Allocated words |
|---|---|---|---|
| 2 | CIO 1550 to CIO 1574 | 10 | CIO 1750 to CIO 1774 |
| 3 | CIO 1575 to CIO 1599 | 11 | CIO 1775 to CIO 1799 |
| 4 | CIO 1600 to CIO 1624 | 12 | CIO 1800 to CIO 1824 |
| 5 | CIO 1625 to CIO 1649 | 13 | CIO 1825 to CIO 1849 |
| 6 | CIO 1650 to CIO 1674 | 14 | CIO 1850 to CIO 1874 |
| 7 | CIO 1675 to CIO 1699 | 15 | CIO 1875 to CIO 1899 |

The Common Operating Memory Area is divided into outputs and inputs. Commands for common PCU operations and settings, such as transferring PCU data (reading, writing, and saving Common Parameters and Axis Parameters) and establishing connections with MECHATROLINK communications are allocated to the output memory area.

Commands are sent to the PCU when the respective bit in the output memory area turns ON or while the respective bit is ON. The common PCU status and MECHATROLINK communications status are input from the PCU to the input memory area.



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## 4-6-2 Common Operating Memory Area Words

The memory allocation of the Common Operating Memory Area is shown in the following table. For details on functions and operations of each word, such as operation timing, refer to the section given in the *Details* column.

**Common Operating Output Memory Area**

n = CIO 1500 + (unit number × 25)

| I/O | Word | Bits | Category | Name | Operation | Details |
|---|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | n | 00 | --- | UNIT ERROR RESET | Resets the Unit common error when this bit turns ON. | *12-6 Error Reset* |
| | | 01 | Data transfer commands | WRITE DATA | Writes data to the PCU from the CPU Unit when this bit turns ON. | *5-2-1 Writing PCU Parameters* |
| | | 02 | | READ DATA | Reads data from the PCU to the CPU Unit when this bit turns ON. | *5-2-2 Reading PCU Parameters* |
| | | 03 | | SAVE DATA | Saves the contents of the PCU's internal memory to its flash memory when this bit turns ON. | *5-2-3 Saving PCU Parameters* |
| | | 04 to 15 | --- | Not used (reserved by the system). | These bits are reserved by the system. Do not use. | --- |
| | n+1 | 00 | Communications control commands | CONNECT | Starts/stops MECHATROLINK communications. | *6-3-1 Establishing Connections* |
| | | 01 to 05 | --- | Reserved by the system. | These bits are reserved by the system. Do not use. | --- |
| | | 06 | | WRITE BACKUP DATA | Writes data saved in the PCU's internal flash memory to the Memory Card installed in the CPU Unit when this bit turns ON. | *13-4-2 Memory Card Backup* |
| | | 07 | | READ BACKUP DATA | Reads data from the Memory Card installed in the CPU Unit to the PCU's internal flash memory when this bit turns ON. | |
| | | 08 to 14 | | Not used (reserved by the system). | These bits are reserved by the system. Do not use. | --- |
| | | 15 | | REJOIN (See note.) | Restarts MECHATROLINK communications. | *6-3-4 Rejoining the Connection* |
| | n+2 | --- | | Axes to connect (See note.) | Specifies the axes for which to start MECHATROLINK communications. | *6-3-5 Specifying the Axes to Connect* |
| | n+3 to n+5 | --- | --- | Not used (reserved by the system). | These bits are reserved by the system. Do not use. | --- |



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| I/O | Word | Bits | Category | Name | Operation | Details |
|---|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | n+6 | --- | Operating data for data transfer | Number of write words | Specifies the number of words to be written from the CPU Unit to the PCU. | *5-2-1 Writing PCU Parameters* |
| | n+7 | --- | | Write source area | Specifies the area containing the data to be written from the CPU Unit to the PCU. | |
| | n+8 | --- | | Write source word | Specifies the beginning word of the data to be written from the CPU Unit to the PCU. | |
| | n+9 | --- | | Write destination address | Specifies the address in the PCU to which the data is to be written. | |
| | n+10 | --- | | Number of read words | Specifies the number of words to be read from the PCU to the CPU Unit. | *5-2-2 Reading PCU Parameters* |
| | n+11 | --- | | Read source address | Specifies the address in the PCU from which the data is to be read. | |
| | n+12 | --- | | Read destination area | Specifies the area used to store the data read from the PCU. | |
| | n+13 | --- | | Read destination word | Specifies the word used to store the data read from the PCU. | |
| | n+14 | --- | --- | Not used (reserved by the system). | These bits are reserved by the system. Do not use. | --- |

**Note** The REJOIN Bit and the Axes to Connect parameter are supported for unit version 2.0 or later. The allocated bit and word are not used for earlier unit versions.



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**Common Operating Input Memory Area** n = CIO 1500 + (unit number × 25)

| I/O | Word | Bits | Category | Name | Operation | Details |
|---|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | n+15 | 00 to 11 | PCU common status words | Not used (reserved by the system). | These bits are reserved by the system. Do not use. | --- |
| | | 12 | | Unit Error Flag | ON when a Unit common error has occurred. | *12-1 Overview of PCU Errors* |
| | | 13 | | Not used (reserved by the system). | This bit is reserved by the system. Do not use. | --- |
| | | 14 | | Data Transferring Flag | ON when data is being transferred between the CPU Unit and PCU, or when data is being saved in the PCU's internal flash memory. | *5-2 Transferring PCU Parameters* |
| | | 15 | | Not used (reserved by the system). | This bit is reserved by the system. Do not use. | --- |
| | n+16 | 00 to 11 | | Reserved by the system. | These bits are reserved by the system. Do not use. | --- |
| | | 12 | | Memory Card Transfer Error | Indicates that an error occurred when writing/reading backup data to/from the Memory Card. | *13-4-2 Memory Card Backup* |
| | | 13 | | Reserved by the system. | This bit is reserved by the system. Do not use. | --- |
| | | 14 | | Unit Busy Flag | ON when PCU is processing command sent to the Common Operating Memory Area.<br>This flag also turns ON during initial processing when PCU power is turned ON or the Unit is restarted. | *12-6 Error Reset* |
| | | 15 | | Connection Status Flag | ON when PCU starts MECHATROLINK communications. | *6-3-2 MECHATROLINK Communications Status* |
| | n+17 to n+20 | --- | --- | Reserved by the system. | These bits are reserved by the system. Do not use. | --- |
| | n+21 | --- | | Unit error code | Returns the error code when a Unit Common error occurs. | *12-4 Error Codes* |



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| I/O | Word | Bits | Category | Name | Operation | Details |
|---|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | n+22 | 00 | Axis communications status bits | Axis 1 communications status | Bits 00 to 15 correspond to the communications status for axes 1 to 16.<br>The bits will turn ON if the corresponding axes registered in the scan list are communicating normally. | *6-3-2 MECHATROLINK Communications Status* |
| | | 01 | | Axis 2 communications status | | |
| | | 02 | | Axis 3 communications status | | |
| | | 03 | | Axis 4 communications status | | |
| | | 04 | | Axis 5 communications status | | |
| | | 05 | | Axis 6 communications status | | |
| | | 06 | | Axis 7 communications status | | |
| | | 07 | | Axis 8 communications status | | |
| | | 08 | | Axis 9 communications status | | |
| | | 09 | | Axis 10 communications status | | |
| | | 10 | | Axis 11 communications status | | |
| | | 11 | | Axis 12 communications status | | |
| | | 12 | | Axis 13 communications status | | |
| | | 13 | | Axis 14 communications status | | |
| | | 14 | | Axis 15 communications status | | |
| | | 15 | | Axis 16 communications status | | |
| | n+23 to n+24 | --- | --- | Not used (reserved by the system). | These bits are reserved by the system. Do not use. | --- |



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# 4-7 Axis Operating Output Memory Areas

The Axis Operating Output Memory Areas contain outputs used to set operation for the Servo Driver and Servomotor axes that are connected using MECHATROLINK communications. These outputs include operating commands, such as direct operation, ORIGIN SEARCH, and JOG, and related position and speed command values.

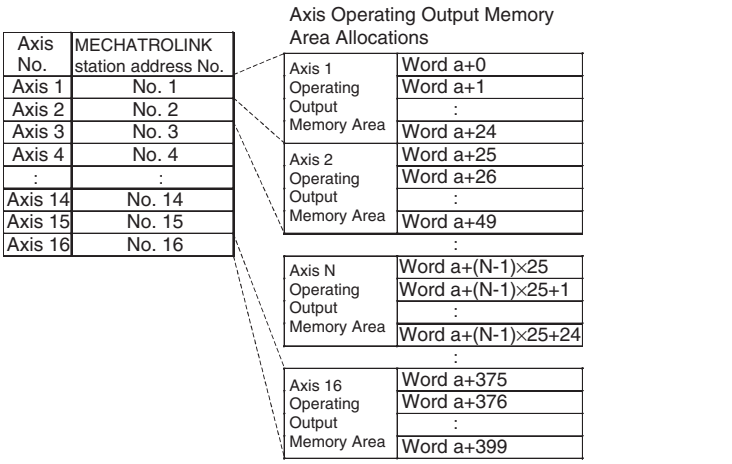
## 4-7-1 Axis Operating Output Memory Area Overview

The Axis Operating Output Memory Areas are allocated 25 words per axis in the CPU Unit's memory area set in the PCU's Common Parameters (Axis Operating Output Memory Area designation, beginning word of Axis Operating Output Memory Area).

The designated beginning word corresponds to the beginning word of the area for axis 1, and the other areas are allocated words in sequence up to the highest axis number registered in the scan list. For details on area allocations, refer to *6-2-2 Scan List and PCU Area Allocations*.

The beginning words of the Axis Operating Output Memory Areas are determined by the axis number of each axis using the following equation.

Beginning Word of Axis Operating Output Memory Area for Axis N:
a= Beginning word of Axis Operating Output Memory Area specified in Common Parameters + (N–1) × 25 (N = 1 to 16)




a = Beginning word of Axis Operating Output Areas specified in Common Parameters



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## 4-7-2 Axis Operating Output Memory Area Allocations

The memory allocation of the Axis Operating Output Memory Areas is shown in the following table. For details on functions and operations of each word, such as operation timing, refer to the section given in the *Details* column.

a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

| I/O | Word | Bits | Category | Name | Operation | Details |
|---|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | a | 00 | Direct operation commands | LINEAR INTERPOLATION SETTING (See note 1.) | Setting the linear interpolation operation is started when this bit turns ON. | *9-7 Linear Interpolation* |
| | | 01 | | LINEAR INTERPOLATION START (See note 1.) | The linear interpolation operation that has been set is started when this bit turns ON. | |
| | | 02 | | Not used (reserved by the system). | These bits are reserved by the system. Do not use. | --- |
| | | 03 | | ABSOLUTE MOVEMENT | Starts positioning operation with the designated position treated as an absolute position when this bit turns ON. | *9-4 Using Direct Operation* |
| | | 04 | | RELATIVE MOVEMENT | Starts positioning operation with the designated position treated as a relative position when this bit turns ON. | |
| | | 05 | | INTERRUPT FEEDING | Interrupt feeding begins for ABSOLUTE MOVEMENT and RELATIVE MOVEMENT commands. | *9-5 Interrupt Feeding* |
| | | 06 | Origin positioning commands | ORIGIN SEARCH | Executes an origin search when this bit turns ON. | *8-2 Origin Search Operation* |
| | | 07 | | ORIGIN RETURN | Returns position to the origin when this bit turns ON. | *8-4 Origin Return* |
| | | 08 | | PRESENT POSITION PRESET | Forcibly changes the present position to the designated position, and thus establishes an origin relative to the position when this bit turns ON. | *8-3 Present Position Preset* |
| | | 09 | Commands for special functions | JOG | Jogging is executed while this bit is ON. | *10-2 Jogging* |
| | | 10 | | Direction designation | This bit designates the direction for when jogging is executed. | |
| | | 11 | | Not used (reserved by the system). | This bit is reserved by the system. Do not use. | --- |
| | | 12 | | ERROR RESET | Resets (turns OFF) the error status for each axis when this bit turns ON. | *12-6 Error Reset* |
| | | 13 | | DEVIATION COUNTER RESET (See note 4.) | Resets the deviation counter to 0 when this bit turns ON. | *10-10 DEVIATION COUNTER RESET* |
| | | 14 | | Override Enable Bit | This bit enables or disables the override. | *10-3 Override* |
| | | 15 | | DECELERATION STOP | Starts decelerating positioning to a stop when this bit turns ON. | *10-9 Stop Functions* |



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| I/O | Word | Bits | Category | Name | Operation | Details |
|---|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | a+1 | 00 | Commands for special functions | SERVO LOCK | Executes SERVO LOCK when this bit turns ON. | *10-1 Servo Lock/ Unlock* |
| | | 01 | | SERVO UNLOCK | Executes SERVO UNLOCK when this bit turns ON. | |
| | | 02 | | SPEED CONTROL | Starts speed control using the speed command value for speed control as the target speed when this bit turns ON. | *10-5 Speed Control* |
| | | 03 | | TORQUE CONTROL | Starts torque control using the torque command value when this bit turns ON. | *10-6 Torque Control* |
| | | 04 to 10 | | Not used (reserved by the system). | These bits are reserved by the system. Do not use. | --- |
| | | 11 | Servo Parameter transfer commands | DEVICE SETUP | Starts Servo Driver setup when this bit turns ON. | *5-3-4 Device Setup* |
| | | 12 | | WRITE SERVO PARAMETER | Writes data to the Servo Driver from the CPU Unit when this bit turns ON. | *5-3-1 Writing Servo Parameters* |
| | | 13 | | READ SERVO PARAMETER | Reads data from the Servo Driver to the CPU Unit when this bit turns ON. | *5-3-2 Reading Servo Parameters* |
| | | 14 | | SAVE SERVO PARAMETER | Writes data to the Servo Driver's non-volatile memory at the same time as writing the Servo Parameters when this bit turns ON. | *5-3-3 Saving Servo Parameters* |
| | | 15 | Special command | EMERGENCY STOP | Executes emergency stop when this bit turns ON. | *10-9 Stop Functions* |
| | a+2 | --- | Operating data for position control | Position command value (rightmost word) | Specifies the position for performing present position preset and direct operation. | *9-4 Using Direct Operation*<br>*9-7 Linear Interpolation*<br>*8-3 Present Position Preset* |
| | a+3 | --- | | Position command value (leftmost word) | | |
| | a+4 | --- | | Speed command value (rightmost word) | Specifies the target speed for performing direct operation, jogging, origin searches, and origin returns. | *8-2 Origin Search Operation*<br>*8-4 Origin Return*<br>*9-4 Using Direct Operation*<br>*9-7 Linear Interpolation*<br>*10-2 Jogging* |
| | a+5 | --- | | Speed command value (leftmost word) | | |



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| I/O | Word | Bits | Category | Name | Operation | Details |
|---|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | a+6 | --- | Speed control data | Speed command value for speed control (rightmost word) | Specifies the target speed for performing speed control. | *10-5 Speed Control* |
| | a+7 | --- | | Speed command value for speed control (leftmost word) | | |
| | a+8 | --- | Torque control data | Torque command value (rightmost word) | Specifies the torque for performing torque control. | *10-6 Torque Control* |
| | a+9 | --- | | Torque command value (leftmost word) | | |
| | a+10 | --- | Position/ speed/ torque control data | Option command value 1 (rightmost word) | Set the command value of the auxiliary functions for position/ speed/torque control, such as the acceleration/deceleration for linear interpolation, torque feed forward command, the torque limit for speed control, and the speed limit for torque control. | *9-7 Linear Interpolation*<br>*10-5 Speed Control*<br>*10-6 Torque Control* |
| | a+11 | --- | | Option command value 1 (leftmost word) | | |
| | a+12 | --- | | Option command value 2 (rightmost word) | | |
| | a+13 | --- | | Option command value 2 (leftmost word) | | |
| | a+14 | --- | Operating data for special function | Override | This bit specifies the override rate. | *10-3 Override* |
| | a+15 | 00 to 03 | Operating data for expanded monitoring | Monitor 1 type | Specifies the monitor type for monitor 1 in the Axis Operating Input Memory Areas. | *4-8-6 Expanded Monitoring* |
| | | 04 to 07 | | Monitor 2 type | Specifies the monitor type for monitor 2 in the Axis Operating Input Memory Area. | |
| | | 08 to 15 | | Not used (reserved by the system). | These bits are reserved by the system. Do not use. | --- |



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| I/O | Word | Bits | Category | Name | Operation | Details |
|---|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | a+16 | 00 to 02 | --- | Reserved by the system. | These bits are reserved by the system. Do not use. | --- |
| | | 03 | Acceleration/deceleration curves | Exponential curve designation | Specifies an exponential curve as the acceleration/deceleration curve for executing direct operation, jogging, origin searches, and origin returns. | *8-2 Origin Search Operation*<br>*8-4 Origin Return*<br>*9-4 Using Direct Operation*<br>*10-2 Jogging* |
| | | 04 | | S-curve designation | Specifies an S-curve (movement average) as the acceleration/deceleration curve for executing direct operation, jogging, origin searches, and origin returns. | |
| | | 05 to 13 | --- | Reserved by the system. | These bits are reserved by the system. Do not use. | --- |
| | | 14 | Torque limit | Forward rotation current limit designation | Specifies the torque limit in the forward direction for axis operation. | *10-4 Torque Limits* |
| | | 15 | | Reverse rotation current limit designation | Specifies the torque limit in the reverse direction for axis operation. | |
| | a+17 | --- | Operating data for transferring Servo Parameters | Servo Parameter No. | Specifies the parameter number for the Servo Parameters to be written from or read to the CPU Unit. | *5-3 Transferring Servo Parameters* |
| | a+18 | --- | | Parameter size | Specifies the parameter size for the Servo Parameters to be written from or read to the CPU Unit. | |
| | a+19 | --- | | Write data (rightmost word) | Specifies the data to be written to the Servo Driver from the CPU Unit. | *5-3-1 Writing Servo Parameters*<br>*5-3-3 Saving Servo Parameters* |
| | a+20 | --- | | Write data (leftmost word) | | |
| | a+21 | 00 to 03 | Linear interpolation data | Interpolation axis designation for axes 1 to 4 (See note 2.) | Specifies the axes for linear interpolation for combinations of axes 1 to 4. | *9-7 Linear Interpolation* |
| | | 04 to 07 | | Interpolation axis designation for axes 5 to 8 (See note 3.) | Specifies the axes for linear interpolation for combinations of axes 5 to 8. | |
| | | 08 to 15 | | Not used (reserved by the system). | These bits are reserved by the system. Do not use. | |
| | a+22 | 00 to 03 | | Interpolation position designation for axes 1 to 4 (See note 2.) | Specify absolute or relative positioning for the axes for linear interpolation. | |
| | | 04 to 07 | | Interpolation position designation for axes 5 to 8 (See note 3.) | | |
| | | 08 to 15 | | Not used (reserved by the system). | These bits are reserved by the system. Do not use. | |
| | a+23 | --- | | Interpolation speed command value (rightmost word) (See note 1.) | Specifies the interpolation speed for linear interpolation. | |
| | a+24 | --- | | Interpolation speed command value (leftmost word) (See note 1.) | | |



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**Note**

(1) Allocated in Axis Operating Output Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(2) Allocated in Axis Operating Output Memory Area for axis 1 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(3) Allocated in Axis Operating Output Memory Area for axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(4) The DEVIATION COUNTER RESET can be used with unit version 1.3 or later. This bit is not used for earlier unit versions.

## 4-7-3 Axis Operating Output Memory Area Priority

The Position Control Unit performs exclusive control for the command executed for the axis operating output bits. Depending on the status of the Position Control Unit (i.e., the Servo locked/unlocked status, Busy Flag status, and ON/OFF status of axis operating output bits), the command is disabled or detected as an error.

The operations that are performed when an attempt is made to execute more than one function are described depending on the operating status.

### When Position Control Unit Is Not Executing a Function (When Busy Flag = 0)

The operation that is performed for each command when the Position Control Unit is not executing a function (including when the Busy Flag is reset after completing or canceling operation) is shown below depending on the Servo locked/unlocked status and the ON/OFF status of axis operating output bits.

(Refer to *12-1 Overview of PCU Errors* for information on executing functions when an error exists.)

**Servo Unlocked**

| | Function to be executed (See note.) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Executing function** | **SERVO UNLOCK** | **DEVIATION COUNTER RESET** | **EMERGENCY STOP** | **DECELERATION STOP** | **JOG** | **ORIGIN SEARCH** | **ORIGIN RETURN** | **ABSOLUTE MOVEMENT** | **RELATIVE MOVEMENT** | **INTERRUPT FEEDING** | **SPEED CONTROL** | **TORQUE CONTROL** | **PRESET POSITION PRESET** | **DEVICE SETUP** | **SERVO LOCK** |
| **SERVO UNLOCK Bit ON** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ❍ | ❍ | --- |
| **DEVIATION COUNTER RESET Bit ON** | ❍ | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ❍ | ❍ | --- |
| **EMERGENCY STOP Bit ON** | ❍ | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ❍ | ❍ | --- |
| **DECELERATION STOP Bit ON** | ❍ | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ❍ | ❍ | --- |
| **Other than above status** | ❍ | --- | --- | --- | × | × | × | × | × | × | × | | ❍ | ❍ | ❍ |

❍: Execution possible

×: A servo unlock error (axis error code: 3040) will occur and the function will not be executed.

---: Execution not possible (ignored)



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**Note:** The above table assumes that the conditions required for executing jogging, origin searches, origin returns, absolute/relative movements (including interrupt feeding), speed control, or torque control, such as command values and origin establishment, have been met.

**Servo Locked**

| | Function to be executed (See note.) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Executing function** | **SERVO UNLOCK** | **DEVIATION COUNTER RESET** | **EMERGENCY STOP** | **DECELERATION STOP** | **JOG** | **ORIGIN SEARCH** | **ORIGIN RETURN** | **ABSOLUTE MOVEMENT** | **RELATIVE MOVEMENT** | **INTERRUPT FEEDING** | **SPEED CONTROL** | **TORQUE CONTROL** | **PRESET POSITION PRESET** | **DEVICE SETUP** | **SERVO LOCK** |
| **DEVIATION COUNTER RESET Bit ON** | ❍ | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ❍ | × | --- |
| **EMERGENCY STOP Bit ON** | ❍ | ❍ | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ❍ | × | --- |
| **DECELERATION STOP Bit ON** | ❍ | ❍ | ❍ | --- | --- | --- | --- | --- | --- | --- | --- | --- | ❍ | × | --- |
| **Other than above status** | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | × | --- |

❍: Execution possible

×: A multistart error (axis error code: 3050) will occur and the function will not be executed.

---: Execution not possible (ignored)

**Note:** The above table assumes that the conditions required for executing jogging, origin searches, origin returns, absolute/relative movements (including interrupt feeding), speed control, or torque control, such as command values and origin establishment, have been met.

## When Position Control Unit Is Executing a Function (When Busy Flag = 1)

The operation that is performed for each command when the Position Control Unit is already executing a function is shown below depending on the Servo locked/unlocked status and the ON/OFF status of axis operating output bits.

| | Function to be executed (See note.) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Executing function** | **SERVO UNLOCK** | **DEVIATION COUNTER RESET** | **EMERGENCY STOP** | **DECELERATION STOP** | **JOG** | **ORIGIN SEARCH** | **ORIGIN RETURN** | **ABSOLUTE MOVEMENT** | **RELATIVE MOVEMENT** | **INTERRUPT FEEDING** | **SPEED CONTROL** | **TORQUE CONTROL** | **PRESET POSITION PRESET** | **DEVICE SETUP** | **SERVO LOCK** |
| **SERVO UNLOCK** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **DEVIATION COUNTER RESET** | ❍ | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **EMERGENCY STOP** | ❍ | ❍ | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |



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| | Function to be executed (See note.) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Executing function** | **SERVO UNLOCK** | **DEVIATION COUNTER RESET** | **EMERGENCY STOP** | **DECELERATION STOP** | **JOG** | **ORIGIN SEARCH** | **ORIGIN RETURN** | **ABSOLUTE MOVEMENT** | **RELATIVE MOVEMENT** | **INTERRUPT FEEDING** | **SPEED CONTROL** | **TORQUE CONTROL** | **PRESENT POSITION PRESET** | **DEVICE SETUP** | **SERVO LOCK** |
| **DECELERATION STOP** | ❍ | ❍ | ❍ | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **JOG** | ❍ | ❍ | ❍ | ❍ | --- | × | × | × | × | × | × | × | × | × | --- |
| **ORIGIN SEARCH** | ❍ | ❍ | ❍ | ❍ | × | × | × | × | × | × | × | × | × | × | --- |
| **ORIGIN RETURN** | ❍ | ❍ | ❍ | ❍ | × | × | × | × | × | × | × | × | × | × | --- |
| **POSITION CONTROL (ABSOLUTE MOVEMENT)** | ❍ | ❍ | ❍ | ❍ | × | × | × | ❍ | ❍ | × | ❍ | ❍ | × | × | --- |
| **POSITION CONTROL (RELATIVE MOVEMENT)** | ❍ | ❍ | ❍ | ❍ | × | × | × | ❍ | ❍ | × | ❍ | ❍ | × | × | --- |
| **INTERRUPT FEEDING** | ❍ | ❍ | ❍ | ❍ | × | × | × | × | × | × | ❍ | ❍ | × | × | --- |
| **SPEED CONTROL** | ❍ | --- | ❍ | ❍ | × | × | × | ❍ | ❍ | ❍ | ❍ | ❍ | × | × | --- |
| **TORQUE CONTROL** | ❍ | --- | ❍ | ❍ | × | × | × | ❍ | ❍ | ❍ | ❍ | ❍ | × | × | --- |
| **PRESENT POSITION PRESET** | ❍ | × | ❍ | ❍ | × | × | × | × | × | × | × | × | × | × | × |
| **DEVICE SETUP** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SERVO LOCK** | ❍ | --- | --- | --- | × | × | × | × | × | × | × | × | × | × | × |

❍: Execution possible

×: A multistart error (axis error code: 3050) will occur and the function will not be executed.

---: Execution not possible (ignored)

**Note:** The above table assumes that the conditions required for executing jogging, origin searches, origin returns, absolute/relative movements (including interrupt feeding), speed control, or torque control, such as command values and origin establishment, have been met.

## Executing Multiple Functions Simultaneously

The following table shows the PCU operations when multiple functions are executed at the same time for the same axis during a servo lock (including executing other functions while the Receiving Command Flag is ON.

| Function | Operation for simultaneous execution |
|---|---|
| SERVO UNLOCK | Takes priority over any other function executed at the same time.<br>All other operations are disabled while the SERVO UNLOCK Bit is ON. |
| DEVIATION COUNTER RESET | Takes priority over any other function executed at the same time except for SERVO UNLOCK.<br>The following functions will not be started while the DEVIATION COUNTER RESET Bit is ON. |
| EMERGENCY STOP | Executed before any other function executed at the same time, except SERVO UNLOCK or DEVIATION COUNTER RESET.<br>All other operation functions are disabled while the EMERGENCY STOP Bit is ON. |



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| Function | Operation for simultaneous execution |
|---|---|
| DECELERATION STOP | Executed before any other function executed at the same time, except SERVO UNLOCK, DEVIATION COUNTER RESET, and EMERGENCY STOP.<br>All other operation functions are disabled while the DECELERATION STOP Bit is ON. |
| ABSOLUTE/RELATIVE MOVEMENT (with INTERRUPT FEEDING)<br>ORIGIN SEARCH<br>ORIGIN RETURN<br>PRESENT POSITION<br>PRESET<br>JOG<br>SPEED CONTROL<br>TORQUE CONTROL<br>DEVICE SETUP<br>SERVO LOCK | A Multistart Error (error code: 3050) will occur if these commands are executed at the same time. |



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# 4-8 Axis Operating Input Memory Areas

The Axis Operating Input Memory Areas are allocated inputs for monitoring the status of axis operations of the Servo Driver and Servomotor axes that are connected using MECHATROLINK communications. These include present position and axis operating status.

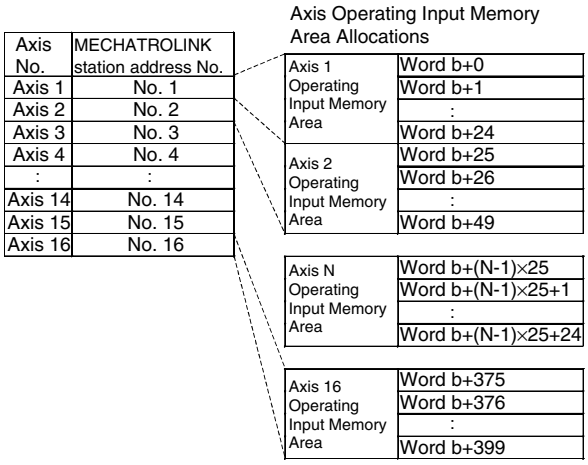
## 4-8-1 Axis Operating Input Memory Area Overview

The Axis Operating Input Memory Areas are allocated 25 words for each axis in the CPU Unit's memory area set in PCU's Common Parameters (Axis Operating Input Memory Area designation and beginning word of Axis Operating Input Memory Area).

The designated beginning word corresponds to the beginning word of the area for axis 1, and the other areas are allocated words in sequence up to the highest axis number registered in the scan list. For details on area allocations, refer to *6-2-2 Scan List and PCU Area Allocations*.

The beginning words of the Axis Operating Input Memory Areas are determined by the axis number of each axis using the following equation.

Beginning Word of Axis Operating Input Memory Area for Axis N:
b = Beginning word of Axis Operating Input Memory Area specified in Common Parameters + (N–1) × 25 (N = 1 to 16)




b: Beginning word of the Axis Operating Memory Areas specified in the Common Parameters.



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## 4-8-2 Axis Operating Input Memory Area Allocations

The memory allocation of the Axis Operating Input Memory Areas is shown in the following table. For details on functions and operations of each word, such as operation timing, refer to the section given in the *Details* column.

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

| I/O | Word | Bits | Category | Name | Function | Details |
|---|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | b | 00 | Axis Control Status Flags | Receiving Command Flag | ON when the PCU is in the process of receiving an operating command.<br>1: Receiving command<br>If another operating command with the same priority level is started while this flag is ON, a Multistart Error (axis error code: 3050) will occur. (Refer to *4-7-3 Axis Operating Output Memory Area Priority*.)<br>The Receiving Command Flag remains ON (1) for at least one cycle time, and turns OFF (0) when the command reception processing is completed. | *4-8-3 Axis Control Status Flags*<br>*9-4 Using Direct Operation*<br>*10-5 Speed Control*<br>*10-6 Torque Control* |
| | | 01 to 04 | | Not used (reserved by the system). | Always 0. | --- |
| | | 05 | | PCU Positioning Completed Flag | ON when a PCU operation executed in response to a positioning command is completed and the axis position is within the positioning completion range set for the target position.<br>1: Any of the following operations are completed: Direct operation (ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, INTERRUPT FEEDING), ORIGIN SEARCH, ORIGIN RETURN<br>The flag turns OFF (0) when the power is turned ON, a connection is established, or when another axis operation is started.<br>This flag remains OFF if EMERGENCY STOP or DECELERATION STOP are executed while the axis is operating. | *4-8-3 Axis Control Status Flags*<br>*8-2 Origin Search Operation*<br>*8-4 Origin Return*<br>*9-4 Using Direct Operation* |



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| I/O | Word | Bits | Category | Name | Function | Details |
|---|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | b | 06 | Axis Control Status Flags | No Origin Flag | ON when the origin is not established. | *4-8-3 Axis Control Status Flags*<br>*8-2 Origin Search Operation*<br>*8-3 Present Position Preset* |
| | | 07 | | Origin Stop Flag | ON when the present position of the axis is stopped within the origin range set in *Zero Point Width*. | *4-8-3 Axis Control Status Flags*<br>*8-2 Origin Search Operation* |
| | | 08 to 10 | | Not used (reserved by the system). | Always 0. | --- |
| | | 11 | | Warning Flag | ON when an axis warning has occurred. | *12-1 Overview of PCU Errors* |
| | | 12 | | Error Flag | ON when an axis error has occurred. | |
| | | 13 | | Busy Flag | ON during axis operation or processing. | *4-8-3 Axis Control Status Flags* |
| | | 14 | | Servo Parameter Transferring Flag | ON during transfer of Servo Parameters. | *5-3 Transferring Servo Parameters* |
| | | 15 | | Stop Execution Flag | ON when axis operation is stopped in response to EMERGENCY STOP or DECELERATION STOP. | *4-8-3 Axis Control Status Flags*<br>*10-9 Stop Functions* |



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| I/O | Word | Bits | Category | Name | Function | Details |
|---|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | b+1 | 00 to 02 | Servo Status Flags | Reserved by the system. | Used by the PCU system. | --- |
| | | 03 | | Servo ON (SVON) Flag | ON while Servo Driver is in Servo lock status. | *4-8-4 Servo Status Flags*<br>*10-1 Servo Lock/ Unlock* |
| | | 04 | | Main Power ON Flag (PON) | Indicates the status of the main circuit power supply to the Servo Driver. | *4-8-4 Servo Status Flags* |
| | | 05 and 06 | | Reserved by the system. | Used by the PCU system. | --- |
| | | 07 | | Positioning Completed (PSET) Flag/ Speed Conformity (V-CMP) Flag | The function of these flags depends on whether position control or speed control is being used.<br>For details, refer to the relevant sections. | *4-8-4 Servo Status Flags*<br>*10-5-2 Starting Speed Control* |
| | | 08 | | Distribution Completed (DEN) Flag/ Zero Speed (ZSPD) Flag | | |
| | | 09 | | Torque Limit (T_LIM) Status Flag | ON when the torque limit function is enabled and activated. | *4-8-4 Servo Status Flags*<br>*10-4-3 Torque Limits Set by Operating Commands* |
| | | 10 | | Reserved by the system. | Used by the PCU system. | --- |
| | | 11 | | Positioning Proximity (NEAR) Flag/ Speed Limit (V_LIM) Status Flag | The function of these flags changes according to whether position control or torque control is being used.<br>For details, refer to the relevant sections. | *4-8-4 Servo Status Flags*<br>*10-6-2 Starting Torque Control* |
| | | 12 | | Forward Software Limit Flag (P_SOT) | Indicates whether the present position is within the forward software limit range. | *4-8-4 Servo Status Flags*<br>*10-8 Software Limits* |
| | | 13 | | Reverse Software Limit Flag (N_SOT) | Indicates whether the present position is within the reverse software limit range. | |
| | | 14 to 15 | | Reserved by the system. | Used by the PCU system. | --- |
| | b+2 | --- | --- | Reserved by the system. | Used by the PCU system. | --- |



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| I/O | Word | Bits | Category | Name | Function | Details |
|---|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | b+3 | 00 | External I/O status | Forward rotation limit input | Returns the status of I/O signals for each axis.<br>1: Signal valid<br>0: Signal invalid<br>The external I/O status shows the enabled/disabled status of signals used for PCU control.<br>This status is different from the electrical ON/OFF status of the I/O signals. | *4-8-5 External I/O Status Bits* |
| | | 01 | | Reverse rotation limit input | | |
| | | 02 | | Origin proximity input | | |
| | | 03 | | Encoder Phase A input | | |
| | | 04 | | Encoder Phase B input | | |
| | | 05 | | Encoder Phase Z input | | |
| | | 06 | | External latch signal 1 input | | |
| | | 07 | | External latch signal 2 input | | |
| | | 08 | | External latch signal 3 input | | |
| | | 09 | | Brake output | | |
| | | 10 | | Emergency stop input | | |
| | | 11 to 15 | | Reserved by the system. | | |
| | b+4 | --- | Errors | Axis error code | Returns the error code for the axis error. | *12-4 Error Codes* |
| | b+5 | 00 to 03 | Expanded monitoring | Monitor 1 type | Indicates the monitor type for the present monitor 1 (b+10, b+11). | *4-8-6 Expanded Monitoring* |
| | | 04 to 07 | | Monitor 2 type | Indicates the monitor type for the present monitor 2 (b+12, b+13). | |
| | | 08 to 15 | | Not used (reserved by the system). | Always 0. | |
| | b+6 | --- | Present position | Feedback present position (rightmost word) | Returns the feedback present position. | *7-3 Coordinate System and Present Position* |
| | b+7 | --- | | Feedback present position (leftmost word) | | |
| | b+8 | --- | | Command present position (rightmost word) | Returns the command present position. | |
| | b+9 | --- | | Command present position (leftmost word) | | |



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| I/O | Word | Bits | Category | Name | Function | Details |
|---|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | b+10 | --- | Expanded monitoring | Monitor 1 (rightmost word) | Returns the value for the monitor specified as monitor 1 type in the Axis Operating Output Memory Areas. | *4-8-6 Expanded Monitoring* |
| | b+11 | --- | | Monitor 1 (leftmost word) | | |
| | b+12 | --- | | Monitor 2 (rightmost word) | Returns the value for the monitor specified as monitor 2 type in the Axis Operating Output Memory Areas. | |
| | b+13 | --- | | Monitor 2 (leftmost word) | | |
| | b+14 | --- | Servo Parameter data | Read data (rightmost word) | Returns the data read to the CPU Unit from the Servo Driver. | *5-3-2 Reading Servo Parameters* |
| | b+15 | --- | | Read data (leftmost word) | | |
| | b+16 to b+23 | --- | --- | Not used (reserved by the system). | Always 0. | --- |
| | b+24 | 00 | Linear interpolation status | Linear interpolation setting completed (See note.) | Indicates when setting the Position Control Unit has been completed for linear interpolation.<br>1: Linear interpolation setting completed. | *9-7 Linear Interpolation* |
| | | 01 to 12 | | Not used (reserved by the system). | Always 0. | |
| | | 13 | | Linear interpolation executing (See note.) | Indicates when linear interpolation is being performed. | |
| | | 14 and 15 | | Not used (reserved by the system). | Always 0. | |

**Note** Allocated in Axis Operating Input Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.



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## 4-8-3 Axis Control Status Flags

The Axis Control Status Flags in word b indicate the control status for each axis connected to the PCU. Use these flags to interface with the CPU Unit when using PCU functions.

| Name | Word | Bits | Contents |
|---|---|---|---|
| Receiving Command Flag | b | 00 | 0: Command reception enabled.<br>0 → 1: Command reception started.<br>1: Receiving command (command reception disabled). |
| PCU Positioning Completed Flag | | 05 | 0 → 1: Positioning completed. |
| No Origin Flag | | 06 | 0: Origin established.<br>1: Origin not established. |
| Origin Stop Flag | | 07 | 0: Outside origin range.<br>1: Within origin range. |
| Warning Flag | | 11 | 0: No warning.<br>1: Warning has occurred. |
| Error Flag | | 12 | 0: No axis error.<br>1: Axis error has occurred. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing). |
| Servo Parameter Transferring Flag | | 14 | 0: Powerup, transfer completed, or transfer failed.<br>1: Servo Parameter transferring. |
| Stop Execution Flag | | 15 | 0 → 1: Stop operation completed. |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The flags that are particularly for controlling axis operation are described next. For details on timing charts for each flag operation, refer to the relevant section.

For details on the Error Flag and Warning Flag, refer to *SECTION 12 Troubleshooting*. For details on the Servo Parameters Transferring Flag, refer to *5-3 Transferring Servo Parameters*.

### Receiving Command Flag

**Word** b

**Bit** 00

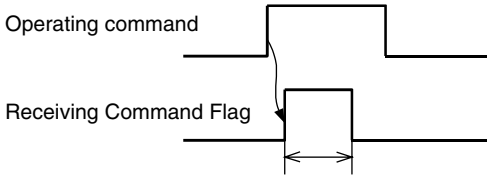
**Function** This flag turns ON when the PCU is in the process of receiving any of the following operating commands.

ABSOLUTE MOVEMENT (including INTERRUPT FEEDING), RELATIVE MOVEMENT (including INTERRUPT FEEDING), ORIGIN SEARCH, ORIGIN RETURN, PRESENT POSITION PRESET, JOG (JOG Bit ON), DECELERATION STOP, EMERGENCY STOP, SERVO LOCK, SERVO UNLOCK, SPEED CONTROL, TORQUE CONTROL, DEVICE SETUP, ERROR RESET, or DEVIATION COUNTER RESET.



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The PCU turns ON the Receiving Command Flag when an operating command is received from the CPU Unit, and the flag remains ON for at least CPU Unit cycle time. The flag turns OFF when the command reception processing is completed.
If another operating command with the same priority level is started while this flag is ON, a Multistart Error (axis error code: 3050) will occur. (Refer to *4-7-3 Axis Operating Output Memory Area Priority*.)




The Receiving Command Flag remains ON for either the length of one CPU Unit cycle time or for the time required by the PCU to process command reception, whichever is longer.

The Receiving Command Flag status does not change when changing the target speed during position control/speed control, changing the torque command value during torque control, switching override enable/disable, changing the override value, or transferring Servo Parameters.
The Receiving Command Flag is used mainly to determine ON/OFF timing of the operating command bits when sending more than one operating command at the same time during axis operation (i.e., while the Busy Flag is ON), such as changing the target position while using direct operation.

## PCU Positioning Completed Flag

**Word** b

**Bit** 05

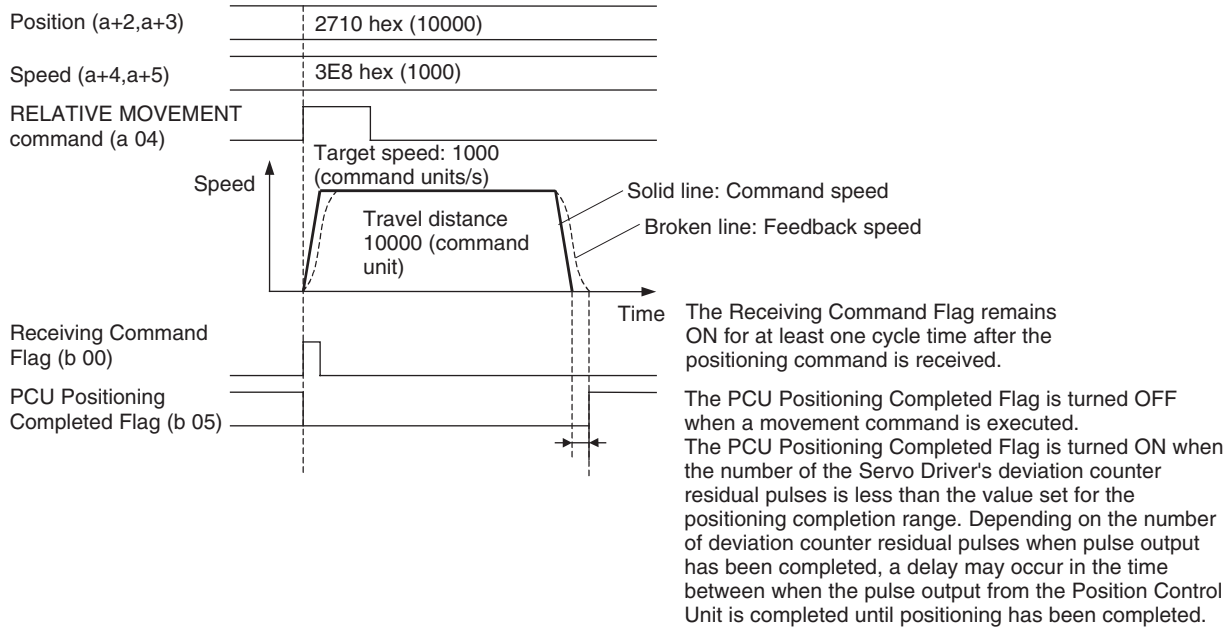
**Function** This flag turns ON when a PCU operation is completed normally in response to any of the following positioning commands and the feedback present position of the axis has reached a position within the range of the Servo Parameter *Positioning Completion Range 1* (Pn500 for R88D-WT□ and Pn522 for R88D-WN□-ML2 and SMARTSTEP Junior) specified for the target position (command position). (The position deviation must be within the range of *Positioning Completion Range 1*.)

ABSOLUTE MOVEMENT (including INTERRUPT FEEDING), RELATIVE MOVEMENT (including INTERRUPT FEEDING), ORIGIN SEARCH, or ORIGIN RETURN.



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Example: Executing RELATIVE MOVEMENT COMMAND.




The PCU Positioning Completed Flag will not turn ON when axis operation stops under the following conditions.

- Stops due to an error during positioning.
- Stops due to DECELERATION STOP or EMERGENCY STOP sent during positioning.
- Jogging (JOG) stops.

The PCU Positioning Completed Flag will also not turn ON when axis operation stops during positioning due to DECELERATION STOP or EMERGENCY STOP, even if the position is within the *Positioning Completion Range 1* specified for the original target position.

The PCU Positioning Completed Flag will turn OFF when the power is turned ON, a connection is released, another axis operation is started successfully (including jogging, speed control, and torque control), or Servo Unlock is executed.

**Note** On machines for which position deviation occurs between the feedback position and target position (command position) when the axis is stopped, such as pushing a load or using a vertical axis, the PCU Positioning Completed Flag will not turn ON if the set value for the *Positioning Completion Range 1* is too small. Adjust the set value for the *Positioning Completion Range 1* to suit the operating conditions for the machine.



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## No Origin Flag

**Word** b

**Bit** 06

**Function** This flag turns ON when the origin is not established. Except when using Servomotors with absolute encoders, the PCU's No Origin Flag turns ON immediately after a connection is established, at which time the origin is not established. (The No Origin Flag turns OFF, however, immediately after the PCU power is turned ON or the Unit is restarted, and the flag remains OFF until the first CONNECT is executed.) The origin for each axis is determined by either of the following origin positioning operations, after which the No Origin Flag turns OFF.

ORIGIN SEARCH, PRESENT POSITION PRESET

When using Servomotors with absolute encoders, the origin is established by reading the absolute value data when establishing a connection or executing SERVO LOCK. The established origin is held even if SERVO UNLOCK is executed, and will not be set to no origin status. No origin status (No Origin Flag ON) occurs under the following conditions.

- When DEVICE SETUP is executed (during Servo unlock status)
- When a connection is released (See note.)

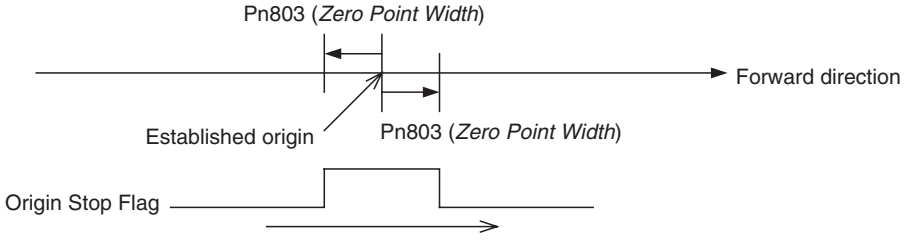
**Note** When a connection is released (including a disconnection due to error), the status for each axis becomes undefined (non-execution), except for the Error Flag and axis error code. The No Origin Flag turns ON while in no origin (origin not established) status.

## Origin Stop Flag

**Word** b

**Bit** 07

**Function** This flag turns ON when the origin has been established and the present position of each axis is within the origin position range set in Servo Parameter *Zero Point Width* (Pn803). This flag turns ON for the interval in which the present position is within the origin position range when it passes the origin during axis operation.




The Origin Stop Flag turns ON while the present position is within the range of ±Pn803 from the established origin when traveling forward.



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## Busy Flag

**Word** b

**Bit** 13

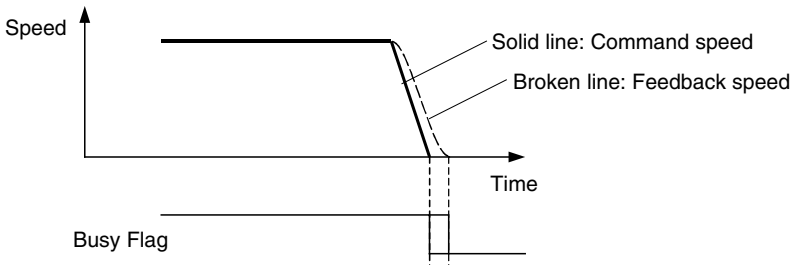
**Function**

This flag turns ON to indicate that the Position Control Unit is executing one of the following operating commands. The flag will turn ON when the operation command is started and remain ON for at least one cycle time of the CPU Unit. For commands associated with axis operations, the Busy Flag remains ON during the axis operation.

ABSOLUTE MOVEMENT (including INTERRUPT FEEDING), RELATIVE MOVEMENT (including INTERRUPT FEEDING), ORIGIN SEARCH, ORIGIN RETURN, PRESENT POSITION PRESET, JOG (JOG ON, JOG OFF), DECELERATION STOP, EMERGENCY STOP, SERVO LOCK, SERVO UNLOCK, SPEED CONTROL, TORQUE CONTROL, DEVICE SETUP, ERROR RESET, or DEVIATION COUNTER RESET.

For operating commands associated with axis operations, the Busy Flag status when the axis operation is completed (axis stops) depends on the operating command, as follows:

- ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, ORIGIN SEARCH, or ORIGIN RETURN:
  The Busy Flag turns OFF when the axis feedback position reaches the *Positioning Completion Range 1* (Servo parameter Pn500 for R88D-WT□ and Pn522 for R88D-WN□-ML2 and SMARTSTEP Junior) set for the target stop position. (The Busy Flag turns OFF at the same time as the PCU Positioning Completed Flag turns ON.)
- Jogging Stopped (JOG Bit OFF), DECELERATION STOP, EMERGENCY STOP (Including Error Stop), or DEVIATION COUNTER RESET:
  The Busy Flag turns OFF regardless of the axis feedback position when the command position reaches the target (stop) position (i.e., when sending the command to the Servo Driver is completed).




The Busy Flag turns OFF at completion of sending the command (i.e., when the command present position stops changing) when the axis stops due to jogging stop (JOG Bit OFF), DECELERATION STOP, or EMERGENCY STOP (including error stop).

When positioning for ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, ORIGIN SEARCH, or ORIGIN RETURN stops, the Busy Flag will not turn OFF until the feedback present position is within the *Positioning Completion Range* for the command position.



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## Stop Execution Flag

| | |
|---|---|
| **Word** | b |
| **Bit** | 15 |
| **Function** | This flag turns ON in response to a DECELERATION STOP or EMERGENCY STOP execution regardless of the axis operation status. If DECELERATION STOP or EMERGENCY STOP is executed during axis operation, the Stop Execution Flag turns ON when the command position reaches the target (stop) position (i.e., when sending the command to the Servo Driver is completed) regardless of the axis feedback position.<br>This flag then turns OFF when the power is turned ON, a connection is released, or when another axis operation is started. |
| **Details** | Refer to *10-9 Stop Functions*. |



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## 4-8-4 Servo Status Flags

The Servo Status Flags (word b+1) are flags that monitor the control status of the Servo Driver. This enables monitoring of the Servo Driver control status (position, speed, torque control loop).

| Name | Word | Bits | Contents |
|---|---|---|---|
| Servo ON Flag | b+1 | 03 | 0: Servo unlocked.<br>1: Servo locked. |
| Main Power ON Flag | | 04 | 0: Main circuit power supply OFF.<br>1: Main circuit power supply ON. |
| Positioning Completed Flag/Speed Conformity Flag | | 07 | During position control: Positioning Completed Flag<br>0: Sending position control command to Servo Driver or the position is outside *Positioning Completion Range 1*.<br>1: Sending position control command to Servo Drivers completed and the position is within *Positioning Completion Range 1*.<br>During speed control: Speed Conformity Flag<br>0: Speed does not match the speed command value for speed control.<br>1: Speed matches the speed command value for speed control. |
| Distribution Completed Flag/Zero Speed Flag | | 08 | During position control: Distribution Completed Flag<br>0: Sending position control command to Servo Driver.<br>1: Sending position control command to Servo Driver completed.<br>During speed control: Zero Speed Flag<br>0: Not zero speed.<br>1: Detecting zero speed. |
| Torque limit | | 09 | 0: Torque limit function disabled.<br>1: Torque limit function enabled. |
| Positioning Proximity Flag/Speed Limit Status Flag | | 11 | During position control: Positioning Proximity Flag<br>0: Outside Positioning *Completion Range 2*<br>1: Within Positioning *Completion Range 2*<br>During torque control: Speed Limit Status Flag<br>0: Speed limit function disabled.<br>1: Speed limit function enabled. |
| Forward Software Limit Flag | | 12 | 0: Within forward software limit.<br>1: Forward software limit exceeded. |
| Reverse Software Limit Flag | | 13 | 0: Within reverse software limit.<br>1: Reverse software limit exceeded. |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25



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The functions of the bits shown in this table are applicable when the Position Control Unit is connected to a W-series Servo Driver combined with a JUSP-NS115 MECHATROLINK-II Application Module, to a W-series Servo Driver with Built-in MECHATROLINK-II communications or to a SMARTSTEP Junior Servo Driver. The functions of Servo Status Flags 07, 08, and 11 depend on whether position control, speed control, or torque control is being used. (The SMARTSTEP Junior Servo Driver supports only position control.)

**Note** The Servo Status Flags are used to monitor the control status of the Servo Driver. The Servo Status Flags may not reflect the Servo status for short-term changes in Servo Driver status, depending on the PLC cycle time and MECHATROLINK communications cycle.

## Servo ON Flag

**Word** b+1

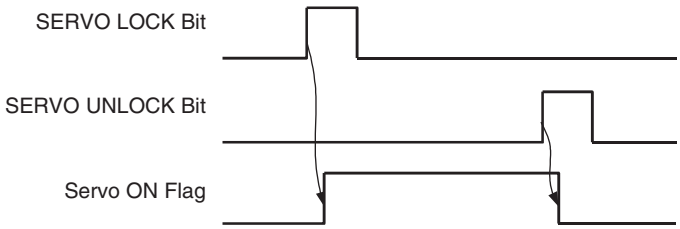
**Bit** 03

**Function** ON while Servo Driver is in Servo lock status during position control or in Servo ON status (Servomotor carrying current) during speed or torque control.

0: Servo unlocked (Servo OFF)

1: Servo locked (Servo ON)

This flag turns ON when the SERVO LOCK Bit (a+1, bit 00) in the Axis Operating Output Memory Area turns ON, and turns OFF when the SERVO UNLOCK Bit (a+1, bit 01) turns ON or an error that sets the Servo in free run state occurs.




**Details** Refer to *10-1 Servo Lock/Unlock*.

## Main Power ON Flag

**Word** b+1

**Bit** 04

**Function** Indicates the status of the main circuit power supply to the Servo Driver.

0: Main circuit power supply OFF

1: Main circuit power supply ON

## Positioning Completed Flag (during Position Control) Speed Conformity Flag (during Speed Control)

**Word** b+1

**Bit** 07

**Function** The function of these flags depends on whether position control or speed control is being used.



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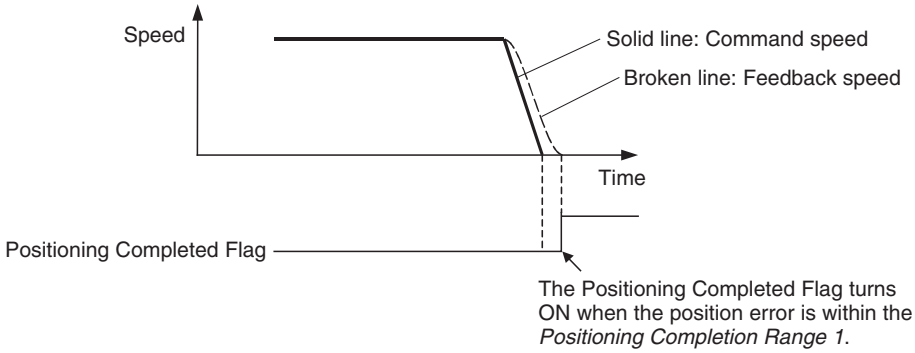
**During Position Control: Positioning Completed Flag**

This flag turns ON when the command position reaches the target (stop) position (Sending position control command to Servo Driver completed), and the feedback position is within the range set for the target (stop) position Servo Parameter *Positioning Completion Range 1* (Pn500 for R88D-WT□ and Pn522 for R88D-WN□-ML2 and SMARTSTEP Junior).

0: Sending position control command to Servo Driver or the position is outside *Positioning Completion Range 1*.

1: Sending position control command to Servo Driver completed and the position is within *Positioning Completion Range 1*.

The Positioning Completed Flag in the Servo Status Flags is different to the PCU Positioning Completed Flag in the Axis Control Status Flags (word b, bit 05). In addition to when positioning stops, this flag turns ON when the number of pulses remaining in the Servo Driver's deviation counter are within the *Positioning Completion Range 1*, even for jogging stops, deceleration stops, emergency stops, and error stops.

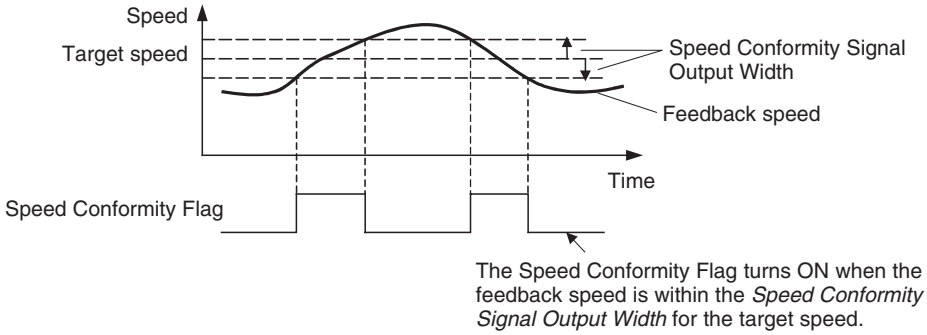



**During Speed Control: Speed Conformity Flag (W-series Servo Drivers Only)**

This flag turns ON when the feedback speed during speed control matches the target speed (speed command value for speed control), i.e., the speed is within the range of the Servo Parameter *Speed Conformity Signal Output Width* (Pn503).

0: Speed does not match the speed command value for speed control.

1: Speed does match the speed command value for speed control.




**Details** Refer to *10-5-2 Starting Speed Control*.



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## Distribution Completed Flag (during Position Control)
## Zero Speed Flag (during Speed Control)

**Word** b+1

**Bit** 08

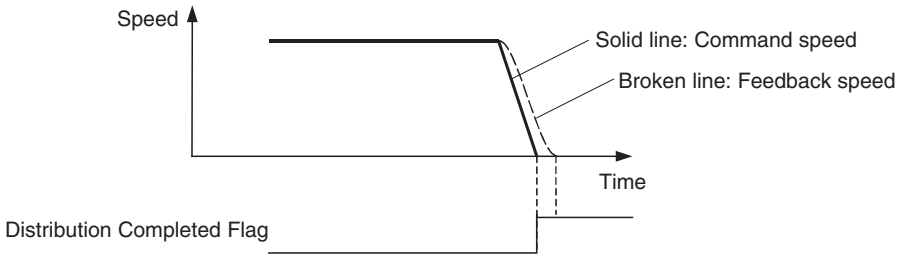
**Function** The function of these flags depends on whether position control or speed control is being used.

**During Position Control: Distribution Completed Flag**

This flag turns ON when the command position reaches the target (stop) position (When sending the position control command to Servo Driver is completed).

0: Sending the position control command to Servo Driver.

1: Sending the position control command to Servo Driver completed.

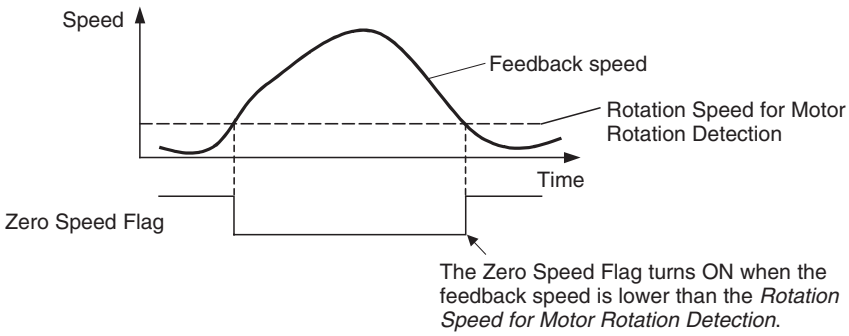



**During Speed Control: Zero Speed Flag (W-series Servo Drivers Only)**

This flag turns ON when the feedback speed during speed control drops below the Servo Parameter *Rotation Speed for Motor Rotation Detection* (Pn502).

0: Not at zero speed

1: Detecting zero speed




**Details** Refer to *10-5-2 Starting Speed Control*.



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## Torque Limit Status Flag

**Word** b+1

**Bit** 09

**Function** This flag turns ON when the Servomotor's output torque is limited by the torque limit. The torque limit will be the lowest one among all the limit values that are enabled for the torque limits specified in *Forward Torque Limit* (Pn402), *Reverse Torque Limit* (Pn403), *Forward Rotation External Current Limit* (Pn404), *Reverse Rotation External Current Limit* (Pn405), or in the option command value for speed control.

0: Torque limit function disabled

1: Torque limit function enabled

**Details** Refer to *10-4 Torque Limits*.

## Positioning Proximity Flag (during Position Control)<br>Speed Limit Status Flag (during Torque Control)

**Word** b+1

**Bit** 11

**Function** The function of these flags depends on whether position control or torque control is being used.

**During Position Control: Positioning Proximity Flag**

This flag turns ON when the feedback position is within the range for Servo Parameter *Positioning Completion Range 2* (Pn504 for R88D-WT□ and Pn524 for R88D-WN□-ML2 and SMARTSTEP Junior) for the target (stop) position.

0: Outside *Positioning Completion Range 2*

1: Within *Positioning Completion Range 2*

**During Torque Control: Speed Limit Status Flag**

This flag turns ON when the feedback speed during torque control is limited by the Servo Parameter *Speed Limit* (Pn407), or option command value.

0: Speed limit function disabled

1: Speed limit function enabled

**Details** Refer to *10-6-2 Starting Torque Control*.



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### Forward Software Limit Flag and Reverse Software Limit Flag

**Word** b+1

**Bits** 12 and 13

**Function** These flags turn ON and OFF when the software limit function is enabled to indicate the present position status for the forward/reverse software limit.

Forward Software Limit Flag

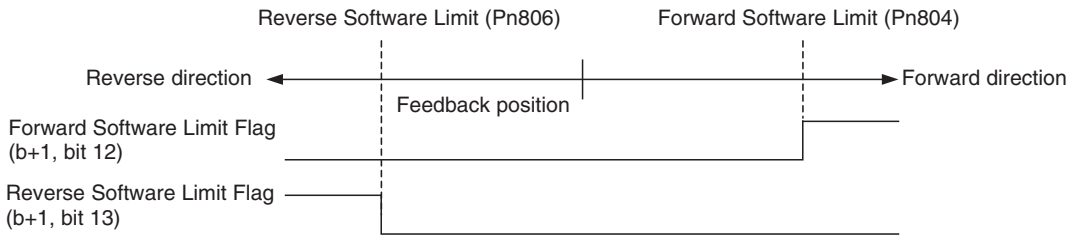
0: Within forward software limit range

1: Forward software limit range exceeded

Reverse Software Limit Flag

0: Within reverse software limit range

1: Reverse software limit range exceeded




**Details** Refer to *10-8 Software Limits*.

## 4-8-5 External I/O Status Bits

The External I/O Status Bits (word b + 3) show the I/O status of the I/O signals allocated to the Servo Driver.

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | b+3 | 00 | External I/O status | Forward rotation limit input | Returns the status of I/O signals for each axis.<br>1: Signal valid<br>0: Signal invalid<br>The external I/O status shows the enabled/disabled status of signals used for PCU control.<br>This status is different from the electrical ON/OFF status of the I/O signals. |
| | | 01 | | Reverse rotation limit input | |
| | | 02 | | Origin proximity input signal | |
| | | 03 | | Encoder Phase A input | |
| | | 04 | | Encoder Phase B input | |
| | | 05 | | Encoder Phase Z input | |
| | | 06 | | External latch signal 1 input | |
| | | 07 | | External latch signal 2 input | |
| | | 08 | | External latch signal 3 input | |
| | | 09 | | Brake output | |
| | | 10 | | Emergency stop input | |
| | | 11 to 15 | | Reserved by the system. | |

Bit 10 (Emergency stop input) indicates the status of the emergency stop input signal input when using a SMARTSTEP Junior Servo Driver. This bit is always 0 when using a W-series Servo Driver, which does not have an emergency stop signal.

The SMARTSTEP Junior Servo Driver does not have inputs for external latch signals 2 and 3. When using a SMARTSTEP Junior Servo Driver, the input status for these signals will always be 0.



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When using a W-series Servo Driver, the allocation and polarity of Servo Driver input signals can be set in the Servo Parameters, but the external I/O status depends on the polarity of the Servo Driver's input signals, as follows:

| External I/O status | Signal | Servo Driver I/O signal name | Signal polarity: Normal (Setting: 0 to 6) | | Signal polarity: Reverse (Setting: 9 to F) | |
|---|---|---|---|---|---|---|
| | | | Sensor status: Base block (not receiving power; Input open) | Sensor status: In operation (Input closed) | Sensor status: Base block (not receiving power; Input open) | Sensor status: In operation (Input closed) |
| Forward rotation limit input | POT | Forward drive prohibited | 1 | 0 | 0 | 1 |
| Reverse rotation limit input | NOT | Reverse drive prohibited | 1 | 0 | 0 | 1 |
| Origin proximity input | DEC | Origin return deceleration limit switch | 0 | 1 | 1 | 0 |
| External latch 1 input | EXT1 | External latch 1 input | 0 | 1 | 1 | 0 |
| External latch 2 input | EXT2 | External latch 2 input | 0 | 1 | 1 | 0 |
| External latch 3 input | EXT3 | External latch 3 input | 0 | 1 | 1 | 0 |

The forward rotation limit input (forward drive prohibited signal), and reverse rotation limit input (reverse drive prohibited signal) are normally-closed contact inputs (N.C. inputs) when polarity is normal. The origin proximity input (origin return deceleration limit switch), and external latch inputs (1 to 3) are normally-open contact inputs (N.O. inputs) when polarity is normal.

When using a SMARTSTEP Junior Servo Driver, the following status is shown. (With the SMARTSTEP Junior, signal polarity is fixed.)

| External I/O status | Signal | Servo Driver I/O signal name | Sensor status: Base block (not receiving power; Input open) | Sensor status: In operation (Input closed) |
|---|---|---|---|---|
| Forward rotation limit input | POT | Forward drive prohibited | 1 | 0 |
| Reverse rotation limit input | NOT | Reverse drive prohibited | 1 | 0 |
| Origin proximity input | DEC | Origin proximity input | 0 | 1 |
| External latch 1 input | EXT1 | External latch 1 input | 0 | 1 |
| Emergency stop input | STOP | Emergency stop input | 1 | 0 |

## 4-8-6 Expanded Monitoring

The PCU has a fixed monitoring function that monitors the following control information for each axis and returns the result to the Axis Operating Input Memory Areas.

Axis control status (word b)

Servo status (word b + 1)

External I/O status (word b + 3)

Present position (Feedback present position: Words b + 6, b + 7; Command present position: Words b + 8, b + 9)

The PCU also has an expanded monitoring function that monitors control information selected from a number of categories, and returns the result to the Axis Operating Input Memory Areas.



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The expanded monitoring function provides two monitors in the Axis Operating Input Memory Areas (Monitor 1: Words b + 10, b + 11; Monitor 2: Words b + 12, b + 13). The information to be monitored by each is selected using Monitor 1 type (Word a + 15, bits 00 to 03) and Monitor 2 type (Word a + 15, bits 04 to 07) in the Axis Operating Output Memory Areas.

### Axis Operating Output Memory Area (Operating Commands)

| Name | Word | Bits | Contents |
|---|---|---|---|
| Monitor 1 type | a+15 | 00 to 03 | Used to select the type of control information to be returned to monitor 1. |
| Monitor 2 type | | 04 to 07 | Used to select the type of control information to be returned to monitor 2. |
| Reserved by the system. | | 08 to 15 | Not used. The setting is disabled. |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

### Axis Operating Input Memory Area (Monitoring)

| Name | Word | Bits | Contents |
|---|---|---|---|
| Monitor 1 type | b+15 | 00 to 03 | Indicates the type of control information selected by Monitor 1. |
| Monitor 2 type | | 04 to 07 | Indicates the type of control information selected by Monitor 2. |
| Not used. | | 08 to 15 | Always 0. |
| Monitor 1 | b+10<br>b+11 | --- | Monitor 1 (rightmost word)<br>Monitor 2 (leftmost word) |
| Monitor 2 | b+12<br>b+13 | --- | Monitor 1 (rightmost word)<br>Monitor 2 (leftmost word) |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

### Monitor Type

The following control information can be selected for Monitor 1 and Monitor 2.

| Monitor Type | Control information | Unit | Details |
|---|---|---|---|
| 0 | Command present position | Command unit | Returns the present position being sent to the Servo Driver.<br>This value is the same as the command present position in words b + 8 and b + 9. |
| 1 | Reserved by the system. | --- | Do not set. |
| 2 | Position deviation | Command unit | Returns the number of pulses remaining in the deviation counter of the Servo Driver in command units.<br>Position deviation = Command present position − Feedback present position |
| 3 | Feedback present position | Command unit | Returns the actual position of the machine based on feedback from the Servomotor's encoder.<br>This value is the same as the feedback present position in words b + 6 and b + 7. |
| 4 to 5 | Reserved by the system. | --- | Do not set. |



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| Monitor Type | Control information | Unit | Details |
|---|---|---|---|
| 6 | Target position | Command unit | Returns the target position (position command value) during positioning. |
| 7 | Reserved by the system. | --- | Do not set. |
| 8 | Feedback speed | See note 1. | Returns the speed of the machine based on feedback from the Servomotor's encoder. |
| 9 | Command speed | See note 1. | Returns the speed designated for the Servo Driver. |
| A | Target speed | See note 1. | Returns the designated target speed (speed command value). |
| B | Torque command | See note 2. | Returns the torque command for the Servo Driver. |
| C to F | Reserved by the system. | --- | Do not set. |

**Note** (1) Speed Monitoring Unit
When the speed (feedback speed, command speed, or target speed) is selected for the monitor type, the monitoring unit for position control/ torque control, and speed control is as follows:

| Control mode | Speed monitoring unit | Unit change timing |
|---|---|---|
| Position control<br>Torque control | Command units/s | The unit changes when the command to switch to position control or torque control is received (when the Receiving Command Flag turns ON). |
| Speed control | 0.001% (percentage of Servomotor's momentary maximum rotation speed) | The unit changes when the command for SPEED CONTROL is received (when the Receiving Command Flag turns ON). |

For further details on operation timing, refer to *10-5 Speed Control*.

(2) Torque Monitoring Unit
When the torque is selected for the monitor type, the monitoring unit for position control, speed control, and torque control is as follows:

| Control mode | Torque monitoring unit | Unit change timing |
|---|---|---|
| Position control<br>Speed control | % (1% unit)<br>(percentage of Servomotor's rated torque) | The unit changes when the command to switch to position control or speed control is received (when the Receiving Command Flag turns ON). |
| Torque control | 0.001% (percentage of Servomotor's momentary maximum torque) | The unit changes when the command for TORQUE CONTROL is received (when the Receiving Command Flag turns ON). |

For further details on operation timing, refer to *10-6 Torque Control*.

**Note** (1) Control data is used to monitor the control status of the Servo Driver. The resolution of the monitor value depends on the specifications of the connected Servo Driver.



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Example: If a W-series Servo Driver equipped with a JUSP-NS115 MECHATROLINK-II Application Module is connected, the minimum resolution of the monitor values for feedback speed and command speed during position/torque control is 1,000 command units/s.

Depending on the length of the PLC cycle and MECHATROLINK communications cycle short-term changes of the Servo Driver status may not be monitored successfully.

(2) If MECHATROLINK communications are stopped (connection released) during speed or torque control and MECHATROLINK communications are restarted to execute SERVO LOCK (Servo ON), the power to the Servomotor will be recovered with the previous control mode maintained. At this point, the PCU cannot obtain correct monitor values for speed or torque monitor in its expanded monitoring.
To stop MECHATROLINK communications during SPEED CONTROL or TORQUE CONTROL execution, either execute DECELERATION STOP or EMERGENCY STOP, or execute SERVO UNLOCK, change to the position control mode, and then release the connection.



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# SECTION 5
# Transferring and Saving Data

This section explains how to transfer and save parameters and data using the data transfer bits.


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# 5-1 Transferring Data

The following two types of data can be transferred by the Position Control Unit (PCU).

***1,2,3...***

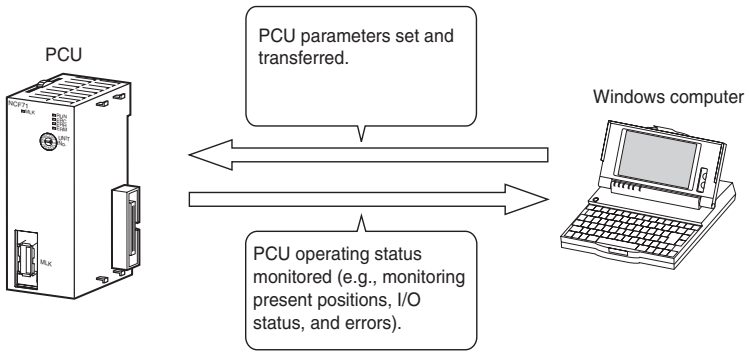
1. PCU Parameters
   - Common Parameters
   - Axis Parameters
2. Servo Driver Parameters
   - Servo Parameters

There are two ways to transfer these parameters.

- Using the Support Software to transfer parameters to and from a Windows computer connected to the CPU Unit
- Using the bits in the Operating Memory Areas allocated to the PCU in the CPU Unit to transfer parameters to and from I/O Memory in the CPU Unit

**Transferring Parameters Using Support Software**

The CX-Motion-NCF Support Software can be used on a Windows computer to set and transfer parameters for the PCU, to save and print the parameters, and to monitor PCU status.




Refer to the *CX-Motion-NCF Operation Manual* (Cat. No. W436) for operating procedures and other information on the CX-Motion-NCF.

**Transferring Parameters Using Bits in Operating Memory Areas**

Bits in the Operating Memory Areas can be manipulated to transfer data between the CPU Unit and the PCU (and Servo Drivers). The Common Operating Memory Area is used for parameters held in the PCU and the Axis Operating Memory Areas are used for parameters held in the Servo Drivers.

**Transferring PCU Parameters**

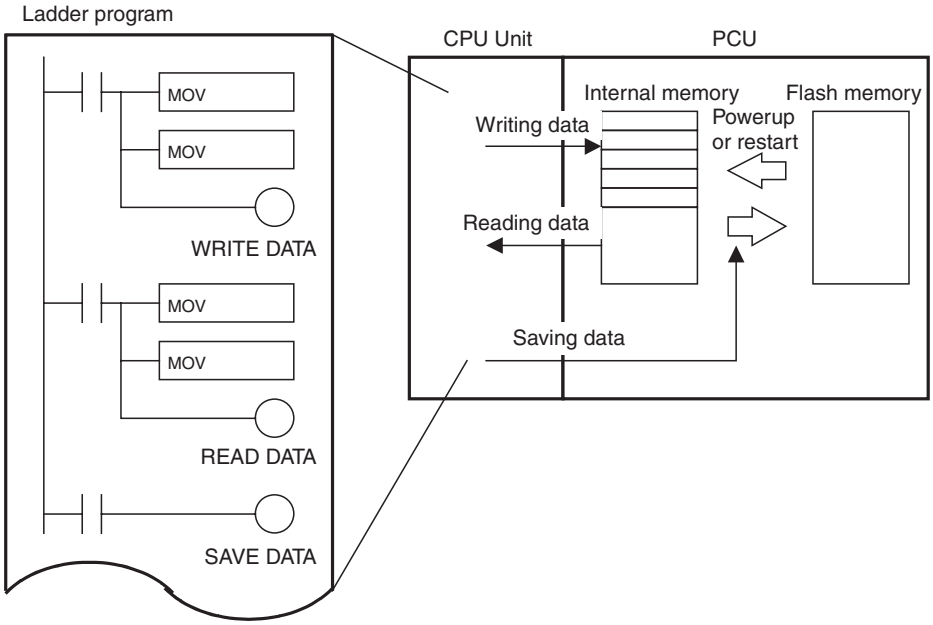
Common Parameters and Axis Parameters are saved in the PCU's internal memory and also in the PCU's flash memory. These parameters are read/written, or saved to flash memory from the CPU Unit using the WRITE DATA, READ DATA, and SAVE DATA Bits allocated in the Common Operating Memory Area.

The number of transfer words, transfer source, and transfer destination are specified in the Common Operating Memory Area. It is possible to transfer multiple parameters at once.

For PCU parameters, the parameters stored in memory are saved altogether to the PCU's internal flash memory.



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**Transferring Servo Driver Parameters**

Servo Parameters are stored in internal memory of the Servo Driver connected to the PCU and then saved in the Servo Driver's non-volatile memory. These parameters are read/written or saved to the non-volatile memory from the CPU Unit using the WRITE SERVO PARAMETER, READ SERVO PARAMETER, and SAVE SERVO PARAMETER Bits allocated in the Axis Operating Memory Areas.

Servo Parameters for a single axis are written and read by parameter by specifying the parameter number. Parameters for different axes can be transferred at the same time.

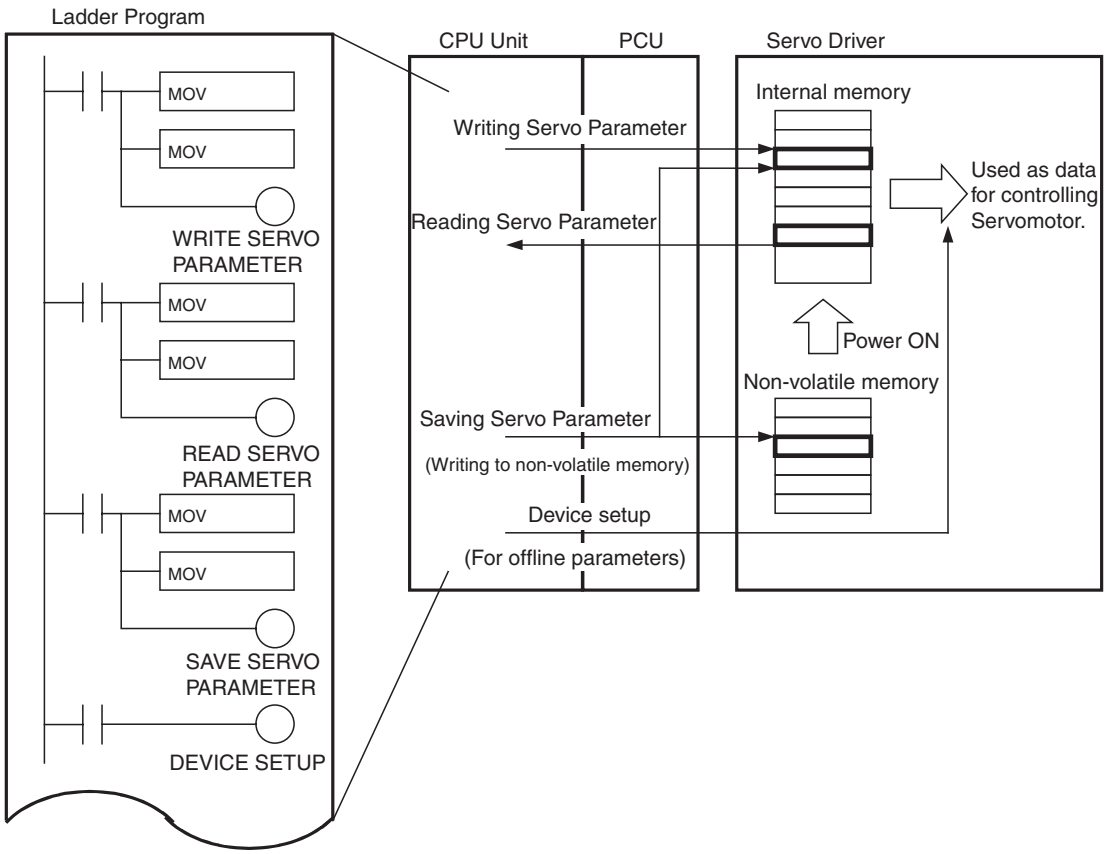
Servo Parameters are saved by executing WRITE DATA to write them to the Servo Driver's non-volatile memory. Therefore, SAVE SERVO PARAMETER must be executed for each parameter separately from writing them to the Servo Driver's memory (WRITE SERVO PARAMETER).

Two types of Servo Parameters are transferred to the Servo Driver: online parameters with set values that are enabled immediately after they are written, and offline parameters, which are not enabled just by writing them. To enable set values for offline parameters in Servo Driver operations, save the parameters to the non-volatile memory, and then cycle the Servo Driver power. Alternatively, execute WRITE SERVO PARAMETER/SAVE SERVO PARAMETER and then execute the Servo Driver's DEVICE SETUP.

When DEVICE SETUP is executed, the Servo Driver enables all the Servo Parameters that are currently being transferred, and initializes the present position and output signal status to set the Servo Driver.



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# 5-2 Transferring PCU Parameters

## 5-2-1 Writing PCU Parameters

The PCU's Common Parameters and Axis Parameters are written from the CPU Unit using the WRITE DATA Bit in the Common Operating Memory Area. The data to be transferred is set by specifying the number of transfer words, transfer source, and transfer destination in the Common Operating Memory Area. Multiple parameters can also be transferred all at once.

The PCU reads the contents of the Common Parameters and Axis Parameters saved in the internal flash memory when the PCU power is turned ON or the Unit is restarted, and enables them as operating parameters. Parameters transferred to the PCU using the WRITE DATA Bit will be lost if the PCU power is turned OFF or the Unit is restarted.

**Note**

(1) The Common Parameter set values are enabled by cycling the PCU power or restarting the Unit after executing WRITE DATA. Therefore, when the WRITE DATA Bit is used to change the contents of the Common Parameters, execute SAVE DATA and save the Common Parameters to the PCU's internal flash memory.

(2) The Axis Parameter settings are enabled when WRITE DATA execution has completed. To change Axis Parameter settings permanently, execute WRITE DATA followed by SAVE DATA (while MECHATROLINK communications are stopped) to save the Axis Parameter settings in the PCU's internal flash memory.

(3) Execute WRITE DATA to write data to the PCU while the Data Transferring Flag is OFF. Writing data to the PCU is disabled while the Busy Flag



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is ON (when the PCU is in initial processing or reading or writing the back-up data from or to the Memory Card).

(4) If data is written while different data is being transferred, a Multistart Error (Unit error code: 0021) will occur and data will not be written to the PCU.

(5) Do not restart the PCU or turn OFF the power to the PLC while data is being written. The data will not be transferred correctly, and normal PCU operations may not be possible.

Data writing starts when the WRITE DATA Bit in the Common Operating Memory Area turns ON. When writing data to the PCU, make sure the WRITE DATA Bit remains ON until the Data Transferring Flag turns ON.

Up to 600 words can be transferred during a single data write operation. The maximum amount of data that can be transferred during a single CPU Unit cycle, however, is 20 words. When more than 20 words of data are transferred, the data is divided and WRITE DATA is executed over multiple cycles. When writing data to the PCU is completed, the Data Transferring Flag turns OFF.

**Common Operating Memory Area (Output)**

| Name | Word | Bit | Contents |
|---|---|---|---|
| WRITE DATA Bit | n | 01 | 0 → 1: Starts writing data. |
| Number of write words | n+6 | --- | Specifies the number of words to be written to the PCU. Up to 600 words can be transferred. |
| Write source area | n+7 | --- | Specifies the area of the data to be written to the PCU.<br>The type of area set as the write source area is specified by specifying the beginning word of the area in the write source word in hexadecimal.<br>Write source area:<br>00B0 hex: CIO Area<br>00B1 hex: Work Area<br>00B2 hex: Holding Area<br>00B3 hex: Auxiliary Area<br>0082 hex: DM Area<br>005□ hex: EM Area<br>□: EM bank No.= 0 to 9, A, B, C |
| Write source word | n+8 | --- | |
| Write destination address | n+9 | --- | Specifies the write destination address in the PCU. |

n = CIO 1500 + (unit number × 25)

**Common Operating Memory Area (Input)**

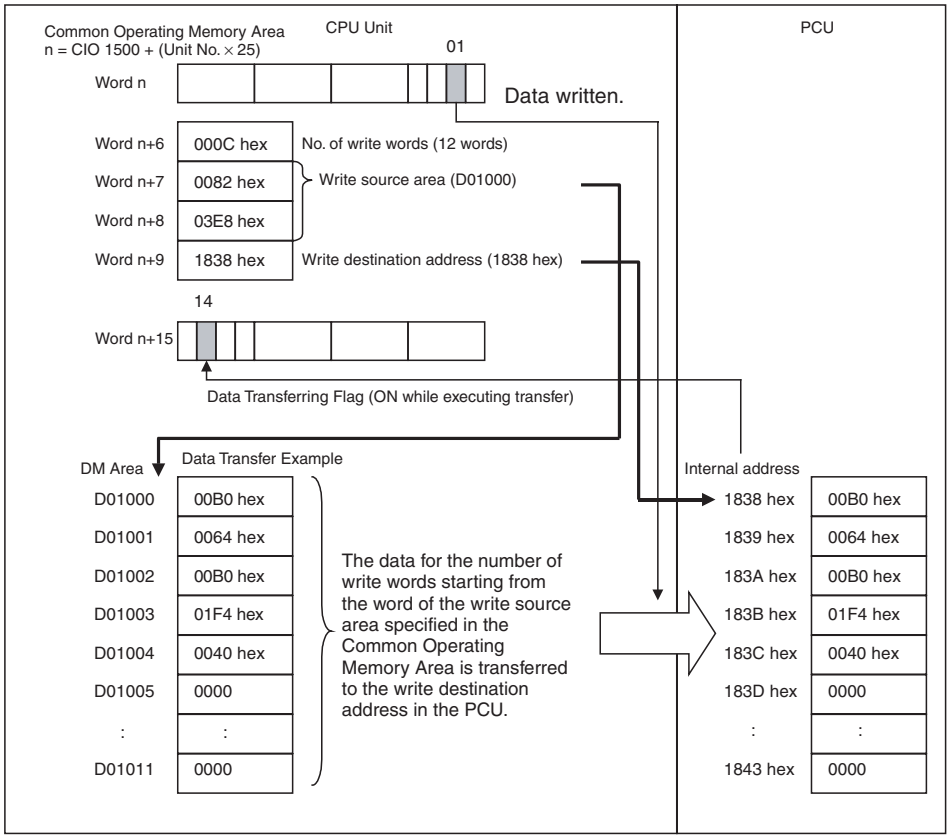
| Name | Word | Bit | Contents |
|---|---|---|---|
| Data Transferring Flag | n+15 | 14 | 0: Powerup, transfer completed, or transfer failed<br>1: Transferring data |
| Unit Busy Flag | n+16 | 14 | 0: PCU is not busy<br>1: PCU is busy |

n = CIO 1500 + (unit number × 25)

The following diagram shows the operation for writing data to the PCU.

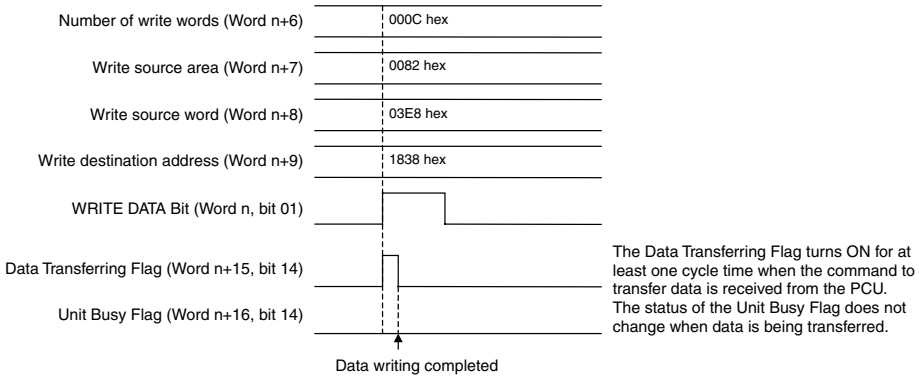


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**Timing Chart for Writing Data to the PCU**

Data can be written to the PCU during axis operation if the Unit Busy Flag is not ON (i.e., except when the PCU is initializing or reading/writing Memory Card backup data). WRITE DATA, READ DATA, and SAVE DATA cannot be executed at the same time.




When writing data to the PCU is completed, the Data Transferring Flag (word n+15, bit 14) turns OFF. When an error occurs during data transfer, the Unit Error Flag (word n+15, bit 12) turns ON, and the corresponding error code is input in word n+21 of the Common Operating Memory Area. Check the error code and perform appropriate troubleshooting.

**Note** If an error occurs while writing data (multistart error, write transfer error, Common Parameter check error during data transfer, or Axis Parameter check error during data transfer), the transferred set value will be destroyed, and the parameter will return to the set value before transferring data. WRITE DATA is still executed if an error occurs, but even if the data is transferred normally, the error that occurred will not be cleared. Make sure to execute ERROR RESET



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before WRITE DATA to enable identifying whether the data that was written has been transferred correctly.

## 5-2-2 Reading PCU Parameters

The PCU's Common Parameters and Axis Parameters are read to the CPU Unit using the READ DATA Bit in the Common Operating Memory Area. The data to be transferred is set by specifying the number of transfer words, transfer source, and transfer destination in the Common Operating Memory Area. Multiple parameters can also be transferred all at once.

**Note**

(1) Read data from the PCU when the Data Transferring Flag is OFF. READ DATA cannot be executed from the PCU while the Unit Busy Flag is ON (PCU initializing or reading/writing Memory Card backup data).

(2) If READ DATA is executed while data is being transferred, a Multistart Error (Unit error code: 0021) will occur and data will not be read from the PCU.

Data reading starts when the READ DATA Bit in the Common Operating Memory Area turns ON. When reading data from the PCU, make sure that the READ DATA Bit remains ON until the Data Transferring Flag turns ON.

Up to 600 words can be transferred during a single data reading operation. The maximum amount of data that can be transferred during a single CPU Unit cycle, however, is 20 words. When reading more than 20 words of data, the data is divided and read over multiple cycles. When reading data from the PCU is completed, the Data Transferring Flag turns OFF.

**Common Operating Memory Area (Output)**

| Name | Word | Bit | Contents |
|---|---|---|---|
| READ DATA | n | 02 | 0 → 1: Starts reading data |
| Number of read words | n+10 | --- | Specifies the number of words to be read from the PCU. |
| Read source address | n+11 | --- | Specifies the read source address in the PCU. |
| Read destination area | n+12 | --- | Specifies the area used to store the data read from the PCU. |
| Read destination word | n+13 | --- | The type of area set as the read destination area is specified by specifying the beginning word of the area in the read destination word in hexadecimal.<br>Read destination area:<br>00B0 hex: CIO Area<br>00B1 hex: Work Area<br>00B2 hex: Holding Area<br>00B3 hex: Auxiliary Area<br>0082 hex: DM Area<br>005□ hex: EM Area<br>□: EM bank No.= 0 to 9, A, B, C |

n = CIO 1500 + (unit number × 25)

**Common Operating Memory Area (Input)**

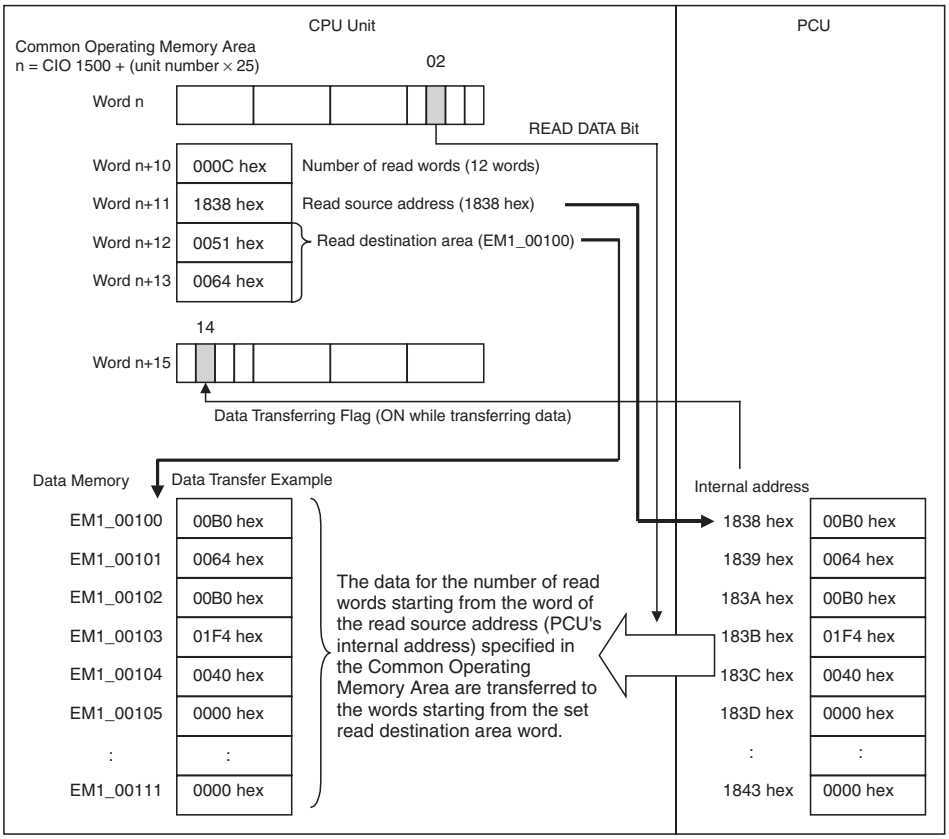
| Name | Word | Bit | Contents |
|---|---|---|---|
| Data Transferring Flag | n+15 | 14 | 0: Powerup, transfer completed, or transfer failed<br>1: Transferring data |
| Unit Busy Flag | n+16 | 14 | 0: PCU is not busy<br>1: PCU is busy |



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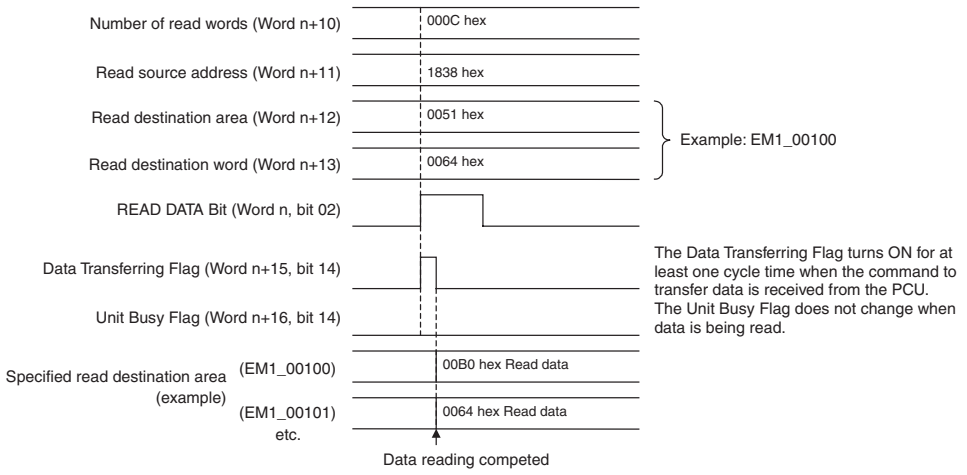
n = CIO 1500 + (unit number × 25)

The following diagram shows the operation for reading data from the PCU.




**Timing Chart for Reading Data From the PCU**

Data can be read from the PCU during axis operation if the Unit Busy Flag is not ON (i.e., except when the PCU is initializing or reading/writing Memory Card backup data). READ DATA, WRITE DATA, and SAVE DATA cannot be executed at the same time.




When reading data from the PCU is completed, the Data Transferring Flag (word n+15, bit 14) turns OFF. When an error occurs during data transfer, the Unit Error Flag (word n+15, bit 12) turns ON, and the corresponding error code is input in word n+21 of the Common Operating Memory Area. Check the error code and perform appropriate troubleshooting.



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**Note** If an error occurs when reading data (multistart error or read transfer error), the data will not be read from the PCU and the data in the read destination area will not be refreshed. READ DATA can still be executed if an error occurs, but even if the data is transferred normally, the error that occurred previously will not be cleared. Make sure to execute ERROR RESET before executing READ DATA to enable identifying whether the data that was read has been transferred correctly.

## 5-2-3 Saving PCU Parameters

When the power is turned ON, the PCU reads the Common Parameters and Axis Parameters saved in the PCU's flash memory to the PCU's internal memory and starts operations. The PCU's parameters are saved to the PCU's internal flash memory using the SAVE DATA Bit in the Common Operating Memory Area.

**Note**

(1) Save data to the PCU when MECHATROLINK communications are stopped and the Data Transferring Flag is OFF. The PCU's data cannot be saved while the Unit Busy Flag is ON (i.e., PCU initializing or reading/writing Memory Card backup data).

(2) If SAVE DATA is executed during MECHATROLINK communications or while data is transferring, a Multistart Error (Unit error code: 0021) will occur and data will not be saved to the PCU.

(3) Do not restart the PCU or turn OFF the power to the PLC while data is being saved. Doing so may result in damage to the PCU's internal flash memory and the PCU may not operate normally.

Data saving starts when the SAVE DATA Bit in the Common Operating Memory Area turns ON, at which time the enabled Common Parameters and Axis Parameters are saved to the PCU's internal flash memory all at once. When saving data to the PCU, make sure that the SAVE DATA Bit remains ON until the Data Transferring Flag turns ON.

**Common Operating Memory Area (Output)**

| Name | Word | Bit | Contents |
|---|---|---|---|
| SAVE DATA | n | 03 | 0 → 1: Starts saving data |

n = CIO 1500 + (unit number × 25)

**Common Operating Memory Area (Input)**

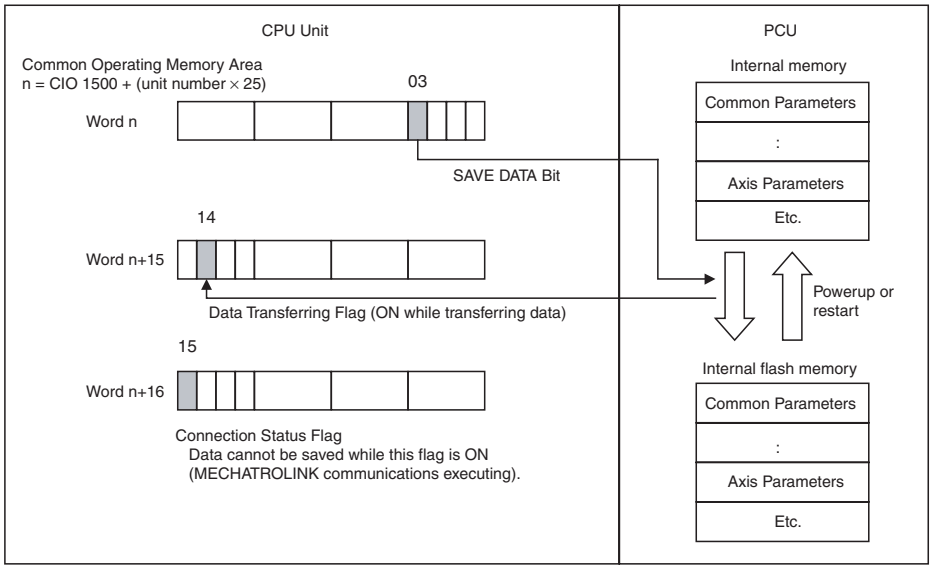
| Name | Word | Bit | Contents |
|---|---|---|---|
| Data Transferring Flag | n+15 | 14 | 0: Powerup, saving completed, or saving failed<br>1: Saving data |
| Unit Busy Flag | n+16 | 14 | 0: PCU is not busy<br>1: PCU is busy |
| Connection Status Flag | | 15 | 0: MECHATROLINK communications stopped<br>1: MECHATROLINK communications executing |

n = CIO 1500 + (unit number × 25)



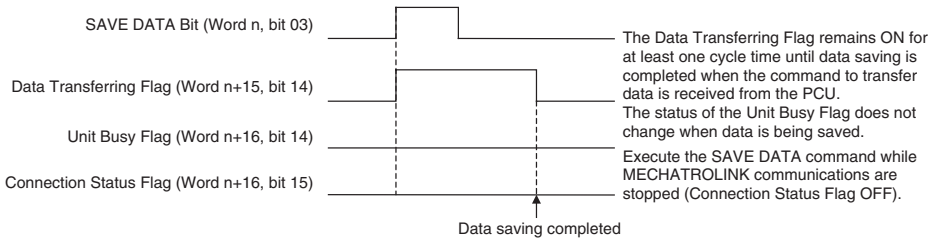
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The following diagram shows the operation for saving data in the PCU.




**Timing Chart for Saving Data to the PCU**

Data can be saved to the PCU while MECHATROLINK communications are stopped if the Unit Busy Flag is not ON (i.e., except when the PCU is initializing or reading/writing Memory Card backup data). SAVE DATA, WRITE DATA, and READ DATA cannot be executed at the same time.




When saving data to the PCU is completed, the Data Transferring Flag (word n+15, bit 14) turns OFF. When an error occurs during data transfer, the Unit Error Flag (word n+15, bit 12) turns ON, and the corresponding error code is input in word n+21 of the Common Operating Memory Area. Check the error code and perform appropriate troubleshooting.

**Note** If an error occurs while SAVE DATA is executing (multistart error), the data will not be saved to the PCU's internal flash memory, and the parameter set values saved in flash memory will be those before SAVE DATA was executed. SAVE DATA is still executed if an error occurs, but even if the data is saved normally, the error that occurred will not be cleared. Make sure that SAVE DATA is executed after ERROR RESET to enable identifying whether data has been saved correctly.

# 5-3 Transferring Servo Parameters

**Note** Make sure that the equipment will not be adversely affected before changing the Servo Parameters (WRITE SERVO PARAMETER, SAVE SERVO PARAMETER). Refer to the Servo Driver's operation manual and always check the effect of changing the settings before changing the Servo Parameters.



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## 5-3-1 Writing Servo Parameters

Servo Parameters are written from the CPU Unit using the WRITE SERVO PARAMETER Bit in the Axis Operating Output Memory Area. Prepare the set values for the parameter number, parameter size (data length), and transfer data in the Axis Operating Output Memory Area and execute WRITE SERVO PARAMETER.

One execution of WRITE SERVO PARAMETER transfers one parameter for each axis. To transfer multiple parameters, WRITE SERVO PARAMETER must be executed separately for each parameter. Parameters for different axes can be written at the same time.

Parameters transferred using WRITE SERVO PARAMETER are written to the control memory in the Servo Driver. Therefore, online parameters that are overwritten are used immediately in Servo Driver control of the Servomotor. After executing WRITE SERVO PARAMETER for offline parameters, DEVICE SETUP must be executed to enable the settings.

When WRITE SERVO PARAMETER is executed, however, the settings are not saved in the Servo Driver's non-volatile memory. When the Servo Driver power is turned OFF, the set parameter settings will be lost and the next time the power is turned ON, operation will be performed using the parameters saved in the non-volatile memory. To save parameters in the Servo Driver's non-volatile memory, SAVE SERVO PARAMETER must be executed for each parameter separately from WRITE SERVO PARAMETER.

**Note**

(1) Execute WRITE SERVO PARAMETER when the Servo Parameter Transferring Flag for the corresponding axis is OFF. If WRITE SERVO PARAMETER is executed while a Servo Parameter is being transferred, a Multistart Error (axis error code: 3050) will occur and the Servo Parameter will not be written.

(2) Do not restart the PCU or turn OFF the power to the PLC while writing a Servo Parameter. Doing so may result in parameters not being transferred correctly and cause unexpected operations.

Servo Parameter writing starts when the WRITE SERVO PARAMETER Bit in the Axis Operating Output Memory Area turns ON. When executing WRITE SERVO PARAMETER, make sure that the WRITE SERVO PARAMETER Bit remains ON until the Servo Parameter Transferring Flag turns ON.

**Axis Operating Output Memory Area (Operating Commands)**

| Name | Word | Bit | Contents |
|---|---|---|---|
| WRITE SERVO PARAMETER Bit | a+1 | 12 | 0 → 1: Starts writing Servo Parameters |
| Servo Parameter No. | a+17 | --- | Specifies the parameter No. of the Servo Driver to which the data is to be written. |
| Parameter size | a+18 | --- | Specifies the data length of the parameter to be written in byte units. |
| Write data (rightmost word) | a+19 | --- | Specifies the setting data (hexadecimal) to be written to the Servo Parameters. For a parameter size of two bytes, the rightmost word is used only, and the data in the leftmost word is ignored. For a parameter size of four bytes, the four bytes of data from the rightmost to leftmost words are transferred. |
| Write data (leftmost word) | a+20 | --- | |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25



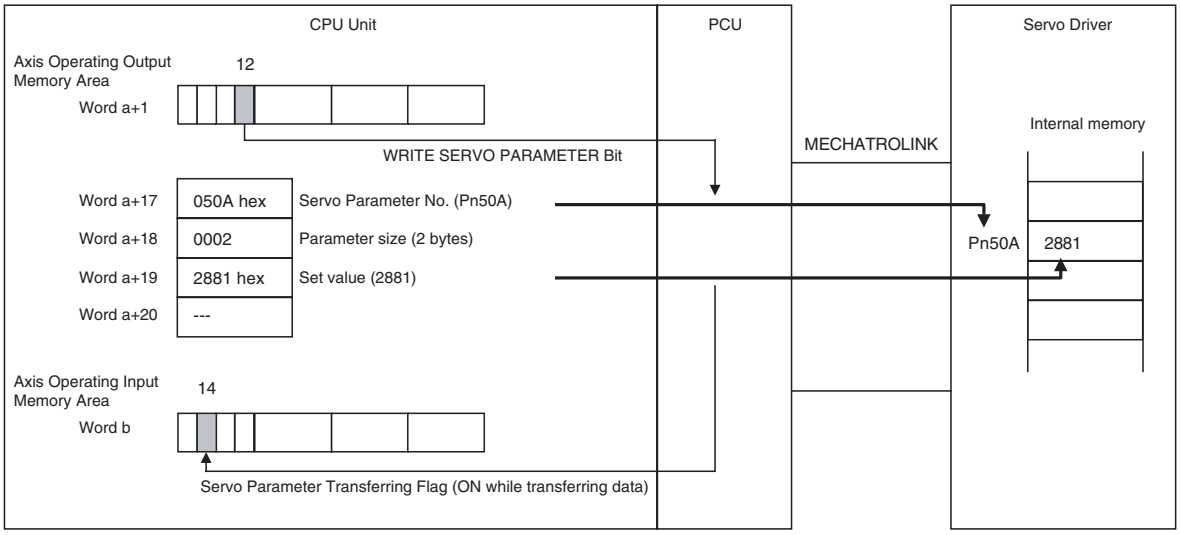
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### Axis Operating Input Memory Area (Monitoring)

| Name | Word | Bit | Contents |
|---|---|---|---|
| Servo Parameter Transferring Flag | b | 14 | 0: Powerup, transfer completed, or transfer failed<br>1: Transferring Servo Parameter |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The following diagram shows the operation used to write parameters to the Servo Driver.



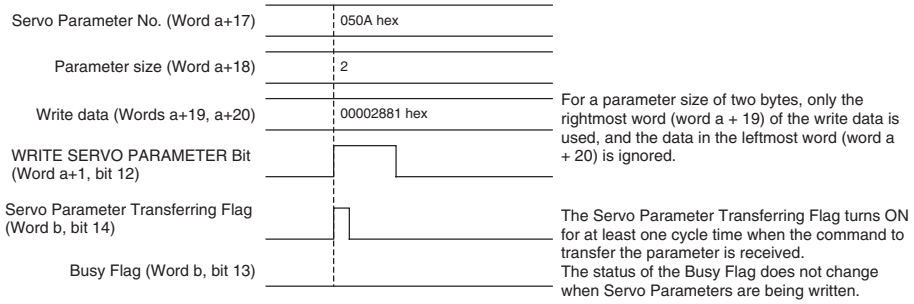

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No.−1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No.−1) × 25

### Timing Chart for Writing Servo Parameters

WRITE SERVO PARAMETER can also be executed while the corresponding axis is operating (Busy Flag ON).

When using Position Control Units with unit version 2.0 or later, any Servo parameter write operations specified during an origin search will be performed after the origin search has been completed.

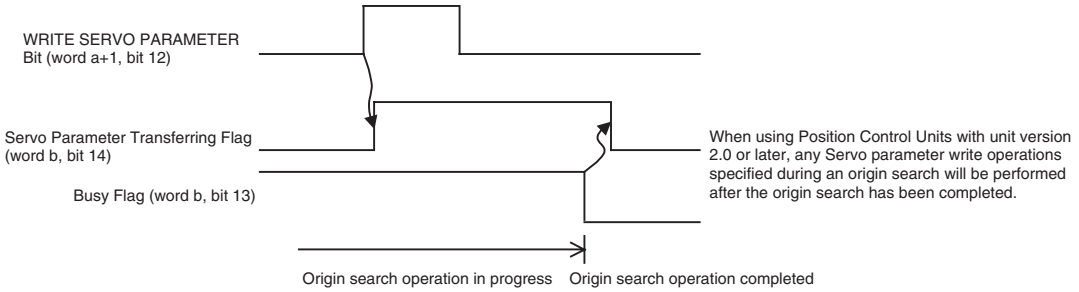
WRITE SERVO PARAMETER, READ SERVO PARAMETER, and SAVE SERVO PARAMETER cannot be executed on one axis at the same time.






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- Writing Servo Parameters during Origin Searches for Position Control Units with Unit Version 2.0 or Later




When writing a Servo Parameter is completed, the Servo Parameter Transferring Flag (word b, bit 14) turns OFF. If an error occurs during Servo Parameter transfer, the Error Flag (word b, bit 12) or the Warning Flag (word b, bit 11) will turn ON, and the corresponding axis error (warning) code is input in word b+4 of the Axis Operating Input Memory Area. Check the error code and perform appropriate troubleshooting.

**Note** With PCUs of unit version 1.2 or earlier, WRITE SERVO PARAMETER cannot be executed when an axis error has occurred. WRITE SERVO PARAMETER will be ignored if it is executed when an axis error has occurred.
With PCUs of version 1.3 or later, WRITE SERVO PARAMETER can be executed even when an axis error has occurred. When the parameters are transferred, however, the Error Flag can no longer be used to determine if an error has occurred during the transfer. It is thus necessary to write Servo Parameters after resetting the error or, if parameters are written when there is an axis error, then steps must be taken to confirm that the parameters were transferred correctly.

## 5-3-2 Reading Servo Parameters

Servo Parameters are read to the CPU Unit using the READ SERVO PARAMETER Bit in the Axis Operating Output Memory Area. Specify the parameter number and parameter size (data length) in the Axis Operating Output Memory Area and execute READ SERVO PARAMETER. The read parameter will be input in the Read data word of the Axis Operating Input Memory Area.

One execution of READ SERVO PARAMETER transfers one parameter for each axis. To transfer multiple parameters, READ SERVO PARAMETER must be executed separately for each parameter. Parameters for different axes can also be read at the same time.

**Note** Execute READ SERVO PARAMETER when the Servo Parameter Transferring Flag for the corresponding axis is OFF. If READ SERVO PARAMETER is executed while a Servo Parameter is being transferred, a Multistart Error (axis error code: 3050) will occur and the Servo Parameter will not be read.

Servo Parameter reading starts when the READ SERVO PARAMETER Bit in the Axis Operating Output Memory Area turns ON. When executing READ SERVO PARAMETER, make sure that the READ SERVO PARAMETER Bit remains ON until the Servo Parameter Transferring Flag turns ON.

**Axis Operating Output Memory Area (Operating Commands)**

| Name | Word | Bit | Contents |
|---|---|---|---|
| READ SERVO PARAMETER Bit | a+1 | 13 | 0 → 1: Starts reading Servo Parameter |



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| Name | Word | Bit | Contents |
|---|---|---|---|
| Servo Parameter No. | a+17 | --- | Specifies the Servo Driver parameter No. from which the data is to be read. |
| Parameter size | a+18 | --- | Specifies the data length of the parameter to be read in byte units. |

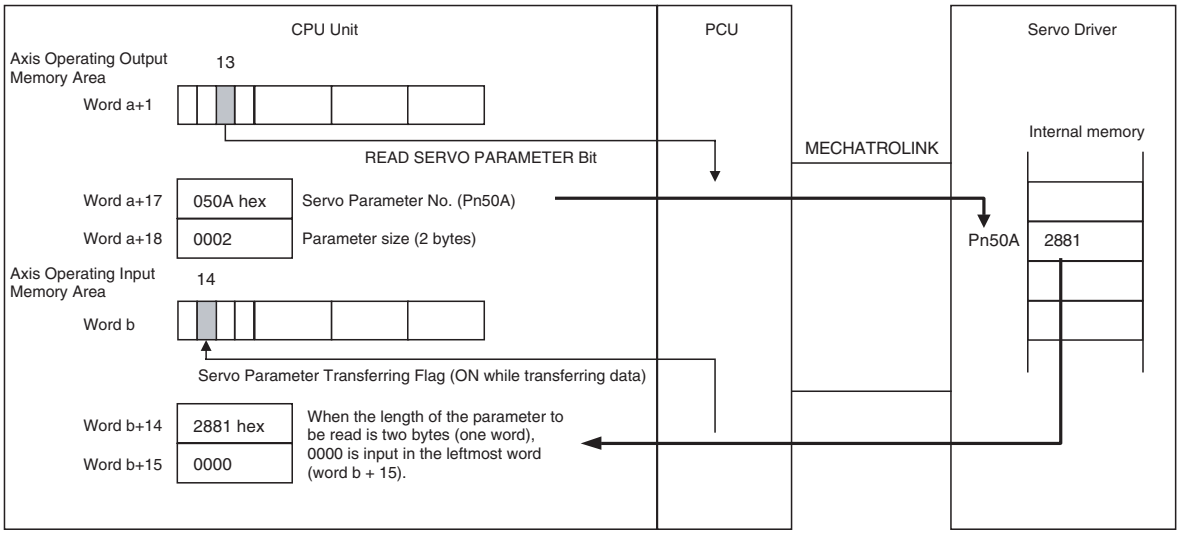
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

### Axis Operating Input Memory Area (Monitoring)

| Name | Word | Bit | Contents |
|---|---|---|---|
| Servo Parameter Transferring Flag | b | 14 | 0: Powerup, transfer completed, or transfer failed<br>1: Transferring Servo Parameter |
| Read data (rightmost word) | b+14 | --- | Contains the Servo Parameter (hexadecimal) that was read. For a parameter size of two bytes, the rightmost word is used only, and 0000 is stored in the leftmost word. For a parameter size of four bytes, four bytes of data from the rightmost to leftmost words are stored. |
| Read data (leftmost word) | b+15 | --- | |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

READ SERVO PARAMETER can be executed while the corresponding axis is operating (Busy Flag ON). The following diagram shows the operation used to read parameters to the Servo Driver.




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

### Timing Chart for Reading Servo Parameters

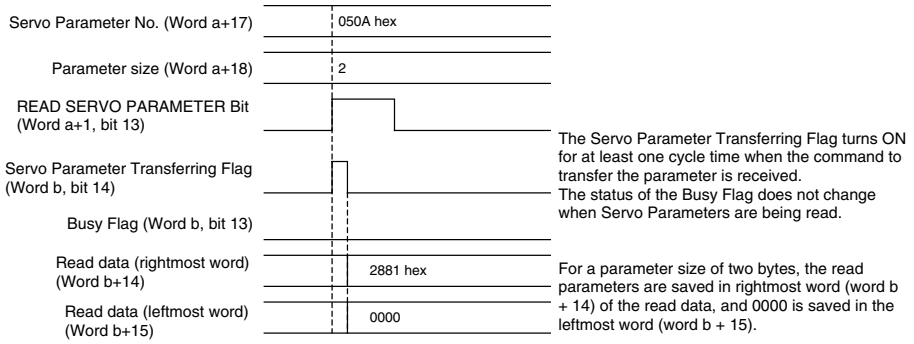
READ SERVO PARAMETER can be executed while the corresponding axis is operating (Busy Flag ON).

When using Position Control Units with unit version 2.0 or later, any Servo parameter read operations specified during an origin search will be performed after the origin search has been completed.

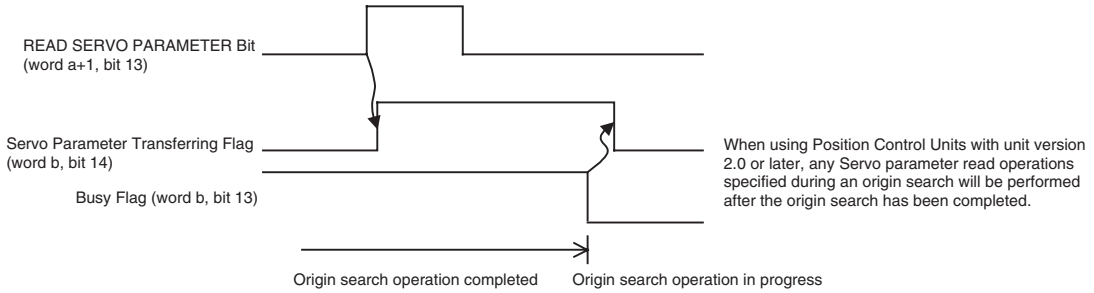
READ SERVO PARAMETER, WRITE SERVO PARAMETER, and SAVE SERVO PARAMETER cannot be executed on one axis at the same time.



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- Reading Servo Parameters during Origin Searches for Position Control Units with Unit Version 2.0 or Later




When READ SERVO PARAMETER execution is completed, the Servo Parameter Transferring Flag (word b, bit 14) turns OFF, and the contents of the parameter that has been read is stored in the read data words (words b+14, b+15).

If an error occurs while transferring Servo Parameters, the Error Flag (word b, bit 12) or the Warning Flag (word b, bit 11) will turn ON, and the corresponding axis error (warning) code will be input in word b+4 of the Axis Operating Input Memory Area. Check the error code and perform appropriate troubleshooting.

**Note** With PCUs of unit version 1.2 or earlier, READ SERVO PARAMETER cannot be executed when an axis error has occurred. READ SERVO PARAMETER will be ignored if it is executed when an axis error has occurred.
With PCUs of version 1.3 or later, READ SERVO PARAMETER can be executed even when an axis error has occurred. When the parameters are transferred, however, the Error Flag can no longer be used to determine if an error has occurred during the transfer. It is thus necessary to read Servo Parameters after resetting the error or, if parameters are read when there is an axis error, then steps must be taken to confirm that the parameters were transferred correctly.

## 5-3-3 Saving Servo Parameters

When Servo Parameters are saved in the Servo Driver's non-volatile memory, the settings are held even after the power is turned OFF and the next time the power is turned ON, the previous settings will be recovered. Saving Servo Parameter is treated as writing data to the Servo Driver's non-volatile memory. Therefore, SAVE SERVO PARAMETER must be executed separately from WRITE SERVO PARAMETER for each parameter.



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Servo Parameters are saved from the CPU Unit using the SAVE SERVO PARAMETER Bit in the Axis Operating Output Memory Area. Specify the parameter number, parameter size (data length), and data to be transferred in the Axis Operating Output Memory Area and execute SAVE SERVO PARAMETER (to write settings to non-volatile memory).

One execution of SAVE SERVO PARAMETER transfers one parameter for each axis. The parameter is written to the Servo Driver's internal memory at the same time as saving it in the non-volatile memory. To save multiple parameters, SAVE SERVO PARAMETER must be executed separately for each parameter. Parameters for different axes can be saved at the same time.

**Note**

(1) There is a limit to the number of times non-volatile memory in the Servo Driver can be written (10,000 times). When Servo parameters are changed frequently during system operation, so not save the parameters, but rather just write them.

(2) Execute SAVE SERVO PARAMETER when the Servo Parameter Transferring Flag for the corresponding axis is OFF. If SAVE SERVO PARAMETER is executed while the Servo Parameter Transferring Flag is ON, a Multistart Error (axis error code: 3050) will occur and the Servo Parameter will not be saved.

(3) Do not restart the PCU or turn OFF the power to the PLC while a Servo Parameter is being saved. Doing so may result in the parameter not being saved correctly and cause unexpected operations.

Servo Parameter saving starts when the SAVE SERVO PARAMETER Bit in the Axis Operating Output Memory Area turns ON. When executing SAVE SERVO PARAMETER, make sure that the SAVE SERVO PARAMETER Bit remains ON until the Servo Parameter Transferring Flag turns ON.

**Axis Operating Output Memory Area (Operating Commands)**

| Name | Word | Bit | Contents |
|---|---|---|---|
| SAVE SERVO PARAMETER Bit | a+1 | 14 | 0 → 1: Starts writing Servo Parameter to non-volatile memory. |
| Servo Parameter No. | a+17 | --- | Specifies the parameter No. of the Servo Driver to which the data is to be written. |
| Parameter size | a+18 | --- | Specifies the data length of the parameter to be written in byte units. |
| Write data (rightmost word) | a+19 | --- | Specifies the setting data (hexadecimal) to be written to the Servo Parameter. For a parameter size of two bytes, the rightmost word is used only, and the data in the leftmost word is ignored. For a parameter size of four bytes, four bytes of data from the rightmost to leftmost words are transferred. |
| Write data (leftmost word | a+20 | --- | |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

**Axis Operating Input Memory Area (Monitoring)**

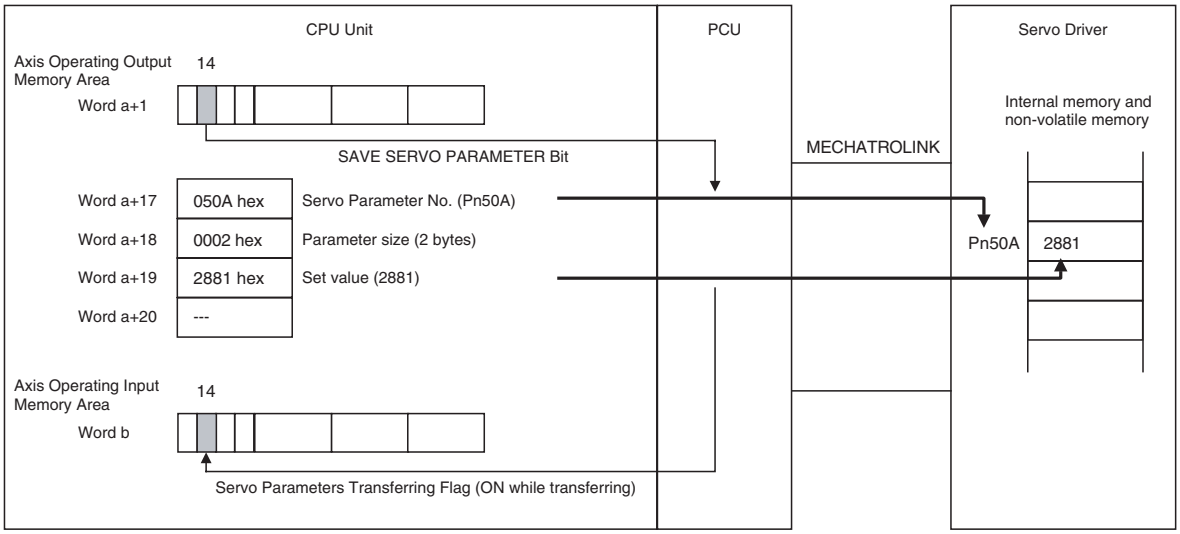
| Name | Word | Bit | Contents |
|---|---|---|---|
| Servo Parameter Transferring Flag | b | 14 | 0: Powerup, transfer completed, or transfer failed<br>1: Transferring Servo Parameter |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25



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SAVE SERVO PARAMETER can be executed while the corresponding axis is operating (Busy Flag ON). The following diagram shows the operation used to save parameters to the Servo Driver.



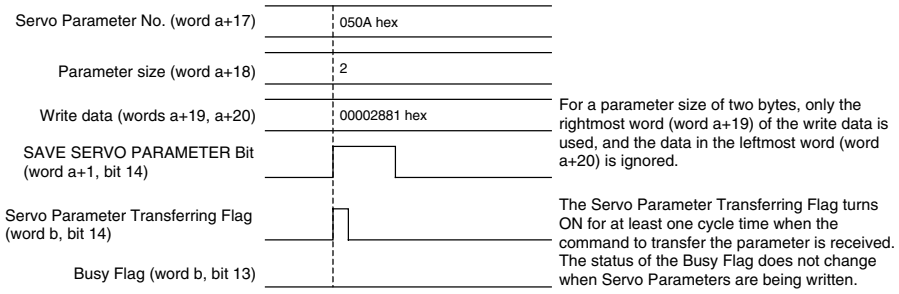

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

### Timing Chart for Saving Servo Parameters

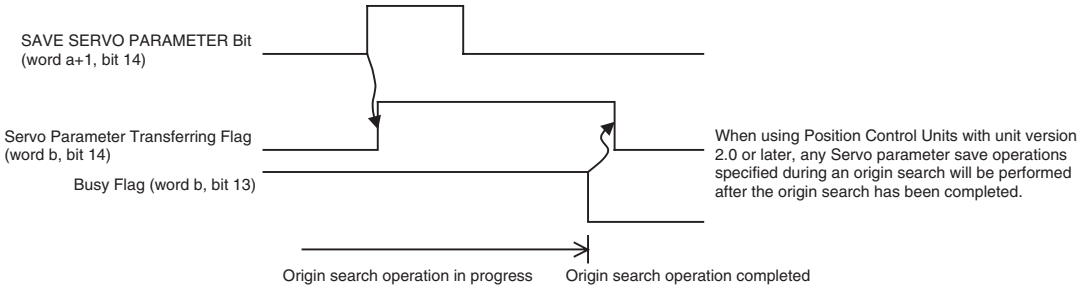
SAVE SERVO PARAMETER can be executed while the corresponding axis is operating (Busy Flag ON).

When using Position Control Units with unit version 2.0 or later, any Servo parameter save operations specified during an origin search will be performed after the origin search has been completed.

SAVE SERVO PARAMETER, WRITE SERVO PARAMETER, and READ SERVO PARAMETER cannot be executed on one axis at the same time.




- Saving Servo Parameters during Origin Searches for Position Control Units with Unit Version 2.0 or Later




When execution of SAVE SERVO PARAMETER has completed, the Servo Parameter Transferring Flag (word b, bit 14) turns OFF.



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If an error occurs while executing SAVE SERVO PARAMETER, the Error Flag (word b, bit 12) or the Warning Flag (word b, bit 11) will turn ON, and the corresponding axis error (warning) code will be input in word b+4 of the Axis Operating Input Memory Area. Check the error code and perform appropriate troubleshooting.

**Note** With PCUs of version 1.2 or earlier, SAVE SERVO PARAMETER cannot be executed if an axis error has occurred. SAVE SERVO PARAMETER will be ignored if it is executed when an axis error has occurred.
With PCUs of version 1.3 or later, SAVE SERVO PARAMETER can be executed even when an axis error has occurred. When the parameters are saved, however, the Error Flag can no longer be used to determine if an error has occurred during the save. It is thus necessary to save Servo Parameters after resetting the error or, if parameters are saved when there is an axis error, then steps must be taken to confirm that the parameters were saved correctly.

## 5-3-4 Device Setup

Two types of Servo Parameters are transferred to the Servo Driver: online parameters with set values that are enabled immediately after they are written, and offline parameters, which are not enabled just by writing them. To enable set values for offline parameters in Servo Driver operations, save the parameters to the non-volatile memory, and then cycle the Servo Driver power. Alternatively, execute WRITE SERVO PARAMETER/SAVE SERVO PARAMETER and then execute the Servo Driver's DEVICE SETUP.

When DEVICE SETUP is executed, the Servo Driver enables all the Servo Parameters that have been transferred to set the Servo Driver, and initializes the present position and output signal status. DEVICE SETUP can be executed in Servo unlock status. If DEVICE SETUP is executed while in Servo lock status, a Multistart Error (axis error code: 3050) will occur and DEVICE SETUP will not be executed.

DEVICE SETUP is executed from the CPU Unit using the DEVICE SETUP Bit in the Axis Operating Output Memory Area. DEVICE SETUP can be executed for different axes at the same time.

**Note** Execute DEVICE SETUP when the Busy Flag for the corresponding axis is OFF. If DEVICE SETUP is executed while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and DEVICE SETUP will not be executed.

Device setup starts when the DEVICE SETUP Bit in the Axis Operating Output Memory Area turns ON. When executing the DEVICE SETUP command, make sure that the DEVICE SETUP Bit remains ON until the Busy Flag in the Axis Operating Input Memory Area turns ON.

**Axis Operating Output Memory Area (Operating Commands)**

| Name | Word | Bit | Contents |
|---|---|---|---|
| DEVICE SETUP Bit | a+1 | 11 | 0 → 1: Starts device setup for the Servo Driver. |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25



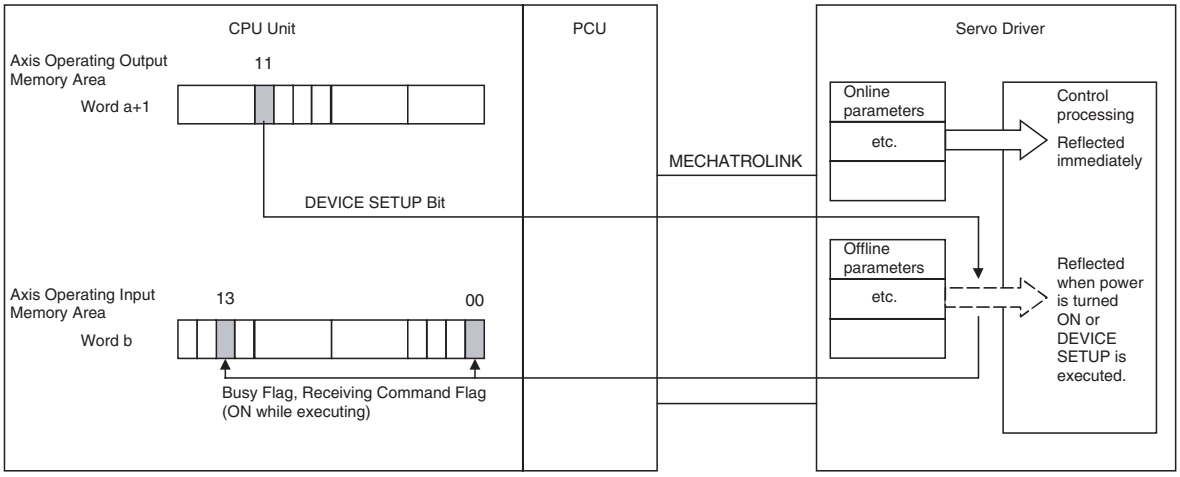
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### Axis Operating Input Memory Area (Monitoring)

| Name | Word | Bit | Contents |
|---|---|---|---|
| Receiving Command Flag | b | 00 | 0: Command reception enabled<br>0 → 1: Command reception started<br>1: Receiving command (command reception disabled) |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing) |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

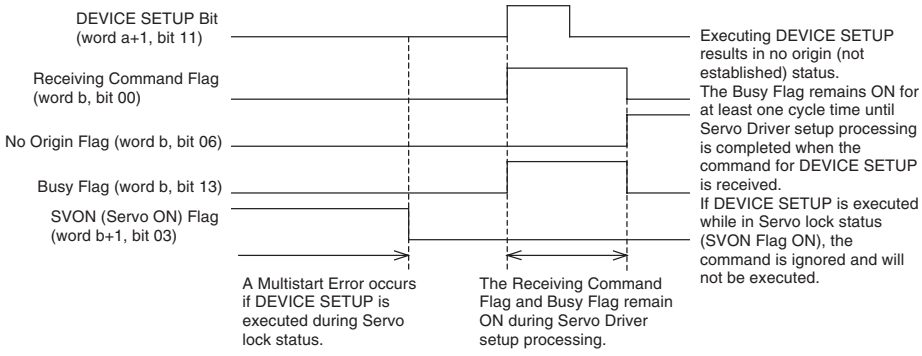
The following diagram shows the device setup operation for the Servo Driver.




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

### Timing Chart for DEVICE SETUP

DEVICE SETUP can be executed when the corresponding axis is in Servo unlocked status and the Busy Flag is not ON. If DEVICE SETUP is executed while in Servo lock status, a Multistart Error (axis error code: 3050) will occur and DEVICE SETUP will not be executed.




During DEVICE SETUP processing, the Receiving Command Flag (word b, bit 00) and Busy Flag (word b, bit 13) remain ON. When DEVICE SETUP execution is completed, both of these Flags turn OFF. When DEVICE SETUP is executed, the origin is lost (No Origin Flag turns ON), and the present position becomes undefined. After DEVICE SETUP is executed, establish the origin again.

During execution of DEVICE SETUP, the Servo status and Servo Driver output signals become undefined.

**Note** DEVICE SETUP cannot be executed if an axis error has occurred. DEVICE SETUP will be ignored if it is executed during an axis error.



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# SECTION 6
# MECHATROLINK

This section provides an overview of MECHATROLINK communications, and includes information on settings and procedures required to use MECHATROLINK with the Position Control Unit.


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# 6-1 MECHATROLINK Overview

## MECHATROLINK

The Position Control Unit (PCU) uses MECHATROLINK (see note) to connect to the Servo Driver.

**Note** MECHATROLINK is a registered trademark of Yaskawa Electric Corporation.

MECHATROLINK is a high-speed field network developed by Yaskawa Electric Corporation. High-speed, high-precision motion control is possible for up to 30 (see note) MECHATROLINK-compatible devices connected to a single communications line using high-speed communications of up to 10 Mbps.

**Note** Up to 16 stations can be connected to the PCU.

MECHATROLINK is available with two baud rates: 4 Mbps for MECHATROLINK-I and 10 Mbps for MECHATROLINK-II. This PCU is designed for MECHATROLINK-II. The connected devices must be compatible with MECHATROLINK-II.

In this manual, the use of MECHATROLINK refers to MECHATROLINK-II unless otherwise specified.

### MECHATROLINK Specifications

| Item | Specifications |
|---|---|
| Communications protocol | MECHATROLINK-II |
| Baud rate | 10 Mbps |
| Maximum transmission distance | 50 m (See note 1.) |
| Minimum distance between stations | 0.5 m |
| Transmission media | Shielded, twisted-pair cables |
| Maximum No. of stations | 30 slave stations max. (See note 2.) |
| Topology | Bus |
| Transfer cycle | 250 μs to 8 ms |
| Communications method | Master-slave, totally synchronous |
| Encoding | Manchester encoding |
| Data length | 17 bytes/32 bytes selectable (See note 3.) |

**Note**

(1) This distance is the total length of the cable connected between devices. The maximum length changes according to the number of devices connected. For details, refer to *3-4-1 MECHATROLINK-II Communications Wiring*.

(2) Up to 16 stations can be connected to the PCU.

(3) The PCU data length is fixed at 32 bytes.

### MECHATROLINK-compatible Devices Supported by PCU

This PCU is designed to be used with MECHATROLINK-II. The maximum number of stations that can be connected to the PCU is 16, and the station addresses of the MECHATROLINK-compatible devices must be set in the range 1 to 16. The MECHATROLINK-II communications settings at the PCU are fixed, as follows:

| Item | Specifications |
|---|---|
| Baud rate | 10 Mbps |
| Data length | 32 bytes (fixed) (See note.) |

**Note** Some devices indicate the data length as 30 bytes, but the meaning is the same.

Make sure that the baud rates and number of transmission bytes for the MECHATROLINK-compatible devices connected to the PCU are set to the same settings as shown in the above table.



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The MECHATROLINK-compatible devices that can be connected to the PCU are shown in the following table.

| Category | Compatible devices |
|---|---|
| Servo Driver | R88D-WT□ OMRON W-series Servo Drivers (equipped with Yaskawa JUSP-NS115 MECHATROLINK-II Application Module) |
| | R88D-WN□-ML2 OMRON W-series Servo Drivers (equipped with built-in MECHATROLINK-II communications) |
| | R7D-ZN□-ML2 OMRON SMARTSTEP Junior Servo Drivers (equipped with built-in MECHATROLINK-II communications) |

The version of R88D-WT□ W-series Servo Drivers used must support JUSP-NS115 MECHATROLINK-II Application Modules. JUSP-NS115 MECHATROLINK-II Application Modules can be installed in R88D-WT□ W-series Servo Drivers with version 39 or later. (For details, refer to *3-1-2 MECHATROLINK-II Application Module*.) The version of R88D-WT□ W-series Servo Drivers is shown on the nameplate located on the side of the Servo Driver. Make sure that the Servo Driver is version 39 or later. Earlier versions will not function properly.

# 6-2 MECHATROLINK Settings

The settings required to use MECHATROLINK with the PCU are described here.

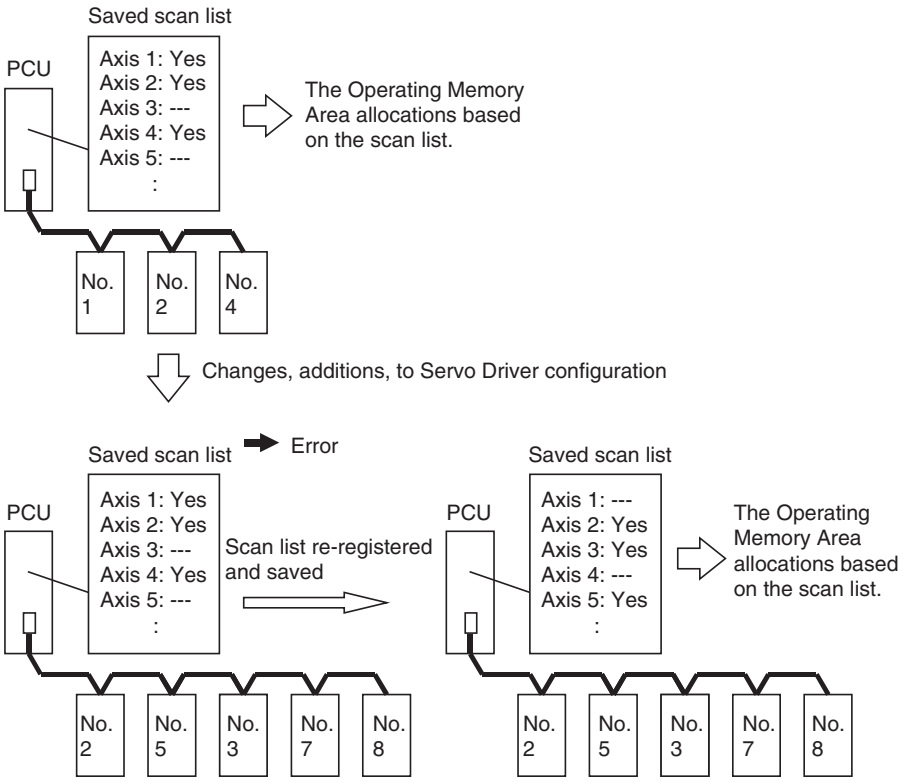
## 6-2-1 Scan List

The scan list is used to register the MECHATROLINK devices connected to the PCU. The PCU connects the axes registered in the scan list to MECHATROLINK communications, detects these axes, and monitors communications for them.

The PCU receives positioning commands allocated in the Work Area (Axis Operating Memory Area) of the CPU Unit and controls positioning of the Servo Driver. The Axis Operating Memory Areas are allocated based on the scan list that is saved in the PCU's internal flash memory. Therefore, to use the PCU, first the scan list must be created and saved, and the connected Servo Drivers must be registered in the list.



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The station address numbers set at the MECHATROLINK device slave stations correspond to the axis numbers registered in the PCU's scan list, regardless of the physical order in which the devices are connected to the MECHATROLINK communications line. The scan list is set as the Common Parameters for the PCU.

The axes are allocated eight bits per axis in the eight words of data in the PCU's internal addresses from 183C to 1843 hex, as shown in the following table. To allocate an axis to the Servo Driver, set the data to 40 hex and when an axis is not used, set the data to 00 hex. (Nothing is registered for the default setting.) The Common Parameters settings saved in the PCU's internal flash memory are enabled when the PCU power is turned ON or the Unit is restarted.

| PCU's address | Contents | | Setting |
|---|---|---|---|
| | Bits 08 to 15 | Bits 00 to 07 | |
| 183C hex | Axis 2 allocation | Axis 1 allocation | 00 hex: Axis not used (default setting).<br>40 hex: Allocates axis to the Servo Driver |
| 183D hex | Axis 4 allocation | Axis 3 allocation | |
| 183E hex | Axis 6 allocation | Axis 5 allocation | |
| 183F hex | Axis 8 allocation | Axis 7 allocation | |
| 1840 hex | Axis 10 allocation | Axis 9 allocation | |
| 1841 hex | Axis 12 allocation | Axis 11 allocation | |
| 1842 hex | Axis 14 allocation | Axis 13 allocation | |
| 1843 hex | Axis 16 allocation | Axis 15 allocation | |



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## 6-2-2 Scan List and PCU Area Allocations

Words are allocated to the PCU in the Work Area in the CPU Unit for use as Axis Operating Output Memory Areas and Axis Operating Input Memory Areas for the Servo Drivers registered in the scan list. An output area of 25 words and an input area of 25 words are allocated to each axis according to the axis number registered in the scan list. The beginning word of these output areas and input areas can be set by the user in the Common Parameter Area.

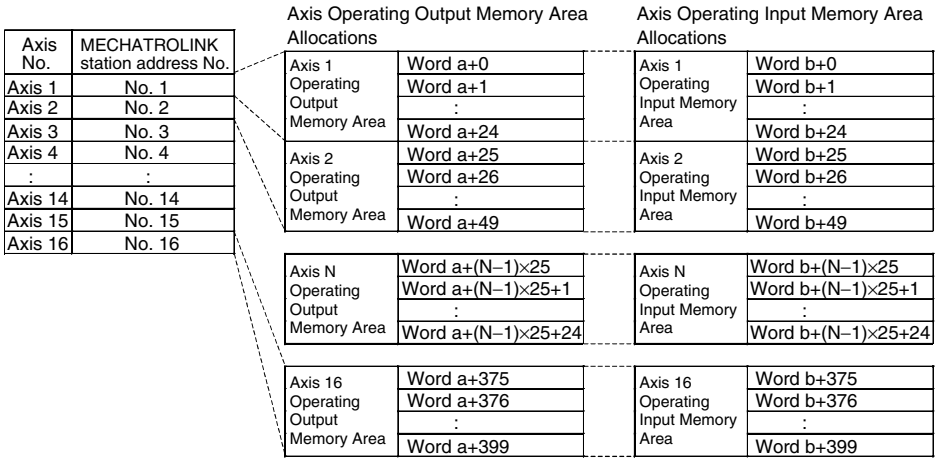
The output areas and input area allocations are specified in the four words of data in the PCU's internal addresses from 1838 to 183B hex, as shown in the following table. The Common Parameters settings saved in the PCU's internal flash memory are enabled when the PCU power is turned ON or the Unit is restarted.

| PCU's address | Contents | Setting |
|---|---|---|
| 1838 hex | Axis Operating Output Memory Area designation | Specifies the words allocated for the Axis Operating Output Memory Areas.<br>0000 hex: No setting (default)<br>00B0 hex: CIO Area<br>00B1 hex: Work Area<br>00B2 hex: Holding Area<br>00B3 hex: Auxiliary Area<br>0082 hex: DM Area<br>0050 to 0059, 005A,005B, 005C hex: EM Area (5□: □ = EM Bank No.) |
| 1839 hex | Beginning word of Axis Operating Output Memory Areas | Specifies the beginning word of the Axis Operating Output Memory Areas. The beginning word of the Operating Output Memory Area for axis 1 is determined by the Axis Operating Output Memory Area designation and the word determined using this parameter. Each axis is allocated 25 words in sequence from this word. |
| 183A hex | Axis Operating Input Memory Area designation | Specifies the words allocated for the Axis Operating Input Memory Areas. The setting method is the same as for the Axis Operating Output Memory Areas. |
| 183B hex | Beginning word of Axis Operating Input Memory Areas | Specifies the beginning word of the Axis Operating Input Memory Areas. The setting method is the same as for the Axis Operating Output Memory Areas. |

The Axis Operating Memory Output and Input Areas are allocated words for each axis from axis 1 up to the highest axis number registered in the scan list. Axis numbers between axis 1 and the highest registered axis number that are not registered as MECHATROLINK devices are also each allocated 25 output words and 25 input words.



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a = Beginning word of Axis Operating Output Areas specified in Common Parameters
b = Beginning word of Axis Operating Input Areas specified in Common Parameters

Example:
Beginning word of Axis Operating Output Memory Areas: CIO 100
Beginning word of Axis Operating Input Memory Areas: CIO 500
Station addresses of connected MECHATROLINK devices (registered in scan list): No. 2, No. 5, and No. 7
In this example, the words occupied as Axis Operating Memory Areas are as follows:

Axis Operating Output Memory Area: CIO 100 to CIO 274 (Axes 1 to 7)
Axis Operating Input Memory Area: CIO 500 to CIO 674 (Axes 1 to 7)
Axis 2 Output Area: CIO 125 to CIO 149;
Axis 2 Input Area: CIO 525 to CIO 549
Axis 5 Output Area: CIO 200 to CIO 224;
Axis 5 Input Area: CIO 600 to CIO 624
Axis 7 Output Area: CIO 250 to CIO 274;
Axis 7 Input Area: CIO 650 to CIO 674

Axes 1, 3, 4, and 6 are not used, but are still allocated words in the PCU. These words cannot be used as work words.

**Note** Set the beginning word of the Axis Operating Output Memory Areas and Axis Operating Input Memory Areas in the Common Parameters so that the words allocated to each area do not exceed the range for each of the CPU Unit's I/O memory areas. If the setting exceeds the range of the I/O memory area, an Initialization Common Parameter Check Error (Unit error code: 0028) will occur when the PCU power is turned ON or the Unit is restarted.

Example:
Beginning word of the Axis Operating Output Memory Areas: CIO 6100
Connected axes: 2 min.

Axis 1: Output Area: CIO 6100 to CIO 6124
Axis 2: Output Area: CIO 6125 to CIO 6149
Etc.

Areas for subsequent axes are allocated in sequence. The highest word in the CIO Area is CIO 6143. Therefore, an error will occur. If the ranges set for the Axis Operating Output Memory Areas and Axis Operating Input Memory Areas overlap, an Initialization Common Parameter Check Error (Unit error code: 0028) will occur when the PCU power is turned ON or the Unit is restarted.



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## 6-2-3 MECHATROLINK Communications Settings

In addition to the scan list, the following four PCU settings are also for MECHATROLINK communications.

- Transfer cycle
- Communications cycle
- Number of communications retries
- C2 master connection

Of these settings, the transfer cycle and communications cycle must always be set when using the PCU. The settings for MECHATROLINK communications are set as the PCU's Common Parameters.

Set the two words of data in the PCU's internal addresses 1856 hex and 1857 hex as shown in the following table. The Common Parameters settings saved in the PCU's internal flash memory are enabled when the PCU power is turned ON or the Unit is restarted.

<table>
<tr><th rowspan="2">PCU's address</th><th colspan="3">Contents</th><th rowspan="2">Setting</th></tr>
<tr><th>Bits 08 to 15</th><th colspan="2">Bits 00 to 07</th></tr>
<tr><td>1856 hex</td><td>Transfer cycle</td><td colspan="2">Communications cycle</td><td>Transfer cycle:<br>00 hex: 1 ms (default setting)<br>01 hex: 1 ms 05 hex: 5 ms<br>02 hex: 2 ms 06 hex: 6 ms<br>03 hex: 3 ms 07 hex: 7 ms<br>04 hex: 4 ms 08 hex: 8 ms<br>A2 hex: 0.25 ms A5 hex: 0.5 ms<br>Communications cycle:<br>Sets a multiplier to obtain integer multiples of the transfer cycle.<br>Set value: 00 to 20 hex<br>The default setting 00 is the same as when the cycle is set to 3.<br>Set as follows:<br>Transfer cycle × communications cycle (multiplier) ≤ 32 ms</td></tr>
<tr><td rowspan="2">1857 hex</td><td rowspan="2">00 (fixed)</td><td>07 to 04</td><td>03 to 00</td><td rowspan="2">C2 master connection:<br>0: No C2 master (default setting)<br>1: C2 master connected<br>Number of communications retries:<br>Set value: 0 to 7, F<br>The default setting 0 is the same as when the number of retries is set to 1.<br>When F is specified, the number of retries is 0 (no retries).</td></tr>
<tr><td>C2 master connection</td><td>Number of communications retries</td></tr>
</table>

### Transfer Cycle

The transfer cycle is the cycle used for sending and receiving data with MECHATROLINK communications. Data (sent and received) is constantly exchanged along the MECHATROLINK communications path during every transfer cycle. The set value and setting range for the transfer cycle depends on the type and number of MECHATROLINK devices connected. When a W-series Servo Driver equipped with a JUSP-NS115 MECHATROLINK-II Application Module or with built-in MECHATROLINK-II communications is connected to the PCU, the setting range for the transfer cycle is 0.5 to 4 ms.

### Communications Cycle

The communications cycle is the cycle used to refresh data in the PCU and MECHATROLINK devices. The PCU sends operating commands to the connected MECHATROLINK devices and refreshes present positions, status, and other monitoring information every communications cycle.

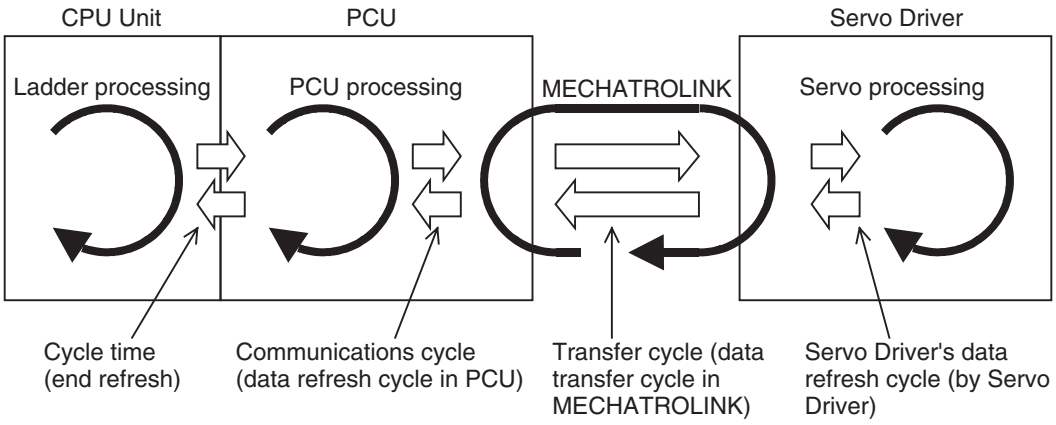


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The set value for the PCU's communications cycle is an integer used as a multiplier to obtain integer multiples of the transfer cycle. The actual communications cycle (data refresh cycle) is a time cycle that is a multiple of the transfer cycle's set value. The set value for the communications cycle is determined by the number of connected MECHATROLINK devices and depends on the PCU communications processing.

The actual communications cycle (data refresh cycle) is a time cycle calculated by multiplying the transfer cycle by a set value. The lower limit of the communications cycle is determined by the number of connected MECHATROLINK devices and depends on the PCU communications processing. When the default setting of 0 is used, the communications cycle is three times the length of the transfer cycle. Set the communications cycle so that the maximum value does not exceed 32 ms.

The following diagram illustrates data exchange with the PCU.




## Number of Communications Retries

The number of communications retries is the number of stations that will perform retries if data sending/receiving fails when transferring data that is exchanged between the PCU and MECHATROLINK devices using the transfer cycle. The set value is set as the maximum number of stations used to retry data transmission with the slave station for which data sending/receiving failed.

The number of communications retries can be set between 0 and 7 (communications retries for up to 7 stations). The set value for the number of retries, however, is added to the number of connected stations that determine the transfer cycle (e.g., for 3 retries, the transfer cycle must be considered as that for the number of stations connected plus 3). For normal use, use the default setting of 0 (1 communications retry).

## C2 Master Connection

The C2 master is a separate communications master connected to the PCU for MECHATROLINK system support. This setting will be used when a future system support device is connected. Use the default setting 0 (No C2 master).

## Setting the Transfer Cycle and Communications Cycle

The transfer cycle and communications cycle are set as Common Parameters in the PCU. Set the PCU's transfer cycle and communications cycle according to the number of connected MECHATROLINK devices so that the set values are not lower than the values shown in the following table.

**Note** Make sure that all of the axis number settings (station numbers of the MECHATROLINK devices) are set to values equal to or less than the number of connected devices for the transfer cycle. Here, the number of connected MECHATROLINK devices is not the actual number of MECHATROLINK devices connected, but the high-



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est registered axis number. For example, when using MECHATROLINK devices for axis number 9 or higher, the transfer cycle must be at least 2 ms even if less than nine devices are connected. If the set value for the transfer cycle is smaller than the number of connected devices or the axis number settings, a Transfer Cycle Setting Error (Unit error code: 0027) will occur when CONNECT is executed.

For the communications cycle, set the multiplier of the transfer cycle set value so that the value is not lower than the values shown in the following table.

For example, if up to 3 Servo Drivers (axis number 1 to 3) equipped with JUSP-NS115 MECHATROLINK-II Application Modules are connected to the PCU, either set the transfer cycle to 0.5 ms min. and the communications cycle set value to 2 (multiplier) or higher, or set the transfer cycle to 1.0 ms min. and the communications cycle set value to 1 (multiplier) or higher.

| Number of devices connected | R88D-WT□ W-series Servo Driver equipped with JUSP-NS115 MECHATROLINK-II Application Module | | R88D-WN□-ML2 W-series Servo Driver equipped with built-in MECHATROLINK-II communications | | R7D-ZN□-ML2 SMARTSTEP Junior Servo Driver equipped with built-in MECHATROLINK-II communications | |
|---|---|---|---|---|---|---|
| | Minimum transfer cycle set value | Minimum communications cycle value | Minimum transfer cycle set value | Minimum communications cycle value | Minimum transfer cycle set value | Minimum communications cycle value |
| 1 | 0.5 ms | 1.0 ms (2) | 0.5 ms | 0.5 ms (1) | 1.0 ms | 1.0 ms (1) |
| 2 | 0.5 ms | 1.0 ms (2) | 0.5 ms | 1.0 ms (2) | 1.0 ms | 1.0 ms (1) |
| 3 | 0.5 ms | 1.0 ms (2) | 0.5 ms | 1.0 ms (2) | 1.0 ms | 1.0 ms (1) |
| 4 | 1.0 ms | 1.0 ms (1) | 1.0 ms | 1.0 ms (1) | 1.0 ms | 1.0 ms (1) |
| 5 | 1.0 ms | 2.0 ms (2) | 1.0 ms | 2.0 ms (2) | 1.0 ms | 2.0 ms (2) |
| 6 | 1.0 ms | 2.0 ms (2) | 1.0 ms | 2.0 ms (2) | 1.0 ms | 2.0 ms (2) |
| 7 | 1.0 ms | 2.0 ms (2) | 1.0 ms | 2.0 ms (2) | 1.0 ms | 2.0 ms (2) |
| 8 | 1.0 ms | 2.0 ms (2) | 1.0 ms | 2.0 ms (2) | 1.0 ms | 2.0 ms (2) |
| 9 | 2.0 ms | 2.0 ms (1) | 2.0 ms | 2.0 ms (1) | 2.0 ms | 2.0 ms (1) |
| 10 | 2.0 ms | 2.0 ms (1) | 2.0 ms | 2.0 ms (1) | 2.0 ms | 2.0 ms (1) |
| 11 | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) |
| 12 | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) |
| 13 | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) |
| 14 | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) |
| 15 | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) |
| 16 | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) | 2.0 ms | 4.0 ms (2) |

**Note**

(1) The set values in the above table apply when the default settings are used for the number of communications retries (once) and C2 master connection (No C2 master).

(2) The values in parentheses in the *Minimum communications cycle value* column are the PCU's communications cycle set value (multiplier to obtain integer multiples of the transfer cycle) used to set the minimum communications cycle for the minimum transfer cycle set value.

(3) When using the R88D-WT□ W-series Servo Driver and JUSP-NS115 together or when using the SMARTSTEP Junior, set the communications cycle so that it is an integer multiple of 1.0 ms. When using the R88D-WN□-ML2 W-series Servo Driver, set the communications cycle so that it is an integer multiple of 0.5 ms.

(4) When connecting a W-series Servo Driver or the SMARTSTEP Junior Servo Driver to the PCU, set the transfer cycle to 4 ms max.



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The PCU default settings are 1.0 ms for the transfer cycle and 3 for the communications cycle (multiplier 3: 1.0 ms × 3 = 3.0 ms). Without changing the default settings, the W-series Servo Driver (equipped with JUSP-NS115 MECHATROLINK-II Application Module or built-in MECHATROLINK-II communications) or the SMARTSTEP Junior Servo Driver can be used for up to eight axes (axis numbers 1 to 8).

**Note**

(1) When using linear interpolation, set the communications cycle to a value 1 ms higher than the minimum value given in the above table. If the communications cycle setting is too small, the command response time of the Position Control Unit function may be greatly extended.

(2) The command response time for axes not used for linear interpolation will be increased by up to four communications cycles per linear interpolation combination being executed. This applies from when setting the linear interpolation operation is started until linear interpolation is completed (i.e., while either the SETTING LINEAR INTERPOLATION Bit or the Linear Interpolation Executing Flag is ON).

### Transfer Cycle and Communications Cycle When Setting the Absolute Encoder Zero Point Position Offset Using an Origin Search Operation with Position Control Units with Unit Ver. 2.0

Make the settings according to the following table when using a Position Control Unit with unit version 2.0. For a Position Control Unit with unit version 2.1 or later, the same settings can be used for the communications cycle as when not setting the absolute encoder zero point position offset using an origin search operation.

If an absolute encoder zero point position offset is set using an origin search operation for a motor with an absolute encoder, set the transfer cycle and communications cycle according to the following table. The settings will depend on the number of axes used and other functions that are executed simultaneously. Refer to *8-6-5 Absolute Encoder's Origin (Zero Point) Position Offset Setting* for details on the position offset setting.

If the settings of the transfer cycle and communications cycle are smaller than the values given in the following table when the absolute encoder zero point position offset is set using an origin search operation, the offset may not be calculated correctly and the position of the origin may not be correct.

| Number of devices connected | Min. set values when setting the absolute encoder zero point position offset using an origin search | | | | | | |
|---|---|---|---|---|---|---|---|
| | Linear interpolation not performed at the same time | | Linear interpolation performed at the same time for one set of axes | | Linear interpolation performed at the same time for two sets of axes | | During online monitoring with the CX-Motion-NCF |
| | Minimum transfer cycle set value | Minimum communications cycle value | Minimum transfer cycle set value | Minimum communications cycle value | Minimum transfer cycle set value | Minimum communications cycle value | |
| 1 | 0.5 ms | 1.0 ms (2) | 0.5 ms | 3.0 ms (6) | --- | --- | Communications cycle time on the left + 1.0 ms |
| 2 | 0.5 ms | 1.0 ms (2) | 0.5 ms | 4.0 ms (8) | --- | --- | |
| 3 | 0.5 ms | 2.0 ms (4) | 0.5 ms | 5.0 ms (10) | --- | --- | |
| 4 | 1.0 ms | 2.0 ms (2) | 1.0 ms | 5.0 ms (5) | --- | --- | |
| 5 | 1.0 ms | 2.0 ms (2) | 1.0 ms | 6.0 ms (6) | 1.0 ms | 7.0 ms (7) | |
| 6 | 1.0 ms | 3.0 ms (3) | 1.0 ms | 6.0 ms (6) | 1.0 ms | 8.0 ms (8) | |
| 7 | 1.0 ms | 3.0 ms (3) | 1.0 ms | 6.0 ms (6) | 1.0 ms | 9.0 ms (9) | |
| 8 | 1.0 ms | 3.0 ms (3) | 1.0 ms | 7.0 ms (7) | 1.0 ms | 10.0 ms (10) | |
| 9 | 2.0 ms | 4.0 ms (2) | 2.0 ms | 8.0 ms (4) | 2.0 ms | 12.0 ms (6) | Same as on the left |



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| Number of devices connected | Min. set values when setting the absolute encoder zero point position offset using an origin search | | | | | | |
|---|---|---|---|---|---|---|---|
| | Linear interpolation not performed at the same time | | Linear interpolation performed at the same time for one set of axes | | Linear interpolation performed at the same time for two sets of axes | | During online monitoring with the CX-Motion-NCF |
| | Minimum transfer cycle set value | Minimum communications cycle value | Minimum transfer cycle set value | Minimum communications cycle value | Minimum transfer cycle set value | Minimum communications cycle value | |
| 10 | 2.0 ms | 4.0 ms (2) | 2.0 ms | 8.0 ms (4) | 2.0 ms | 12.0 ms (6) | Communications cycle time on the left + 2.0 ms |
| 11 | 2.0 ms | 4.0 ms (2) | 2.0 ms | 8.0 ms (4) | 2.0 ms | 12.0 ms (6) | |
| 12 | 2.0 ms | 4.0 ms (2) | 2.0 ms | 8.0 ms (4) | 2.0 ms | 12.0 ms (6) | |
| 13 | 2.0 ms | 6.0 ms (3) | 2.0 ms | 8.0 ms (4) | 2.0 ms | 12.0 ms (6) | |
| 14 | 2.0 ms | 6.0 ms (3) | 2.0 ms | 10.0 ms (5) | 2.0 ms | 12.0 ms (6) | |
| 15 | 2.0 ms | 6.0 ms (3) | 2.0 ms | 10.0 ms (5) | 2.0 ms | 12.0 ms (6) | |
| 16 | 2.0 ms | 6.0 ms (3) | 2.0 ms | 10.0 ms (5) | 2.0 ms | 14.0 ms (7) | Same as on the left |

**Note**

(1) The values in parentheses in the *Minimum communications cycle value* column are the PCU's communications cycle set value (multiplier to obtain integer multiples of the transfer cycle) used to set the minimum communications cycle for the minimum transfer cycle set value.

(2) The above table gives values for when an absolute encoder zero point position offset is set using an origin search operation when a Position Control Unit of unit version 2.0 is used. If this function is not being used, set the transfer cycle and communications cycle based on the table on page 203.

(3) The settings of the transfer cycle and communications cycle have a large effect on the PCU's command response time. (Refer to *Command Response Time* in *Appendix A Performance Characteristics*.) As shown in the above table, the communications cycle (time) must be increased, e.g., particularly when linear interpolation is used at the same time as an origin search is used to set the absolute encoder zero point position offset (for different axes). The affect on system performance must thus be considered when making the settings. If it is not possible to increase the communications cycle, provide an interlock circuit between the operation of different axes so that linear interpolation is not performed for one axis while an origin search is being performed for a motor with an absolute encoder on another axis.

# 6-3 MECHATROLINK Communications Control

MECHATROLINK communications control used for the PCU is described here.

## 6-3-1 Establishing Connections

Establishing a connection refers to starting communications between the PCU and the MECHATROLINK devices registered in the scan list. Connections are established by turning ON the CONNECT Bit in the Common Operating Output Memory Area. When CONNECT is executed, the PCU executes ERROR RESET (UNIT ERROR RESET or AXIS ERROR RESET) for the PCU itself and all the axes registered in the scan list.



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For any error that occurs in an axis, ERROR RESET is executed when the connection with the corresponding axis is established. Therefore, if the cause of an error is removed, unless an error occurs due to connection processing, the PCU will start MECHATROLINK communications with all errors reset when CONNECT is executed.

The PCU status is initialized when a connection is established, as follows:

- PCU Positioning Completed Flag OFF
- Origin not established (No Origin Flag ON)

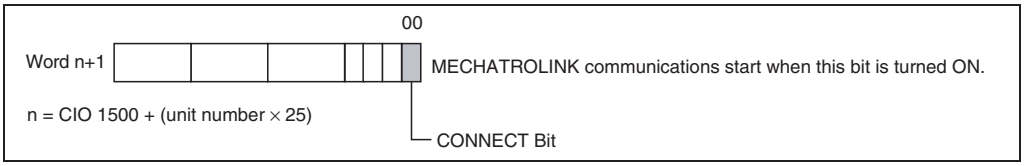
  When using Servomotors with absolute encoders for which the encoder type is set to absolute encoder in the axis parameters, however, the origin is established (No Origin Flag OFF) by reading the absolute value data when the connection is established.
- Stop Execution Flag OFF

For details on errors when establishing connections, refer to *6-3-3 MECHATROLINK Communications Errors*. The CONNECT Bit is allocated in CIO 1501 + (unit number × 25), bit 00.

**Common Operating Memory Area (Output)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| CONNECT Bit | n+1 | 00 | 0 → 1: Establishes connection.<br>1 → 0: Releases connection. |

n = CIO 1500 + (unit number × 25)




If the CONNECT Bit is turned OFF while a connection is established, the PCU will stop MECHATROLINK communications (connection released).

When a connection is released, the active axis is put in the Servo free run state.

For all axes registered in the scan list, the status that is input in the Axis Operating Input Memory Areas for each axis becomes the initial status (non-executing status), except for the Error Flag and axis error code. For example, the No Origin Flag turns ON because the origin is not established.

**Note** When a connection is released, the PCU immediately stops controlling the active axes. If a connection is released while another command is being processed, the Servo Driver may not respond to the command properly. Make sure that command processing has been completed (Busy Flag = 0 and Servo Parameter Transferring Flag = 0) before releasing a connection. When a connection is reestablished after recovering from an error that caused the PCU to release a connection, confirm that the settings and operating status of the Servo Driver are correct before restarting operations. (If necessary, transfer the Servo parameters again and execute DEVICE SETUP.)

## 6-3-2 MECHATROLINK Communications Status

The MECHATROLINK communications status is given using the following two status flags allocated in the Common Operating Input Memory Area of the PCU.

- Connection Status Flag



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- Axis Communications Status Flags

**Connection Status Flag**

This status flag turns ON when the PCU has established a connection (MECHATROLINK communications have started).

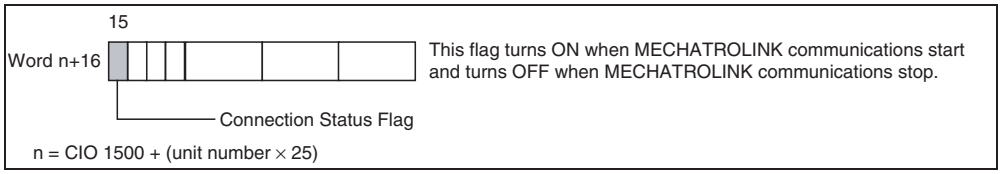
The PCU starts MECHATROLINK communications for the axes registered in the scan list. This status flag will turn ON, however, when CONNECT is executed, even if nothing is registered in the scan list.

The Connection Status Flag turns OFF when the connection is released. The Connection Status Flag is allocated in CIO 1516 + (unit number × 25), bit 15.

**Common Operating Memory Area (Input)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| Connection Status Flag | n+16 | 15 | 0: MECHATROLINK communications stopped.<br>1: MECHATROLINK communications executing. |

n = CIO 1500 + (unit number × 25)




**Axis Communications Status Flags**

These status flags turn ON when a connection has been established between the PCU and the MECHATROLINK devices connected to the PCU. The Axis Communications Status Flags are allocated in one word with 16 bits, with one bit assigned to each of the 16 axes showing the corresponding communications status.

The PCU connects the axes registered in the scan list to MECHATROLINK communications, recognizing those axes and monitoring their communications. Therefore, the Axis Communications Status Flags for axes not registered in the scan list are always OFF.



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The operation of the Axis Communications Status Flag depends on the unit version of the PCU as shown in the following table

| Unit version | Setting conditions | Resetting conditions |
|---|---|---|
| Unit version 1.3 or earlier | • The flags will turn ON when connections are made for the axes registered in the scan list and MECHATROLINK communications start. | • The flags will remain OFF when MECHATROLINK communications cannot be started when connections are made for the axes registered in the scan list.<br>• The flags will turn OFF if MECHATROLINK communications stop because the axis is disconnected.<br>• The flags will turn OFF if a Unit error occurs that requires disconnection. |
| Unit version 2.0 or later | • The flags will turn ON when connections are made for the axes registered in the scan list and MECHATROLINK communications start.<br>• The flags will turn ON when the rejoin function is used to start MECHATROLINK communications for an axis registered in the scan list. | • The flags will remain OFF when MECHATROLINK communications cannot be started when connections are made for the axes registered in the scan list.<br>• The flags will turn OFF if MECHATROLINK communications stop because the axis is disconnected.<br>• The flags will turn OFF if a Unit error occurs that requires disconnection.<br>• The flags will turn OFF whenever a communications error occurs after MECHATROLINK communications have been started for the axis. |

With unit version 1.3 or earlier, once MECHATROLINK communications have been started by establishing connections, the Axis Communications Status Flags will not change unless communications are disconnected (including Unit errors that required disconnection).

With unit version 2.0 or later, the Axis Communications Status Flags will turn OFF after connections have been established whenever axis operation becomes impossible due to a communications error (synchronous communications alarm or communications alarm).

Refer to *6-3-3 MECHATROLINK Communications Errors* for information on errors that occur when establishing connections.

The Axis Communications Status Flags are allocated in CIO 1522 + (unit number × 25).

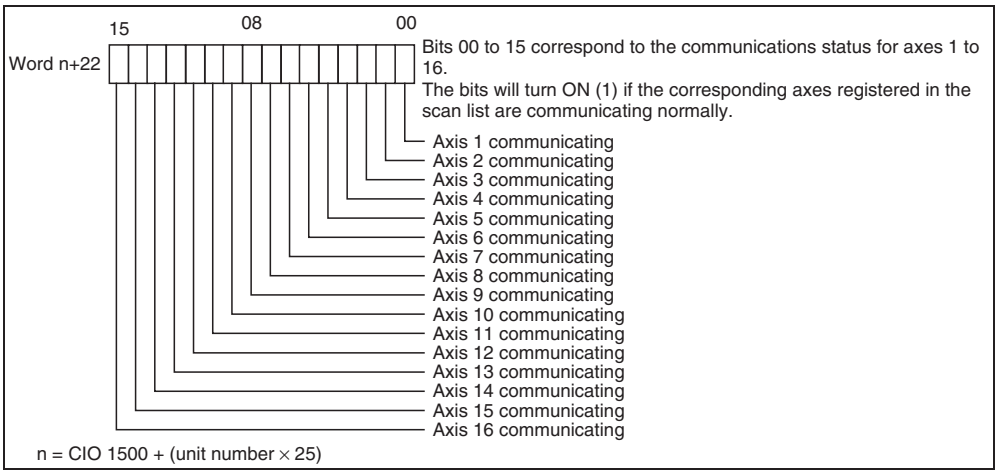


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### Common Operating Memory Area (Input)

| Name | Word | Bits | Contents |
|---|---|---|---|
| Axis Communications Status Flags | n+22 | 00 | 0: Axis 1 communications stopped, or axis not registered in scan list.<br>1: Axis 1 communications executing. |
| | | 01 | Same as above for axis 2. |
| | | 02 | Same as above for axis 3. |
| | | 03 | Same as above for axis 4. |
| | | 04 | Same as above for axis 5. |
| | | 05 | Same as above for axis 6. |
| | | 06 | Same as above for axis 7. |
| | | 07 | Same as above for axis 8. |
| | | 08 | Same as above for axis 9. |
| | | 09 | Same as above for axis 10. |
| | | 10 | Same as above for axis 11. |
| | | 11 | Same as above for axis 12. |
| | | 12 | Same as above for axis 13. |
| | | 13 | Same as above for axis 14. |
| | | 14 | Same as above for axis 15. |
| | | 15 | Same as above for axis 16. |

n = CIO 1500 + (unit number × 25)

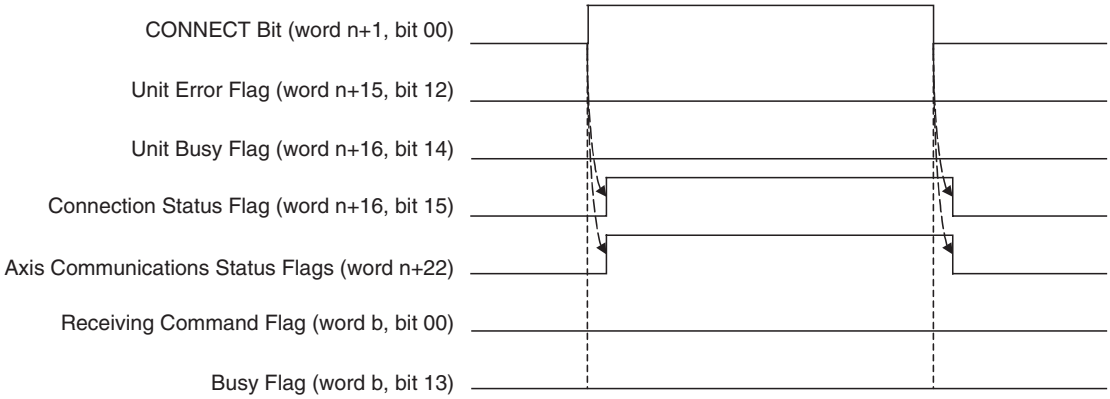





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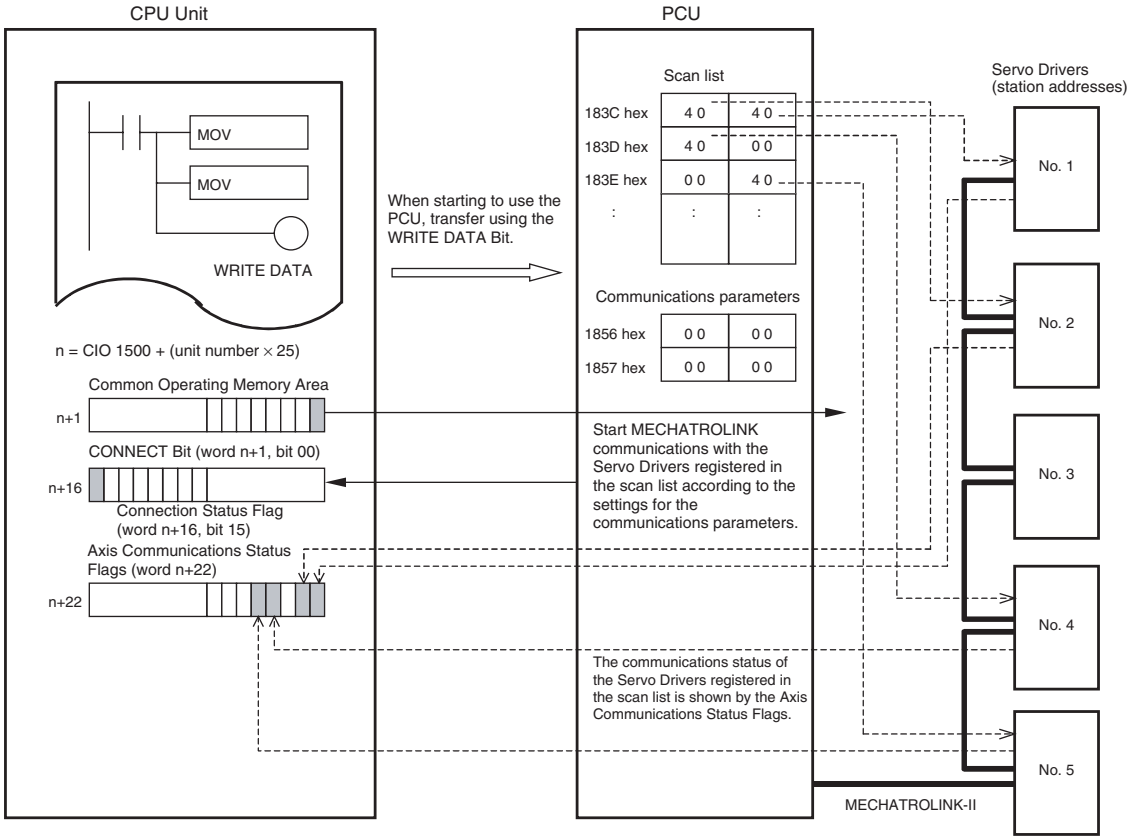
## Timing Chart

The following diagram shows the timing chart for establishing and releasing a connection.




When the PCU starts MECHATROLINK communications as a result of the CONNECT Bit turning ON, the Connection Status Flag turns ON. The Axis Communications Status Flags turn ON when the connection is established for axes registered in the scan list only.
There is no change in status of the Unit Busy Flag, or the Receiving Command Flags or Busy Flags for the connected axes when a connection is established or released.

n = CIO 1500 + (unit number × 25)
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25




In the above example, Servo Drivers are registered to axes 1, 2, 4, and 5 in the scan list (set to 40 hex). Therefore, MECHATROLINK communications start with the Servo Drivers with station addresses No. 1, No. 2, No. 4, and No. 5 when CONNECT is executed.



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## Restrictions in Establishing a Connection According to Servo Driver Status

Functionality for axis operations after establishing a connection depends on the unit version of the PCU as described below if the following conditions exist when a connection is established for an axis (Servo Driver) registered in the scan list.

- Disconnection
- Control power supply interruption
- An alarm that cannot be reset (i.e., when the power must be cycled)

### ■ PCUs with Unit Version 1.2 or Earlier

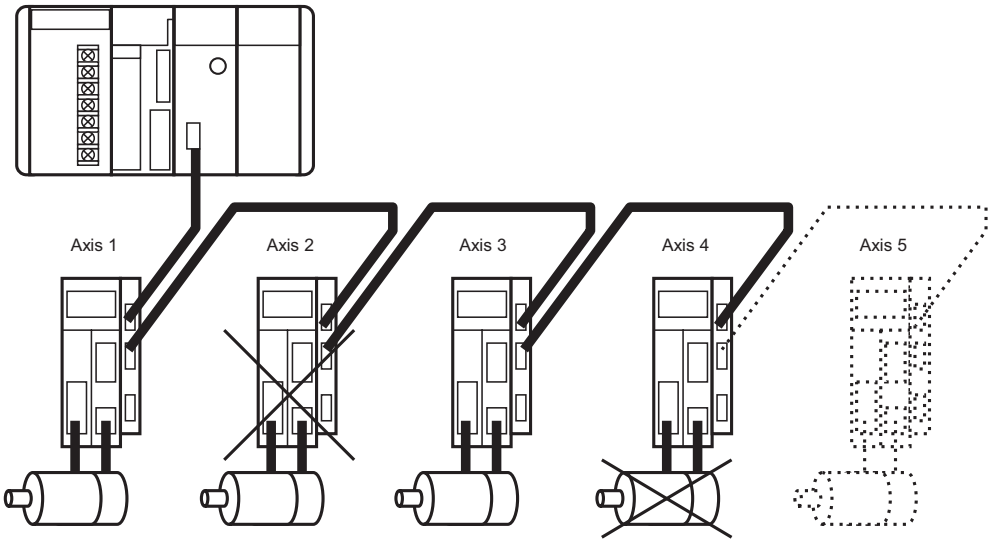
An MLK initialization error (unit error code 0020 hex) will occur in these situations, and operation for MECHATROLINK communications will stop for all axes. To start MECHATROLINK communications normally, any errors must be cleared for all axes registered in the scan list before establishing a connection.

### ■ PCUs with Unit Version 1.3 or Later

Axis operation is possible for axes that are registered in the scan list and for which MECHATROLINK communications was started (i.e., axes for which Axis Communications Status Flags are ON), regardless of whether an alarm is present in the Servo Driver or whether the connected axes match the scan list. If MECHATROLINK communications cannot be started for all axes registered in the scan list, an MLK initialization error (unit error code 0020 hex) will occur to provide notification of the inconsistency between the registered axes and the axes that are communicating.

The following example shows the restrictions in operations according to axis status when connections are established.

**Example: When Axes 1 to 5 Are Registered in the Scan List**




| Axis No. | No. 1 | No. 2 | No. 3 | No. 4 | No. 5 |
|---|---|---|---|---|---|
| Axis status (example)<br>Function | Normal | Control power supply interrupted (See note 1.) | Normal | Alarm that cannot be reset (See note 2.) | Disconnection |
| Connection | Possible | Not possible | Possible | Possible | Not possible |
| Axis Communications Status Flag | ON | OFF | ON | ON | OFF |
| Monitoring (including error codes) | Possible | Not possible | Possible | Possible | Not possible |



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| Axis No. | No. 1 | No. 2 | No. 3 | No. 4 | No. 5 |
|---|---|---|---|---|---|
| Servo parameter transfer | Possible | Not possible | Possible | Possible | Not possible |
| Axis operating commands | Possible | Not possible | Possible | Not possible | Not possible |

**Note** (1) It is assumed that the MECHATROLINK communications cable is connected.

(2) For example, when A.81 (backup error) occurs. MECHATROLINK communications may not be possible, depending on the individual Servo Driver specifications and on the type of alarm that cannot be reset.

For axes 1 and 3, MECHATROLINK communications can be started and all axis operations can be executed if there is no Servo Driver error. For axis 2 (with no control power supply) and axis 5 (disconnected), MECHATROLINK communications cannot be started, and operations and monitoring are not possible. If MECHATROLINK communications can be started for axis 4 (alarm that cannot be reset), depending on the handling of the Servo Driver error, the axis can be monitored and parameters can be transferred but axis operations cannot be executed. In this example, the axes for which MECHATROLINK communications can actually be started are 1, 3, and 4. This does not match the axes registered in the scan list (i.e., axes 1 to 5), so an MLK initialization error (unit error code 0020 hex) occurs.

## 6-3-3 MECHATROLINK Communications Errors

The PCU monitors and detects errors if they occur at the start of or during MECHATROLINK communications. Detected errors are largely categorized as PCU common errors that stop MECHATROLINK communications and operation of all axes, and axis errors that stop individual axes. Moreover, they are classified into three types of error: Errors at Communications Startup, Errors Detected by PCU during Communications, and Errors Detected in MECHATROLINK Slave Stations Connected to PCU during Communications.

### Errors that Stop MECHATROLINK Communications (Unit Common Errors)

**Errors at Communications Startup**

The following errors in MECHATROLINK (MLK) communications are monitored by the PCU when CONNECT is executed.

Errors in MECHATROLINK slave station devices cannot be detected by the PCU before a connection is established. The PCU will execute ALARM RESET for the devices communicating with MECHATROLINK when a connection is established.

#### MLK Device Initialization Error (Unit Error Code: 0030 Hex)

This error occurs if initialization of MECHATROLINK communications fails when CONNECT is executed, and causes connection processing to stop. When this error occurs, confirm that the PCU's common parameters and MECHATROLINK communications settings are set correctly, restart the PCU, and then execute CONNECT again. If the error occurs again, it is a result of an error in the MECHATROLINK communications section of the PCU and requires replacement of the PCU.



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**MLK Initialization Error (Unit Error Code: 0020 Hex)**

This error occurs if the MECHATROLINK slave station device corresponding to the axis number registered in the scan list is not detected within 10 seconds after CONNECT is executed. This error may occur if a MECHATROLINK slave station communications settings are not set, or if the settings for the MECHATROLINK communications line connection and slave device's station address do not match the settings in the scan list. Verify that the contents registered in the scan list matches the MECHATROLINK device settings and connection configuration.

If this error occurs, the PCU will stop and the connection status will remain ON (communications still in an executing state).

For PCUs with unit version 1.2 or earlier, operation will not be possible for all axes registered in the scan list. For PCUs with unit version 1.3 or later, all or part of the axis operations will be possible assuming that MECHATROLINK communications can be established (i.e., if the Axis Communications Status Flag is ON). (Refer to *6-3-2 MECHATROLINK Communications Status* for axis operation restrictions according to Servo Driver status.)

After recovering from the error, release the connection and then execute CONNECT again. When using a Position Control Unit with unit version 2.0 or later, the REJOIN command can be used to rejoin the connection without breaking the connection.

**MLK Communications Error (Unit Error Code: 0025 Hex)**

This error occurs if two or more connected MECHATROLINK slave station devices have the same station number when CONNECT is executed. This error also occurs when communications errors that are not specific to a particular slave station occur during MECHATROLINK communications, and causes MECHATROLINK communications to stop (connection released). This error may occur during MECHATROLINK communications as a result of a faulty communications path such as noise, breaks, or faulty connections in the communications line. After removing the cause of the error, restart the PCU and execute CONNECT again.

**MLK Device Error (Unit Error Code: 0026 Hex)**

This error occurs if an error in the MECHATROLINK communications section of the PCU is detected, and causes MECHATROLINK communications to stop (connection released). This error will occur if the MECHATROLINK communications section of the PCU is faulty. Replace the PCU if this error occurs.

**Transfer Cycle Setting Error (Unit Error Code: 0027 Hex)**

This error may occur when establishing a connection if the transfer cycle set in the PCU's Common Parameters is unsuitable for the axis numbers or number of slave stations connected to MECHATROLINK, and causes MECHATROLINK communications to stop (connection released). This error indicates that the set value for the transfer cycle is too small for the axis numbers or number of connected slave stations. Change the transfer cycle setting in the Common Parameters. After removing the cause of the error, restart the PCU and execute CONNECT again.

If a Unit common error occurs, the Unit Error Flag in the Common Operating Memory Area of the PCU turns ON, and the corresponding error code is input in the Unit Error Code Bits. After the cause of the error is removed, the Unit common error is cleared by turning ON the UNIT ERROR RESET Bit in the Common Operating Memory Area.

When clearing a Unit common error, make sure that the UNIT ERROR RESET Bit will remain ON until the Unit Busy Flag turns ON.



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The UNIT ERROR RESET Bit cannot be used to clear errors that require PCU replacement (MLK Device Initialization Error or MLK Device Error), or that cause MECAHTROLINK communications to stop (MLK Communications Error or Transfer Cycle Setting Error). After removing the cause of the error, turn ON the power to the PLC again or restart the PCU.

**Common Operating Memory Area (Output)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| UNIT ERROR RESET Bit | n | 00 | 0 → 1: Clears the Unit common error that occurred. |

n = CIO 1500 + (unit number × 25)

**Common Operating Memory Area (Input)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| Unit Error Flag | n+15 | 12 | 0: Unit common error has not occurred.<br>1: Unit common error has occurred. |
| Unit Busy Flag | n+16 | 14 | 0: PCU is not busy.<br>1: PCU is busy. |
| Connection Status Flag | | 15 | 0: MECHATROLINK communications stopped.<br>1: MECHATROLINK communications executing. |
| Unit error code | n+21 | 00 to 15 | Indicates the error code for the common Unit error that occurred. |

n = CIO 1500 + (unit number × 25)

## Individual Axis Errors

**Errors Detected by PCU during Communications**

**Synchronous Communications Alarm (Axis Error Code: 3010 Hex)**

This error occurs for errors in synchronous MECHATROLINK communications processing with an axis.

If this error occurs, the corresponding axis will stop operating according to the stop method that is set in the Servo Driver for when alarms occur.

This error may occur as a result of a faulty communications path with the corresponding axis, such as noise, breaks, or faulty connections in the communications line.

If this error occurs, the corresponding axis may not be able to accept operations through MECHATROLINK communications such as ERROR RESET. To recover from this error, release the connection and remove the cause of the error, and then execute CONNECT again. When using a Position Control Unit with unit version 2.0 or later, the REJOIN command can be used to rejoin the connection without breaking the connection.

**Communications Alarm (Axis Error Code: 3011 Hex)**

This error occurs for errors in MECHATROLINK communications processing with an axis. The communications alarm will occur if the PCU fails twice in succession to exchange data using MECHATROLINK communications, such as not receiving communications data. The corresponding axis will stop operating if this alarm occurs according to the stop method that is set in the Servo Driver for when alarms occur.

This error may occur as a result of a faulty communications path with the corresponding axis, such as noise, breaks, or faulty connections in the communications line.



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If this error occurs, the corresponding axis may not be able to accept operations through MECHATROLINK communications such as ERROR RESET. To recover from this error, release the connection, remove the cause of the error, and then execute CONNECT again. When using a Position Control Unit with unit version 2.0 or later, the REJOIN command can be used to rejoin the connection without breaking the connection.

### Errors Detected in MECHATROLINK Slave Station Connected to PCU during Communications

Errors detected in the slave stations connected to the PCU via MECHATROLINK after a connection is established cause axis errors or axis warnings in the PCU, as follows:

**MLK Device Alarm/Warning (Axis Error Code 40□□ Hex)**

The boxes (□□) indicate the alarm number for the connected MECHATROLINK devices. The operations of each axis when an error occurs depend on each of the MECHATROLINK slave station devices.

For errors in MECHATROLINK communications that occur in individual axes, the Error Flags for the corresponding axes turn ON in the Axis Operating Input Memory Areas of the PCU, and the corresponding error code is input in the axis error code word.

After the cause of the error is removed, the axis error is cleared by turning ON the ERROR RESET Bit in the Axis Operating Output Memory Area. When clearing the axis error, make sure that the ERROR RESET Bit will remain ON until the Busy Flag for the corresponding axis turns ON.

The ERROR RESET Bit cannot be used to clear errors such as Synchronous Communications Alarms or Communications Alarms. To recover from these errors, release the connection, remove the cause of the error, and then execute CONNECT again. When using a Position Control Unit with unit version 2.0 or later, the REJOIN command can be used to rejoin the connection without breaking the connection.

### Axis Operating Output Memory Areas

| Name | Word | Bits | Contents |
|---|---|---|---|
| ERROR RESET Bit | a | 12 | 0 → 1: Clears the axis error that occurred. |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

### Axis Operating Input Memory Areas

| Name | Word | Bits | Contents |
|---|---|---|---|
| Warning Flag | b | 11 | 0: Axis warning has not occurred.<br>1: Axis warning has occurred. |
| Error Flag | | 12 | 0: Axis error has not occurred.<br>1: Axis error has occurred. |
| Busy Flag | | 13 | 0: Axis is not busy.<br>1: Axis is busy. |
| Axis error code | b+4 | 00 to 15 | Indicates the axis error code/warning code for each axis. |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

For details on indicators and troubleshooting for when errors occur in the PCU, refer to *SECTION 12 Troubleshooting*. For details on error displays and troubleshooting for MECHATROLINK slave station devices, refer to the operation manuals for the corresponding device.



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**Note** If an axis warning occurs (Warning Flag = 1), the PCU's command response time is delayed due to the PCU's warning processing. The PCU processing time required after receiving a command from the CPU Unit until the command is sent using MECHATROLINK communications is one MECHATROLINK communications cycle if an axis warning has not occurred, and three MECHATROLINK communications cycles if an axis warning has occurred. If the machine's operation would be affected by the PCU's command response time, clear the axis warning status using ERROR RESET or set the Servo Driver settings so that the warnings will not occur. For details on the PCU's command response time, refer to *Command Response Time* in *Appendix A Performance Characteristics*.

## 6-3-4 Rejoining the Connection

### Overview

The rejoin function can be used to rejoin the connection for an axis for which operations are not possible using MECHATROLINK communications either when initially establishing the connection or after the connection has been established.

This function can be used only with Position Control Units with unit version 2.0 or later.

If any axis registered in the scan list is in either of the following conditions, the error cannot be cleared with the normal error reset procedure and axis operations will not be possible from the Position Control Unit.

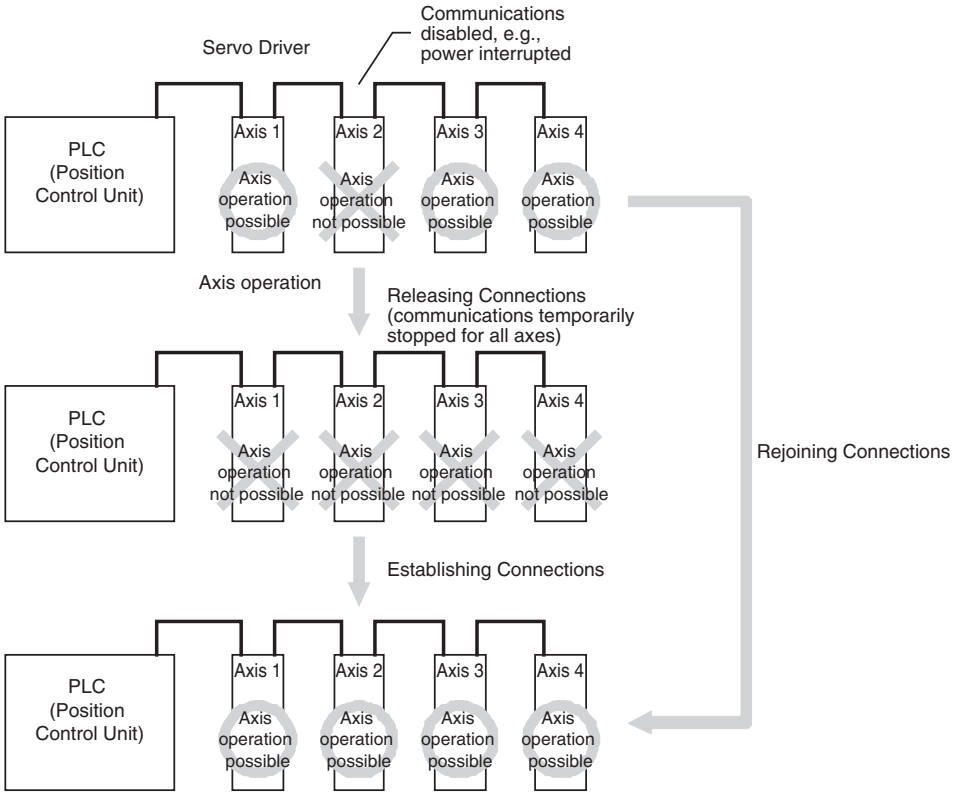
- If an axis cannot be detected and MECHATROLINK communications cannot be started within 10 s after executing the connection command (An MLK initialization error (Unit error code: 0020 (hex)) will occur.)
- If a synchronous communications alarm (axis error code: 3010 (hex)) occurs or a communications alarm (axis error: 3011 (hex)) occurs

To restart communications for the axis for which axis operations are not possible with Position Control Units with unit version 1.3 or earlier, the connection must be broken and MECHATROLINK communications must be stopped for all axes, and then connection must be re-established.



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With Position Control Units with unit version 2.0 or later, the rejoin function can be used to restart MECHATROLINK communications for specific axes without stopping MECHATROLINK communications for all axes.




## Using the Rejoin Function

The rejoin function is used by turning ON the REJOIN command bit in the Common Operating Output Memory Area of the Position Control Unit.

When the REJOIN command bit is turned ON, the process to start MECHATROLINK communications is performed in the same way as when a connection is established. This can be used to restart communications for any axes registered in the scan list that are not part of the connection or for which axis operations are not possible due to a communications error.

When using the REJOIN command bit, the axis for which rejoin processing is to be performed can be specified in the Axes to Connect parameter. Refer to *6-3-5 Specifying the Axes to Connect* for details on the Axes to Connect parameter.

When rejoining the connection, errors that occur in the Position Control Unit or the axes will be reset.

Functionality for axis operations after rejoining a connection are the same as when establishing the connection.

The REJOIN command bit is bit 15 of CIO 1501+ (unit number × 25). Keep the REJOIN command bit ON until the Unit Busy Flag turns ON.

### Common Operating Output Memory Area

| Name | Word | Bit | Contents |
|---|---|---|---|
| REJOIN | n+1 | 15 | Rejoining the connection is started when this bit is turned ON. |



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n = 1500 + (unit number × 25)

**Common Operating Input Memory Area**

| Name | Word | Bit | Contents |
|---|---|---|---|
| Unit Busy Flag | n+16 | 14 | 0: PCU is not busy.<br>1: PCU is busy. |
| Connection Status Flag | | 15 | 0: MECHATROLINK communications stopped.<br>1: MECHATROLINK communications executing. |
| Axis Communications Status Flags | n+22 | 00 to 15 | Indicate the communications status for each axis. |

n = 1500 + (unit number × 25)

The REJOIN command bit can be used when the Connection Status Flag is ON (i.e., when a connection is established).

When executing processing for an axis to rejoin a connection, the Unit Busy Flag will turn ON for a minimum of one scan time and until the Axis Communications Status Flags turn ON for the axes being processed or until a MLK initialization error (Unit error code: 0020 (hex)) occurs after the REJOIN command bit is turned ON.

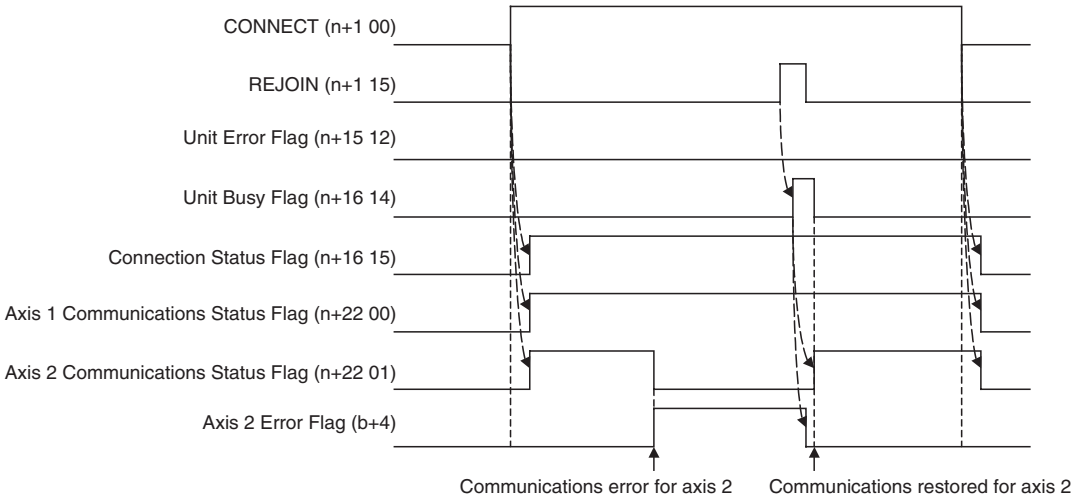
**Note** When the REJOIN command is executed, processing to restart MECHATROLINK communications is performed for all specified axes. If there are any axes for which MECHATROLINK communications cannot be started, communications errors will not occur for individual axes, but rather an MLK initialization error (Unit error code: 0020 (hex)) will occur for the entire Unit. If MECHATROLINK communications cannot be restarted when attempting to recover from communications errors for only specific axes, the error status will thus change from one for specific axes before rejoin processing to one for the entire Unit after rejoin processing. Monitor the status of these error flags to determine the result of rejoin processing.



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### Timing Chart

A timing chart for rejoin processing is provided below for Position Control Units with unit version 2.0 or later. In this example, axes 1 and 2 are registered in the scan list. After a connection is established, a communications error occurs for axis 2 (i.e., either a sync communications alarm or a communications alarm).




When a communications error occurs for axis 2, the Axis 2 Error Flag and Axis 2 Communications Status Flag will turn OFF.
After removing the cause of the error, the REJOIN command bit is turned ON to clear the error for axis 2 and restart MECHATROLINK communications. The Axis Communications Status Flag turns ON.

n = CIO 1500 + (unit number × 25)
b = First word specified in the Common Parameters for the Axis Operating Input Memory Area + (Axis No. −1) × 25

## 6-3-5 Specifying the Axes to Connect

The Axes to Connect parameter can be used to temporarily disable MECHATROLINK communications for one or more axes registered in the scan list. This enables starting MECHATROLINK communications without errors occurring for axes that are not connected without changing the scan list. This can be used, for example, during system design and startup when all axes are not yet connected.

This function can be used only with Position Control Units with unit version 2.0 or later.

The Axes to Connect parameter is in CIO 1502 + (unit number × 25).



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**Common Operating Output Memory Area**

| Name | Word | Bit | Contents |
|---|---|---|---|
| Axes to connect | n+2 | 00 | The following settings apply if axis 1 is registered in the scan list:<br>0: MECHATROLINK communications started for axis 1<br>1: MECHATROLINK communications not started for axis 1 |
| | | 01 | Same as above for axis 2 |
| | | 02 | Same as above for axis 3 |
| | | 03 | Same as above for axis 4 |
| | | 04 | Same as above for axis 5 |
| | | 05 | Same as above for axis 6 |
| | | 06 | Same as above for axis 7 |
| | | 07 | Same as above for axis 8 |
| | | 08 | Same as above for axis 9 |
| | | 09 | Same as above for axis 10 |
| | | 10 | Same as above for axis 11 |
| | | 11 | Same as above for axis 12 |
| | | 12 | Same as above for axis 13 |
| | | 13 | Same as above for axis 14 |
| | | 14 | Same as above for axis 15 |
| | | 15 | Same as above for axis 16 |

n = 1500 + (unit number × 25)

The Axes to Connect parameter is valid only when establishing a connection or when rejoining a connection.

**Example**

This example shows how to use a scan list in which axes 1 to 5 are registered and connect only axes 1, 2, and 5.

- Establishing a Connection for All Axes (n+2 = 0000 (Hex))
  Axes 1, 2, and 5: MECHATROLINK communications started
  Axes 3 and 4: MECHATROLINK communications not started
  In this case, the connection cannot be established for axes 3 and 4, causing an MLK initialization error (Unit error code: 0020 (hex)) to occur in the Position Control Unit.
- Establishing a Connection for All Axes Except Axes 3 and 4 (n+2 = 000C (Hex))
  Axes 1, 2, and 5: MECHATROLINK communications started
  Axes 3 and 4: MECHATROLINK communications not started
  In this case, axes 3 and 4 are treated as if they are not registered in the scan list and an MLK initialization error does not occur in the Position Control Unit.

**Note** The Axes to Connect parameter is valid only when using the CONNECT or REJOIN command bits in the Common Operating Memory Area. When establishing connections from the CX-Motion-NCF, the Axes to Connect parameter is ignored and processing to start MECHATROLINK communications is performed for all axes registered in the scan list.

If MECHATROLINK communications cannot be started when establishing a connection from the CX-Motion-NCF, an MLK initialization error (Unit error code: 0020 (hex)) regardless of the setting of the Axes to Connect parameter. Provide interlock circuits to allow for this as required by the system.



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# 6-4 Standard Settings for Servo Drivers Using MECHATROLINK

## 6-4-1 W-series Servo Driver Settings (R88D-WT□ Equipped with JUSP-NS115)

When the R88D-WT□ W-series Servo Driver equipped with a JUSP-NS115 MECHATROLINK-II Application Module is used, settings for some parameters of the W-series user constants (Servo Parameters) may be limited.

**Automatically Set Servo Parameters**

By equipping the W-series Servo Driver with the JUSP-NS115, the Servo Parameters in the following table will be automatically changed to the fixed settings and saved when the power to the W-series Servo Driver is turned ON for the first time. These parameters are used by the system as fixed settings and must not be changed. (The default settings are those used for W-series Servo Drivers before installing the JUSP-NS115.)

| Parameter No. | Parameter name | Unit | Fixed setting | Details | Default setting |
|---|---|---|---|---|---|
| Pn004 | Reserved by the system. | --- | 0200 | --- | 0000 |
| Pn200 | Position control setting 1 | --- | 0100 | --- | 1011 |
| Pn204 | Position command filter time constant 1 | ×0.01 ms | 0 | Sets soft start for command. | 0 |
| Pn207.1 | Position control setting 2<br>Speed command input switching | --- | 1 | REF used as feed-forward input | 0 |
| Pn50A.0 | Input signal selection 1<br>Input signal allocation mode | --- | 1 | User-defined sequence input signal allocation | 0 |
| Pn50A.1 | Input signal selection 1<br>RUN signal (RUN command) input terminal allocation | --- | 8 | Always invalid. | 0 |
| Pn50A.2 | Input signal selection 1<br>MING (gain reduction) signal input terminal allocation | --- | 8 | Always invalid. | 1 |
| Pn50B.1 | Input signal selection 2<br>RESET (alarm reset) signal input terminal allocation | --- | 8 | Always invalid. | 4 |
| Pn50C | Input signal selection 3<br>RDIR (rotation direction command signal)<br>SPD1 (speed selection command 1 signal)<br>SPD2 (speed selection command 2 signal)<br>TVSEL (control mode switching signal) | --- | 8888 | Always invalid. | 8888 |
| Pn50D.0 | Input signal selection 4<br>PLOCK (position lock command signal) | --- | 8 | Always invalid. | 8 |
| Pn50D.1 | Input signal selection 4<br>IPG (pulse disable signal) | --- | 8 | Always invalid. | 8 |

**Compulsory Parameter Settings**

The following Servo Parameter must be set to enable PCU control. Do not change this setting.

**Pn800.0 Communications Control: MECHATROLINK Communications Check Mask**

| Parameter No. | Parameter name | Unit | Fixed setting | Details | Default setting |
|---|---|---|---|---|---|
| Pn800.0 | Communications control<br>MECHATROLINK-II communications check mask | --- | 0 | 0: Communications errors (A.E6) and synchronization errors (A.E5) both detected. | 0 |



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The MECHATROLINK communications errors A.E6 (communications errors) and A.E5 (synchronization errors) are used when the PCU is controlling communications. Make sure to set this parameter so that these errors are always detected. Leave Pn800.0 set to the default setting 0 (detects communications errors (A.E6) and synchronization errors (A.E5)).

**Pn800.1 Communications Control: Warning Check Mask**

| Parameter No. | Parameter name | Unit | Fixed setting | Details | Default setting |
|---|---|---|---|---|---|
| Pn800.1 | Communications control<br>Warning check mask | --- | 4 or 0 | 4: Communications warning (A.96) ignored.<br>0: A.94, A.95, and A.96 all detected. | 4 |

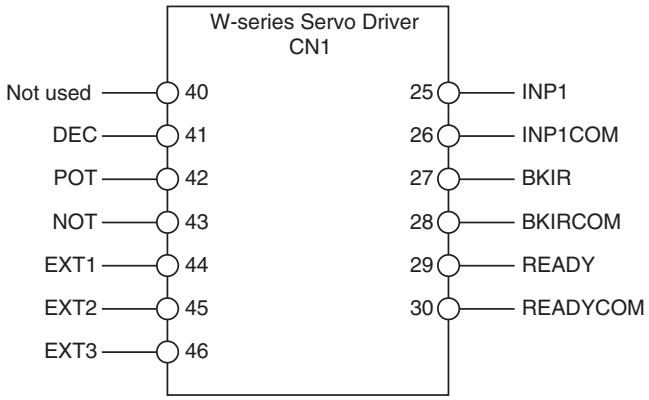
The MECHATROLINK communications warnings A.94 (parameter setting warning) and A.95 (MECHATROLINK command warning) are used when the PCU is controlling communications. Set the parameter so that they are not ignored. Either leave Pn800.1 set to the default setting 4 (ignores communications errors (A.96) only) or set to 0 (detects A.94, A.95, and A.96).

### Standard Settings for I/O Signals Using MECHATROLINK

When MECHATROLINK communications are used by a W-series Servo Driver equipped with JUSP-NS115, the standard settings for the Servo Driver's external I/O signal allocations are as follows:

The standard input signal settings are used for the PCU's positioning control functions such as limit inputs, origin searches, and interrupt feeding. When using a system configuration combining a W-series Servo Driver and JUSP-NS115, use the standard settings for the I/O signal allocations. (The following default settings are those used by W-series Servo Drivers before installing the JUSP-NS115.)

**I/O Signal Allocations (Standard Settings)**




| Parameter No. | Parameter name | Standard setting | Details | Default setting |
|---|---|---|---|---|
| Pn50A.3 | Input signal selection 1<br>POT (forward drive prohibited input) signal input terminal allocation | 2 | Allocated to CN1, pin 42<br>Valid for low input (N.C. contact) | 8 |
| Pn50B.0 | Input signal selection 2<br>NOT (reverse drive prohibited input) signal input terminal allocation | 3 | Allocated to CN1, pin 43<br>Valid for low input (N.C. contact) | 8 |
| Pn50B.2 | Input signal selection 2<br>PCL (forward rotation current limit) signal input terminal allocation | 8 | Always invalid. | 5 |



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| Parameter No. | Parameter name | Standard setting | Details | Default setting |
|---|---|---|---|---|
| Pn50B.3 | Input signal selection 2<br>NCL (reverse rotation current limit) signal input terminal allocation | 8 | Always invalid. | 6 |
| Pn511.0 | Input signal selection 5<br>DEC (origin return deceleration limit switch) signal input terminal allocation | 1 | Allocated to CN1, pin 41<br>Valid for low input (N.O. contact) | 8 |
| Pn511.1 | Input signal selection 5<br>EXT1 (external latch 1 input) signal input terminal allocation | 4 | Allocated to CN1, pin 44<br>Valid for low input (N.O. contact) | 8 |
| Pn511.2 | Input signal selection 5<br>EXT2 (external latch 2 input) signal input terminal allocation | 5 | Allocated to CN1, pin 45<br>Valid for low input (N.O. contact) | 8 |
| Pn511.3 | Input signal selection 5<br>EXT3 (external latch 3 input) signal input terminal allocation | 6 | Allocated to CN1, pin 46<br>Valid for low input (N.O. contact) | 8 |
| Pn50E.0 | Output signal selection 1<br>INP1 (positioning completed 1) signal output terminal allocation | 1 | Allocated to CN1, pins 25 and 26 | 1 |
| Pn50E.1 | Output signal selection 1<br>VCMP (speed conformity) signal output terminal allocation | 0 | No output | 1 |
| Pn50E.2 | Output signal selection 1<br>TGON (Servomotor rotation detection) signal output terminal allocation | 0 | No output | 2 |
| Pn50E.3 | Output signal selection 1<br>READY (Servomotor warmup complete) signal output terminal allocation | 3 | Allocated to CN1, pins 29 and 30 | 3 |
| Pn50F.0 | Output signal selection 2<br>CLIMT (current limit detection) signal output terminal allocation | 0 | No output | 0 |
| Pn50F.1 | Output signal selection 2<br>VLIMT (speed limit detection) signal output terminal allocation | 0 | No output | 0 |
| Pn50F.2 | Output signal selection 2<br>BKIR (brake interlock) signal output terminal allocation | 2 | Allocated to CN1, pins 27 and 28 | 0 |
| Pn50F.3 | Output signal selection 2<br>WARN (warning) signal output terminal allocation | 0 | No output | 0 |
| Pn510.0 | Output signal selection 3<br>INP2 (positioning completed 2) signal output terminal allocation | 0 | No output | 0 |
| Pn510.1 | Not used. | 0 | --- | 0 |
| Pn510.2 | Output signal selection 3<br>PSON (command pulse factor enabled) signal output terminal allocation | 0 | No output | 0 |
| Pn510.3 | Not used. | 0 | --- | 0 |

**Note** The PCU uses the forward drive prohibited input, reverse drive prohibited input, and origin return deceleration limit switch allocated in the Servo Driver's external inputs as the forward rotation limit input signal, reverse rotation limit input signal, and origin proximity input signal, respectively. Make sure that these input signals maintain a signal width no shorter than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU is unable to detect the input signals, and operations cannot be performed normally.



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## 6-4-2 W-series Servo Driver Settings (R88D-WN□-ML2 with Built-in MECHATROLINK-II Communications)

When the R88D-WN□-ML2 W-series Servo Driver equipped with built-in MECHATROLINK-II communications is used, the Servo Driver's default settings are used as the standard settings for MECHATROLINK communications.

### Compulsory Parameter Settings

The following Servo parameters must be set to enable PCU control. Do not change this setting.

**Pn800.0 Communications Control: MECHATROLINK Communications Check Mask**

| Parameter No. | Parameter name | Unit | Fixed setting | Details | Default setting |
|---|---|---|---|---|---|
| Pn800.0 | Communications control<br>MECHATROLINK communications check mask | --- | 0 | 0: Communications errors (A.E6□) and synchronization errors (A.E5□) both detected. | 0 |

The MECHATROLINK communications errors A.E6□ (communications errors) and A.E5□ (synchronization errors) are used when the PCU is controlling communications. Make sure to set this parameter so that these errors are always detected. Leave Pn800.0 set to the default setting 0 (detects communications errors (A.E6□) and synchronization errors (A.E5□)).

**Pn800.1 Communications Control: Warning Check Mask**

| Parameter No. | Parameter name | Unit | Fixed setting | Details | Default setting |
|---|---|---|---|---|---|
| Pn800.1 | Communications control<br>Warning check mask | --- | 4 or 0 | 4: Communications warning (A.96□) ignored.<br>0: A.94□, A.95□, and A.96□ all detected. | 4 |

The MECHATROLINK communications warnings A.94□ (parameter setting warning) and A.95□ (MECHATROLINK command warning) are used when the PCU is controlling communications. Set the parameter so that they are not ignored. Either leave Pn800.1 set to the default setting 4 (ignores communications errors (A.96□) only) or set to 0 (detects A.94□, A.95□, and A.96□).

### Standard Settings for I/O Signals Using MECHATROLINK

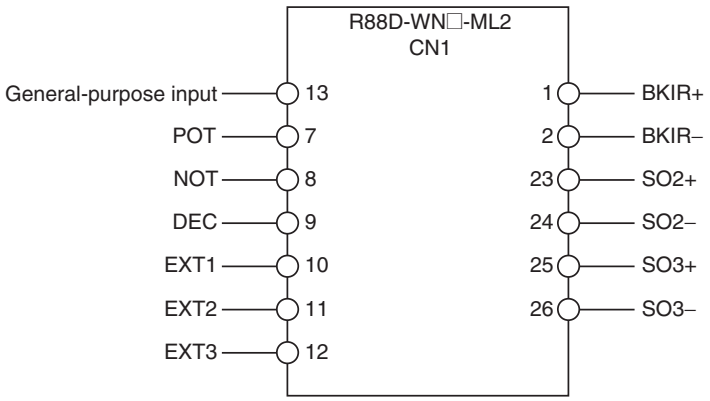
When the R88D-WN□-ML2 W-series Servo Driver equipped with built-in MECHATROLINK-II communications is used, the Servo Driver's default I/O signal allocations are used as the standard settings for MECHATROLINK communications.

The standard settings for input signals use the position control functions, such as PCU limit inputs, origin search inputs, and interrupt feeding inputs. The default I/O signal allocations of the Servo Driver should thus be used.



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**I/O Signal Allocations (Default Settings)**




**Note** The PCU uses the forward drive prohibited input, reverse drive prohibited input, and origin return deceleration limit switch allocated in the Servo Driver's external inputs as the forward rotation limit input signal, reverse rotation limit input signal, and origin proximity input signal, respectively. Make sure that these input signals maintain a signal width no shorter than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU is unable to detect the input signals, and operations cannot be performed normally.

## 6-4-3 SMARTSTEP Junior Servo Driver Settings (R7D-ZN□-ML2 with Built-in MECHATROLINK-II Communications)

When the R7D-ZN□-ML2 SMARTSTEP Junior Servo Driver Settings equipped with built-in MECHATROLINK-II communications is used, the Servo Driver's default settings are used as the standard settings for MECHATROLINK communications.

**Compulsory Parameter Settings**

The following Servo parameter must be set to enable PCU control. Do not change this setting.

**Pn800.1 Communications Control: Warning Check Mask**

| Parameter No. | Parameter name | Unit | Fixed setting | Details | Default setting |
|---|---|---|---|---|---|
| Pn800.1 | Communications control<br>Warning check mask | --- | 4 or 0 | 4: Communications warning (A.96) ignored.<br>0: A.94, A.95, and A.96 all detected. | 4 |

The MECHATROLINK communications warnings A.94 (parameter setting warning) and A.95 (MECHATROLINK command warning) are used when the PCU is controlling communications. Set the parameter so that they are not ignored. Either leave Pn800.1 set to the default setting 4 (ignores communications errors (A.96) only) or set to 0 (detects A.94, A.95, and A.96).

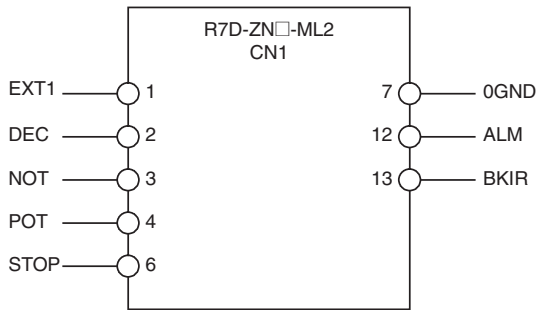
**Standard Settings for I/O Signals When Using MECHATROLINK**

When the R7D-ZN□-ML2 SMARTSTEP Junior Servo Driver equipped with built-in MECHATROLINK-II communications is used, the Servo Driver's default settings are the standard settings for I/O signals for MECHATROLINK communications. The standard I/O signal settings are used for limit inputs, origin searches, interrupt feeding, and other position control functions of the Position Control Unit. Use the default settings for the I/O signal allocations for the Servo Driver.



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**I/O Signal Allocations (Default Settings)**




**Note** The PCU uses the forward drive inhibit input, reverse drive inhibit input, and origin proximity input allocated in the Servo Driver's external inputs as the forward rotation limit input signal, reverse rotation limit input signal, and origin proximity input signal, respectively. Make sure that these input signals maintain a signal width no shorter than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU is unable to detect the input signals, and operations cannot be performed normally.



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# SECTION 7
# Position Control Structure

This section provides an overview of the control system used by the Position Control Unit, including information on the control units, coordinate system, acceleration/deceleration operations, and limit input operations.


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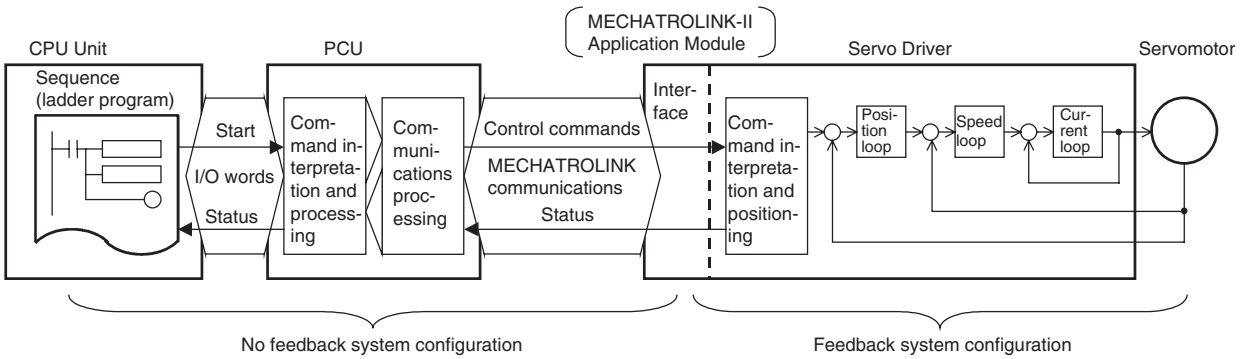



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# 7-1 PCU Control System

This section describes the configuration, principles, and basic information on position control when using a control system configured with a PCU and a W-series Servo Driver.

## 7-1-1 Control System Configuration and Principles

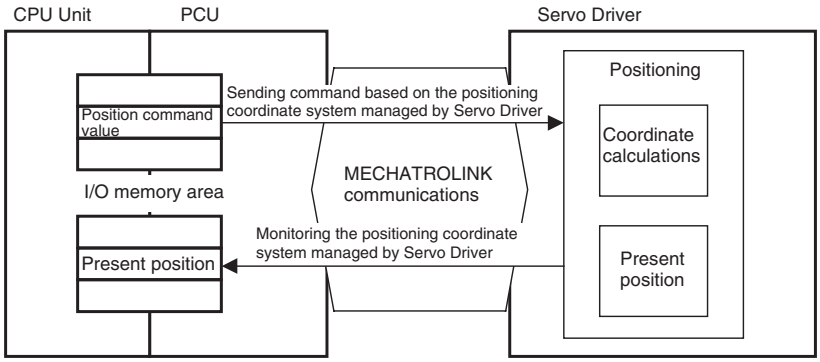



The control system configured using the PCU basically controls Servomotor operations using the semi-closed loop method. The semi-closed loop method detects the number of Servomotor rotations for the command value using the rotary encoder mounted to the Servomotor, and sends this feedback as the machine's travel distance. While calculating the deviation between the command value and actual number of Servomotor rotations, the machine is controlled so that the deviation is compensated to 0.

In the PCU system configuration, a feedback system is configured in the Servo Driver, without using feedback information for the commands sent from the CPU Unit's ladder program to the PCU and Servo Driver.

## 7-1-2 Position Control

The control system configured using the PCU uses the Servo Driver's position loop to perform position control. The PCU achieves positioning by using the Servo Driver's position control functions together with control units and coordinate systems.






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# 7-2 Control Units

## 7-2-1 Control Units for Position Control

### Control Units for Position Control

The command units are used as the basic control units for the position command values and speed command values that the PCU uses in position control axis operations, such as direct operation, origin searches, and jogging. (The unit for speeds is command units/s.) These units are determined by the electronic gear ratio in the Servo Parameters. The Servo Parameter settings such as *Positioning Completion Range* and *Software Limit* and the present position monitor unit input in the CPU Unit are also based on these command units.

The *Electronic Gear Ratio G1/G2* parameters determine the ratio between the command unit and travel distance (pulse unit) of the Servomotor.

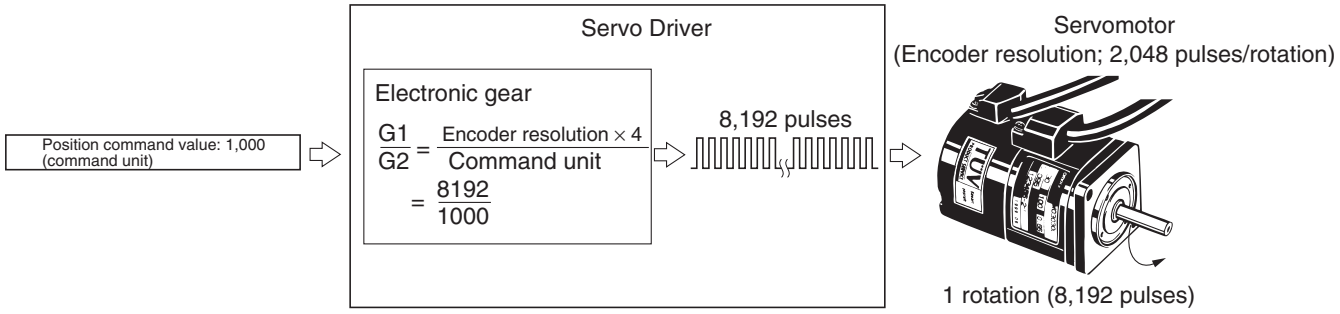
| Model | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| R88D-WT□ | Pn202 | Electronic gear ratio G1 (numerator) | --- | 1 to 65535 | 2 | 4 |
| | Pn203 | Electronic gear ratio G2 (denominator) | --- | 1 to 65535 | 2 | 1 |
| R88D-WN□-ML2 | Pn20E | Electronic gear ratio G1 (numerator) | --- | 1 to 1073741824 | 4 | 4 |
| | Pn210 | Electronic gear ratio G2 (denominator) | --- | 1 to 1073741824 | 4 | 1 |
| SMART-STEP Junior | Pn20E | Electronic gear ratio G1 (numerator) | --- | 1 to 1073741824 | 4 | 1 |
| | Pn210 | Electronic gear ratio G2 (denominator) | --- | 1 to 1073741824 | 4 | 1 |

Set the electronic gear ratio such that $0.01 \leq G1/G2 \leq 100$ when using R88D-WT□ W-series Servo Drivers or SMARTSTEP Junior Servo Drivers and such that $0.001 \leq G1/G2 \leq 1000$ when using R88D-WN□-ML2 W-series Servo Drivers.

In the Servo Driver, the control unit is the pulse unit determined by the Servomotor's encoder resolution. (The Servo Driver operates internally with a pulse multiplier of four. Therefore, the Servomotor's encoder resolution multiplied by four is the number of pulses in one rotation.) The electronic gear ratio is used to convert the command value (i.e., command units) handled by the PCU into the control unit (i.e., pulses) used in the Servo Driver (the G1/G2 unit is pulses/command unit.) When the Servo Driver's default setting (G1/G2 = 4/1) is used, the command unit is the number of pulses equivalent to the Servomotor's encoder resolution.

**Servomotor with 2,048 (Pulses/Rotation) Encoder**

When set to G1/G2 = 8192/1000, the command units for which the Servomotor makes one rotation for a position command value of 1,000 can be obtained.

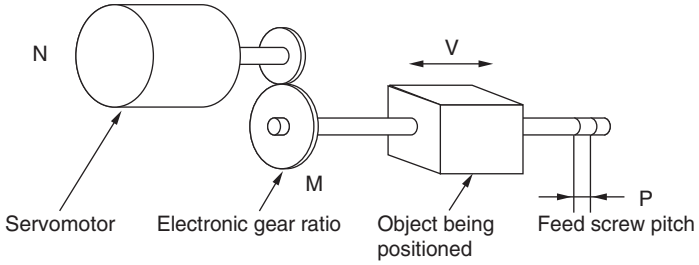





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**Command Unit Setting Example**

Consider the following positioning example.




M: Deceleration gear ratio
V: Feed speed of object being positioned (mm/s)
P: Feed screw pitch (mm/rotation)
R: Servomotor encoder resolution (pulses/rotation)

The equation for calculating the distance traveled per Servomotor encoder resolution pulse is as follows:

$$\frac{\text{Feed screw pitch}}{(\text{Servomotor encoder resolution} \times 4) \times (\text{deceleration ratio})} = \frac{\text{P (mm/rotation)}}{\text{R (pulses/rotation)} \times 4 \times \text{M}} \text{ (mm/pulse)}$$

The Servo Driver performs control internally at four times the Servomotor's encoder resolution. Therefore, in the above equation, the Servomotor's encoder resolution is multiplied by four. If the command unit used is mm, the electronic gear ratio is set as the reciprocal of the above equation and G1/G2 is set as follows:

$$\text{Command unit (mm):}\ \frac{\text{G1}}{\text{G2}} = \frac{\text{R (pulses/rotation)} \times 4 \times \text{M}}{\text{P (mm/rotation)}} \text{ (pulses/mm)}$$

If the command unit used is 0.01 mm (= 10 μm), the unit is converted by multiplying the travel distance per encoder resolution pulse by 100, and the electronic gear ratio is set as follows:

$$\text{Command unit (0.01 mm):}\ \frac{\text{G1}}{\text{G2}} = \frac{\text{R (pulses/rotation)} \times 4 \times \text{M}}{\text{P (mm/rotation)} \times 100} \text{ (pulses/0.01 mm)}$$

## 7-2-2 Control Units for Speed/Torque Control

The unit used for the speed command value in speed control is the percentage (unit: 0.001%) of the Servo Driver's/Servomotor's momentary maximum rotation speed. The unit used for the torque command value in torque control is the percentage (unit: 0.001%) of the Servo Driver's/Servomotor's momentary maximum torque. The Servomotor's momentary maximum rotation speed and momentary maximum torque depend on the Servomotor model.

For details on specifications, refer to the corresponding operation manuals for the Servo Driver and Servomotor.



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## 7-2-3 Units of the PCU's Main Controlled Variables

| Function | Category | Controlled variable | Unit | Details |
|---|---|---|---|---|
| Common | Servo Parameter data | Torque limit value | % | (percentage of Servomotor's rated torque) |
| | Monitor value | Feedback present position | Command unit | --- |
| | | Command present position | Command unit | --- |
| | | Position deviation | Command unit | --- |
| Position control | Command value | Position command value | Command unit | --- |
| | | Speed command value | Command units/s | --- |
| | Servo Parameter data | Acceleration | 10,000 command units/$s^2$ | --- |
| | | Deceleration | 10,000 command units/$s^2$ | --- |
| | | Zero point return approach speed 1 | 100 command units/s | --- |
| | | Zero point return approach speed 2 | 100 command units/s | --- |
| | Monitor value | Speed monitor value | Command units/s | --- |
| | | Torque monitor value | % | (percentage of Servomotor's rated torque) |
| Speed control | Command value | Speed command value (for speed control) | 0.001% | (percentage of Servomotor's momentary maximum rotation speed) |
| | | Torque limit value (option command value) | % | (percentage of Servomotor's momentary maximum torque) |
| | Monitor value | Speed monitor value | 0.001% | (percentage of Servomotor's momentary maximum rotation speed) |
| | | Torque monitor value | % | (percentage of Servomotor's rated torque) |
| Torque control | Command value | Torque command value | 0.001% | (percentage of Servomotor's momentary maximum torque) |
| | | Speed limit value (option command value) | 0.001% | (percentage of Servomotor's momentary maximum rotation speed) |
| | Monitor value | Speed monitor value | Command units/s | --- |
| | | Torque monitor value | 0.001% | (percentage of Servomotor's momentary maximum torque) |

The units for speed and torque depend on the control mode (position, speed, or torque control). For details, refer to *10-5 Speed Control*, and *10-6 Torque Control*.

**Note** The resolution of the controlled variables that can be monitored by the PCU depends on the specifications of the connected Servo Driver.

For example, when using a W-series Servo Driver equipped with a JUSP-NS115 MECHATROLINK-II Application Module, the minimum resolution for the command speed monitor value and feedback speed in position/torque control is 1,000 command units/s.

Depending on the PLC's cycle time and MECHATROLINK communications cycle, short-term changes in status of the Servo Driver may not be monitored successfully.



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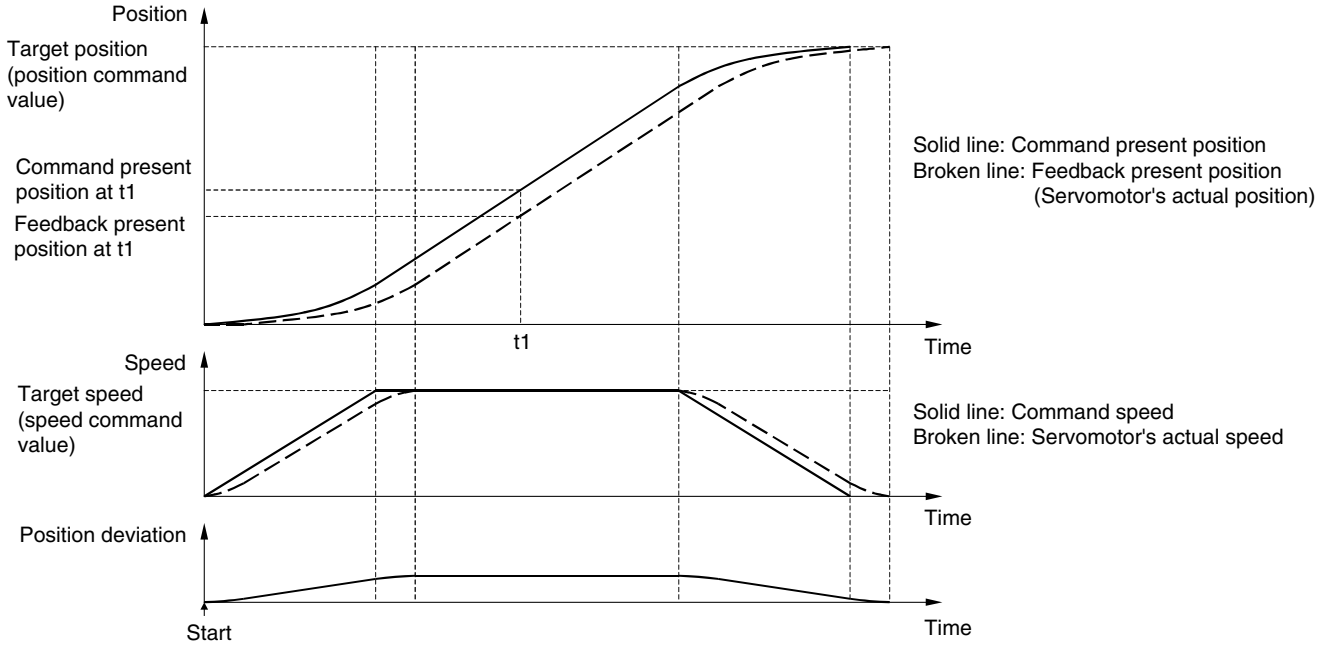
# 7-3 Coordinate System and Present Position

The PCU uses a single coordinate system based on the origin determined for each axis using the origin defining functions. This coordinate system provides two types of present positions for each axis: a feedback present position and a command present position.

### Feedback/Command Present Position

The Servo Driver uses a rotary encoder to detect Servomotor rotations (providing feedback), and the Servomotor is controlled so that the deviation between the feedback and command values is compensated to 0. Therefore, while a position deviation remains in the Servo Driver, a difference equivalent to the position deviation between the position command value and the integrated value of the feedback, which indicates the actual machine (Servomotor) position, should exist.

The PCU outputs to the I/O memory area allocated for each axis in the CPU Unit the amount of feedback indicating the actual position of the machine (Servomotor) as the feedback present position and the position given in the command as the command present position.



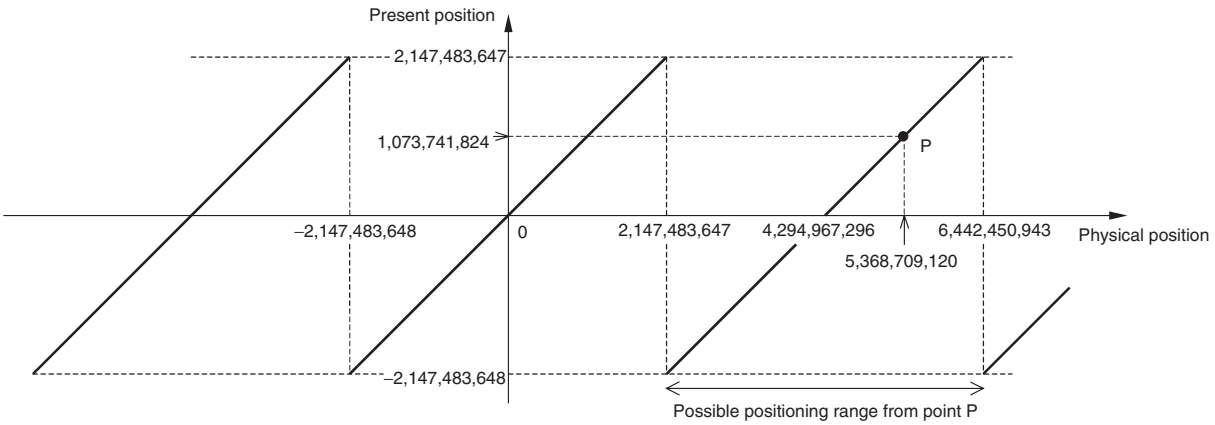

**Note** When executing speed control and torque control commands, there is no command present position because a positioning loop is not configured. A command present position calculated from the position deviation assumed from the current speed is output as monitor information.

### Present Position Upper/Lower Limits

The feedback present position and command present position can be displayed as values in the range –2,147,483,648 to 2,147,483,647 (command units). When an operation in a fixed direction without a target position using jogging, speed control, or torque control is continued, the present value that exceeds the above range and is not limited by limit input signals or software limits is given as follows:



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For example, if the physical position is 5,368,709,120 (command units), as indicated by point P in the above diagram, which exceeds 2,147,483,647 (command units), 1,073,741,824 will be given as the present position (command units).

The position range for the ABSOLUTE MOVEMENT and RELATIVE MOVEMENT commands is –2,147,483,648 to 2,147,483,647 (command units) for the command present position when they are not limited by limit input signals or software limits.

If the physical position is point P in the diagram, the physical position that can be moved to using ABSOLUTE MOVEMENT or RELATIVE MOVEMENT is 2,147,483,648 to 6,442,450,943 (command units). The PCU will treat the position command value and present position in the range as –2,147,483,648 to 2,147,483,647 (command units).

**Note** With the direct operation position range, the operation for position command values is different for ABSOLUTE MOVEMENT and RELATIVE MOVEMENT commands. Refer to *9-4-1 Starting Direct Operation* for further details.

# 7-4 Acceleration and Deceleration Operations

The acceleration and deceleration operations that can be used when the PCU is connected to a W-series Servo Driver or SMARTSTEP Junior Servo Driver are described here.

## 7-4-1 Overview of Acceleration/Deceleration Operations

The PCU creates the specified acceleration/deceleration curve for the operating commands performing position control, such as direct operation or origin searches. The acceleration/deceleration speed settings are set for each axis according to the Servo Parameters for acceleration/deceleration and are enabled for the following acceleration/deceleration operations.

| Operating command | Acceleration operation | Deceleration operation |
|---|---|---|
| ABSOLUTE MOVEMENT/ RELATIVE MOVEMENT | Starting<br>Changing speed (acceleration)<br>Changing override (acceleration) | Stopping positioning<br>Changing speed (deceleration)<br>Changing override (deceleration) |
| JOG | Starting jogging<br>Changing speed (acceleration)<br>Changing override (acceleration) | Stopping jogging<br>Changing speed (deceleration)<br>Changing override (deceleration) |
| ORIGIN SEARCH | See *7-4-4 Origin Search Acceleration/Deceleration Operations* | See *7-4-4 Origin Search Acceleration/Deceleration Operations* |



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| Operating command | Acceleration operation | Deceleration operation |
|---|---|---|
| DECELERATION STOP | --- | Decelerating to a stop |
| Errors with DECELERATION STOP | --- | When errors occur |

Acceleration/deceleration curves cannot be set for speed control or torque control. Continuous speed changes using speed control, however, are possible by setting the *Soft Start Acceleration Time* and *Soft Start Deceleration Time* in the Servo Parameters.

## 7-4-2 Acceleration/Deceleration Settings

The acceleration/deceleration settings are set for each axis according to the Servo Parameters for acceleration/deceleration. Set these Servo Parameters using WRITE/SAVE SERVO PARAMETER before sending operating commands.

Do not change the acceleration/deceleration constants during axis operation (i.e., while the Busy Flag for the corresponding axis is ON due to execution of an operating command). Changing parameters while the axis is operating may result in incorrect positioning or other malfunction.

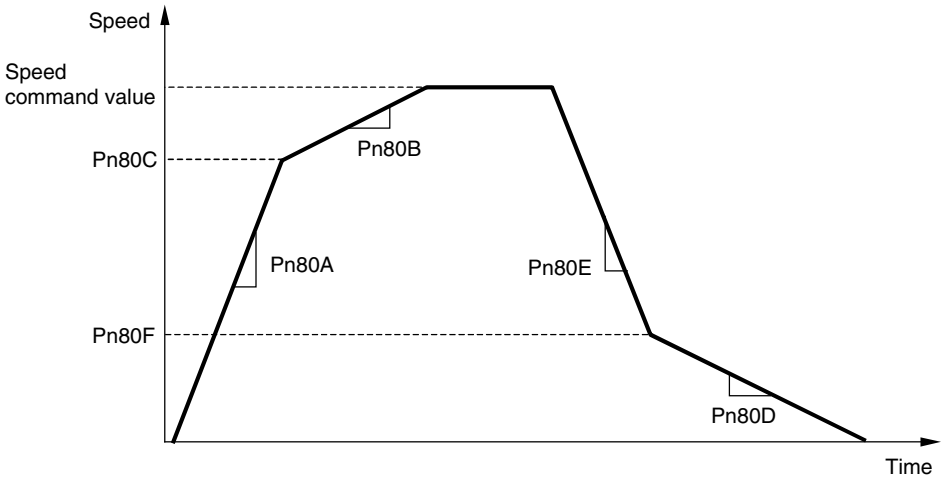
**Servo Parameters** **Acceleration/Deceleration Constants**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|---|---|
| Acceleration/ deceleration constants | Pn80A | First-step linear acceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 | Supported | Not supported |
| | Pn80B | Second-step linear acceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 | Supported | Supported |
| | Pn80C | Acceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 | Supported | Not supported |
| | Pn80D | First-step linear deceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 | Supported | Not supported |
| | Pn80E | Second-step linear deceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 | Supported | Supported |
| | Pn80F | Deceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 | Supported | Not supported |

The SMARTSTEP Junior Servo Drivers do not support the following parameters: Pn80A, Pn80C, Pn80D, and Pn80F. One-step linear acceleration/deceleration curves are set using only Pn80B and Pn80E.



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To operate an axis using only a first-step acceleration/deceleration curve with a W-series Servo Driver, only settings for the parameters Pn80B and Pn80E are required if the default settings (0) are used for the Servo Parameters *Acceleration Constant Switching Speed* and *Deceleration Constant Switching Speed* (Pn80C and Pn80F).

## Unit for Acceleration/ Deceleration Constants

The unit for the acceleration/deceleration filters set in the Position Control Unit is 10000 command units/s$^2$ using the command unit determined by the electronic gear ratio in the Servo parameters.

The setting of the command unit can cause the setting unit for the acceleration/deceleration constants to become imprecise or changes in the setting can greatly affect the size of accelerations/decelerations.

To create a more precise setting unit for accelerations/decelerations, increase the resolution of the command unit (i.e., increase the number of digits).

**Example**

If the command unit is 0.1 mm, the target speed is 1,000 mm/s (1,000.0 mm/s = 10,000 command units/s) and the target speed must be reached in 250 ms, the acceleration constant would be set to 4, as shown below.

1000 [command units/s]/250 [ms] = 40,000 [command units/s$^2$]
= 4 [10,000 command units/s$^2$]

If the acceleration constant is increased or decreased by only 1, the acceleration time required to reach the same target speed is greatly affected, as shown below:

Acceleration constant = 3:10000 [command units/s]/3 [10,000 command units/s$^2$] = 333 [ms]

Acceleration constant = 5:10000 [command units/s]/5 [10,000 command units/s$^2$] = 200 [ms]

If the precision of the command unit is increased by 2 digits to 0.001 mm, the acceleration constant would be set to 400 to reach the same target speed of 1,000 mm/s (1000.000 mm/s = 1,000,000 command units/s) in the same time of 250 ms.

1,000,000 [command units/s]/250 [ms] = 4,000,000 [command units/s$^2$]
= 400 [10,000 command units/s$^2$]



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If the acceleration constant is increased or decreased by 1, the acceleration time required to reach the same target speed is affected very little, as shown below:

Acceleration constant = 399:1000000 [command units/s]/399 [10000 command units/$s^2$] = 250.6 [ms]

Acceleration constant = 401:1000000 [command units/s]/401 [10000 command units/$s^2$] = 249.3 [ms]

## 7-4-3 Acceleration/Deceleration Filter Settings

When a W-series Servo Driver is connected, acceleration/deceleration filters can be set for each axis to avoid rapid changes in acceleration or deceleration. A acceleration/deceleration filter can be set for each axis to enable non-linear acceleration/deceleration curves. Using an acceleration/deceleration filter enables an exponential acceleration/deceleration curve and acceleration/deceleration S-curves using a movement (running) average.

The SMARTSTEP Junior Servo Drivers do not support acceleration/deceleration filters and the filters cannot be set.

To use the acceleration/deceleration filter, set the acceleration/deceleration curve designation in the Axis Operating Output Memory Area when specifying the operating command as well as setting the acceleration/deceleration filter settings in the Servo Parameters.

**Servo Parameters** **Acceleration/Deceleration Constants**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|---|---|
| Acceleration/ deceleration filters | Pn810 | Exponential acceleration/deceleration bias | Command units/s | 0 to 32767 | 2 | 0 | Supported | Not supported |
| | Pn811 | Exponential acceleration/deceleration time constant | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |
| | Pn812 | Movement average time | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |

For the acceleration/deceleration curve, Pn810 and Pn811 must be set when using an exponential curve, and Pn812 must be set when using an S-curve.

**Axis Operating Output Memory Areas**

| Name | | Word | Bit | Contents | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|
| Acceleration/deceleration curve designation | Exponential curve designation | a+16 | 03 | 1: Use exponential acceleration/deceleration curve. | Supported | Not supported |
| | S-curve designation | | 04 | 1: Use S-curve acceleration/deceleration curve. | Supported | Not supported |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

The acceleration/deceleration curve designation setting is enabled when the bit for the movement command turns ON.

**Note**

(1) Do not set both the exponential curve designation and S-curve designation to 1 (enabled) in the acceleration/deceleration curve designation. Enabling both settings may cause a malfunction.

(2) If an error occurs, the acceleration/deceleration curve for the deceleration stop operation will be that currently specified in the acceleration/deceler-

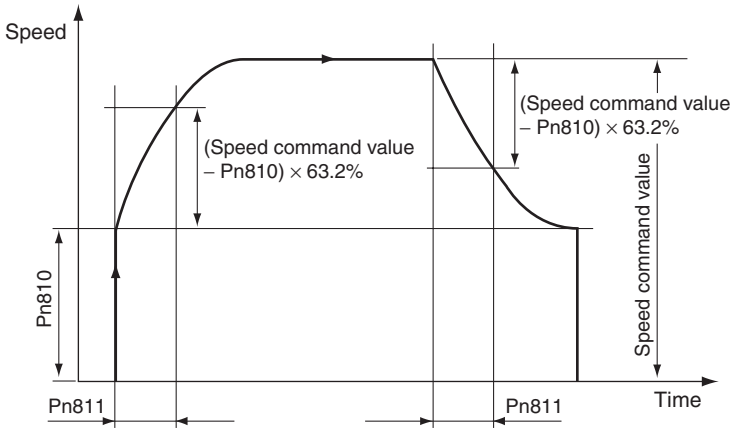


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ation curve designation, except for limit inputs and software limits. To use a non-linear acceleration/deceleration curve for the deceleration stop operation both when an error occurs and when operation is normal, make sure that the acceleration/deceleration curve designation is kept enabled during axis operations.

(3) Change the acceleration/deceleration constants using WRITE SERVO PARAMETER while axis operation is stopped (Busy Flag =0). Do not change parameters during axis operation. Changing parameters of an active axis may result in incorrect positioning or other malfunction.

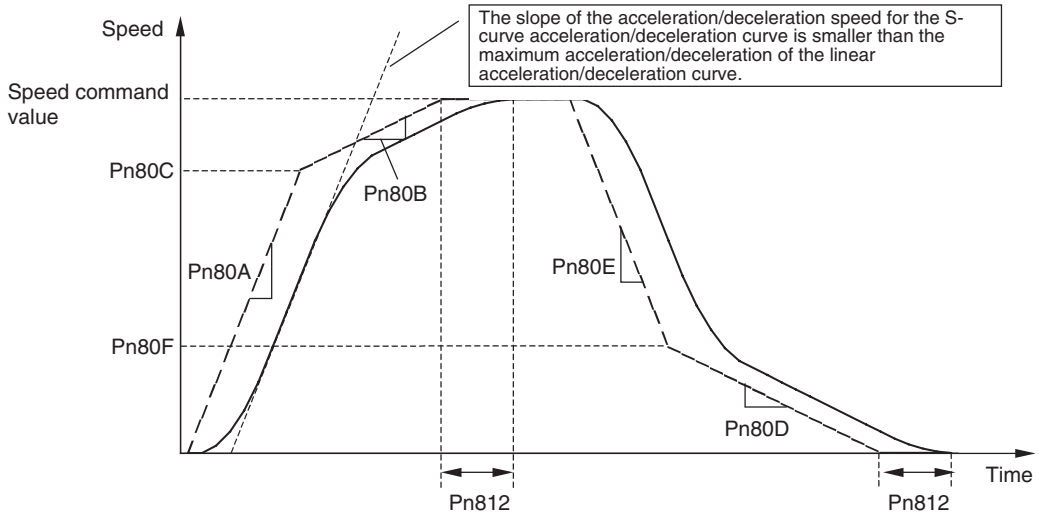
## Exponential Acceleration/Deceleration Curve




The acceleration/deceleration for the exponential acceleration/deceleration curve is determined by the Servo Parameters *Exponential Acceleration/Deceleration Bias* (Pn810) and *Exponential Acceleration/Deceleration Time Constant* (Pn811). The speed set in *Exponential Acceleration/Deceleration Bias* (Pn810) is used as the start speed. The time until reaching 63.2% of the difference between the speed command value and the start speed is set in the *Exponential Acceleration/Deceleration Time Constant* (Pn811).

When an exponential acceleration/deceleration curve is used, the acceleration/deceleration time is always fixed regardless of the speed command value.

## S-curve (Movement Average) Acceleration/Deceleration Curve



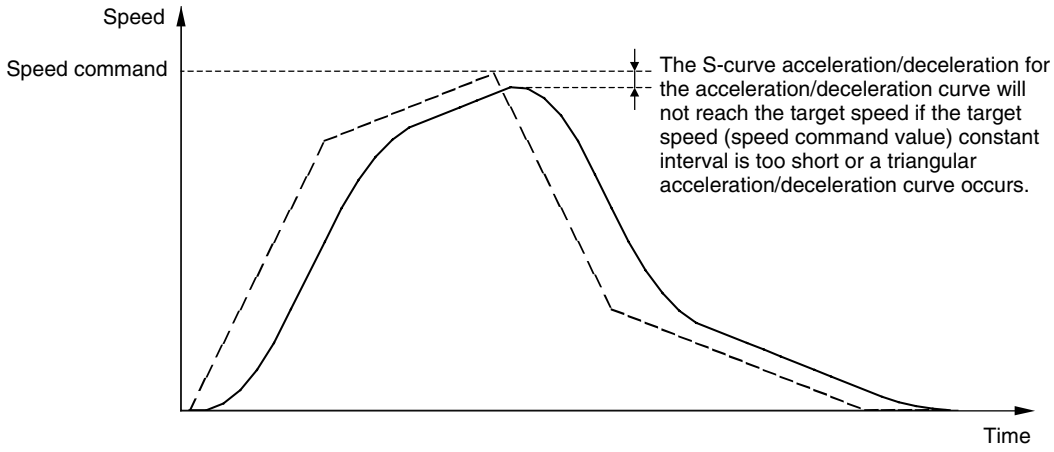



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The S-curve acceleration/deceleration curve obtains the movement average using *Movement Average Time* (Pn812) for the linear acceleration/deceleration curve specified in Pn80A to Pn80F to smooth out sudden changes to the acceleration/deceleration (acceleration/deceleration curve angle). The acceleration/deceleration for the S-curve acceleration/deceleration curve will not exceed the maximum acceleration/deceleration of the linear acceleration/deceleration curve prior to taking the movement average. Set the length of time in which the average acceleration/deceleration curve will be taken in *Movement Average Time* (Pn812).

When there is a sufficient constant speed interval at the target speed (speed command value), the time taken to reach target speed for S-curve acceleration/deceleration is delayed in relation to the linear acceleration/deceleration curve by the set value for *Movement Average Time* (Pn812). In the same way, the time required to stop after positioning will be delayed by this set amount.

If the constant speed interval for the target speed is less than the movement (running) average time or a triangular acceleration/deceleration curve occurs, the achieved speed of S-curve acceleration/deceleration will be less than the target speed.




## 7-4-4 Origin Search Acceleration/Deceleration Operations

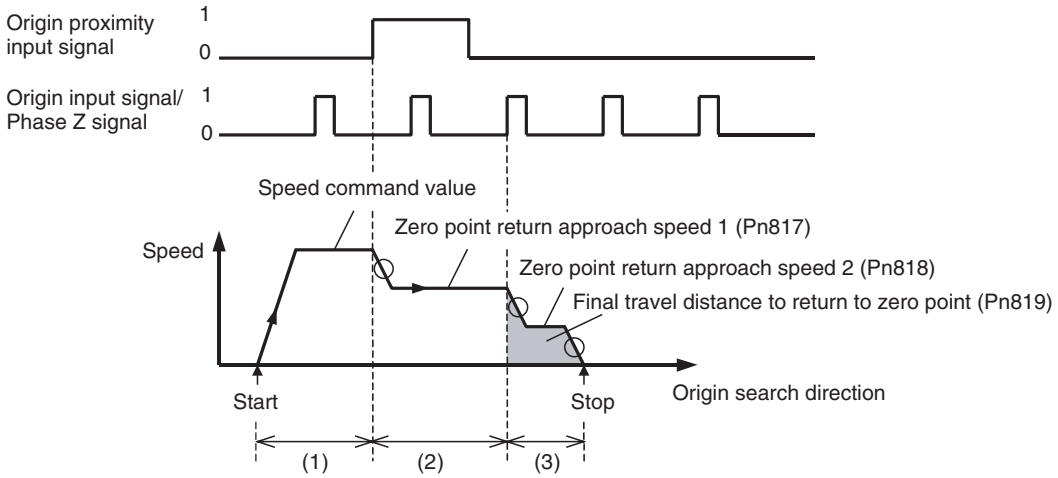
The origin search operation of the PCU consists of the following three steps.

***1,2,3...***

1. Search for origin proximity signal
2. Search for origin signal after detection of origin proximity signal
3. Positioning for final travel distance to return to zero point (origin) after detection of origin signal



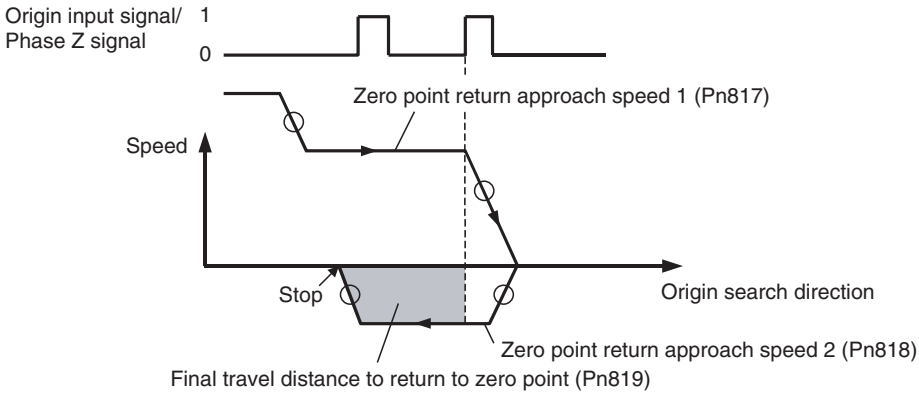
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For details on the origin search, refer to *8-2 Origin Search Operation*.

The acceleration when origin search starts and the speed change when switching to another step depend on the acceleration/deceleration curve (circled in above diagram) determined by the acceleration/deceleration filter setting and acceleration/deceleration set in Servo Parameters Pn80A to Pn812.

When the final travel distance to return to zero point (origin) is a negative or small value, the axis will decelerate to a stop as shown in the following diagram, and then reverse and perform the set positioning. Both the deceleration and acceleration will be determined also by the set acceleration/deceleration curve (circled in following diagram).




If the reversal mode operation using limit input is set, however, the stop operation when a limit input signal is input will depend on the Servo Driver setting. For details on stop operations when using limit input signal inputs, refer to *7-5 Limit Input Operations* and *Reversal Mode Operation Using Limit Inputs* in *8-2-4 Origin Search Operation*.

## 7-4-5 Acceleration and Deceleration Operations during Speed Control

When the speed control command is executed, the Servo Driver performs stepped speed control from the present feedback speed to the target speed specified in the speed command value for speed control. Apart from smoothly increasing/decreasing the speed command value (for speed control) when starting speed control, shock in acceleration/deceleration when performing speed control can also be minimized by setting the Servo Parameters *Soft Start Acceleration Time* (Pn305) and *Soft Start Deceleration Time* (Pn306) to create a trapezoidal speed curve.

For details on speed control, refer to *10-5 Speed Control*.



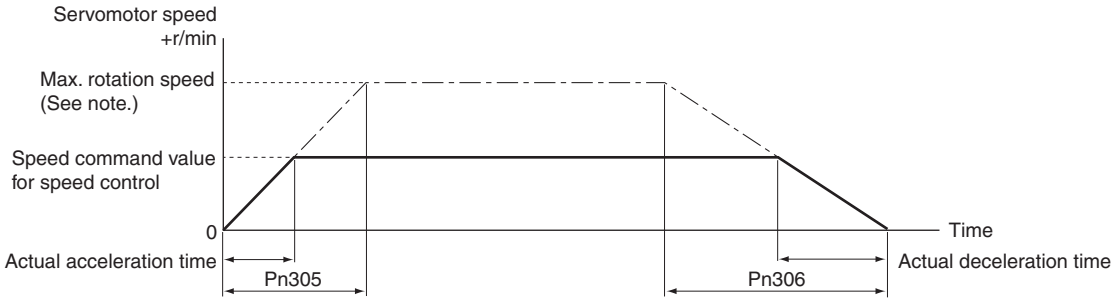
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### Acceleration/Deceleration Constants for Speed Control

| Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|
| Pn305 | Soft start acceleration time | ms | 0 to 10000 | 2 | 0 |
| Pn306 | Soft start deceleration time | ms | 0 to 10000 | 2 | 0 |

The *Soft Start Acceleration Time* and *Soft Start Deceleration Time* are set respectively as the acceleration time and deceleration time between speed 0 (speed command value for speed control: 0%) and the maximum rotation speed of the Servomotor (speed command value for speed control: 100%). The acceleration time and deceleration time for the actual target speed are as follows:

$$\text{Actual acceleration (deceleration) time} = \frac{\text{Speed command value for speed control (r/min)}}{\text{Maximum rotation speed (r/min)}} \times \text{Soft start acceleration (deceleration) time}$$




**Note** The maximum rotation speed depends on the Servomotor used. Refer to the maximum momentary rotation speed for the Servomotor used. The following values apply to W-series Servomotors.

3,000-r/min Servomotor (cylinder type or flat type): 5,000 r/min
1,000-r/min Servomotor: 2,000 r/min
1,500-r/min Servomotor (450 W to 7.5 kW): 3,000 r/min
1,500-r/min Servomotor (11 to 15 kW): 2,000 r/min



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# 7-5 Limit Input Operations

The PCU uses the Servo Driver's internal forward drive prohibited signal input and reverse drive prohibited signal input as the forward rotation limit input signal and reverse rotation limit input signal, respectively. Additionally, the forward/reverse software limits can be used by setting the Servo Parameters.

The stop operation when the forward/reverse rotation limit input signal is input, and the forward/reverse software limit is reached depend on the Servo Parameter settings, as shown in the following table.

| | Travel direction limit | Reverse travel direction limit (See note 1.) |
|---|---|---|
| Limit input signal | The Servomotor operation is stopped at the Servo Driver according to the setting of Servo Parameter Pn001.1.<br>At the PCU, a limit input error occurs, causing an emergency stop, except when using the origin search operation's reversal mode. | An emergency stop caused by a limit input error is executed at the PCU, except when executing ORIGIN SEARCH. |
| Software limit | The Servomotor operation is stopped at the Servo Driver according to the setting of Servo Parameter Pn001.1. (See note 2.)<br>At the PCU, a software limit error occurs, causing an emergency stop. | --- |

**Note**

(1) This operation occurs when a limit input signal is input in the direction opposite to the travel direction due to incorrect wiring or other cause.

(2) For details on software limit functions, refer to *10-8 Software Limits*.

(3) If the limit input signal inputs (Servo Driver's forward drive prohibited signal and reverse drive prohibited signal) are not allocated, the Servo Driver will not stop the Servomotor when the signal is input, and the PCU will also not detect limit inputs as errors. When using a PCU, always allocate the Servo Driver's forward drive prohibited signal and reverse drive prohibited signal to enable use of the limit input signals. (Refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.)

(4) Make sure that the limit input signals maintain a signal width no shorter than the MECHATROLINK communications cycle. Input signals that are shorter than the communications cycle cannot be detected by the PCU.

When using a W-series Servo Driver, the Servomotor's stop operation at the Servo Driver when a limit input signal is input or a software limit is reached is set in the Servo Parameters for limit input operations.

When using a SMARTSTEP Junior Servo Driver, the Servo is locked after decelerating to a stop with the maximum Servomotor torque. The following function cannot be used.

**Servo Parameters**

The following parameters are used for limit input operations.

| Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|
| Pn001.1 | Function selection application switch 1<br>Select stop when prohibited drive is input | --- | 0 to 2 | 2 | 0 |
| Pn406 | Emergency stop torque | % | 0 to 800 | 2 | 350 |



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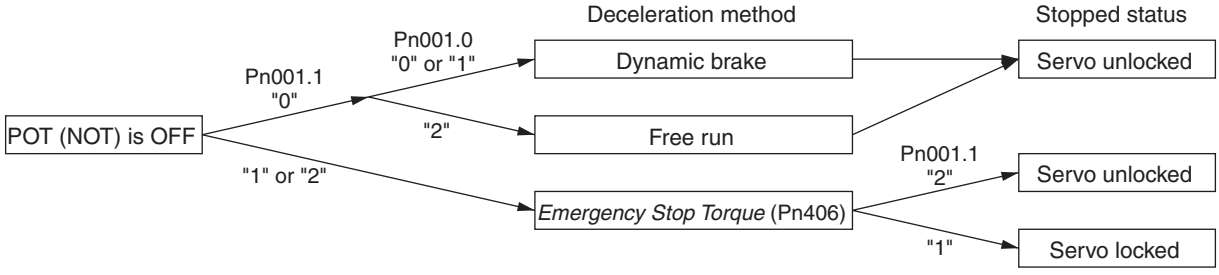
**Note** The Pn406 default setting corresponds to that used for W-series Servo Drivers.

Pn001.1 is used to set the stop operation of the Servomotor when a forward/reverse rotation limit input is input or a forward/reverse software limit is reached. The parameter size of Pn001.1 in the above table is the set value to be specified when transferring the Servo Parameter Pn001 (including Pn001.1).

The following table shows the Servomotor stop operations using Pn001.1 settings.

<table>
<tr><th>Parameter No.</th><th>Set value</th><th>Details</th></tr>
<tr><td>Pn001.1</td><td>0</td><td>Stops operation according to the setting in Pn001.0 (selects stop if an alarm occurs when Servomotor is OFF).<br>Puts Servomotor in Servo unlock status after stopping operation.
<table>
<tr><th>Parameter No.</th><th>Set value</th><th>Details</th></tr>
<tr><td>Pn001.0</td><td>0</td><td>Servomotor stopped by dynamic brake.<br>Dynamic brake held after stopping.</td></tr>
<tr><td></td><td>1</td><td>Servomotor stopped by dynamic brake.<br>Dynamic brake OFF after stopping.</td></tr>
<tr><td></td><td>2</td><td>Servomotor stopped with free run.</td></tr>
</table></td></tr>
<tr><td></td><td>1</td><td>Stops Servomotor using torque set in Emergency Stop Torque (Pn406).<br>Puts Servomotor in Servo lock status after stopping operation.</td></tr>
<tr><td></td><td>2</td><td>Stops Servomotor using torque set in Emergency Stop Torque (Pn406).<br>Puts Servomotor in Servo unlock status after stopping operation.</td></tr>
</table>

**Stopping Methods when Forward/Reverse Drive Prohibit Is OFF**




**Note** The brake interlock output (BKIR output) will not function while there is a limit input signal (Servo Driver's forwarded drive prohibited signal or reverse drive prohibited signal) or while the Servo is unlocked as the result of reaching a software limit. Unlock the Servo before activating a machine holding brake.



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# SECTION 8
# Defining the Origin

This section provides information on the various operations used to determine the origin, including origin searches, origin returns, presetting the present position, calculating phase Z margins, and using the absolute encoder.

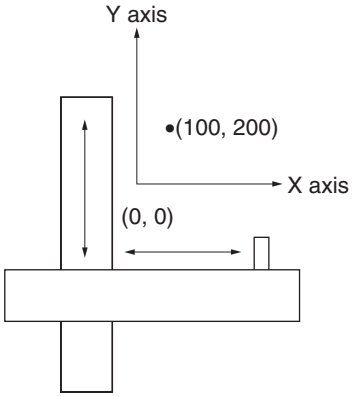

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# 8-1 Overview

When performing positioning for a system in terms of absolute positions in that system, it is first necessary to define the origin. For example, in the X-Y plane shown below, before positioning to (X, Y) = (100 mm, 200 mm), the origin (0,0) of the machine must be established, i.e., it is necessary to define the origin.




With the PCU, the mechanical origin can be defined using any of the following three methods.

| Name | Contents |
|---|---|
| ORIGIN SEARCH | The origin is determined by actually operating the Servomotor and using the limit input signal, origin proximity input signal, and origin input signal.<br>A photoelectric sensor or the phase Z signal from an encoder can be used as the origin input signal.<br>Execute this function when using an incremental encoder Servomotor or Servomotor with absolute encoder used as an incremental encoder. |
| PRESENT POSITION PRESET | The origin can be determined by forcibly setting the position at which the Servomotor is stopped to a user-specified position. |
| ABSOLUTE ENCODER ORIGIN | By using a Servomotor with absolute encoder, the absolute value data saved in the encoder can be read and the mechanical origin can be established when starting to use the device. |

The PCU also features a positioning function to return to the established origin.

| Name | Contents |
|---|---|
| ORIGIN RETURN | Positioning is performed from the position where the Servomotor is stopped to the origin that has been established using ORIGIN SEARCH or PRESENT POSITION PRESET. |

The PCU can also be operated without defining the origin but the axis operation for each function is as follows:

| Function | Operation |
|---|---|
| JOG | Can be executed. |
| ORIGIN RETURN | Cannot be executed.<br>If executed, a Present Position Unknown Error (axis error code: 3030 hex) will occur. |



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| Function | | Operation |
|---|---|---|
| Position control | ABSOLUTE MOVEMENT | Cannot be executed.<br>If executed, a Present Position Unknown Error (axis error code: 3030 hex) will occur. |
| | RELATIVE MOVEMENT | Can be executed. |
| | INTERRUPT FEEDING | Can be executed only with RELATIVE MOVEMENT.<br>If executed with ABSOLUTE MOVEMENT, a Present Position Unknown Error (axis error code: 3030 hex) will occur, and the function will not be executed. |
| SPEED CONTROL | | Can be executed. |
| TORQUE CONTROL | | Can be executed. |

For W-series Servo Drivers used with incremental encoders or absolute encoders used as incremental encoders, the present position is taken as 0 when the power is turned ON. When the executable functions shown in the above table are executed by the PCU without a defined origin, the present position will be calculated from the position of the axis (0) when the power was turned ON with no origin established.

# 8-2 Origin Search Operation

## 8-2-1 Origin Search Overview

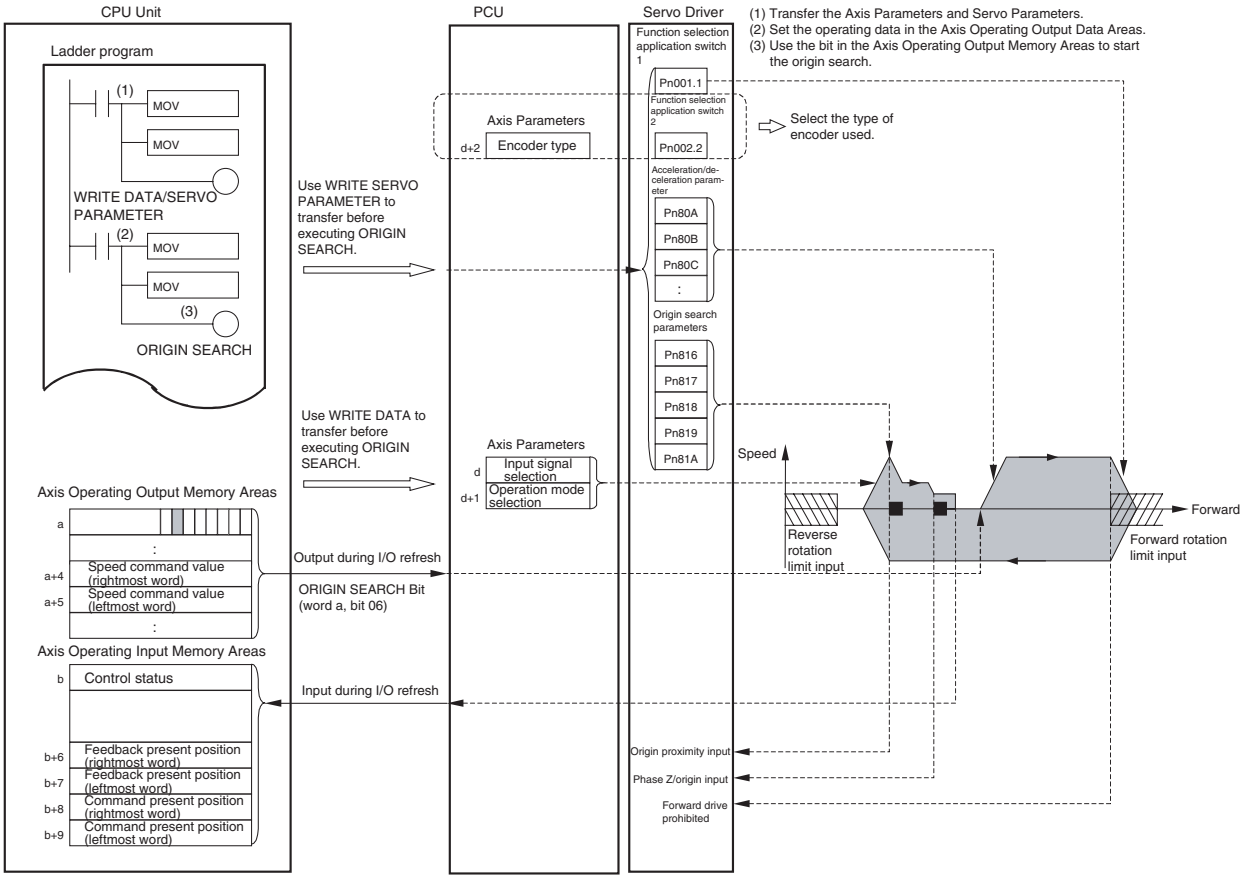
Origin searches are performed by actually operating the Servomotor, searching for the mechanical origin based on the limit input signal, origin proximity input signal, and origin input signal, and to define the origin.

**Note** In ORIGIN SEARCH execution, the present position is cleared to 0 at the same time when an origin is defined. Unless the Absolute Encoder Zero Point Position Offset is set using an Origin Search Operation with Position Control Units with unit version 2.0 or later, the absolute value data read to the PCU when SERVO LOCK was executed will be lost when the origin is established. (The absolute data saved in the absolute encoder will not be lost and can be obtained by executing SERVO LOCK after SERVO UNLOCK.) When using a Position Control Unit with unit version 2.0 or later and not setting an Absolute Encoder Zero Point Position Offset, execute ORIGIN SEARCH using either a Servomotor with incremental encoder or a Servomotor with absolute encoder that is used as an incremental encoder.



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The following diagram shows the operation for ORIGIN SEARCH.




a: Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. –1) × 25
b: Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. –1) × 25
d: 1860 hex + (Axis No. –1) × 14 hex

The speed command value set in the Axis Operating Output Memory Area using the MOV instruction is output to the PCU automatically during I/O refresh.

The origin search is started when the ORIGIN SEARCH Bit allocated in the Axis Operating Output Memory Area turns ON.

**Note** Once the origin is established by the PCU, it will not be lost if ORIGIN SEARCH is executed again. If ORIGIN SEARCH is executed again, the search operation will be executed using the coordinates based on the previous origin until the new origin is established. If the software limits are enabled at this point, the software limits will apply to the origin search operation, causing operation to stop due to an error. (Positioning will not be reversed at the software limits when origin searches are performed in reversal mode.) To execute ORIGIN SEARCH again after the origin has been established, either disable the software limits, or execute DEVICE SETUP or another operation that will cancel the origin (No Origin Flag = 1) before executing ORIGIN SEARCH.

## 8-2-2 Origin Search Procedure

Use the following procedure to perform an origin search.

***1,2,3...*** 1. Set the Common Parameters and save them.
2. Set the Axis Parameters and save them.



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3. Turn ON the PCU again or restart the Unit.
   The data for the Common Parameters and Axis Parameters set in steps 1 and 2 above are enabled.
4. Start MECHATROLINK communications.
5. Set the Servo Parameters and save them.
   Set the Servo Parameters required to execute origin searches.
   To set parameters permanently, execute SAVE SERVO PARAMETER (writes to the non-volatile memory)
   To enable changed offline parameters, turn the power to the Servo Driver OFF and then ON again or execute DEVICE SETUP.
   For details, refer to *5-3 Transferring Servo Parameters*.
6. Execute SERVO LOCK.
7. Set the data used for origin search.
   Set the origin search speed data in the speed command value of the Axis Operating Output Memory Area.
8. Execute ORIGIN SEARCH.

When using the PCU for the first time or to change the PCU parameter settings, steps 1 to 3 must be performed.

**Note** To specify the Servo Parameters for acceleration/deceleration every time, make sure that the axis operation is stopped (Busy Flag = 0) while changing the acceleration/deceleration constants using WRITE SERVO PARAMETER. Do not change the settings during axis operation. Changing parameters while the axis is operating may result in incorrect positioning or other malfunction.

## 8-2-3 Data Settings Required for Origin Search

A simple explanation of the main parameters and data used to execute ORIGIN SEARCH is provided here. For details on the parameters required when using absolute encoders, refer to *8-6 Absolute Encoder Origin*.

To execute ORIGIN SEARCH, apart from the parameters explained here, the following parameters also need to be set as basic settings for operating the PCU.

- External I/O Signal Allocations
  Refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.
  The origin proximity input signal must be allocated to execute ORIGIN SEARCH.
- Command Unit
  Refer to *7-2 Control Units*.
  The setting units for parameters and data depend on the specified command unit.



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**Axis Parameter Area** The following parameters are for the operation mode for origin searches.

| PCU's address | Contents | | | | | | Setting |
|---|---|---|---|---|---|---|---|
| | 15 to 14 | 13 | 12 | 11 to 08 | 07 to 04 | 03 to 00 | |
| d+1 | 0 (fixed) | Origin search preset | Origin search direction | Origin detection method | Origin search operation | 0 (fixed) | Set the origin search operation.<br>Origin search direction<br>0: Reversal mode 1 (default setting)<br>1: Reverse mode 2<br>2: Single-direction mode<br>3: Reversal mode 3 (See note.)<br>Origin detection method (See note.)<br>0: With origin proximity input signal reversal (default setting)<br>1: Without origin proximity input signal reversal<br>2: Not use origin proximity input signal<br>Origin search direction<br>0: Forward (default setting)<br>1: Reverse<br>Origin search preset (See note.)<br>0: Not Set (default setting)<br>1: Set |
| d+2 | 0 (fixed) | 0 | 0 | 0 (fixed) | 0 (fixed) | Encoder type | 0: Incremental encoder (default setting)<br>1: Absolute encoder |

d = 1860 hex + (Axis No. −1) × 14 hex

**Note**

(1) The reversal mode 3 setting for the origin search operation, the origin detection method, and the origin search preset can be used only with Position Control Units with unit version 2.0 or later. They cannot be used with Position Control Units with unit version 1.3 or earlier.

(2) Make sure that the same direction is set for *Origin Search Direction* in the Axis Parameters and *Zero Point Return Direction* (Pn816) in the Servo Parameters. Setting different directions may result in a malfunction.

(3) When using an absolute encoder, make sure that the settings for the *Encoder Type* in the Axis Parameters and *Operation Switch when Using Absolute Encoder* (Pn002.2) in the Servo Parameters match. If the settings do not match, ORIGIN SEARCH execution will not be possible, or another malfunction may occur.

(4) Make sure that the external input signals for origin searches (limit input signal and origin proximity input signal) maintain a signal width no shorter than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU is unable to detect the input signals, and operations cannot be performed normally.

| Axis Parameter Area<br>Encoder type | Servo Parameter Pn002.2 (Operation switch when using absolute encoder) | |
|---|---|---|
| | 0: Use as absolute encoder. | 1: Use as incremental encoder. |
| 0: Incremental encoder | Do not set this combination. | This setting is used when using an absolute encoder as an incremental encoder. |
| 1: Absolute encoder | This setting is used when using an absolute encoder as an absolute encoder. | Do not set this combination. |



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When using an incremental encoder, only the *Encoder Type* setting in the Axis Parameters is required (the Pn002.2 setting in Servo Parameters is disabled when an incremental encoder is used).

An absolute encoder cannot be used with a SMARTSTEP Junior Servo Driver, and Pn002.2 is not supported. Use the Servo Driver as if the axis parameters are set for an incremental encoder.

**Origin Input Signal Parameters**

| PCU's address | Contents | | Setting |
|---|---|---|---|
| | Bits 15 to 08 | Bits 07 to 00 | |
| d | Origin input signal selection | Interrupt input signal selection | Origin input signal selection<br>00: Phase Z (default setting)<br>01: External latch signal 1 input<br>02: External latch signal 2 input<br>03: External latch signal 3 input |

d = 1860 hex + (Axis No. −1) × 14 hex

Use this parameter to select the origin input signal to be used with origin search. When external latch signals 1 to 3 are used as the origin input signal, the external latch signal used must be allocated in the Servo Driver's external input allocations.

When using a SMARTSTEP Junior Servo Driver, only the Z phase or the external latch signal 1 input can be set for the origin input signal.

**Servo Parameters**

The following parameters are used for limit input operations.

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|---|---|
| --- | Pn001.1 | Function selection application switch 1<br>Select stop when prohibited drive is input | --- | 0 to 2 | 2 | 0 | Supported | Not supported |
| --- | Pn406 | Emergency stop torque | % | 0 to 800 | 2 | 350 | Supported | Not supported |

**Note** The Pn406 default setting corresponds to that used for W-series Servo Drivers.

When using a W-series Servo Driver, Pn001.1 is used to set the stop operation of the Servomotor for forward/reverse rotation limit inputs. When reversal mode is used for the origin search, it is also used as the operation setting when limit inputs are input in the origin search direction. The parameter size for Pn001.1 is the set value to be specified when transferring the Servo Parameter Pn001 (including Pn001.1).

Pn406 sets the stopping torque when the stop operation for limit inputs is set to 1 (decelerates to a stop at set torque or lower, and locks Servo in zero clamp mode), or 2 (decelerates to a stop at set torque or lower, and puts Servo in free run state).

When using a SMARTSTEP Junior Servo Driver, the Servomotor will decelerate to a stop with the maximum Servomotor torque and the Servo will be locked when the forward or reverse rotation limit input is received.



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**Parameters for Using Absolute Encoders**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|---|---|
| --- | Pn002.2 | Function selection application switch 2 Operation switch when using absolute encoder | --- | 0, 1 | 2 | 0 | Supported | Not supported |

When using a Servomotor with absolute encoder, select whether the absolute encoder will be used as an absolute encoder or as an incremental encoder. These parameter settings are disabled if a Servomotor with incremental encoder is used.

Set this parameter to 1 if using a Servomotor with absolute encoder as a Servomotor with incremental encoder.

When using an absolute encoder, make sure that the settings for the *Encoder Type* in the Axis Parameters and *Operation Switch when Using Absolute Encoder* (Pn002.2) in the Servo Parameters match. If the settings do not match, ORIGIN SEARCH execution will not be possible, or another malfunction may occur.

A motor with an absolute encoder cannot be used with a SMARTSTEP Junior Servo Driver. When using a SMARTSTEP Junior Servo Driver, Pn002.2 is not supported. Use the Servo Driver as for an incremental encoder.

If the settings do not agree, origin searches may not be possible and other malfunctions may occur.

**Command Unit Parameters**

| Model | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| R88D-WT□ | Pn202 | Electronic gear ratio G1 (numerator) | --- | 1 to 65535 | 2 | 4 |
| | Pn203 | Electronic gear ratio G2 (denominator) | --- | 1 to 65535 | 2 | 1 |
| R88D-WN□-ML2 | Pn20E | Electronic gear ratio G1 (numerator) | --- | 1 to 1073741824 | 4 | 4 |
| | Pn210 | Electronic gear ratio G2 (denominator) | --- | 1 to 1073741824 | 4 | 1 |
| SMARTSTEP Junior | Pn20E | Electronic gear ratio G1 (numerator) | --- | 1 to 1073741824 | 4 | 1 |
| | Pn210 | Electronic gear ratio G2 (denominator) | --- | 1 to 1073741824 | 4 | 1 |

The command unit default setting is pulses.



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**Acceleration/Deceleration Constants**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|---|---|
| Acceleration/deceleration constants | Pn80A | First-step linear acceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Not supported |
| | Pn80B | Second-step linear acceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Supported |
| | Pn80C | Acceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 | Supported | Not supported |
| | Pn80D | First-step linear deceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Not supported |
| | Pn80E | Second-step linear deceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Supported |
| | Pn80F | Deceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 | Supported | Not supported |
| Acceleration/deceleration filters | Pn810 | Exponential acceleration/deceleration bias | Command units/s | 0 to 32767 | 2 | 0 | Supported | Not supported |
| | Pn811 | Exponential acceleration/deceleration time constant | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |
| | Pn812 | Movement average time | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |

First-step acceleration/deceleration curve operations require parameter settings for Pn80B and Pn80E only. For the acceleration/deceleration curve, Pn810 and Pn811 must be set when using an exponential curve, and Pn812 must be set when using an S-curve.

The SMARTSTEP Junior Servo Drivers do not support the following parameters: Pn80A, Pn80C, Pn80D, and Pn80F. They also do not support acceleration/deceleration filters, so the filters cannot be set. One-step linear acceleration/deceleration curves are set using only Pn80B and Pn80E.

For details on acceleration/deceleration curves, refer to *7-4 Acceleration and Deceleration Operations*.

**Origin Search Parameters**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn814 (See note.) | Final travel distance for external positioning | Command unit | –1,073,741,823 to 1,073,741,823 | 4 | 100 |
| | Pn816 | Zero point return direction | --- | 0000 hex or 0001 hex | 2 | 0 |
| | Pn817 | Zero point return approach speed 1 | 100 command units/s | 0 to 65535 | 2 | 50 |
| | Pn818 | Zero point return approach speed 2 | 100 command units/s | 0 to 65535 | 2 | 5 |
| | Pn819 | Final travel distance to return to zero point | Command unit | –1,073,741,823 to 1,073,741,823 | 4 | 100 |



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**Note** When using a Position Control Unit with unit version 2.0 or later, Pn814 is used for internal processing in the Position Control Unit for either of the following origin search operation patterns.

- When the origin detection method is set to any value except for 0 (Origin proximity input signal reversal)
- When setting a zero point position offset for an origin search using an absolute encoder

Pn814 is automatically overwritten by the Position Control Unit when the origin search operation is started. If interrupt feeding is used after the origin search, Pn814 must be reset. Also, the Servo parameters are read out by the Position Control Unit for the following parameters when the origin search operation is started.

Pn817, Pn818, Pn819
Pn808 (when using an absolute encoder)

Make sure that the same direction is set for *Origin Search Direction* in the Axis Parameters and *Zero Point Return Direction* (Pn816) in the Servo Parameters. Setting different directions may result in a malfunction.

**Control Status Parameters**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| R88D-WT□ | Pn500 | Positioning completion range 1 | Command unit | 0 to 250 | 2 | 3 |
| | Pn803 | Zero point width | Command unit | 0 to 250 | 2 | 10 |
| R88D-WN□-ML2 | Pn522 | Positioning completion range 1 | Command unit | 0 to 1073741824 | 4 | 3 |
| | Pn803 | Zero point width | Command unit | 0 to 250 | 2 | 10 |
| SMART-STEP Junior | Pn522 | Positioning completion range 1 | Command unit | 0 to 1073741824 | 4 | 10 |
| | Pn523 | Zero point width | Command unit | 0 to 250 | 2 | 10 |

**Axis Operating Output Memory Areas (Operating Commands)**

| Name | Word | Bits | Contents | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|
| ORIGIN SEARCH | a | 06 | 0 → 1: Starts origin search | Supported | Supported |
| Position command value | a+2<br>a+3 | --- | Position command value (rightmost word)<br>Position command value (leftmost word)<br>Unit: Command units/s<br>Command range: –2,147,483,648 to 2,147,483,647 (80000000 hex to 7FFFFFFF hex)<br>This value is also used as the preset value when a preset value is being set after completing an origin search. | Supported | Supported |



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| Name | | Word | Bits | Contents | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|
| Speed command value | | a+4<br>a+5 | --- | Speed command value (rightmost word)<br>Speed command value (leftmost word)<br>Unit: Command units/s<br>Command range: 1 to 2,147,483,647 (00000001 hex to 7FFFFFFF hex)<br>The upper limit setting of the speed command value depends on the specifications of the Servo Driver. | Supported | Supported |
| Acceleration/deceleration curve designation | Exponential curve designation | a+16 | 03 | 1: Use exponential acceleration/deceleration curve. | Supported | Not supported |
| | S-curve designation | | 04 | 1: Use S-curve acceleration/deceleration curve. | Supported | Not supported |
| Forward rotation current limit | | | 14 | 1: Use forward torque limit | Supported | Not supported |
| Reverse rotation current limit | | | 15 | 1: Use reverse torque limit | Supported | Not supported |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

The speed command value specifies the initial origin search speed until the origin proximity signal is input. When an origin search is started with the speed command set to 0 (command units/s), a Speed Designation Error (axis error code: 3061) will occur and the origin search will not be executed.

Torque limit during operation is possible with origin searches. For further details on the torque limit function, refer to *10-4 Torque Limits*.

The speed command value, acceleration/deceleration curve designation, and forward/reverse rotation current limit designation data are enabled when the ORIGIN SEARCH Bit turns ON.

The SMARTSTEP Junior Servo Drivers do not support acceleration/deceleration filters and torque limits. When using a SMARTSTEP Junior Servo Driver, do not attempt to use an acceleration/deceleration curve designation or forward/reverse torque limit designation.

**Note** Do not set both the exponential curve designation and S-curve designation to 1 (enabled) in the acceleration/deceleration curve designation. Enabling both settings may cause a malfunction.

### Axis Operating Input Memory Areas (Monitor)

| Name | Word | Bits | Contents |
|---|---|---|---|
| PCU Positioning Completed Flag | b | 05 | 0 → 1: Positioning completed. |
| No Origin Flag | | 06 | 0: Origin established.<br>1: No origin established. |
| Origin Stop Flag | | 07 | 0: Outside origin range.<br>1: Within origin range. |
| Error Flag | | 12 | 0: No axis error.<br>1: Axis error. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing) |



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| Name | Word | Bits | Contents |
|---|---|---|---|
| Feedback present position | b+6<br>b+7 | --- | Present position:<br>Feedback position (rightmost word)<br>Feedback position (leftmost word) |
| Command present position | b+8<br>b+9 | --- | Present position:<br>Command position (rightmost word)<br>Command position (leftmost word) |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

## 8-2-4 Origin Search Operation

### Origin Search Operation Summary

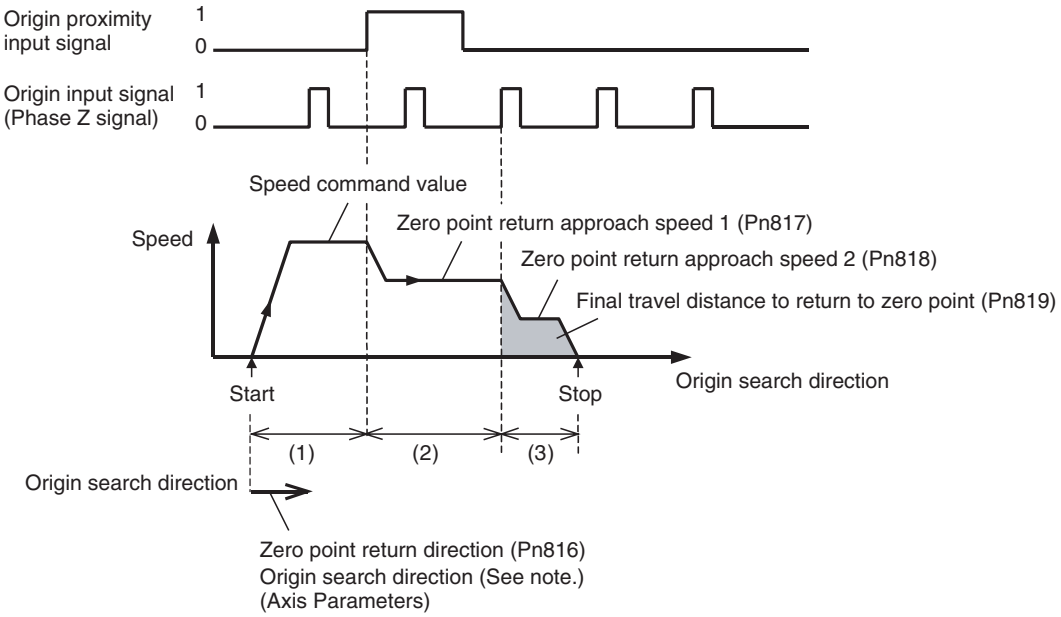
Basically, the PCU's origin search operation consists of the following three steps.

***1,2,3...***

1. Search for origin proximity signal
2. Search for origin signal after detection of origin proximity signal
3. Positioning for final travel distance to return to zero point after detection of origin signal

Each of these steps is executed using the operation direction and speed according to the Axis Parameters, Servo Parameters, and speed command value for origin search as shown in the following diagram.

The origin proximity signal is not always used in the origin search operation pattern and an origin search can be started at the zero point return approach speed. For details on origin search operation patterns, refer to *Origin Search Operation Modes* on page 255.




**Note** The operation direction for origin search is determined by the setting in Servo Parameter *Zero Point Return Direction* (Pn816). Make sure that the same direction is set for *Origin Search Direction* in the Axis Parameters and *Zero Point Return Direction* (Pn816) in the Servo Parameters. Setting different directions may result in a malfunction.

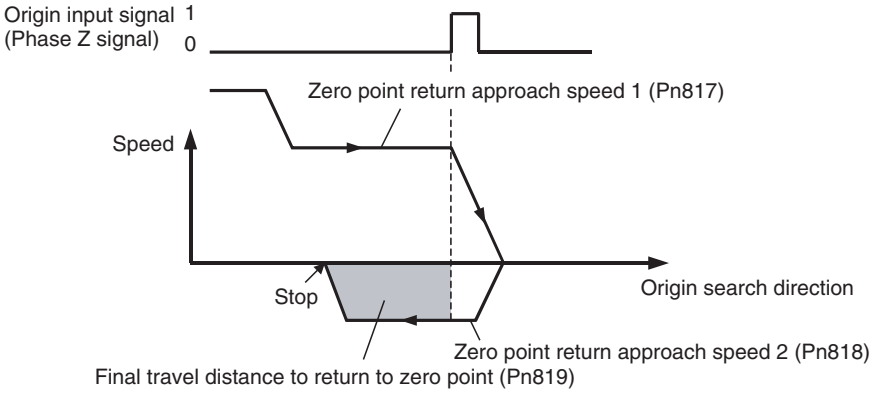
The override function is disabled during origin searches.



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The parameter *Final Travel Distance to Return to Zero Point* (Pn819) sets the amount of compensation positioning used after the origin input signal has been detected. The value is set as the relative travel distance in the origin search direction.

When *Final Travel Distance to Return to Zero Point* (Pn819) is set to a negative or small value, the axis will decelerate to a stop, and then reverse and perform the set positioning.




For details on the acceleration/deceleration operation during origin search, refer to *7-4 Acceleration and Deceleration Operations*.

## Origin Search Operation Modes

The following four modes are available for origin search operation.

- Origin search operation
  - Reversal modes ····· The operation is reversed in the direction opposite to the origin search direction.
    - Reversal mode 1 ····· Direction reversed when limit input is input in the origin search direction.
    - Reversal mode 2 ····· Operation is stopped and an error is generated when limit input is input in the origin search direction.
    - Reversal mode 3 ····· The operation is basically the same as that for reversal mode 2, but shock on the machine is reduced when reversing at the origin proximity input.
  - Single-direction mode ··· Origin search is always performed in one direction only.

Select the origin search operation by setting *Origin Search Operation* in the Axis Parameters.

0: Reversal mode 1
1: Reversal mode 2
2: Single-direction mode
3: Reversal mode 3 (Can be used only for Position Control Units with unit version 2.0 or later.)



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**Origin Detection method**

The Origin Detection Method parameter determines how the origin proximity input signal is used. Any of the following three patterns can be selected in the Axis Parameters.

| Setting | Origin detection method | Origin input signal detection | Remarks |
|---|---|---|---|
| 0 | With origin proximity input signal reversal | The origin input signal is detected after the origin proximity input signal turns ON and then OFF. | --- |
| 1 | Without origin proximity input signal reversal | The origin input signal is detected after the origin proximity input signal turns ON. | This setting is possible only for Position Control Units with unit version 2.0 or later. |
| 2 | Not use origin proximity input signal | The origin proximity input signal is not used. | The origin search operation is started at the zero point return approach speed 1.<br>If this setting is used along with reversal mode 3, and axis parameter check error (error code: 3091) will occur when the data is transferred.<br>This setting is possible only for Position Control Units with unit version 2.0 or later. |

**Note**

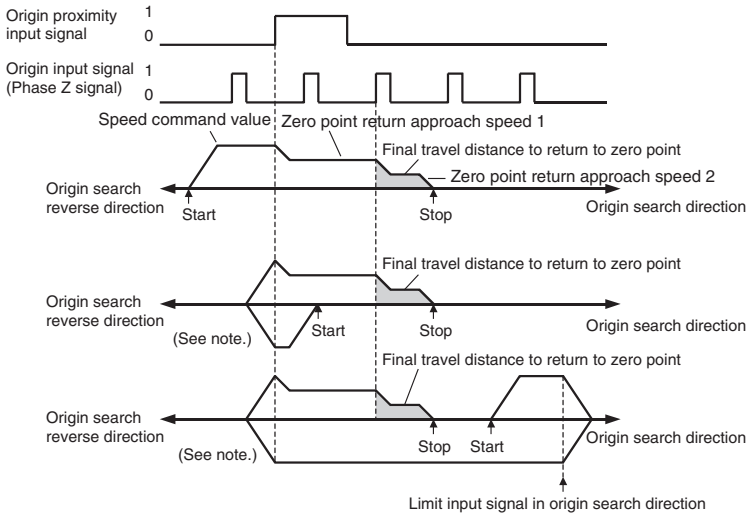
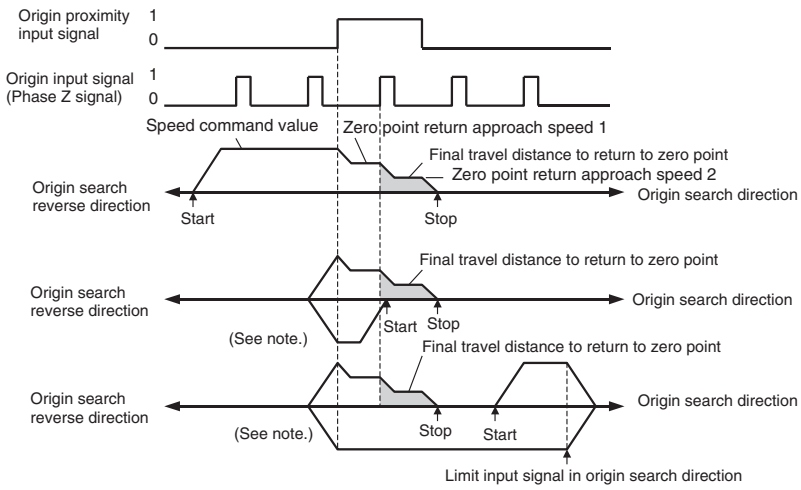
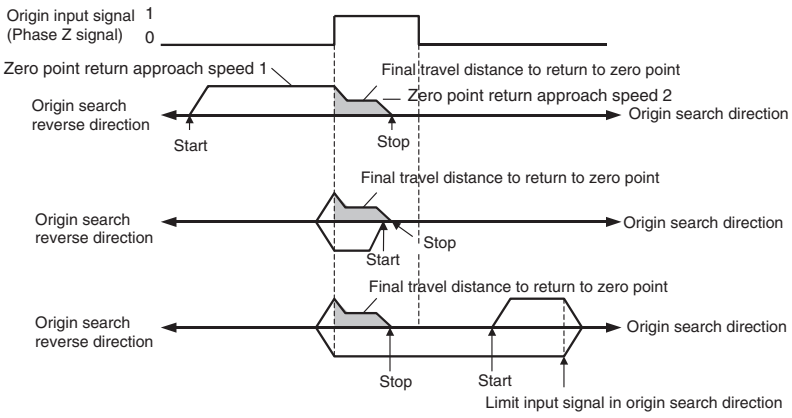
(1) The Servo Driver's origin proximity input signal (origin return deceleration limit switch signal) must be allocated to execute ORIGIN SEARCH. The forward/reverse rotation limit signal (forward/reverse drive prohibited signal) must be allocated to use a reversal mode. If these input signals are not allocated, ORIGIN SEARCH cannot be executed properly. For details on allocating Servo Driver input signals, refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.

(2) Make sure that the external input signals for origin searches (limit input signal and origin proximity input signal) maintain a signal width no shorter than the MECHATROLINK communications cycle. If the input signal width is shorter than the communications cycle, the PCU is unable to detect the input signals, and operations cannot be performed normally.

(3) For origin searches, the origin signal is detected after the origin proximity input signal (origin return deceleration limit switch) changes from ON to OFF. Therefore, be sure to use a sensor for the origin proximity input signal, such as a photoelectric switch, that does not produce chattering. Chattering from contact switches may result in the displacement of the origin position.

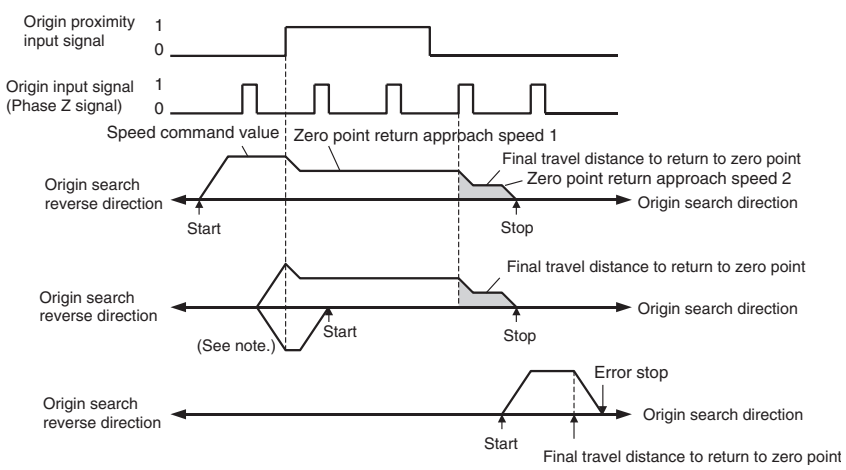
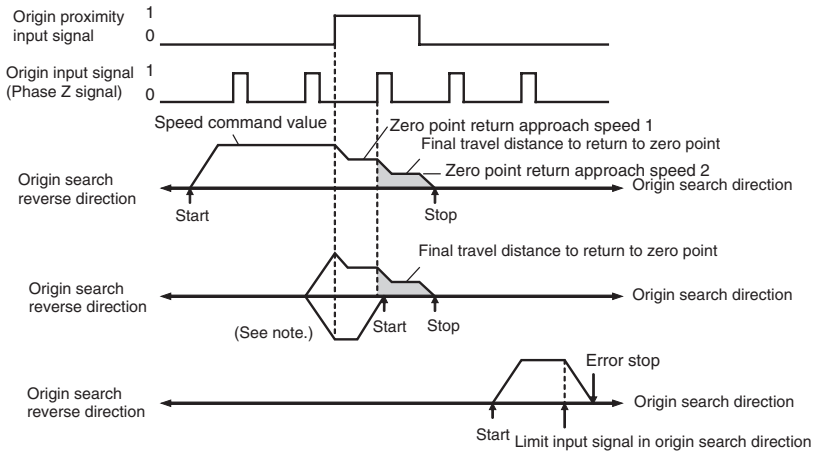
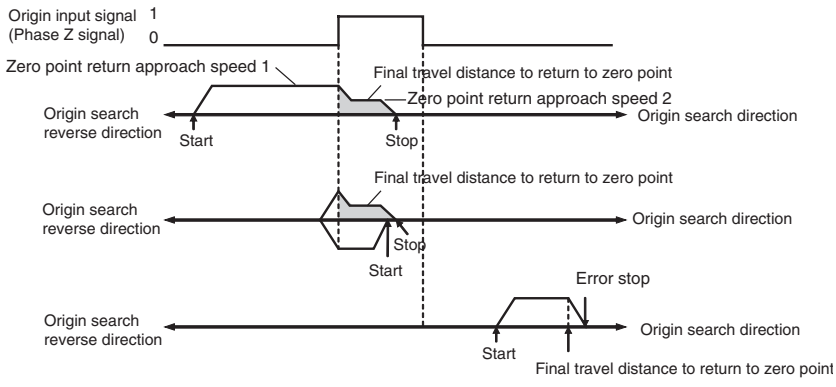


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| **Origin search operation mode** | **0: Reversal mode 1** |
|---|---|
| **Origin detection method** | |
| 0: With origin proximity input signal reversal |  |
| 1: Without origin proximity input signal reversal (unit version 2.0 or later) |  |
| 2: Not use origin proximity input signal (unit version 2.0 or later) |  |

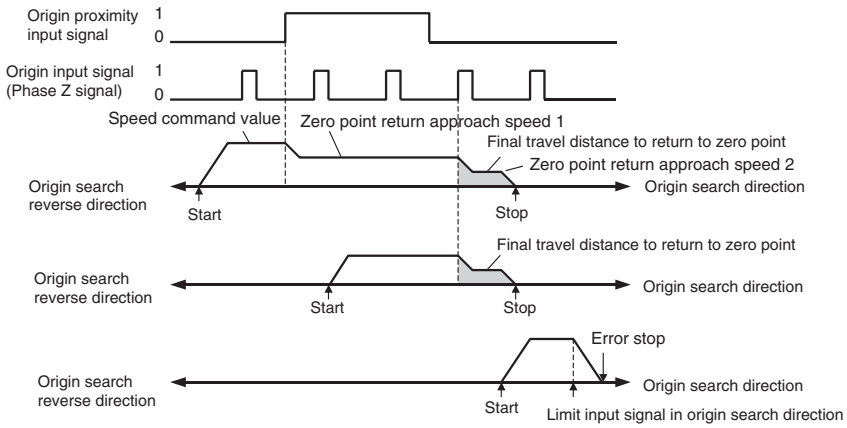
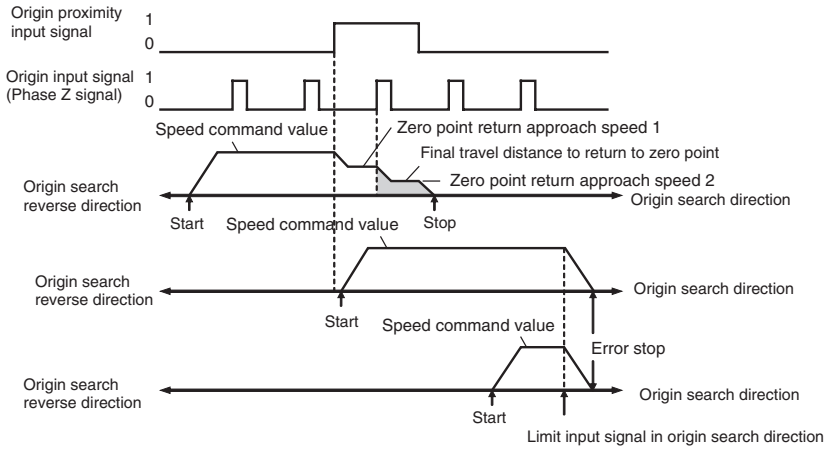
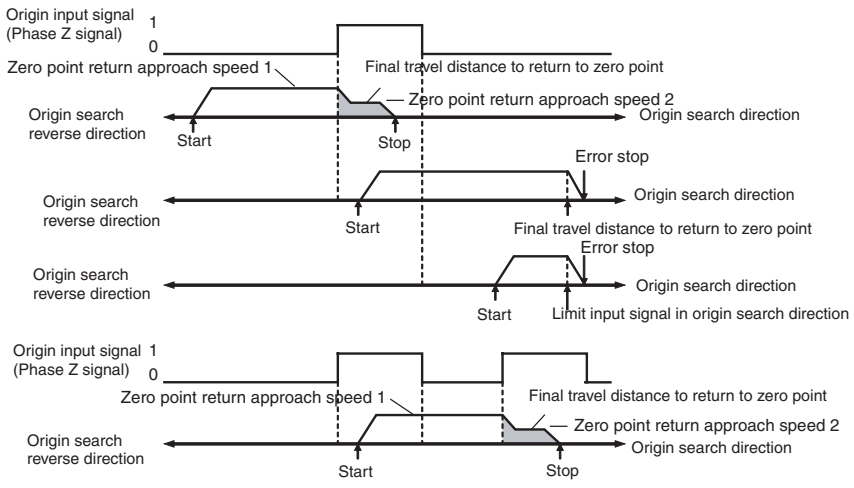


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| Origin search operation mode / Origin detection method | 1: Reversal mode 2 |
|---|---|
| 0: With origin proximity input signal reversal |  |
| 1: Without origin proximity input signal reversal (unit version 2.0 or later) |  |
| 2: Not use origin proximity input signal (unit version 2.0 or later) |  |

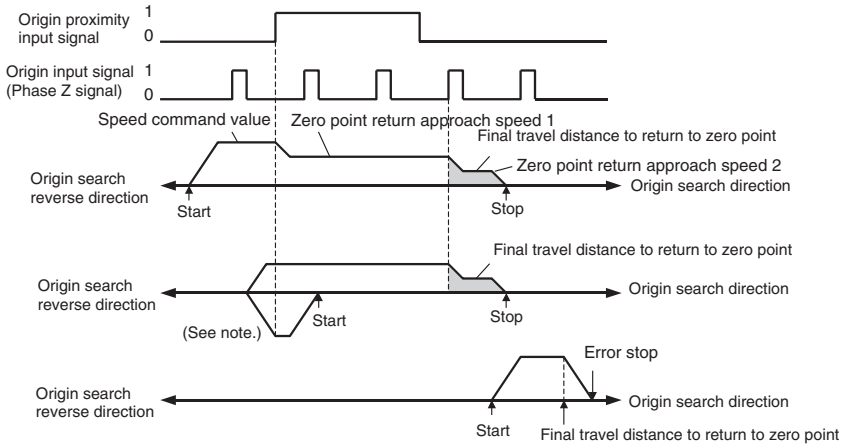
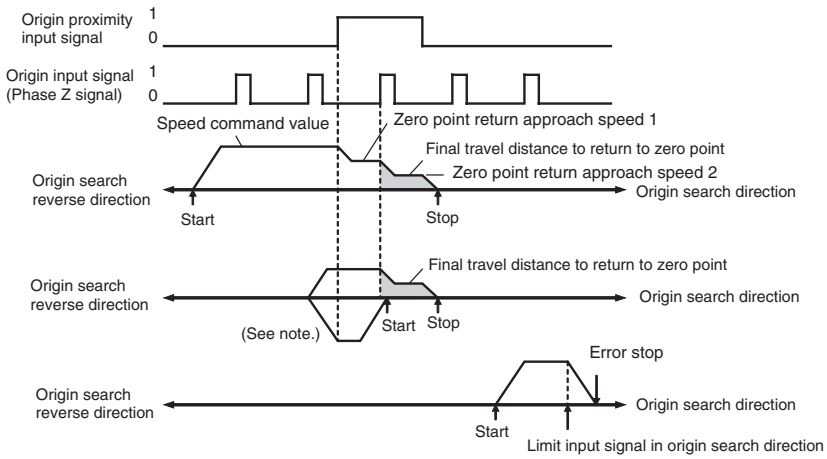


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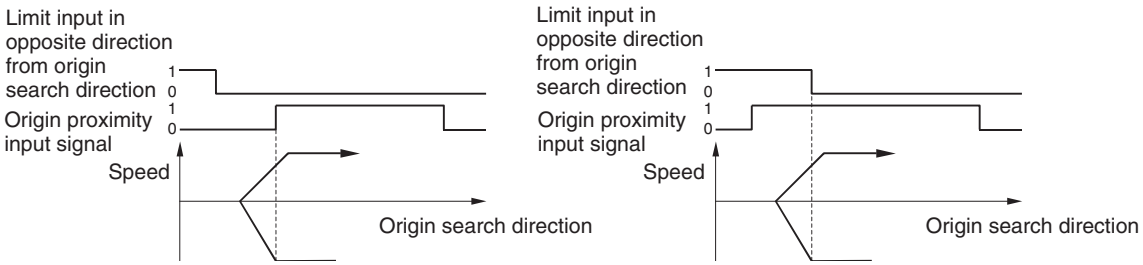
| **Origin search operation mode** / **Origin detection method** | **2: Single-direction mode** |
|---|---|
| 0: With origin proximity input signal reversal |  |
| 1: Without origin proximity input signal reversal (unit version 2.0 or later) |  |
| 2: Not use origin proximity input signal (unit version 2.0 or later) |  |



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| Origin search operation mode | 3: Reversal mode 2 (unit version 2.0 or later) |
|---|---|
| **Origin detection method** | |
| 0: With origin proximity input signal reversal |  |
| 1: Without origin proximity input signal reversal (unit version 2.0 or later) |  |
| 2: Not use origin proximity input signal (unit version 2.0 or later) | Cannot be set. (An axis parameter check error (error code: 3091) will occur when the data is transferred.) |

**Note** The reversal operation for an origin search in the reverse direction is executed either when the origin proximity input signal turns OFF during the origin search in the reverse direction, or when the limit input signal turns ON during the origin search in the reverse direction while the origin proximity input signal is ON, whichever occurs first.




**Reversal Mode Operation Using Limit Inputs**

When the origin search operation mode is set to reversal mode 1 to 3, axis operation stops or changes to the opposite direction when the limit input signal turns ON.



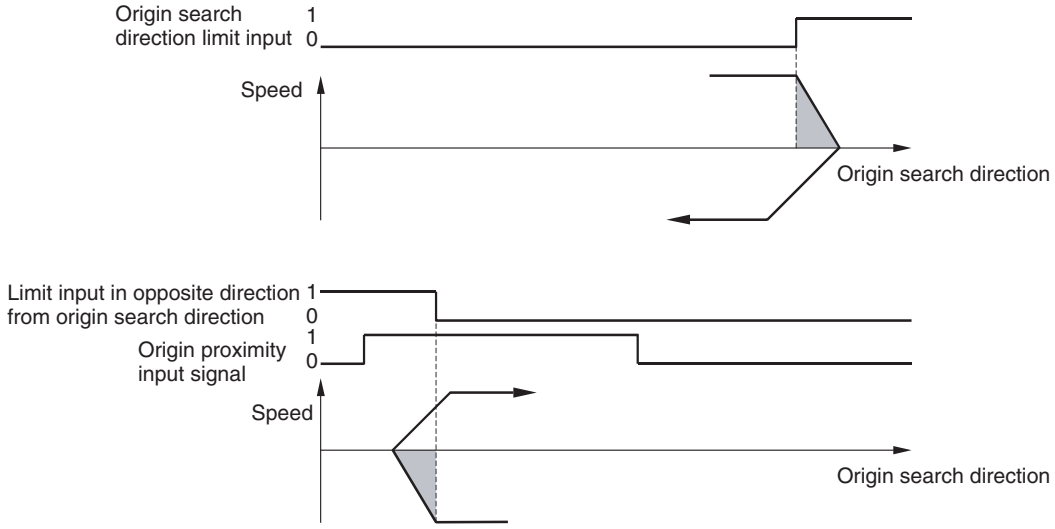
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When using a W-series Servo Driver, the axis will operate according to the *Select Stop when Prohibited Drive Is Input* (Pn001.1) setting in the Servo Parameters after the limit input signal turns ON and until the axis operation stops.

When using a SMARTSTEP Junior Servo Driver, the Servomotor will decelerate to a stop using the maximum Servomotor torque.

**Reverse Pattern**

For reversal mode 1, the positioning relationship between the limit input and the origin proximity signal is as shown by the two patterns in the following diagram. For reversal mode 2 or 3, only the bottom pattern is possible. When these modes are used, the axis operates according to the setting in Pn001.1 for the shaded areas in the diagram.




**Note** If the Servo Parameter Pn001.1 is set to stop operation with a free run when a limit input is input when using a W-series Servo Driver, the momentum of the previous operation may cause the machine to run in the limit input direction. When origin searches are performed using reversal mode 1 to 3 as the operation mode, either enable the Servo Driver's dynamic brake, or set Pn001.1 to 1 (decelerates to a stop using emergency stop torque set in Pn406 or lower, and locks Servo in zero clamp mode) or 2 (decelerates to a stop using emergency stop torque set in Pn406 or lower, and puts Servo in free run state) so that the Servomotor stops properly when a limit input is received.

## 8-2-5 Starting Origin Search

Origin search is performed according to the speed command value set in the Axis Operating Output Memory Areas and started when the ORIGIN SEARCH Bit turns ON. Execute ORIGIN SEARCH when the Busy Flag for the corresponding axis is OFF. If ORIGIN SEARCH is executed while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and ORIGIN SEARCH will not be executed.

When starting ORIGIN SEARCH, make sure that the ORIGIN SEARCH Bit will remain ON until the Busy Flag turns ON.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the ORIGIN SEARCH command will be ignored. Be sure that all of these command bits are OFF before executing an origin search.

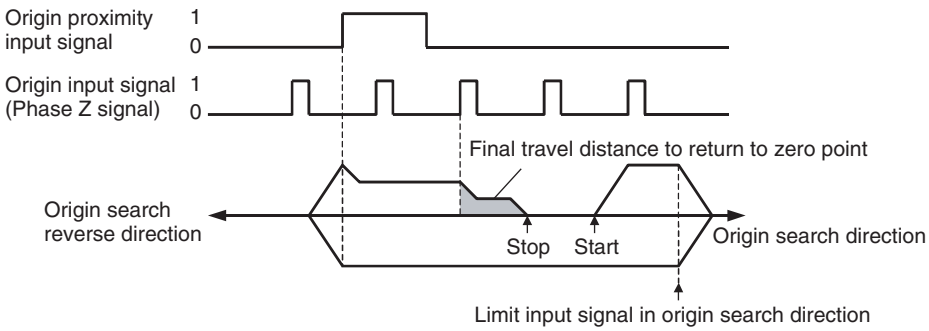


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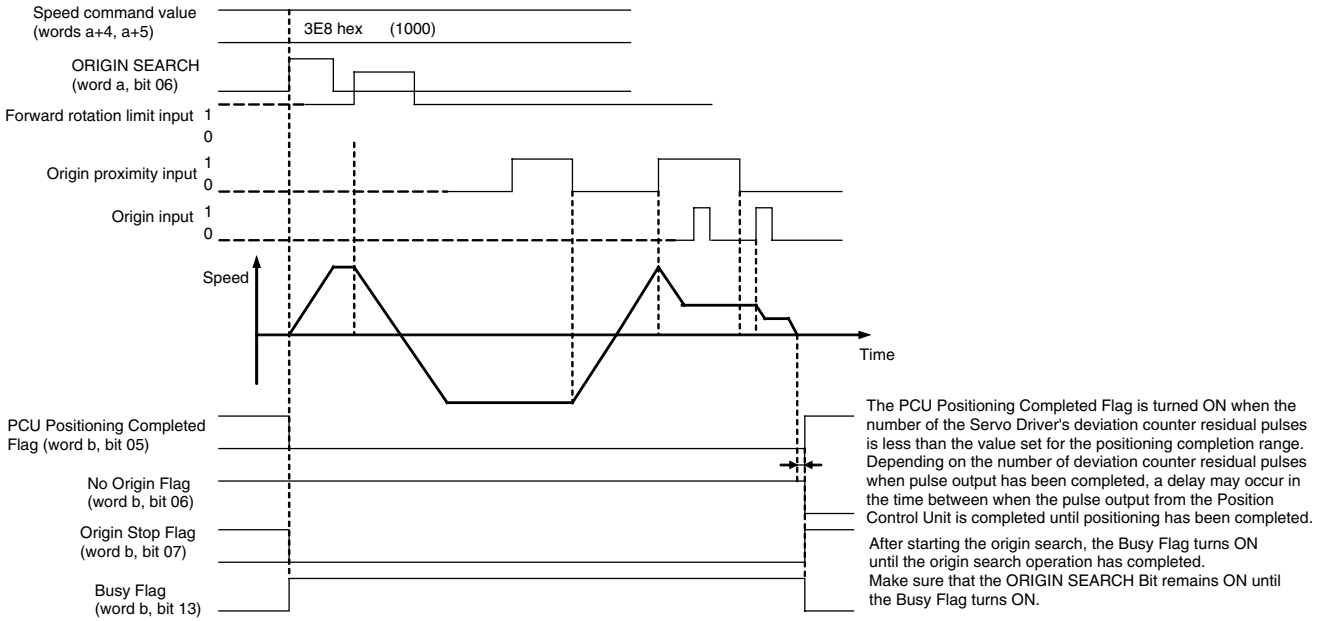
## Timing Chart

The following timing charts are for when ORIGIN SEARCH is executed with the origin search operation set to reversal mode 1, the origin detection mode set to origin proximity input signal reversal, and the origin search direction set to forward.

### Timing Chart Operation




### Timing Chart




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

**Note** If the origin search preset is used, the PCU Positioning Completed Flag, No Origin Flag, and Busy Flag will change status only after the present position preset operation is completed after finishing the origin search operation.

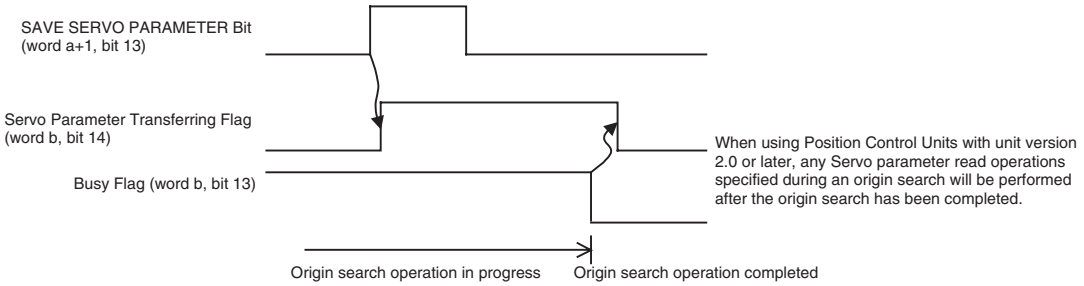
## Transferring Parameters during Origin Search Operations

The Position Control Unit can transfer Servo Parameters during axis operations (i.e., while the Busy Flag is ON). With Position Control Units with unit version 2.0 or later, Servo Parameter transfers specified during origin search operation are performed after completing the origin search.



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Example: The following example illustrates reading Servo Parameters during an origin search operation.




## 8-2-6 Origin Search Preset

The present position can be set to any desired position after completing an origin search. This enables setting an arbitrary electrical origin point corresponding to the mechanical origin point.

This function can be used only with Position Control Units with unit version 2.0 or later.

The origin search preset operation is selected using the following Origin Search Preset parameter in the Axis Parameters.

**Axis Parameters**

The following parameters are used to set the origin search operation mode.

| PCU's address | Contents | | | | | | Setting |
|---|---|---|---|---|---|---|---|
| | 15 to 14 | 13 | 12 | 11 to 08 | 07 to 04 | 03 to 00 | |
| d+1 | 0 (fixed) | Origin search preset | Origin search direction | Origin detection method | Origin search operation | 0 (fixed) | Bit 13: Origin Search Preset<br>0: Do not set the present position to the preset position after completing the origin search (default setting).<br>1: Set the present position to the preset position after completing the origin search. |

d = 1860 hex + (Axis No. −1) × 14 hex

The position command value set in the Axis Operating Output Memory Areas is used as the preset value to be set after completing an origin search.

**Axis Operating Output Memory Areas (Operating Commands)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| Position command value | a+2<br>a+3 | --- | Position command value (rightmost word)<br>Position command value (leftmost word)<br>Unit: Command units/s<br>Command range: −2,147,483,648 to 2,147,483,647 (80000000 hex to 7FFFFFFF hex)<br>This value is also used as the preset value when a preset value is being set after completing an origin search. |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25



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The position command value that is set when the ORIGIN SEARCH command bit turns ON is used as the origin search preset.

The origin search preset operation is executed only after the origin search operation has been completed normally, i.e., when positioning for the final travel distance to return to zero point has entered the positioning completion range after the origin signal has been detected.

If an absolute encoder is used, the origin search operation is set to reversal mode 1, and the origin search preset is enabled, a zero point position offset for the absolute encoder can be automatically set. Refer to *8-6-5 Absolute Encoder's Origin (Zero Point) Position Offset Setting* for details.

**Note** The origin search preset function of the Position Control Unit cannot be used with the function block for origin searches in the OMRON FB Library (_NCF05□_Home) if the Library is version is 1.13 or lower. Use the present value preset function provided in the library. To use the origin search function block and enable the origin search preset, the OMRON FB Library with a version higher than 1.13 must be used.

# 8-3 Present Position Preset

PRESENT POSITION PRESET changes the present position to any position and then establishes the origin.

## 8-3-1 Outline of Operation

When the PRESENT POSITION PRESET Bit is turned ON, the present position is changed to the value set as the position command value in the Axis Operating Output Memory Areas. during present position preset, the Busy Flag is ON (1 cycle time min.). The Busy Flag turns OFF to indicate that preset operation has been completed. After this, the origin is established. If the present position is changed to “0,” then that position will become the origin.

## 8-3-2 Data Settings for Present Position Preset

A simple explanation of the main parameters and data used to execute PRESENT POSITION PRESET is provided here. For details on command units, refer to *7-2 Control Units*.

The setting units for parameters and data depend on the specified command unit.

**Servo Parameter Area** **Command Unit Parameters**

| Model | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| R88D-WT□ | Pn202 | Electronic gear ratio G1 (numerator) | --- | 1 to 65535 | 2 | 4 |
| | Pn203 | Electronic gear ratio G2 (denominator) | --- | 1 to 65535 | 2 | 1 |
| R88D-WN□-ML2 | Pn20E | Electronic gear ratio G1 (numerator) | --- | 1 to 1073741824 | 4 | 4 |
| | Pn210 | Electronic gear ratio G2 (denominator) | --- | 1 to 1073741824 | 4 | 1 |
| SMART-STEP Junior | Pn20E | Electronic gear ratio G1 (numerator) | --- | 1 to 1073741824 | 4 | 1 |
| | Pn210 | Electronic gear ratio G2 (denominator) | --- | 1 to 1073741824 | 4 | 1 |

The command unit default setting is pulses.



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### Axis Operating Output Memory Areas (Operating Commands)

| Name | Word | Bits | Contents |
|---|---|---|---|
| PRESENT POSITION PRESET | a | 08 | 0 → 1: Starts present position preset |
| Position command value | a+2<br>a+3 | --- | Position command value (rightmost word)<br>Position command value (leftmost word)<br>Unit: Command unit<br>Command range: –2,147,483,648 to 2,147,483,647 (80000000 hex to 7FFFFFFF hex) |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. –1) × 25

Present position preset is performed according to the position command value set in the Axis Operating Output Memory Area and started when the PRESENT POSITION PRESET Bit turns ON.

Execute PRESENT POSITION PRESET when the Busy Flag for the corresponding axis is OFF. If PRESENT POSITION PRESET is executed while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and PRESENT POSITION PRESET will not be executed. When executing PRESENT POSITION PRESET, make sure that the PRESENT POSITION PRESET Bit will remain ON until the Busy Flag turns ON.

### Axis Operating Input Memory Areas (Monitor)

| Name | Word | Bits | Contents |
|---|---|---|---|
| No Origin Flag | b | 06 | 0: Origin established.<br>1: No origin established. |
| Origin Stop Flag | | 07 | 0: Outside origin range.<br>1: Within origin range. |
| Error Flag | | 12 | 0: No axis error.<br>1: Axis error. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing). |
| Feedback present position | b+6<br>b+7 | --- | Present position:<br>Feedback present position (rightmost word)<br>Feedback present position (leftmost word) |
| Command present position | b+8<br>b+9 | --- | Present position:<br>Command position (rightmost word)<br>Command position (leftmost word) |

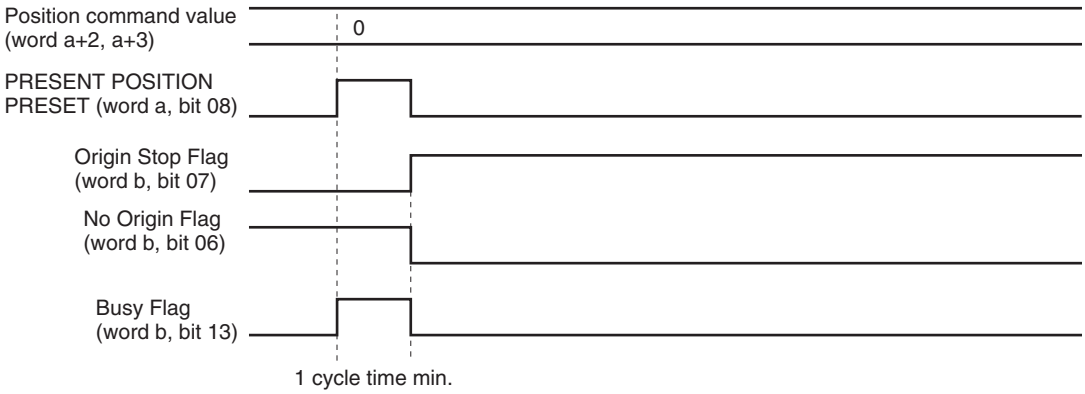
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. –1) × 25

## Timing Chart

In the following timing chart, the present position is changed to “0.” When the present position changes to “0,” that position becomes the origin, so the Origin Stop Flag turns ON. The status of the PCU Positioning Completed Flag (word b, bit 05) does not change.



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a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

# 8-4 Origin Return

The origin return operation is used to return the axis to the origin from any position. ORIGIN RETURN is executed when the ORIGIN RETURN Bit turns ON.

**Note** Execute ORIGIN RETURN when the origin has been established. If ORIGIN RETURN is executed when the origin has not been established, a Present Position Unknown Error (axis error code: 3030) will occur.

## 8-4-1 Origin Return Data Settings

A simple explanation of the main parameters and data used to execute ORIGIN RETURN is provided here. To execute ORIGIN RETURN, apart from the parameters explained here, the following parameters also need to be set as basic settings for operating the PCU.

For details on command units, refer to *7-2 Control Units*. The setting units for parameters and data depend on the specified command unit.

**Servo Parameter Area** **Command Unit Parameters**

| Model | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| R88D-WT□ | Pn202 | Electronic gear ratio G1 (numerator) | --- | 1 to 65535 | 2 | 4 |
| | Pn203 | Electronic gear ratio G2 (denominator) | --- | 1 to 65535 | 2 | 1 |
| R88D-WN□-ML2 | Pn20E | Electronic gear ratio G1 (numerator) | --- | 1 to 1073741824 | 4 | 4 |
| | Pn210 | Electronic gear ratio G2 (denominator) | --- | 1 to 1073741824 | 4 | 1 |
| SMART-STEP Junior | Pn20E | Electronic gear ratio G1 (numerator) | --- | 1 to 1073741824 | 4 | 1 |
| | Pn210 | Electronic gear ratio G2 (denominator) | --- | 1 to 1073741824 | 4 | 1 |

The command unit default setting is pulses.



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**Acceleration/Deceleration Constants**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|---|---|
| Acceleration/deceleration constants | Pn80A | First-step linear acceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Not supported |
| | Pn80B | Second-step linear acceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Supported |
| | Pn80C | Acceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 | Supported | Not supported |
| | Pn80D | First-step linear deceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Not supported |
| | Pn80E | Second-step linear deceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Supported |
| | Pn80F | Deceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 | Supported | Not supported |
| Acceleration/deceleration filters | Pn810 | Exponential acceleration/deceleration bias | Command units/s | 0 to 32767 | 2 | 0 | Supported | Not supported |
| | Pn811 | Exponential acceleration/deceleration time constant | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |
| | Pn812 | Movement average time | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |

First-step acceleration/deceleration curve operations require parameter settings for Pn80B and Pn80E only. For the acceleration/deceleration curve, Pn810 and Pn811 must be set when using an exponential curve, and Pn812 must be set when using an S-curve.

The SMARTSTEP Junior Servo Drivers do not support the following parameters: Pn80A, Pn80C, Pn80D, and Pn80F. They also do not support acceleration/deceleration filters, so the filters cannot be set. One-step linear acceleration/deceleration curves are set using only Pn80B and Pn80E.

Refer to *7-4 Acceleration and Deceleration Operations* for details on acceleration/deceleration curves.

**Control Status Parameters**

| Model | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| R88D-WT□ | Pn500 | Positioning completion range 1 | Command unit | 0 to 250 | 2 | 3 |
| | Pn803 | Zero point width | Command unit | 0 to 250 | 2 | 10 |
| R88D-WN□-ML2 | Pn522 | Positioning completion range 1 | Command unit | 0 to 1073741824 | 4 | 3 |
| | Pn803 | Zero point width | Command unit | 0 to 250 | 2 | 10 |
| SMARTSTEP Junior | Pn522 | Positioning completion range 1 | Command unit | 0 to 1073741824 | 4 | 10 |
| | Pn803 | Zero point width | Command unit | 0 to 250 | 2 | 10 |



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**Axis Operating Output Memory Areas (Operating Commands)**

| Name | | Word | Bits | Contents | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|
| ORIGIN RETURN Bit | | a | 07 | 0 → 1: Starts origin return operation | Supported | Supported |
| Speed command value | | a+4<br>a+5 | --- | Speed command value (rightmost word)<br>Speed command value (leftmost word)<br>Unit: Command units/s<br>Command range: 1 to 2,147,483,647 (00000000 hex to 7FFFFFFF hex)<br>The upper limit setting for the speed command value depends on the Servo Driver specifications. | Supported | Supported |
| Acceleration/deceleration curve designation | Exponential curve designation | a+16 | 03 | 1: Use exponential acceleration/deceleration curve. | Supported | Not supported |
| | S-curve designation | | 04 | 1: Use S-curve acceleration/deceleration curve. | Supported | Not supported |
| Forward rotation current limit | | | 14 | 1: Use forward torque limit | Supported | Not supported |
| Reverse rotation current limit | | | 15 | 1: Use reverse torque limit | Supported | Not supported |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Origin return is performed according to the speed command value set in the Axis Operating Output Memory Areas and started when the ORIGIN RETURN Bit turns ON.

Execute ORIGIN RETURN when the Busy Flag for the corresponding axis is OFF. If ORIGIN RETURN is executed while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and ORIGIN RETURN will not be executed. When starting ORIGIN RETURN, make sure that the ORIGIN RETURN Bit will remain ON until the Busy Flag turns ON.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the ORIGIN RETURN command will be ignored. Be sure that all of these command bits are OFF before executing an origin return.

The target speed for an origin return operation can be changed while ORIGIN RETURN is being executed by setting the new speed command value in the Axis Operating Output Memory Area. (For details on changing the target speed, which is the same as positioning operations, refer to *9-4-4 Changing Target Speed*.)

Torque limit during operation is possible with origin return operations. For further details on the torque limit function, refer to *10-4 Torque Limits*.

The acceleration/deceleration curve designation, and forward/reverse rotation current limit designation data are enabled when the ORIGIN RETURN Bit turns ON.

The SMARTSTEP Junior Servo Drivers do not support acceleration/deceleration filters and torque limits. When using a SMARTSTEP Junior Servo Driver, do not attempt to use an acceleration/deceleration curve designation or forward/reverse torque limit designation.



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**Note** Do not set both the exponential curve designation and S-curve designation to 1 (enabled) in the acceleration/deceleration curve designation. Enabling both settings may cause a malfunction.

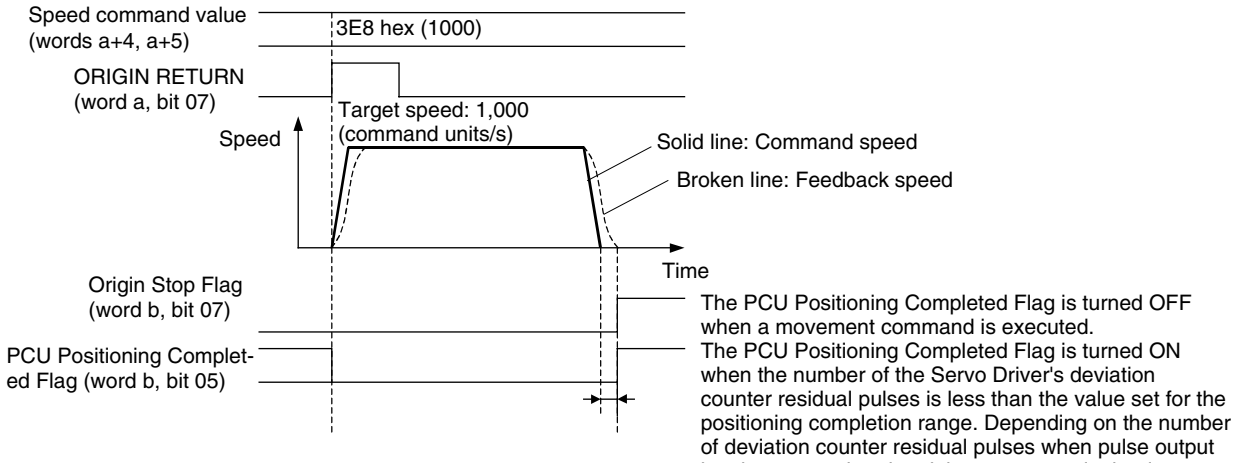
### Axis Operating Input Memory Areas (Monitor)

| Name | Word | Bits | Contents |
|---|---|---|---|
| PCU Positioning Completed Flag | b | 05 | 0 → 1: Positioning completed. |
| No Origin Flag | | 06 | 0: Origin established.<br>1: No origin established. |
| Origin Stop Flag | | 07 | 0: Outside origin range.<br>1: Within origin range. |
| Error Flag | | 12 | 0: No axis error.<br>1: Axis error. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing). |
| Feedback present position | b+6<br>b+7 | --- | Present position:<br>Feedback present position (rightmost word)<br>Feedback present position (leftmost word) |
| Command present position | b+8<br>b+9 | --- | Present position:<br>Command position (rightmost word)<br>Command position (leftmost word) |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

## Timing Chart

The following timing chart is for when ORIGIN RETURN is executed.




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25



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# 8-5 Phase Z Margin

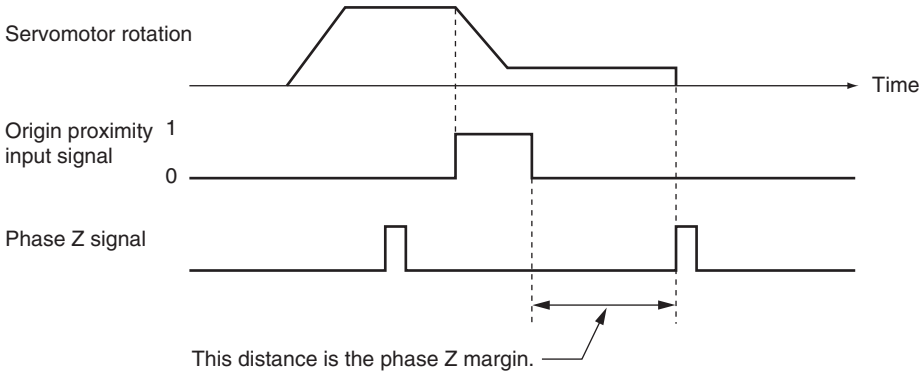
## 8-5-1 Description

Although there are some variations for different settings, the PCU's origin search basically works by latching (detecting) the first encoder phase Z after confirming ON/OFF status of the origin proximity signal, performing positioning for the final travel distance to return to the origin, and then setting that position as the origin.

When the time (distance) from when the origin proximity signal changes from ON to OFF until the first phase Z is detected is extremely short or is almost the same as the time taken for one rotation of the Servomotor, the position at which the phase Z is detected may be displaced by one phase due to discrepancies in the ON response of the origin proximity sensor or the Servo Driver speed. This displacement is prevented by confirming the “phase Z margin.” The phase Z margin indicates the amount by which the Servomotor rotated during the time from when the origin proximity signal changed from ON to OFF until the phase Z was detected.

If this value is close to 0 or close to one motor rotation, there is a possibility of origin displacement during origin search. A simple way of reducing the probability of this is to adjust the Servomotor's mounting angle or the origin proximity sensor's mounting position so that this value is approximately half a rotation of the Servomotor.

Example: Final travel distance to return to zero point = 0




## 8-5-2 Calculating the Phase Z Margin (Example)

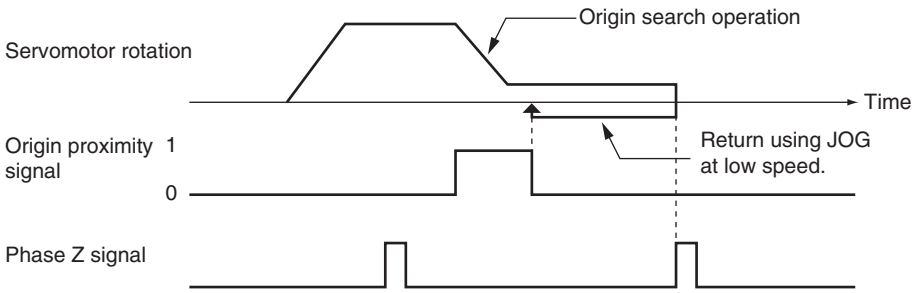
One method used to obtain the phase Z margin is to perform jogging after origin search in the opposite direction to origin search, with the final travel distance to return to origin set to 0. Then stop operation at the point where the origin proximity signal changes from OFF to ON, and read the value of the present position at that point. The value of this present position is equal to the phase Z margin.

If the speed at the point when the origin proximity signal turns ON is fast, there will be some inaccuracy in the value read for the phase Z margin. Reduce the speed of the jogging in the vicinity of the point where the origin proximity signal turns ON.

The required phase Z margin can be obtained by adjusting mounting positions and angles so that this position corresponds to approximately half the distance moved for one rotation of the motor.



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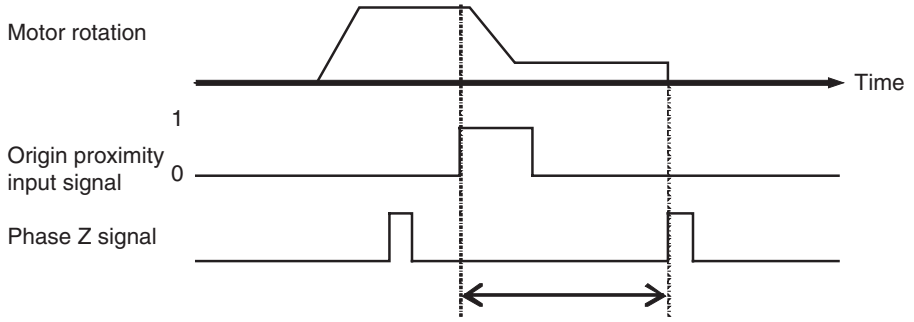

## 8-5-3 Phase Z Margin for Specific Operation Patterns

**Phase Z Margin Required for Origin Search Settings**

Up to a maximum of two MECHATROLINK communications cycles plus 4 ms may be required to start searching for the origin signal after detecting the origin proximity signal for the following origin search operation patterns.

- When the origin detection method is set to any setting other than 0 (Origin proximity input signal reversal)
- When an absolute encoder zero point position offset is set for the origin search

When performing an origin search with one of the above operation patterns, the following margin must be provided in the phase Z signal after the origin proximity input signal turns ON.




Provide a margin in the phase Z signal of at least two MECHATROLINK communications cycles plus 4 ms.

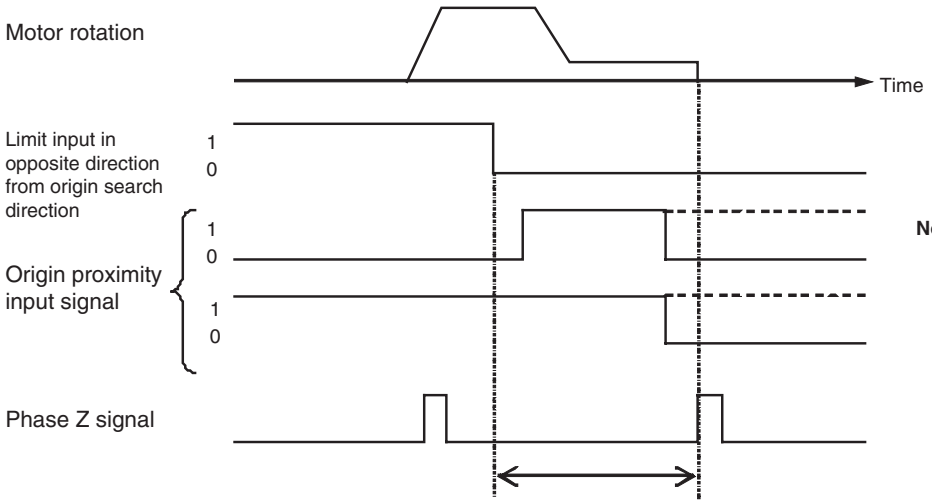
**Phase Z Margin Required for External Input Signals**

If the limit input signal in opposite direction from origin search direction and the origin proximity signal are close or overlapping, up to a maximum of two MECHATROLINK communications cycles plus 4 ms may be required to start searching for the origin signal after detecting the origin proximity signal.

In this case, the following margin must be provided in the phase Z signal after the limit input signal in opposite direction from origin search direction turns OFF.



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**Note:** The origin search operation settings determine the motor operation and phase Z signal detection operation when the origin proximity input signal turns ON or OFF.

Provide a margin in the phase Z signal of at least two MECHATROLINK communications cycles plus 4 ms.

# 8-6 Absolute Encoder Origin

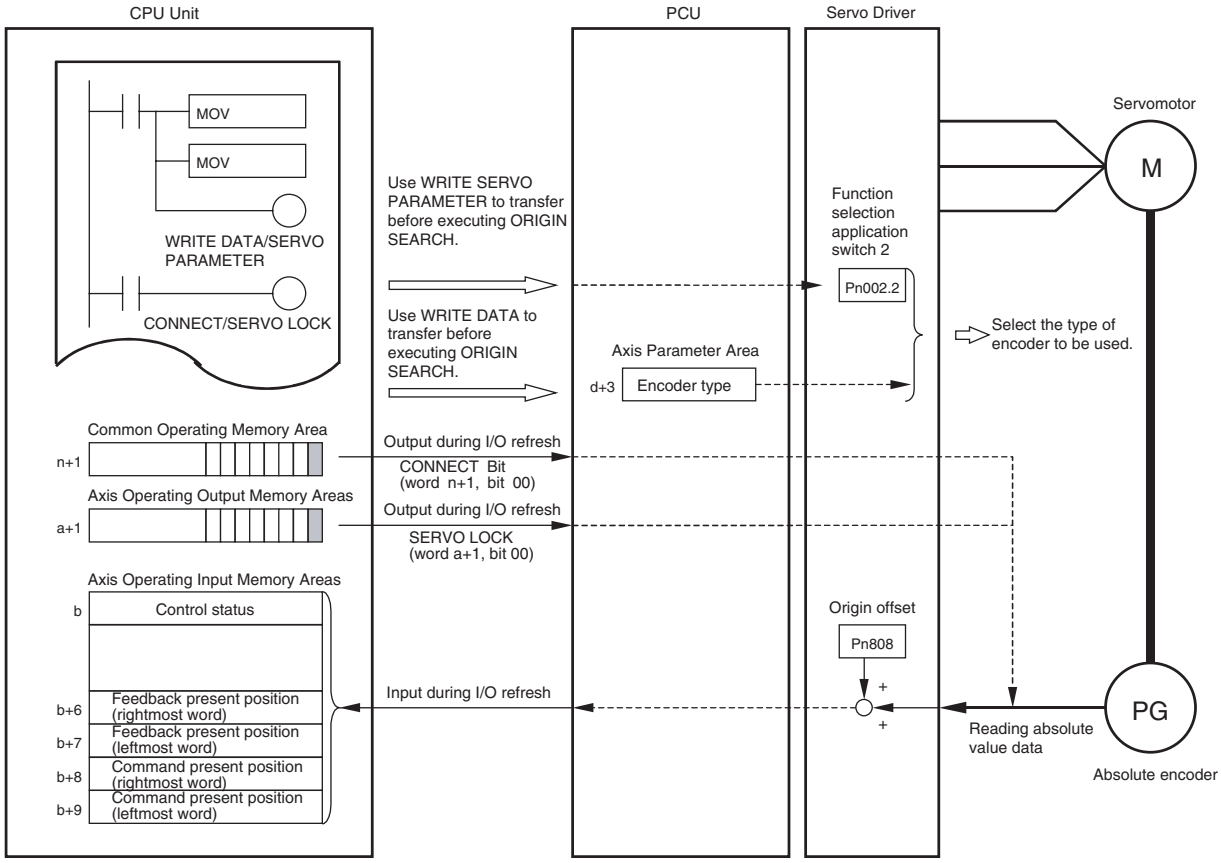
## 8-6-1 Absolute Encoder Overview

The absolute encoder's battery backup enables absolute value data to be held even if the power to the CPU Unit (PCU) or Servo Driver is turned OFF. Therefore, after turning ON the power to the CPU Unit (PCU), the saved absolute value data can be read, enabling positioning at the present position that existed before the power was turned OFF.

The Servo Parameter for absolute encoder origin offset (Pn808: *Absolute Encoder Zero Point Position Offset*) for absolute value data that is read can be used to offset the mechanical origin. When an absolute encoder is used to determine the origin, it is not necessary to perform origin searches every time the power is turned ON, as is required for devices such as incremental encoders.



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n: Beginning word of Common Operating Memory Area: n = CIO 1500 + (unit number × 25)
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

**Applicable Servomotors**

The following Servomotors with absolute encoders support this function.

OMRON W-series Servomotors
Model: R88M-W□S/W□T

The SMARTSTEP Junior Servo Drivers cannot be used with motors with absolute encoders.

## 8-6-2 Absolute Encoder Operating Procedure

The procedure for using an absolute encoder is as given below. The following procedure is performed just once when using the absolute encoder for the first time, when replacing the Servomotor, when the absolute encoder's battery expires, or when another reason occurs that results in loss of absolute value data.

***1,2,3...***

1. Set the Common Parameters and save them.
2. Set the Axis Parameters and save them.
3. Turn the PCU OFF and then ON again or restart the Unit.
   The data for the Common Parameters and Axis Parameters set in steps 1 and 2 above are enabled.
4. Start MECHATROLINK communications.
5. Set the Servo Parameters (*Function Selection Application Switch 2*).
   Set the absolute encoder type to be used in Pn002.2.
   This step is not required if using the default setting.



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6. Setup the absolute encoder.
   After setting up the absolute encoder, the power to the Servo Driver must be turned OFF and then ON again.
7. Start MECHATROLINK communications.
   When the connection is established, the absolute value data is read from the absolute encoder.
8. Set the mechanical origin.
9. Set the origin position offset for the absolute encoder.

After completing this procedure, the mechanical origin will be set whenever the power is turned ON or MECHATROLINK communications are started.

**Establishing the Origin with an Absolute Encoder**

The following differences exist in origin searches when using a motor with an absolute encoder depending on the unit version of the Position Control Unit.

**Position Control Units with Unit Version 1.3 or Earlier**

Position Control Units with unit version 1.3 or earlier do not support origin search operations for absolute encoders.

When the origin search operation is executed, the present position is cleared to 0 or, if the origin search preset function is enabled, it is set to the present command value after the origin has been established. Any absolute value data previously read by the Position Control Unit is lost. If the absolute value data is later read from the absolute encoder, e.g., when the Servo is unlocked and locked, the coordinate system based on the absolute value data previously saved in the absolute encoder will be used instead of the origin established by the origin search operation.

**Position Control Units with Unit Version 2.0 or Later**

When the origin search operation is executed, the present position is cleared to 0 or, if the origin search preset function is enabled, it is set to the present command value after the origin has been established. If the origin search operation pattern is set to reversal mode 1, the zero point position offset of the absolute encoder will be set automatically and saved in the Servo Parameters. The mechanical origin and the zero point position offset in the absolute encoder can thus be set simultaneously by using a Position Control Units with unit version 2.0 or later and reversal mode 1 with an absolute encoder.

Refer to *8-6-5 Absolute Encoder's Origin (Zero Point) Position Offset Setting* for details on setting the zero point position offset using an origin search.

**Note** ORIGIN SEARCH can also be executed when using Servomotors with absolute encoders. By executing ORIGIN SEARCH, however, the present position will be cleared to 0 when the origin is established. Therefore, the absolute data read to the PCU in Servo lock status will be lost unless the zero point position offset is set using the origin search operation for a Position Control Units with unit version 2.0 or later. The absolute data saved in the absolute encoder will not be lost and can be obtained by executing SERVO UNLOCK after the origin search has been completed, and then executing SERVO LOCK again. The origin position detected, however, will be displaced due to SERVO UNLOCK execution. Therefore, do not execute ORIGIN SEARCH when using a Servomotor with absolute encoder unless you set the zero point position offset using the origin search operation for a Position Control Units with unit version 2.0 or later.

## 8-6-3 PCU Data Settings for Using Absolute Encoders

The parameters and data required when using absolute encoders are as follows:



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**Axis Parameter Area**

The following parameters are for the operation mode for origin searches.

| PCU's address | Contents | | | | Setting |
|---|---|---|---|---|---|
| | 15 to 12 | 11 to 08 | 07 to 04 | 03 to 00 | |
| d+2 | 0 (fixed) | 0 (fixed) | 0 (fixed) | Encoder type | 0: Incremental encoder (default setting)<br>1: Absolute encoder |

d = 1860 hex + (Axis No. −1) × 14 hex

When using an absolute encoder, make sure that the settings for the *Encoder Type* in the Axis Parameters and *Operation Switch When Using Absolute Encoder* (Pn002.2) in the Servo Parameters match.

| Axis Parameter Area<br>Encoder type | Servo Parameter Pn002.2 (Operation switch when using absolute encoder) | |
|---|---|---|
| | 0: Use as absolute encoder. | 1: Use as incremental encoder. |
| 0: Incremental encoder | Do not set this combination. | This setting is used when using an absolute encoder as an incremental encoder |
| 1: Absolute encoder | This setting is used when using an absolute encoder as an absolute encoder.<br>(Set this combination when using an absolute encoder.) | Do not set this combination. |

If the settings do not match, reading absolute data will not be possible, or another malfunction may occur.

**Servo Parameter Area**

**Parameters for Using Absolute Encoders**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn002.2 | Function selection application switch 2 (operation switch when using absolute encoder) | --- | 0, 1 | 2 | 0 |

When using a Servomotor with an absolute encoder, select whether the absolute encoder will be used as an absolute encoder or as an incremental encoder. Set this parameter to 0 if using the absolute encoder as an absolute encoder. The parameter size is the set value specified to transfer Pn002 (including Pn002.2) when transferring Servo Parameters.

**Origin Position Offset Parameters**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn808 | Absolute encoder zero point position offset | Command unit | −1,073,741,823 to 1,073,741,823 | 4 | 0 |

This parameter sets the offset for the mechanical origin from the absolute encoder's absolute value data. The present position will be the absolute value data that was read added to the value in this parameter, and that position is set as the origin.

**Note** When using the zero point position offset setting function with Position Control Units with unit version 2.0 or later, Pn808 is automatically overwritten when an origin search is performed with an absolute encoder. (Refer to *8-6-5 Absolute Encoder's Origin (Zero Point) Position Offset Setting*) To achieve this, the Position Control Unit reads and writes Servo Parameter for Pn808 when the origin search operation is started and when it is completed.



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**Axis Operating Input Memory Areas (Monitor)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| No Origin Flag | b | 06 | 0: Origin established.<br>1: No origin established. |
| Origin Stop Flag | | 07 | 0: Outside origin range.<br>1: Within origin range. |
| Error Flag | | 12 | 0: No axis error.<br>1: Axis error. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing). |
| Feedback present position | b+6<br>b+7 | --- | Present position:<br>Feedback present position (rightmost word)<br>Feedback present position (leftmost word) |
| Command present position | b+8<br>b+9 | --- | Present position:<br>Command position (rightmost word)<br>Command position (leftmost word) |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

## 8-6-4 Absolute Encoder Setup

The absolute encoder setup must be performed when using the absolute encoder for the first time, initializing the rotation amount to 0, or having left the absolute encoder for a long time without connecting a battery.

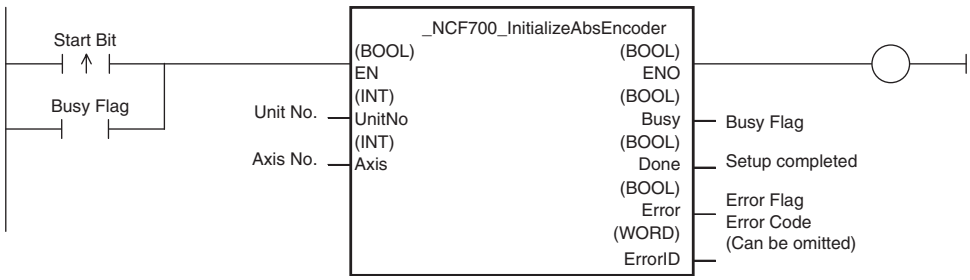
The following methods can be used to set up the absolute encoder when using a Position Control Unit with unit version 1.2 or later.

- The absolute encoder can be set up using the CX-Motion-NCF.
- The absolute encoder can be set up from the user program using a function block from the OMRON FB Library.
- The absolute encoder can be set up using the Servo Driver's Setting Tool.

Refer to the *SYSMAC CX-Motion-NCF Programmable Controller Operation Manual* (Cat. No. W436) for information on setting up the absolute encoder from the CX-Motion-NCF.

When setting up an absolute encoder using the function block from the OMRON FB Library, use a CPU Unit with unit version 3.0 or later.

**Absolute Encoder Setup Function Block in OMRON FB Library: _NCF700_InitializeAbsEncoder**




The absolute encoder setup can be executed by specifying the unit number and axis number for the function block, and setting the Start Bit.

For information on function block operating requirements and precautions, refer to the *OMRON FB Library Reference Manual* (Cat. No. W442).



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When using a PCU with unit version 1.1 or earlier, absolute encoder setup is executed using the Servo Driver's Setting Tool. For details on absolute encoder setup operations using the Servo Driver Setting Tool, refer to the operation manual for the connected Servo Driver.

**Note** After executing absolute encoder setup, be sure to turn ON the Servo Driver's control power supply again. Not doing so will prevent the Servo Driver's response to PCU commands, and normal operation will not be possible.

## 8-6-5 Absolute Encoder's Origin (Zero Point) Position Offset Setting

**When Absolute Encoder Zero Point Position Offset (Pn808) = 0 (Default)**

***1,2,3...***

1. Start MECHATROLINK communications (establish a connection using CONNECT).
2. Use jogging or other operation to place the machine in the mechanical origin position. ORIGIN SEARCH cannot be used when using an absolute encoder.
3. Confirm the feedback present position in the Servo unlocked state and set the origin position offset based on this present position. When the Servo is locked, the present position may oscillate, or deviation will accumulate in the Servo Driver, which may prevent the correct set value from being obtained for the origin position offset, causing displacement of the origin.
4. Reverse the sign of the value for the feedback present position read in step 3 and write this value in *Absolute Encoder Zero Point Position Offset* (Pn808). Use SAVE SERVO PARAMETER to write the value to the Servo Driver's non-volatile memory.
5. Execute DEVICE SETUP or turn the power to the Servo Driver OFF and then ON again.

The absolute encoder origin position offset that has been set is now enabled.

**When Absolute Encoder Zero Point Position Offset (Pn808) = Not 0**

When Pn808 is set to a value other than 0, such as when replacing the Servomotor, use either of the following methods to set the origin position offset.

Method 1: First set the origin position offset to 0 (set *Absolute Encoder Zero Point Position Offset* (Pn808) to 0 using SAVE SERVO PARAMETER), and then set it according to the setting method for when Pn808 is 0.

Method 2: Use the above setting method for when the absolute encoder zero point position offset is 0, and calculate the set value in step 4 using the following equation.
New zero point position offset value = Present zero point position offset value − Feedback present position

**Note** There is a limit to the number of times non-volatile memory in the Servo Driver can be written (10,000 times). Do not save the absolute encoder zero point position offset (Pn808) too frequently.

**Setting the Absolute Encoder Zero Point Position Offset Using an Origin Search Operation**

The absolute encoder zero point position offset can be automatically set in Pn808 at the end of an origin search by executing the origin search with the following operation pattern with a Position Control Unit with unit version 2.0 or later.

Operation pattern: Reversal mode 1

Origin detection method: Origin proximity input signal reversal, No origin proximity input signal reversal, or Do not use origin proximity input signal



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To enable setting the absolute encoder zero point position offset with an origin search operation, the following axis parameter settings must be used with the above origin search operation pattern.

Origin search preset: Set.

Encoder type: Absolute Encoder

**Axis Parameters**

The following parameters are used to set the origin search operation mode.

| PCU's address | Contents | | | | | | Setting |
|---|---|---|---|---|---|---|---|
| | 15 to 14 | 13 | 12 | 11 to 08 | 07 to 04 | 03 to 00 | |
| d+1 | 0 (fixed) | Origin search preset | Origin search direction | Origin detection method | Origin search operation | 0 (fixed) | Set the origin search operation.<br>Origin search direction<br>0: Reversal mode 1<br>Origin detection method<br>0: With origin proximity input signal reversal (default setting)<br>1: Without origin proximity input signal reversal<br>2: Not use origin proximity input signal<br>Origin search direction<br>0: Forward (default setting)<br>1: Reverse<br>Origin search preset<br>1: Set |
| d+2 | 0 (fixed) | 0 | 0 | 0 (fixed) | 0 (fixed) | Encoder type | 1: Absolute encoder |

d = 1860 hex + (Axis No. −1) × 14 hex

When setting the absolute encoder's zero point position offset using an origin search, set the position command value (i.e., the present position preset value) to 0 and enable the origin search preset even when the preset value is not being used for the origin search.

**Note**

- Each time the absolute encoder zero point position offset is set using an origin search operation, the absolute encoder zero point position offset parameter (Pn808) is saved to non-volatile memory in the Servo Driver. There is a limit to the number of times non-volatile memory in the Servo Driver can be written (10,000 times). Do not save the absolute encoder zero point position offset (Pn808) too frequently.
- The absolute encoder zero point position offset will not be set correctly using an origin search operation if an error occurs before the end of the origin search operation. Repeat the operation if an error occurs.
- If the absolute encoder PG zero point position offset is set using an origin search operation, the MECHATROLINK transfer cycle and communications cycle settings will need to be changed. Refer to *Transfer Cycle and Communications Cycle When Setting the Absolute Encoder Zero Point Position Offset Using an Origin Search Operation with Position Control Units with Unit Ver. 2.0* on page 204 and set the transfer cycle and communications cycle correctly. If the transfer cycle and communications cycle are not set correctly, the function to set the absolute encoder PG zero point position offset using an origin search operation will not operate correctly.



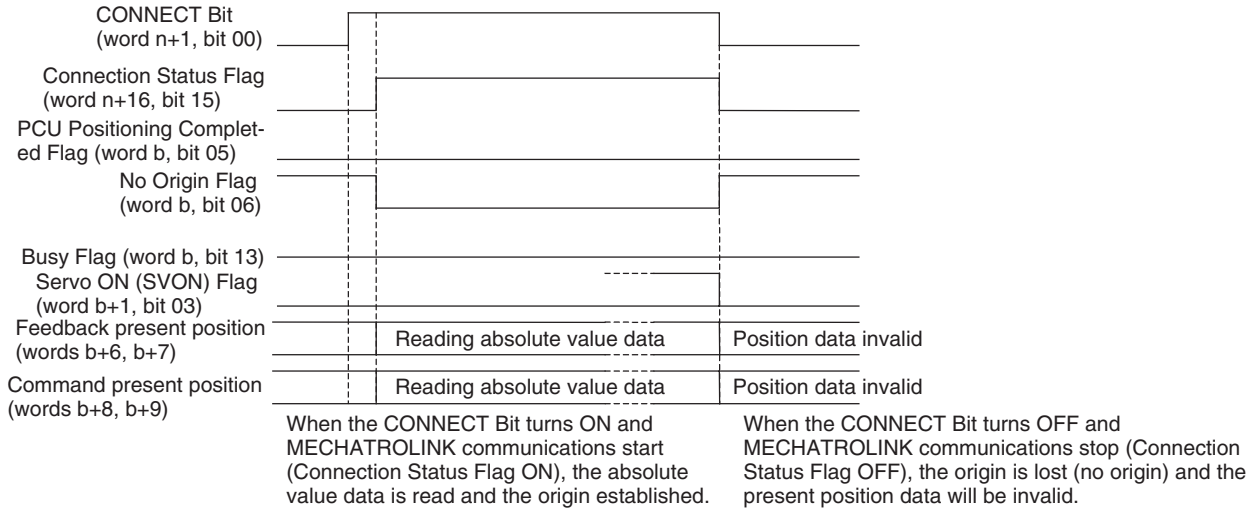
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## 8-6-6 Establishing Origin Using Absolute Encoder

The PCU establishes the origin by reading the absolute value data saved in the absolute encoder using the following timing.

**Starting MECHATROLINK Communications (Using CONNECT)**

The absolute value data for all axes registered in the scan list for the Servomotor with the absolute encoder is read.




n: Beginning word of Common Operating Memory Area: n = CIO 1500 + (unit number × 25)
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

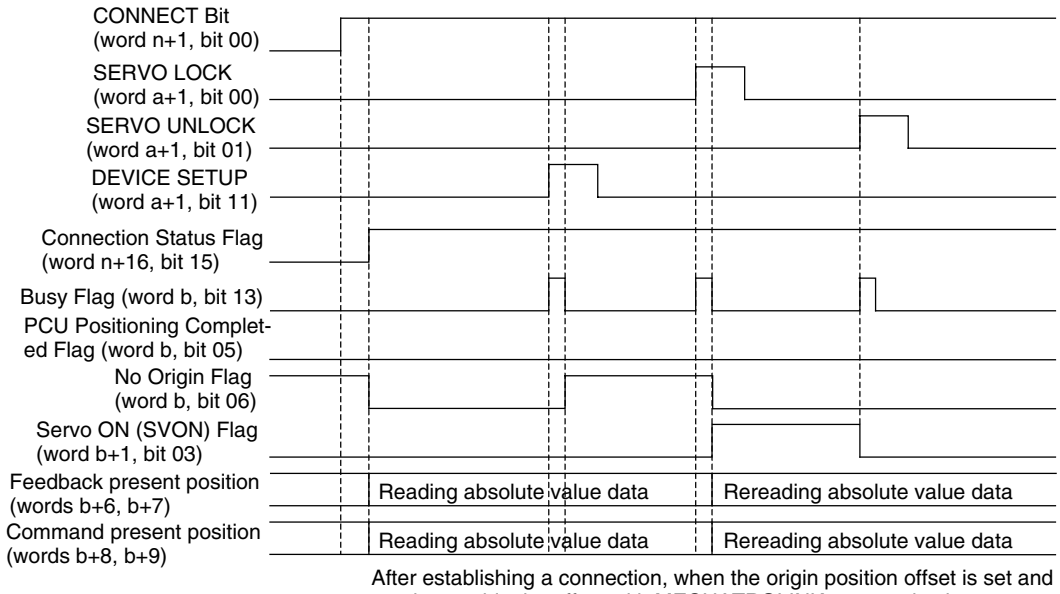
**Executing SERVO LOCK**

The absolute value data of the axes for which SERVO LOCK was executed is read. When the offline parameters, such as *Absolute Encoder Zero Point Position Offset*, are set, MECHATROLINK communications are continued, and DEVICE SETUP is executed to enable the parameters, the origin for the corresponding axis is lost (no origin).

By executing SERVO LOCK at this point, the absolute value data is read again and the origin is established based on the new parameter settings.



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After establishing a connection, when the origin position offset is set and DEVICE SETUP is used to enable the offset with MECHATROLINK communications connected, the origin will be lost (no origin). Afterwards, by executing SERVO LOCK, the absolute value data is reread, and the origin is established based on the origin position offset that has been set.

n: Beginning word of Common Operating Memory Area: n = CIO 1500 + (unit number × 25)
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The absolute value data that has been read is added to the origin position offset that is set in the Servo Parameters, and the result of the addition is input in the Axis Operating Input Memory Area as the PCU present position. The present position is thereafter given as the total travel distance for the corresponding axis operation.



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# SECTION 9
# Positioning

This section provides an overview of direct operation and describes the parameter settings, data settings, and procedures required to perform direct operation. Information on interrupt feeding and torque limits is also provided here.


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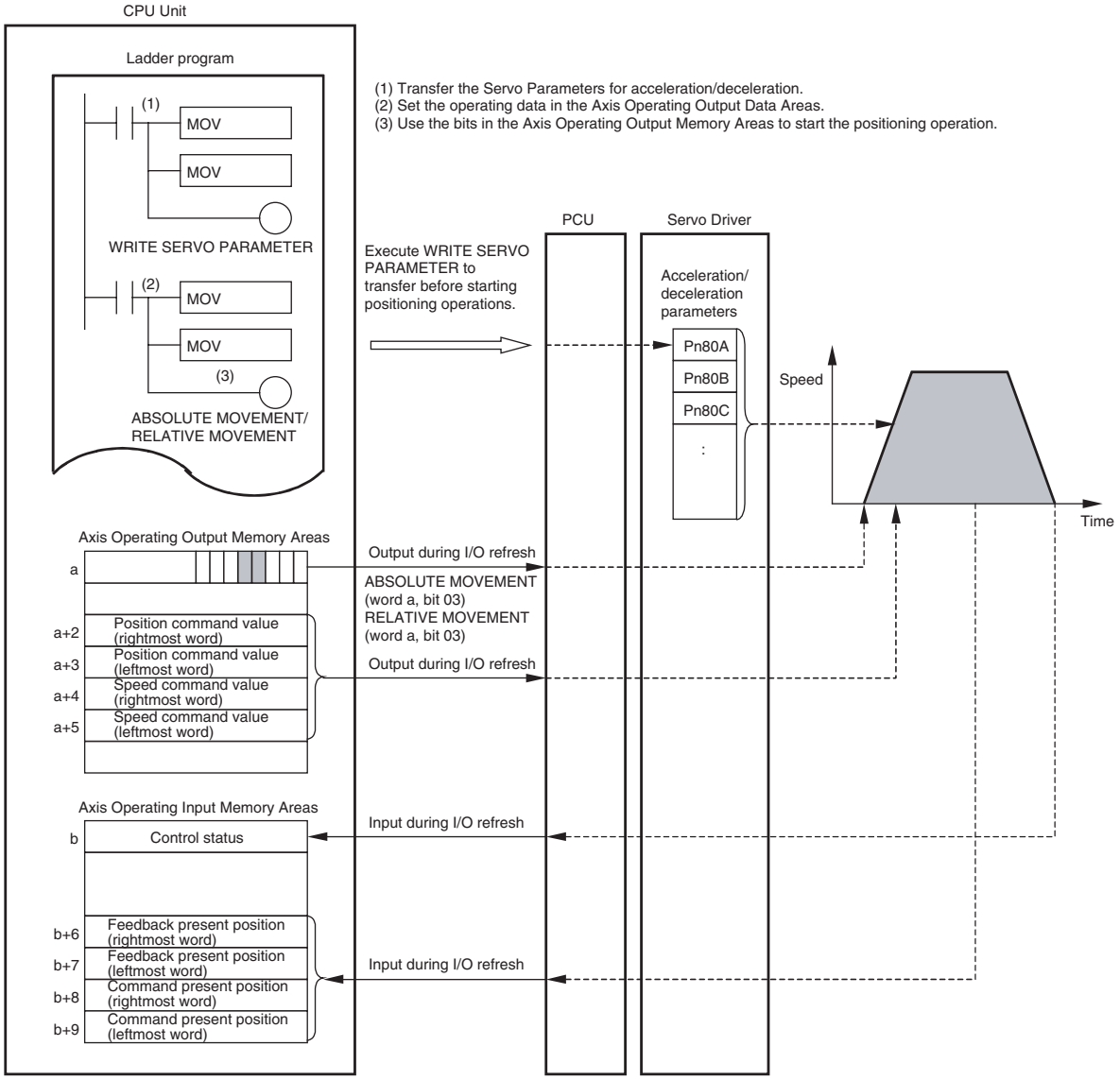



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# 9-1 Direct Operation Overview

Direct operation of the PCU enables positioning by simply writing target position data and target speed data directly from a ladder program to a specified area in the CPU Unit.

Positioning operations using direct operation are executed according to the position command value and speed command value in the Axis Operating Memory Area set in Common Parameters and the acceleration/deceleration constants set in the Servo Parameters.




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. –1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. –1) × 25

The position command value and speed command value set in the Axis Operating Output Memory Area using the MOV instruction are output to the PCU automatically during I/O refresh. Direct operation is started when the ABSOLUTE MOVEMENT Bit or RELATIVE MOVEMENT Bit allocated in the Axis Operating Output Memory Area turns ON.



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# 9-2 Direct Operation Procedure

The procedure for using direct operation is as follows:

***1,2,3...***

1. Set the Common Parameters and save them.
2. Turn ON the PCU again or restart the Unit.
   The data for the Common Parameters set in step 1 above is enabled.
3. Start MECHATROLINK communications.
4. Set the Servo Parameters and save them.
   Set the Servo Parameters required to execute direct operation.
   To set parameters permanently, execute SAVE SERVO PARAMETER (writes to the non-volatile memory).
   To enable changed offline parameters, turn ON the power to the Servo Driver again or execute DEVICE SETUP.
   For details, refer to *5-3 Transferring Servo Parameters*.
5. Execute SERVO LOCK.
6. Set the data used for direct operation.
   Set the positioning data for direct operation in the position command value of the Axis Operating Output Memory Area.
   Set the speed data for direct operation in the speed command value of the Axis Operating Output Memory Area.
7. Start ABSOLUTE MOVEMENT or RELATIVE MOVEMENT.

When using the PCU for the first time or to change the Common Parameter data, steps 1 and 2 must be performed.

After executing SERVO LOCK, WRITE SERVO PARAMETER can be executed to set the acceleration/deceleration used each time positioning is performed.

**Note** When specifying the Servo Parameters for acceleration/deceleration every time, make sure that the axis operation is stopped (Busy Flag = 0) while changing the acceleration/deceleration constants using WRITE SERVO PARAMETER. Do not change parameters during axis operation.
Changing parameters while the axis is operating may result in incorrect positioning or other malfunction.

# 9-3 PCU Data Settings for Direct Operation

A simple explanation of the main parameters and data used to execute direct operation is provided here. To execute direct operation, apart from the parameters explained here, the following parameters also need to be set as basic settings for operating the PCU.

- External I/O Signal Allocations
  Refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.
- Command Unit
  Refer to *7-2 Control Units*.
  The setting units for parameters and data depend on the specified command unit.



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**Servo Parameter Area** **Acceleration/Deceleration Constants**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|---|---|
| Acceleration/deceleration constants | Pn80A | First-step linear acceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Not supported |
| | Pn80B | Second-step linear acceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Supported |
| | Pn80C | Acceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 | Supported | Not supported |
| | Pn80D | First-step linear deceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Not supported |
| | Pn80E | Second-step linear deceleration constant | 10,000 command units/s$^2$ | 1 to 65535 | 2 | 100 | Supported | Supported |
| | Pn80F | Deceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 | Supported | Not supported |
| Acceleration/deceleration filters | Pn810 | Exponential acceleration/deceleration bias | Command units/s | 0 to 32767 | 2 | 0 | Supported | Not supported |
| | Pn811 | Exponential acceleration/deceleration time constant | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |
| | Pn812 | Movement average time | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |

First-step acceleration/deceleration curve operations require parameter settings for Pn80B and Pn80E only. For the acceleration/deceleration curve, Pn810 and Pn811 must be set when using an exponential curve, and Pn812 must be set when using an S-curve.

The SMARTSTEP Junior Servo Drivers do not support the following parameters: Pn80A, Pn80C, Pn80D, and Pn80F. They also do not support acceleration/deceleration filters, so the filters cannot be set. One-step linear acceleration/deceleration curves are set using only Pn80B and Pn80E.

For details on acceleration/deceleration curves, refer to *7-4 Acceleration and Deceleration Operations*.

**Control Status Parameters**

| Model | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| R88D-WT□ | Pn500 | Positioning completion range 1 | Command unit | 0 to 250 | 2 | 3 |
| R88D-WN□-ML2 | Pn522 | Positioning completion range 1 | Command unit | 0 to 1073741824 | 4 | 3 |
| SMARTSTEP Junior | Pn522 | Positioning completion range 1 | Command unit | 0 to 1073741824 | 4 | 10 |

**Minimum Limit Settings**

Under the following conditions, the Servo Parameters listed above, apart from Pn80B, Pn80E, and Pn500/Pn522, are used with the default settings and do not need to be changed.

- Command unit: Pulse



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- Acceleration/deceleration curve: Linear acceleration/deceleration for a single step only (trapezoidal curve)

**Axis Operating Output Memory Areas (Operating Commands)**

| Name | | Word | Bits | Contents | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|
| ABSOLUTE MOVEMENT | | a | 03 | 0 → 1: Starts absolute movement. | Supported | Supported |
| RELATIVE MOVEMENT | | | 04 | 0 → 1: Starts relative movement. | Supported | Supported |
| INTERRUPT FEEDING | | | 05 | 1: Enables interrupt feeding. | Supported | Supported |
| Position command value | | a+2<br>a+3 | --- | Position command value (rightmost word)<br>Position command value (leftmost word)<br>Unit: Command unit<br>Command range: –2,147,483,648 to 2,147,483,647 (80000000 hex to 7FFFFFFF hex)<br>The command value is limited by the allowable positioning range when using RELATIVE MOVEMENT.<br>(For details, refer to *9-4-1 Starting Direct Operation*.) | Supported | Supported |
| Speed command value | | a+4<br>a+5 | --- | Speed command value (rightmost word)<br>Speed command value (leftmost word)<br>Unit: Command units/s<br>Command range: 0 to 2,147,483,647 (00000000 hex to 7FFFFFFF hex)<br>The upper limit setting of the speed command value depends on the Servo Driver specifications. | Supported | Supported |
| Acceleration/deceleration curve designation | Exponential curve designation | a+16 | 03 | 1: Use exponential acceleration/deceleration curve. | Supported | Not supported |
| | S-curve designation | | 04 | 1: Use S-curve acceleration/deceleration curve. | Supported | Not supported |
| Forward rotation current limit | | | 14 | 1: Use forward torque limit. | Supported | Not supported |
| Reverse rotation current limit | | | 15 | 1: Use reverse torque limit. | Supported | Not supported |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. –1) × 25

The settings of the following are enabled when the movement command start bit turns ON: Position command value, Acceleration/Deceleration Curve Designation Bit, Interrupt Feeding Designation Bit, and Forward/Reverse Rotation Current Limit Designation Bit.

The speed command value can always be changed during operation. By overwriting the speed command value, the speed for the positioning operation can be changed.

The SMARTSTEP Junior Servo Drivers do not support acceleration/deceleration filters and torque limits. When using a SMARTSTEP Junior Servo Driver, do not attempt to use an acceleration/deceleration curve designation or forward/reverse torque limit designation.



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**Note** Do not set both the exponential curve designation and S-curve designation to 1 (enabled) in the acceleration/deceleration curve designation. Enabling both settings may cause a malfunction.

**Axis Operating Input Memory Areas (Monitoring)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| Receiving Command Flag | b | 00 | 0: Command reception enabled.<br>0 → 1: Command reception started.<br>1: Receiving command (command reception disabled). |
| PCU Positioning Completed Flag | | 05 | 0 → 1: Positioning is completed. |
| No Origin Flag | | 06 | 0: Origin established.<br>1: No origin established. |
| Error Flag | | 12 | 0: No axis error.<br>1: Axis error has occurred. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing) |
| Feedback present position | b+6<br>b+7 | --- | Present position:<br>Feedback present position (rightmost word)<br>Feedback present position (leftmost word) |
| Command present position | b+8<br>b+9 | --- | Present position:<br>Command position (rightmost word)<br>Command position (leftmost word) |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The Receiving Command Flag turns ON for at least one cycle time when the command to start direct operation is received by the PCU. Use the Receiving Command Flag when starting and changing target positions to control the ON/OFF timing for ABSOLUTE MOVEMENT and RELATIVE MOVEMENT.

# 9-4 Using Direct Operation

## 9-4-1 Starting Direct Operation

Two methods for starting direct operation are available, as follows:

***1,2,3...***

1. When the ABSOLUTE MOVEMENT Bit turns ON
2. When the RELATIVE MOVEMENT Bit turns ON

When starting direct operation, make sure that the ABSOLUTE MOVEMENT/RELATIVE MOVEMENT Bit remains ON until the Receiving Command Flag or the Busy Flag in the Axis Operating Input Memory Area turns ON.

Direct operation commands will be ignored if the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, or DECELERATION STOP Bit is ON. Be sure these bits remain OFF while performing direct operation.

**Executing ABSOLUTE MOVEMENT**

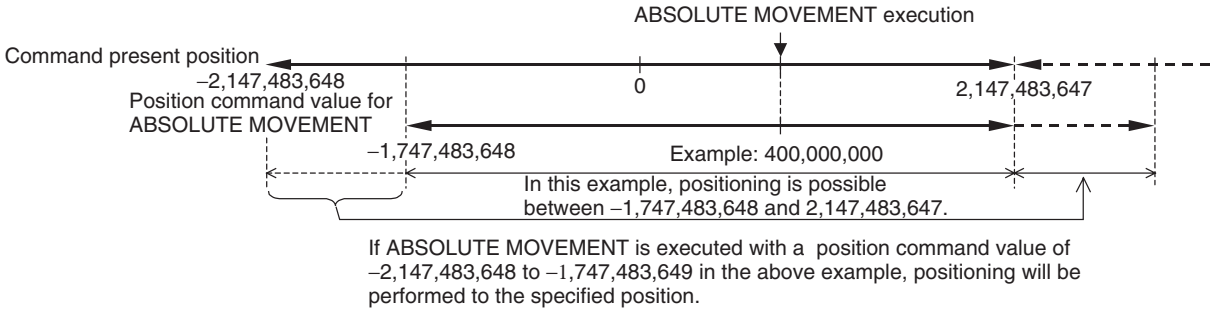
ABSOLUTE MOVEMENT positions the axis at the specified position using the position command value in the Axis Operating Output Memory Area as absolute data. If ABSOLUTE MOVEMENT is started without the origin established (No Origin Flag = 1), a Present Position Unknown Error (axis error code: 3030) will occur, and positioning will not be executed.



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The positioning range for ABSOLUTE MOVEMENT is any absolute position for which the travel amount from the present position is between –2,147,483,648 and 2,147,483,647 (command units).

If ABSOLUTE MOVEMENT is executed for an absolute position that exceeds this range, positioning will be performed not to a position based on the present origin, but to a position exceeding the upper or lower limit of the command present position.



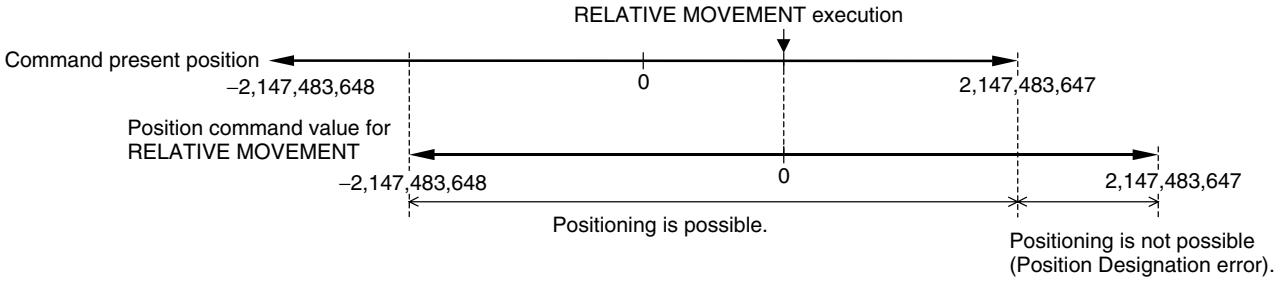

**Note** If ABSOLUTE MOVEMENT is executed for an absolute position that exceeds the positioning range, the positioning operation will be in the reverse direction to the present origin and the origin will be offset. Do not allow the position command value for ABSOLUTE MOVEMENT to exceed the positioning range. Also, set limit input signals and software limits so that operation will not be performed outside the present positioning range.

**Executing RELATIVE MOVEMENT**

RELATIVE MOVEMENT positions the axis at the specified position using the position command value in the Axis Operating Output Memory Area as incremental data. RELATIVE MOVEMENT can be executed without the origin established (No Origin Flag = 1), and the position command value will be added to the present position (relative travel distance).

The positioning range for RELATIVE MOVEMENT is a command present position range of –2,147,483,648 to 2,147,483,647 (command units) when it is not limited by limit input signals or software limits. (For details on the command present position, refer to *7-3 Coordinate System and Present Position*.)

The position command value used as the relative travel distance can be specified in the range –2,147,483,648 to 2,147,483,647 (command units), but if the positioning is started with a position command value such that the target position exceeds the positioning range for RELATIVE MOVEMENT, a Position Designation Error (axis error code: 3060) will occur, and the positioning operation will not be executed.




For details on acceleration/deceleration operations during direct operation, refer to *7-4 Acceleration and Deceleration Operations*.

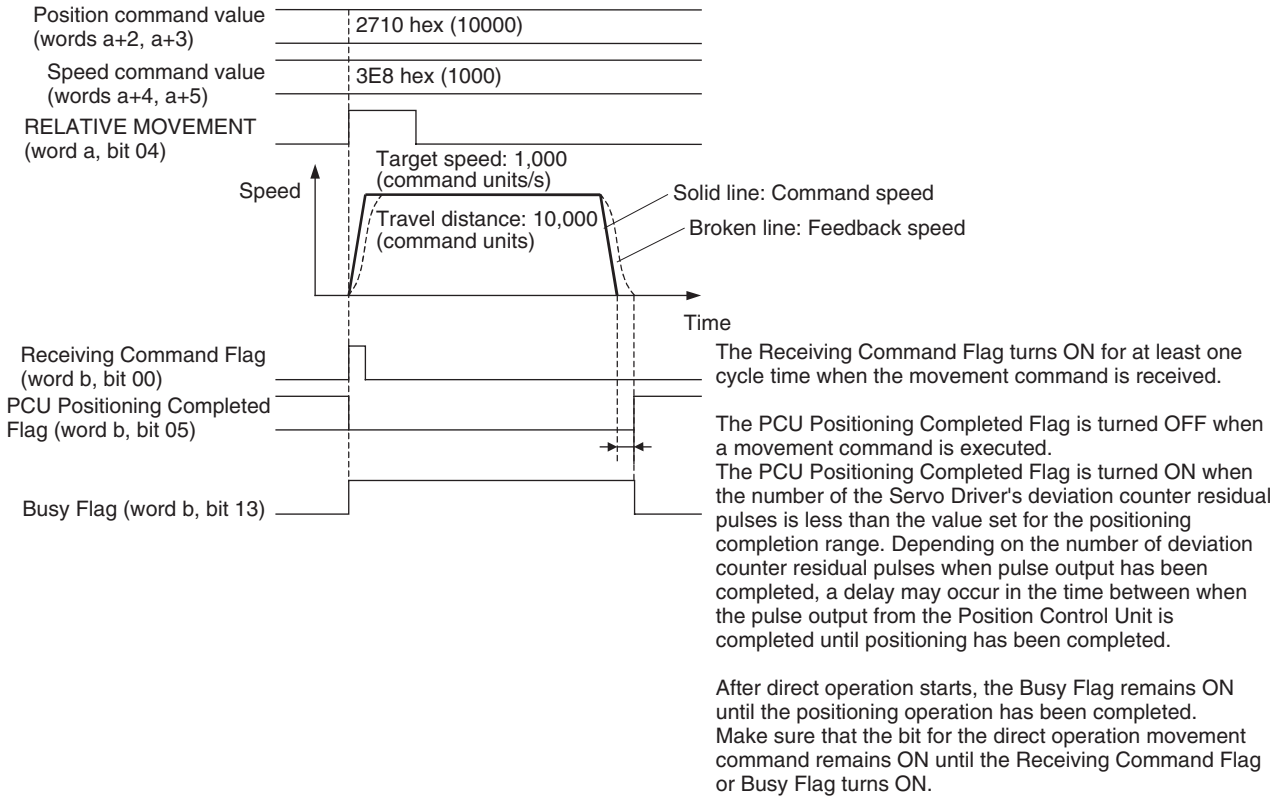


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## 9-4-2 Direct Operation Timing Charts

### Timing Chart for Movement Command Execution

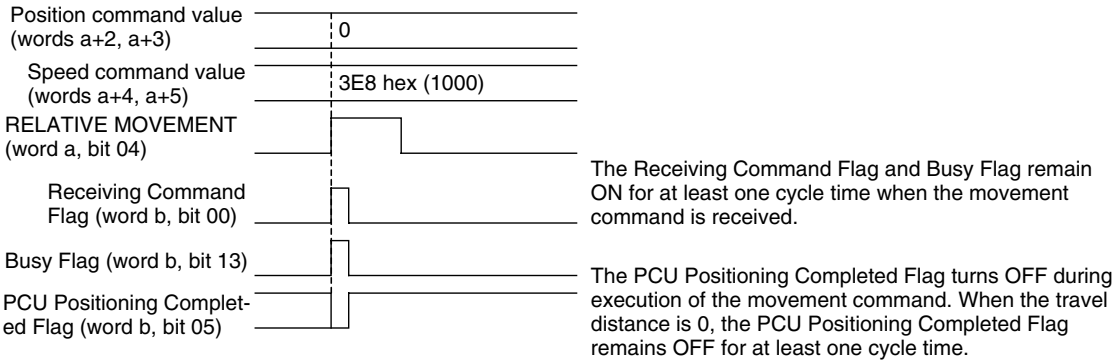
The following timing chart is for when RELATIVE MOVEMENT is executed. The timing chart for ABSOLUTE MOVEMENT is the same, except that positioning is executed with the absolute position.




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

### Timing Chart for Zero or Minute Travel Distance

The following timing chart applies when ABSOLUTE MOVEMENT is executed to move to the same position as the present position, or RELATIVE MOVEMENT is executed for position data of 0 (i.e., direct operation executed for travel distance of 0), or the positioning operation is ABSOLUTE or RELATIVE MOVEMENT for a minute travel distance that will finish in less than one CPU Unit cycle time.




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25



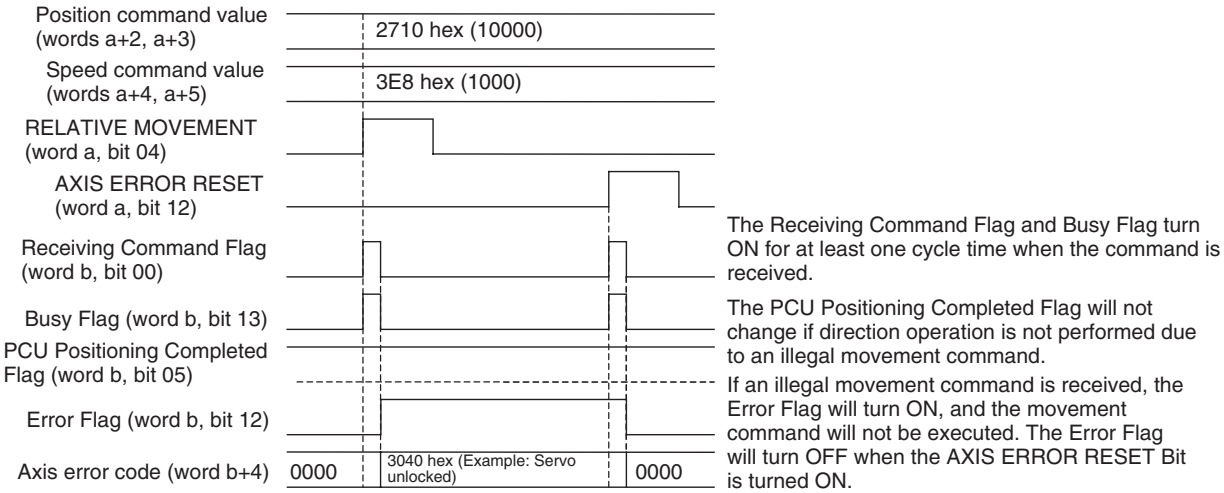
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Even for a zero or minute travel distance, the Receiving Command Flag and Busy Flag for the movement command will remain ON for at least one CPU Unit cycle time.

The PCU Positioning Completed Flag for the movement command will remain OFF for at least one cycle time if positioning stops within the positioning completion range for the target position.

### Timing Chart for Error/Warning Flag during Command Execution

If an error occurs due to an illegal command value when a direct operation command is executed, the command will not be executed, and the timing chart will be as follows:




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

If a Servo Driver warning occurs when a movement command is being executed, such as the speed command value exceeding the Servo Driver's limit value, the Error Flag in the above timing chart is replaced by the Warning Flag (word b, bit 11). After the command has been executed and the Busy Flag has been ON for at least one CPU Unit cycle time, the Error Flag and Warning Flag will turn ON at the same time as the Receiving Command Flag and Busy Flag turn OFF after either one PLC cycle time or after one MECHATROLINK communications time, whichever is longer.

### Timing Chart for Errors or Warnings during Axis Operation

When an error occurs during direct operation, such as a limit input during axis operation, the axis will either decelerate to a stop, immediately stop (emergency stop), or continue operation, depending on the error.

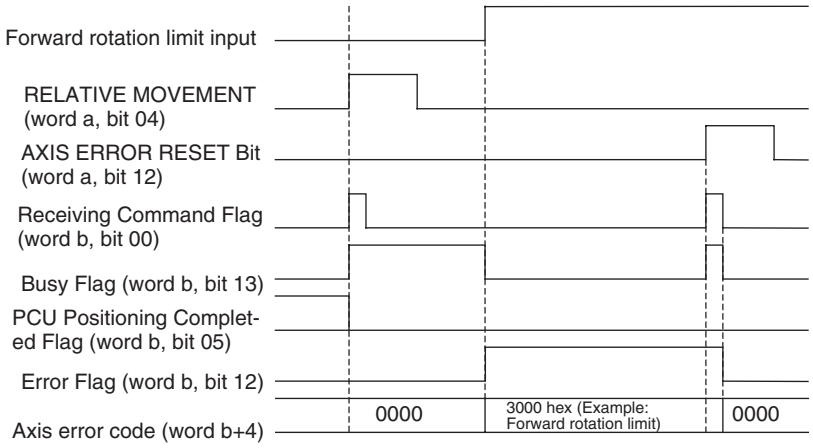
The timing charts when an error occurs during axis operation are provided below.



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### When an Error that Stops (Deceleration/Emergency Stop) Axis Operation Occurred

Example: Limit Input Error

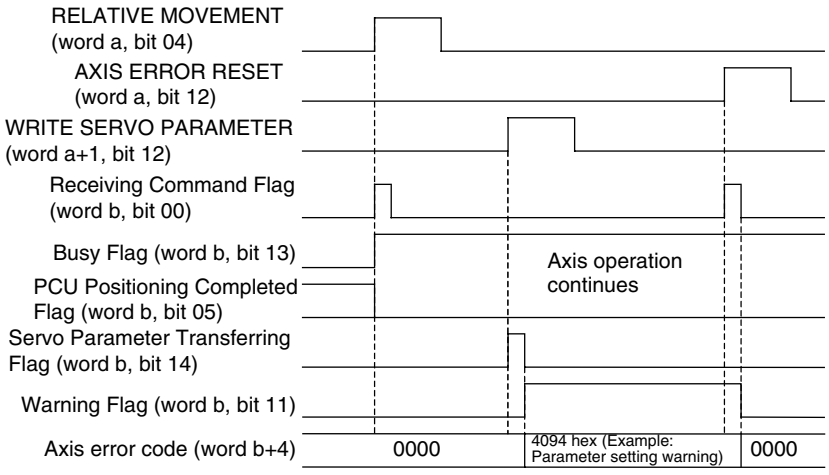



The PCU Positioning Completed Flag turns OFF during execution of the movement command. This flag will not turn ON if the executed positioning command is not completed due to an error.
If an error occurs, the Error Flag will turn ON, the axis error code stored, and the axis will stop according to the stopping method set for when errors occur. The Error Flag will turn OFF when AXIS ERROR RESET is executed. If an error occurs, after the Busy Flag turns ON, the Error Flag and axis error code will remain ON and set for either one cycle time or MECHATROLINK communications cycle, whichever is longer.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

### When a Warning Allowing Axis Operation to Continue Occurred

Example: Parameter Setting Warning during Servo Parameter Transfer




The PCU Positioning Completed Flag turns OFF during execution of the movement command. This flag will not turn ON if the executed positioning command is not completed due to an error.

When a warning occurs, the Warning Flag turns ON and the axis error code (warning code) is stored. The Warning Flag will turn OFF when AXIS ERROR RESET is executed.
If an error occurs, after Busy Flag turns ON, the Warning Flag will turn ON and the axis error code will be set after either one cycle time or MECHATROLINK communications cycle, whichever is longest.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

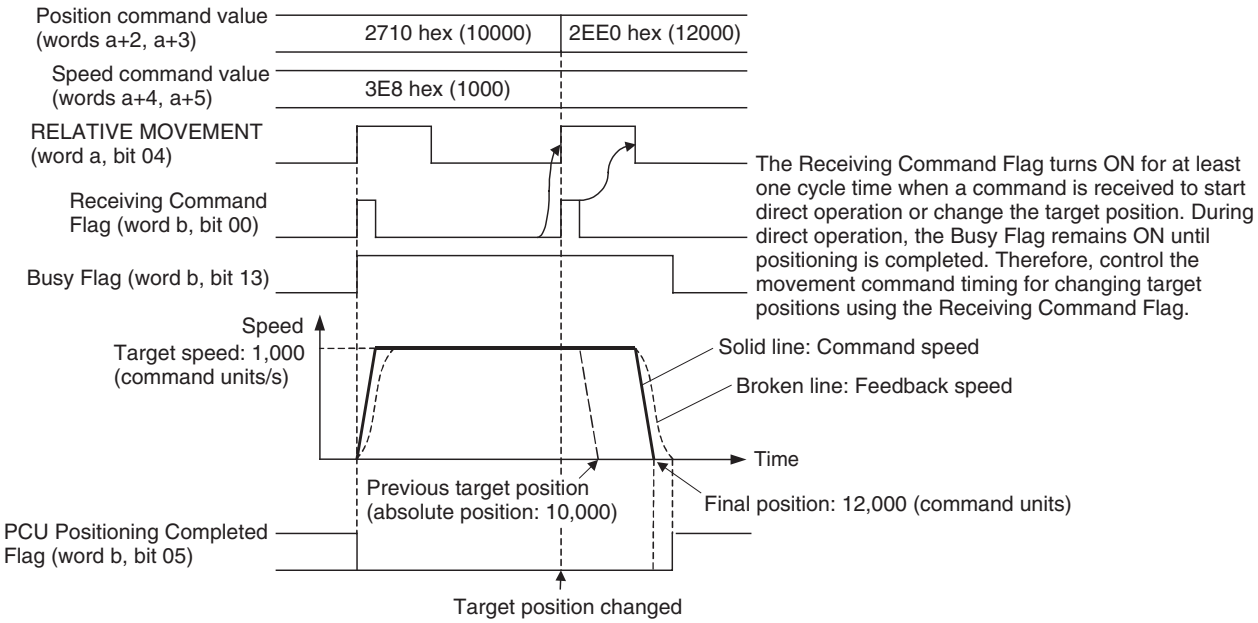


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## 9-4-3 Changing Target Position

during direct operation, the target position for the positioning operation can be changed by setting a new position command value in the Axis Operating Output Memory Area and executing ABSOLUTE MOVEMENT or RELATIVE MOVEMENT again.

The Busy Flag remains ON during direct operation until the positioning operation is completed. The Receiving Command Flag in the Axis Operating Input Memory Area is used to control the ON/OFF timing of the ABSOLUTE/RELATIVE MOVEMENT Bit to change the target position. The target position can be changed when the Receiving Command Flag is OFF. When executing the target position change, make sure that the ABSOLUTE/RELATIVE MOVEMENT Bit remains ON until the Receiving Command Flag turns ON.




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

**Note**

(1) When executing movement commands sequentially, make sure that the movement command bit remains OFF for a minimum of either the PLC cycle time × 2 or the MECHATROLINK communications cycle × 2, whichever is longer. If the time when the movement command bit is OFF is too short, the PCU will not be able to detect the rising edge of the movement command bit, preventing reception of the command.

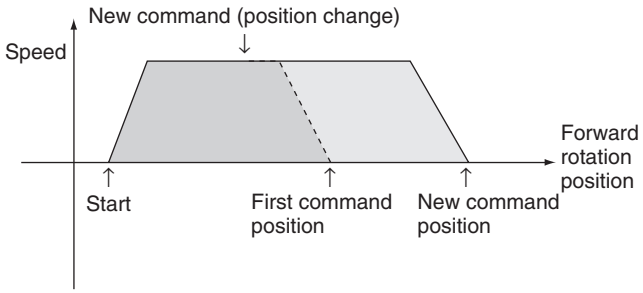
(2) When executing the movement command again during axis operation to change the target position, do not change the acceleration/deceleration curve designation from the original setting when operation was started. Changing the acceleration/deceleration curve designation when changing the target position during axis operation may result in displaced positioning or other malfunction.



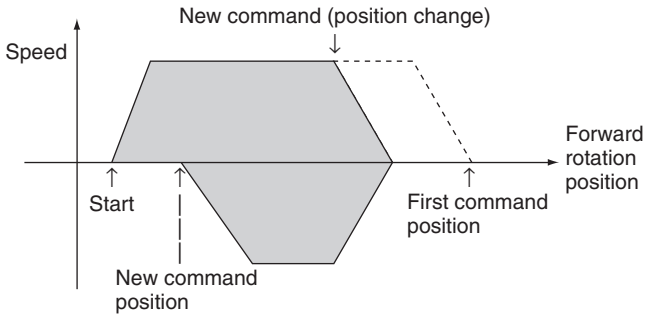
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## Operation Pattern when Changing the Target Position

**Without Reversal Operation**

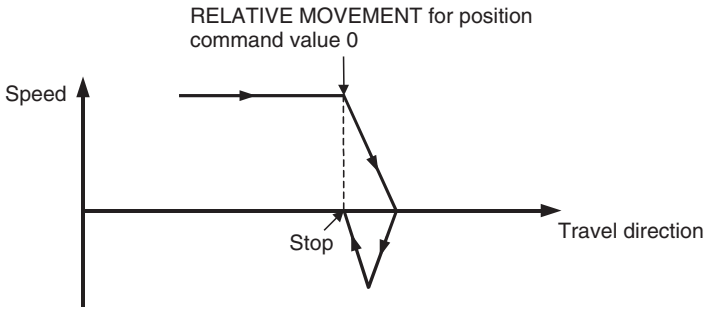



**With Reversal Operation**




**Executing Change to Target Position for Small Travel Distance**

If the target position is changed using RELATIVE MOVEMENT executed for a zero or minute travel distance or ABSOLUTE MOVEMENT executed to a position near the present position, positioning will be performed to the target position after decelerating to a stop and reversing direction.

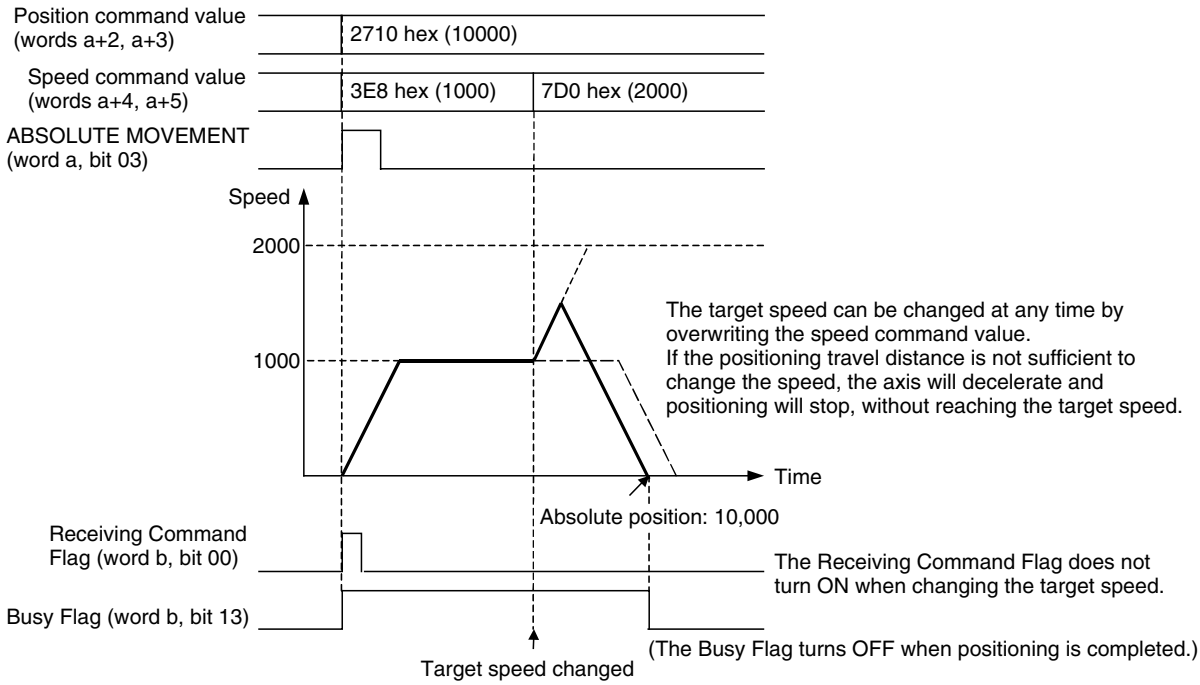




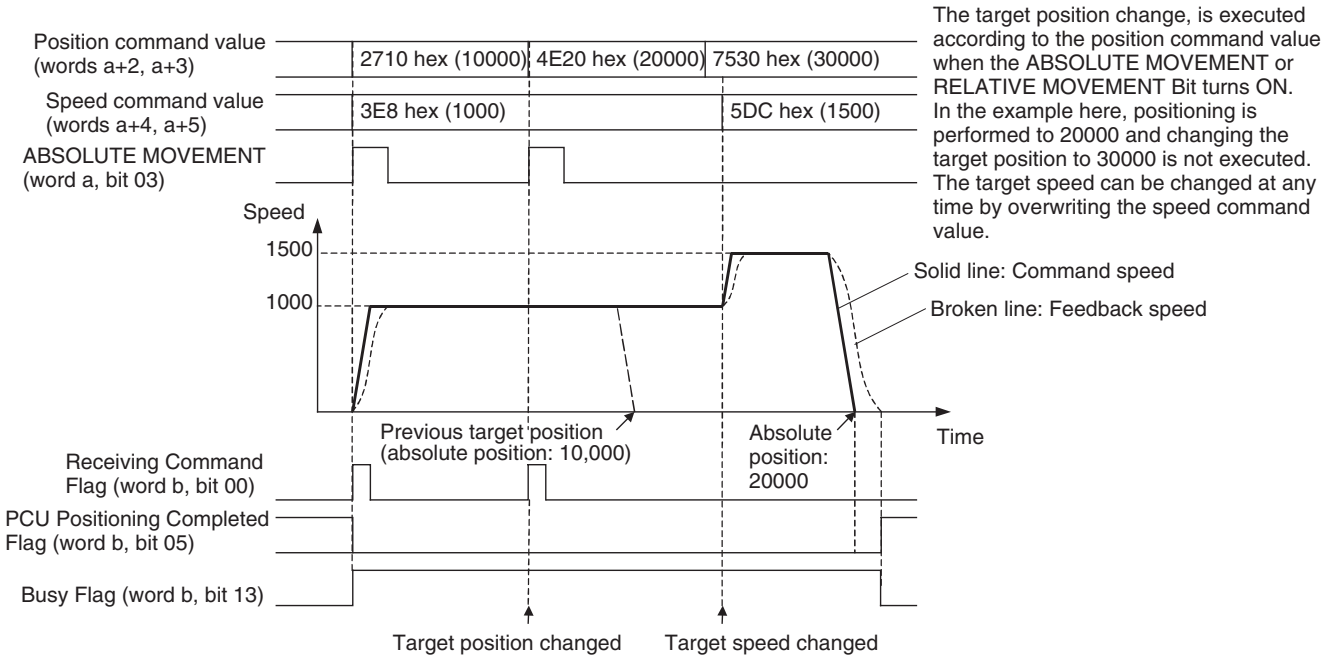

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## 9-4-4 Changing Target Speed

during direct operation, by setting a new speed command value in the Axis Operating Output Memory Area, the target speed for the positioning operation can be changed. The speed command value is enabled at the I/O refresh after it is set in the Axis Operating Memory Area. The PCU starts changing to the new target speed at the acceleration/deceleration set in the Servo Parameters when the new speed command value is enabled.




### Timing Chart for Changing Target Position and Target Speed





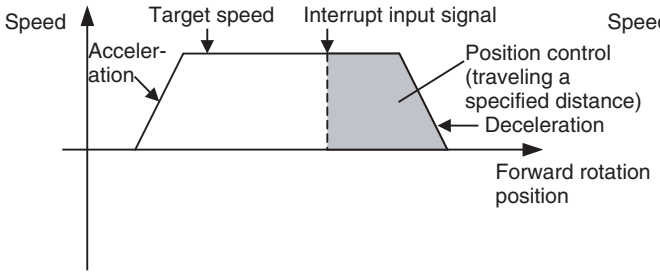

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# 9-5 Interrupt Feeding

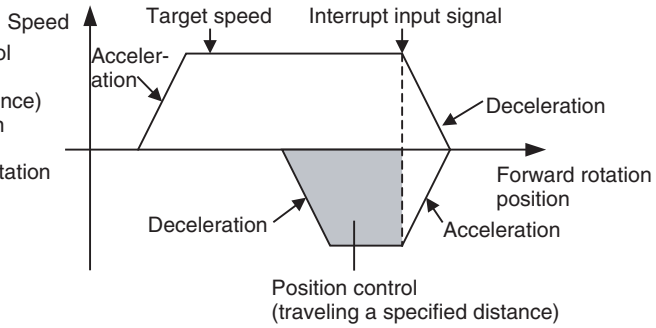
## 9-5-1 Overview

The PCU's interrupt feeding is a positioning operation that moves the axis for a specified amount, separate from the position command value, from the position at which the external interrupt signal was input either in the same direction as the direction of travel or in the opposite direction. The specified amount of travel is performed at the speed being used when the external interrupt signal was input.

**Moving for a Specified Distance in the Direction of Travel**




**Moving for a Specified Distance in Opposite Direction**




When an interrupt input signal is not input, positioning is performed to the target position specified in the position command value, as normal.

## 9-5-2 Interrupt Feeding Procedure

The interrupt feeding function is a supplementary function for positioning operations using direct operation (ABSOLUTE MOVEMENT, RELATIVE MOVEMENT). Interrupt feeding can be executed using the same procedure as for direct operation by simply specifying interrupt feeding at the start of direct operation.

The following procedure omits the steps up to SERVO LOCK, showing the start procedure only.

***1,2,3...***

1. Transfer the Servo Parameters for interrupt feeding.
   To set parameters permanently, execute SAVE SERVO PARAMETER (writes to the non-volatile memory).
2. Set the data used for direct operation.
   Set the positioning data for direct operation in the position command value of the Axis Operating Output Memory Area.
   Set the speed data for direct operation in the speed command value of the Axis Operating Output Memory Area.
3. Turn ON the INTERRUPT FEEDING Bit.
4. Start ABSOLUTE MOVEMENT or RELATIVE MOVEMENT.



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## 9-5-3 Data Settings for Using Interrupt Feeding

To execute interrupt feeding, the following parameters and data must be set in addition to the parameters and data required for direct operation.

**Axis Parameter Area**

**Interrupt Input Signal Parameters**

| PCU's address | Contents | | Setting |
|---|---|---|---|
| | Bits 08 to 15 | Bits 00 to 07 | |
| d | Origin input signal selection | Interrupt input signal selection | Interrupt input signal selection<br>00: Phase Z<br>01: External latch signal 1 input<br>02: External latch signal 2 input<br>03: External latch signal 3 input |

d = 1860 hex + (Axis No. −1) × 14 hex

When using external latch signals 1 to 3, the external latch signal to be used must be allocated in the Servo Driver's external input allocations.

When using a SMARTSTEP Junior Servo Driver, only 00 (phase Z) and 01 (external latch signal 1) can be used for the origin input signal selection.

**Servo Parameter Area**

**Interrupt Feeding Parameters**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn814 | Final travel distance for external positioning | Command unit | −1,073,741,823 to 1,073,741,823 | 4 | 100 |

Set the travel distance from the position at which the interrupt input signal is input. The travel direction for when the interrupt input signal is input is determined by the sign (positive or negative) in the set value. The operation performed when the interrupt input signal is input depends on the sign for this parameter and the sign of the position command value for direct operation, as follows:

| Position command value for direct operation | Servo Parameter Pn814 (Final travel distance for external positioning) | |
|---|---|---|
| | Positive value | Negative value |
| **Positive value** | When the interrupt input signal is input, interrupt feeding is executed in the same direction as the travel direction when movement was started. | When the interrupt input signal is input, interrupt feeding is executed in the opposite direction from the travel direction when movement was started.<br>(Reversal mode operation) |
| **Negative value** | When the interrupt input signal is input, interrupt feeding is executed in the opposite direction from the travel direction when movement was started.<br>(Reversal mode operation) | When the interrupt input signal is input, interrupt feeding is executed in the same direction as the travel direction when movement was started. |

**Note** When using a Position Control Unit with unit version 2.0 or later, Pn814 is used for internal processing in the Position Control Unit for either of the following origin search operation patterns.

- When the origin detection method is set to any value except for 0 (Origin proximity input signal reversal)
- When setting a zero point position offset for an origin search using an absolute encoder



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Pn814 is automatically overwritten by the Position Control Unit when the origin search operation is started. If interrupt feeding is used after the origin search, Pn814 must be reset.

**Axis Operating Output Memory Areas (Operating Commands)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| INTERRUPT FEEDING | a | 05 | 1: Enables interrupt feeding |

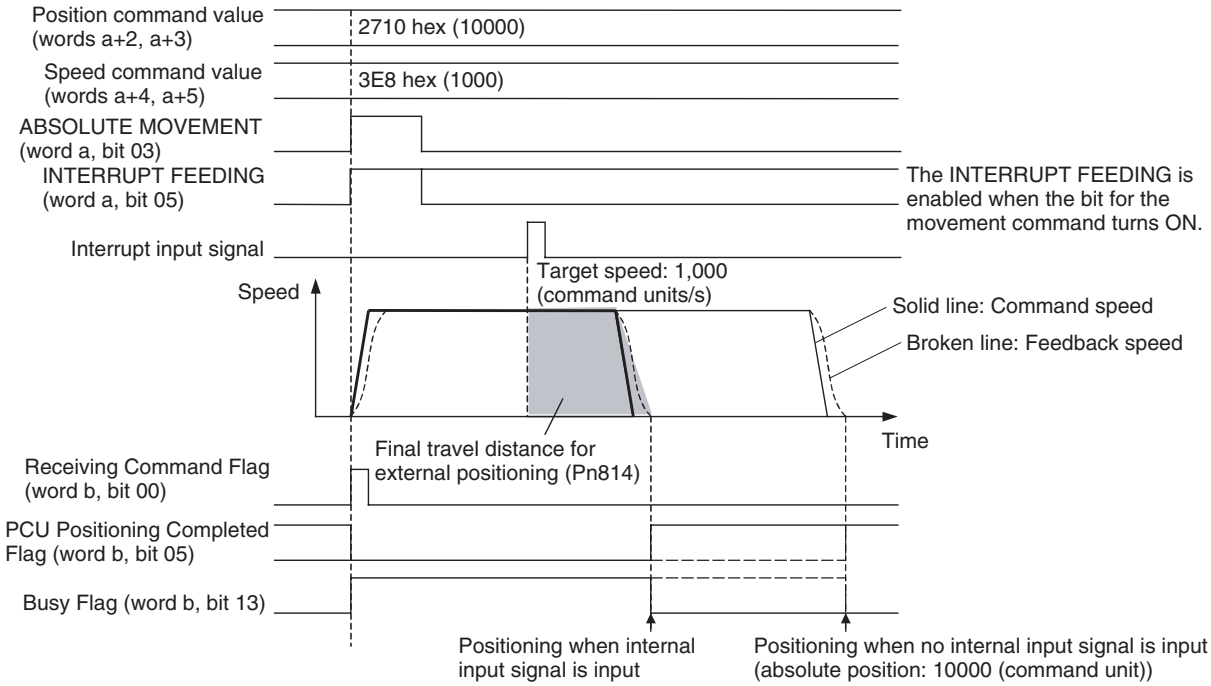
a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

## 9-5-4 Timing Chart for Interrupt Feeding

Interrupt feeding is executed by turning ON the INTERRUPT FEEDING Bit in the Axis Operating Output Area and starting direct operation.

**Timing Chart for Interrupt Feeding Using ABSOLUTE MOVEMENT**

The following timing chart is for when INTERRUPT FEEDING is executed with ABSOLUTE MOVEMENT. The timing chart for RELATIVE MOVEMENT is the same, except that positioning is executed with the relative position if no interrupt input signal is input.




In interrupt feeding as well as normal direct operations, the target position (target position for when no interrupt input signal is input), target speed, and override value can be changed by executing another movement command. Note that, however, in the interval of positioning for the final travel distance for external positioning after the input of the interrupt input signal, another INTERRUPT FEEDING cannot be executed (it will be ignored).



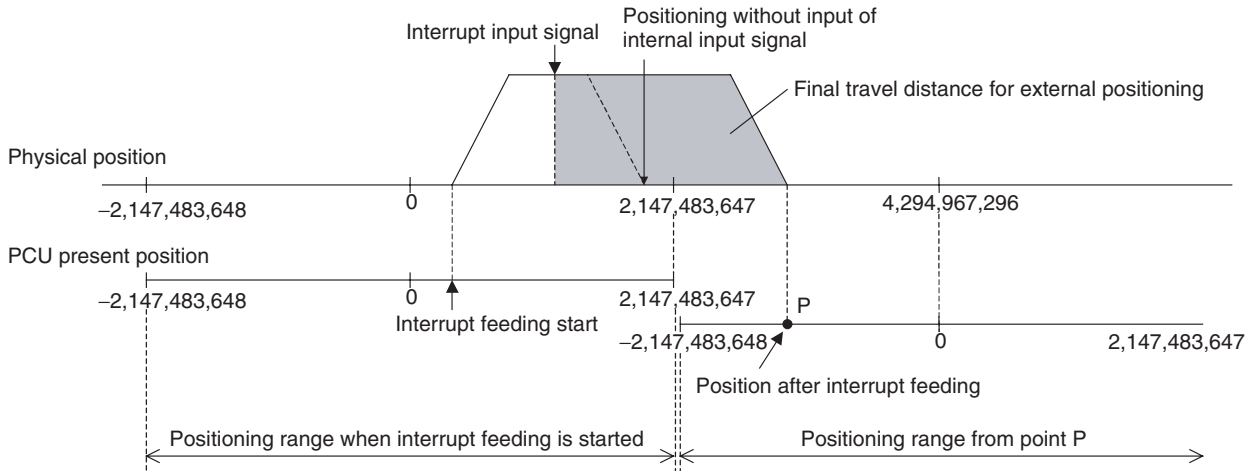
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## 9-5-5 Present Position during Interrupt Feeding

The positioning range for direct operation (ABSOLUTE MOVEMENT and RELATIVE MOVEMENT) is a command present position range of –2,147,483,648 to 2,147,483,647 (command units) when it is not limited by limit input signals or software limits. (For details on the command present position, refer to *7-3 Coordinate System and Present Position*. For details on RELATIVE MOVEMENT, refer to *Executing RELATIVE MOVEMENT* in *9-4-1 Starting Direct Operation*.)

When INTERRUPT FEEDING is executed, the positioning range and position command value setting range are the same, but the positioning range is subject to the following conditions when interrupt input signals are input near the upper limit/lower limit of the positioning range.

When the interrupt feeding operation after interrupt input exceeds the upper or lower limit of the positioning range due to the *Final Travel Distance for External Positioning* setting and the input position of the interrupt input signal, the current position reference point (i.e., the origin) and the positioning range change and positioning to the original position is no longer possible.




When interrupt feeding is used, set the limit inputs, software limits, and other required settings, and make sure that the positioning range is not exceeded due to the interrupt feeding operation.

# 9-6 Torque Limit Function

When using a W-series Servo Driver, set Servo Parameters *Forward Rotation External Current Limit* (Pn404) and *Reverse Rotation External Current Limit* (Pn405), and turn ON the Forward Rotation External Current Limit Designation Bit and Reverse Rotation External Current Limit Designation Bit in the Axis Operating Output Memory Area when starting a direct operation to apply a current (torque) limit during direct operation. The Current Limit Designation Bit can also be turned ON during direct operation started without turning ON the Current Limit Designation Bits. If another direct operation command is executed at this point, the torque limit function can be switched during operation.

For further details on the torque limit function, refer to *10-4 Torque Limits*.

The SMARTSTEP Junior Servo Drivers do not support torque control.



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# 9-7 Linear Interpolation

With unit version 1.1 or later of the Position Control Unit, a linear interpolation function that can perform linear interpolation using multiple axes in combination has been added.

Linear interpolation can be executed for the axes of a Servo Driver connected to the Position Control Unit, using up to four axes in any combination for axes 1 to 4 or axes 5 to 8.

**Note** Do not write data to the CJ1W-NCF71 unit version 1.1 or later that has been backed up from the CJ1W-NCF71 unit version 1.0 to a Memory Card in the CPU Unit (using either the CPU Unit's simple backup function or the Position Control Unit's backup function). When unit version 1.0 backup data is restored to unit version 1.1 or later, the linear interpolation function cannot be used. To transfer unit version 1.0 settings to unit version 1.1 or later, use the parameter transfer function using the READ DATA, WRITE DATA, or SAVE DATA Bit in the Common Operating Memory Area.

## 9-7-1 Overview of Linear Interpolation Function

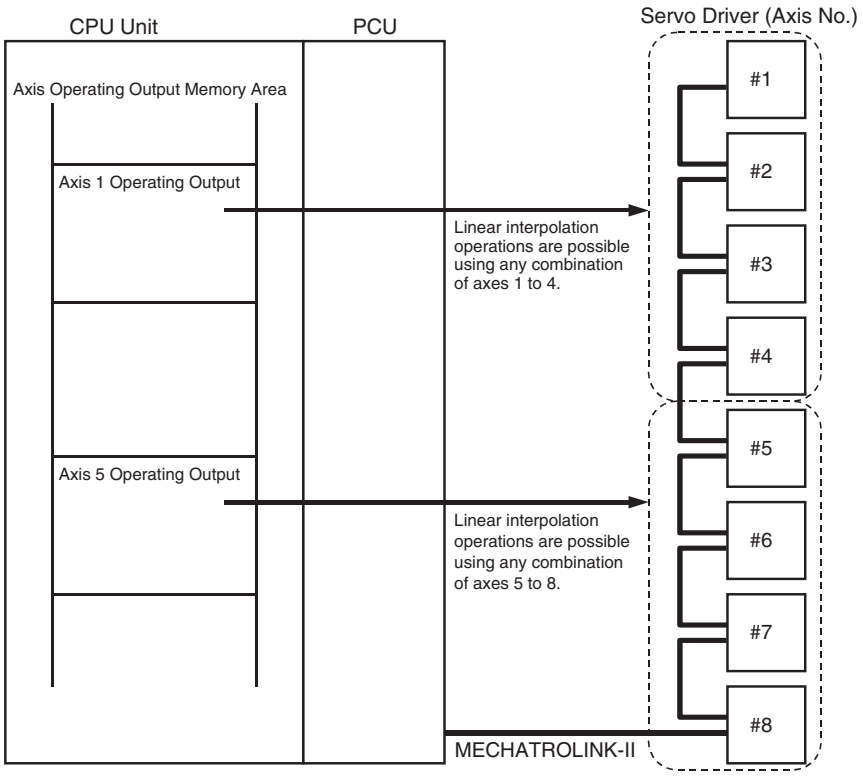
Linear interpolation operates according to the following settings data for axes 1 to 4 or axes 5 to 8.

- Designation of axes to combine for linear interpolation (Interpolation axis designation)
- Position command values for individual interpolation axes
- Designation of absolute and relative positions for position command values for individual interpolation axes (interpolation position designation)
- Interpolation speed command values and speed command values for individual interpolation axes
- Interpolation acceleration and deceleration times

Based on these commands, the respective linear interpolation operations are started by the LINEAR INTERPOLATION START Bit allocated in the Axis Operating Output Memory Area (axis 1 for interpolation operations using axes 1 to 4, and axis 5 for interpolation operations using axes 5 to 8).



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The speeds for individual axes in linear interpolation are determined by the following equations. (The same equations are used for 2-axis or 3-axis linear interpolation.)

**Example: Linear Interpolation for 4-axis (Axis 1 to Axis 4) Operation**

Axis 1 speed = Interpolation speed × Movement of Axis 1 / Total movement

Axis 2 speed = Interpolation speed × Movement of Axis 2 / Total movement

Axis 3 speed = Interpolation speed × Movement of Axis 3 / Total movement

Axis 4 speed = Interpolation speed × Movement of Axis 4 / Total movement

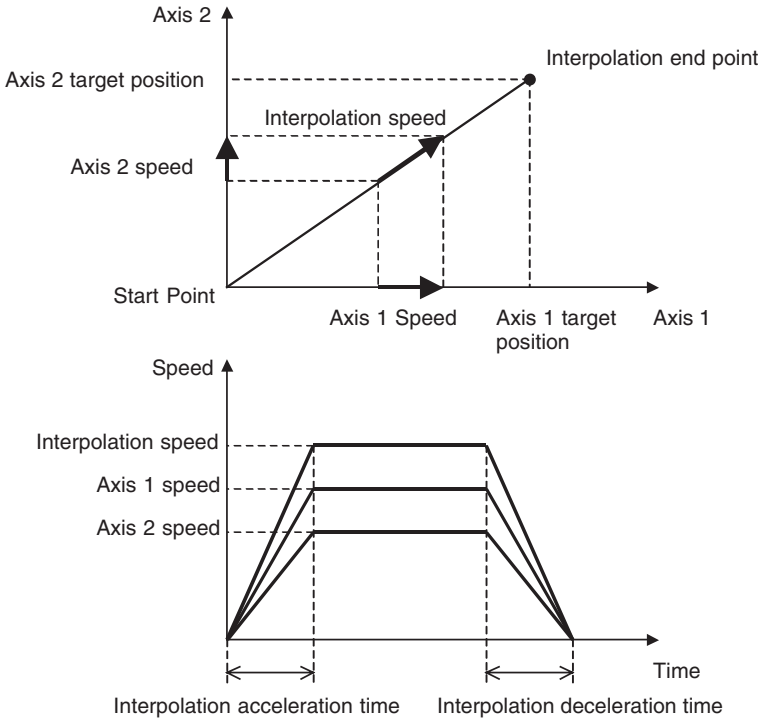
$$\text{Total movement} = \sqrt{(\text{Movement of Axis 1})^2 + (\text{Movement of Axis 2})^2 + (\text{Movement of Axis 3})^2 + (\text{Movement of Axis 4})^2}$$

If speeds set using speed command values for individual interpolation axes are exceeded when interpolation speed command values are resolved into individual axis speeds by the above equations, those speeds are automatically lowered so that each axis involved in linear interpolation is moved at the set speed command value.



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**Example: Linear Interpolation for 2-axis (Axis 1 and Axis 2) Operation**




**Note**

(1) The interpolation speed, axis 1 speed, and axis 2 speed are the maximum speeds for executing linear interpolation operations without exceeding their respective speed command values.

(2) The second-step linear acceleration constant (Pn80B) and second-step linear deceleration constant (Pn80E) in the Axis Servo Parameters are used for axis acceleration/deceleration operations for the set interpolation acceleration and deceleration times for linear interpolation in Position Control Unit. The setting unit for the second-step linear acceleration constant (Pn80B) and second-step linear deceleration constant (Pn80E) is 10,000 command units/$s^2$. In operation, the actual acceleration and deceleration times are thus affected by the precision of the command unit.

## 9-7-2 Linear Interpolation Operation Procedure

Just as with direct operation (absolute and relative movement commands), linear interpolation is executed by setting operation commands in the Axis Operating Output Memory Area.

Common commands for linear interpolation operations, such as designation of interpolation axis combinations, interpolation speeds, and interpolation acceleration and deceleration times, are set in the Axis Operating Output Memory Area for axis 1 or axis 5, and position and speed command values for individual linear interpolation axes are set in the Axis Operating Output Memory Area for those particular axes. Then linear interpolation operations are started by using the LINEAR INTERPOLATION SETTING and LINEAR INTERPOLATION START Bits.

The following procedure describes the steps related to starting linear interpolation operations, from servolock onwards.



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***1,2,3...***

1. Set the data for linear interpolation operation.
   Set the axis combination designation, the absolute and relative positioning designation for individual interpolation axes, the interpolation acceleration and deceleration times, and the interpolation speed command value in the Axis Operating Output Memory Area for axis 1 (when using any combination of axes 1 to 4 for linear interpolation) or axis 5 (when using any combination of axes 5 to 8 for linear interpolation).
   ↓
2. Set the data for individual axis interpolation operations.
   In the Axis Operating Output Memory Area, for each axis specified for interpolation, set the position data in the position command value and the speed data in the speed command value.
   ↓
3. Set linear interpolation.
   Turn ON the LINEAR INTERPOLATION SETTING Bit in the Axis Operating Output Memory Area for axis 1 (or axis 5).
   ↓
4. Start linear interpolation operation.
   Turn ON the LINEAR INTERPOLATION START Bit in the Axis Operating Output Memory Area for axis 1 (or axis 5).

**Note**

(1) When the linear interpolation function is used, set the communications cycle (PCU address 1856 hex: bits 07 to 00) in the MECHATROLINK communications settings in the CPU's Common Parameter Area to a value at least one greater than the normal minimum value. If the communications cycle is set too low, the command response times for PCU functions may become too long.

(2) From the point where linear interpolation is first set until axis operation is finished (i.e., while the LINEAR INTERPOLATION SETTING Bit is ON or until the Linear Interpolation Executing Flag turns OFF), command response times for the other axes not involved in the linear interpolation are delayed by up to four communications cycles per combination of axes executing linear interpolation.

## 9-7-3 Setting Data for Linear Interpolation Operation

PCU linear interpolation operations can be executed simultaneously for two combinations of axes, from axes 1 to 4 and axes 5 to 8. For a combination of axes 1 to 4, set the following linear interpolation-related data in the Axis 1 Operating Output Memory Area, and for a combination of axes 5 to 8 set the data in the Axis 5 Operating Output Memory Area.

- Interpolation acceleration and deceleration times
- Interpolation axis designation
- Interpolation position designation
- Interpolation speed command value

Also, in the Axis Operating Output Memory Area for each axis, make the following settings related to individual axes specified for linear interpolation.

- Position command value (Command value absolute and relative positions are handled according to the interpolation position designation.)
- Speed command value (Functions as the maximum speed designation for individual interpolation axes, with respect to the interpolation speed command value.)

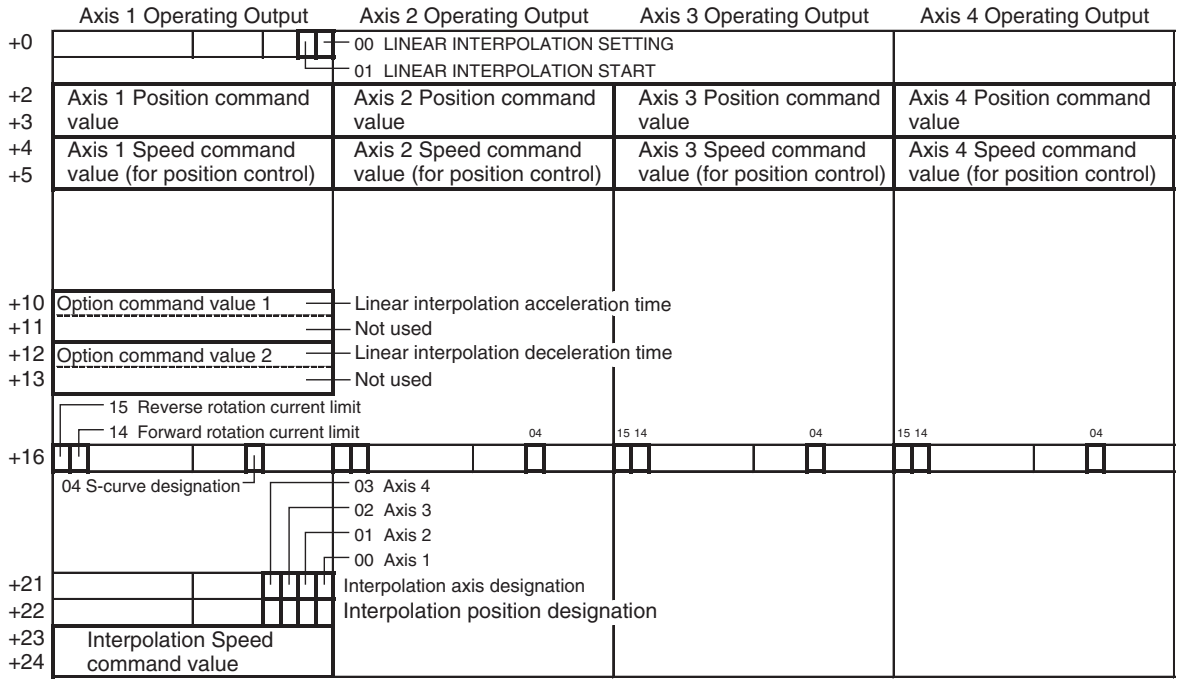


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Once the above settings have been made, then execute linear interpolation operations by using the following two bits allocated in the Axis Operating Output Memory Area for axis 1 or axis 5.

- LINEAR INTERPOLATION SETTING
- LINEAR INTERPOLATION START

**Example: Linear Interpolation for 4-axis (Axis 1 to Axis 4) Operation**




**Note**

(1) When executing interpolation operations using a combination of axes 5 to 8, the interpolation axis designation and interpolation position designation are made for axes 5 to 8 respectively in the Axis 5 Operating Output Memory Area, in bits 04 to 07 in the corresponding words in the above diagram.

(2) Set the acceleration/deceleration curve designation (the S-curve designation) and the forward/reverse torque designation for each designated interpolation axis.

**Common Parameter Area** **MECHATROLINK Communications Settings**

| PCU's address | Contents | | Setting |
|---|---|---|---|
| | Bits 08 to 15 | Bits 00 to 07 | |
| 1856 hex | Transfer cycle | Communications cycle | Set the communications cycle to a value one greater than the minimum communications cycle value determined by the number of connected devices. (Refer to *6-2-3 MECHATROLINK Communications Settings*.) |

**Servo Parameter Area** **Acceleration/Deceleration Constants**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| Acceleration/deceleration constants | Pn80C | Acceleration constant switching speed | 100 command units/s | Must be set to 0. | 2 | 0 |
| | Pn80F | Deceleration constant switching speed | 100 command units/s | Must be set to 0. | 2 | 0 |



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**Note** When executing linear interpolation operations, the Acceleration Constant Switching Speed (Pn80C) and the Deceleration Constant Switching Speed (Pn80F) in the Servo Parameter Area must each be set to 0. Linear interpolation operations cannot be properly executed if any number other than 0 is set. Linear interpolation operations can be executed for this PCU only with a 1-step acceleration/deceleration curve.

**Axis Operating Output Memory Areas (Operating Commands)**

**Settings for Linear Interpolation Operations: Axis 1, Axis 5 Operating Output Memory Areas**

| Name | Word | Bits | Contents |
|---|---|---|---|
| LINEAR INTERPOLATION SETTING | a | 00 | 0 → 1: Starts linear interpolation setting<br>1: LINEAR INTERPOLATION START valid. |
| LINEAR INTERPOLATION START | | 01 | 0 → 1: Starts linear interpolation movement<br>(Valid only when LINEAR INTERPOLATION SETTING = 1) |
| Option Command Value 1 | a+10 | --- | Linear interpolation acceleration time<br>Unit: ms<br>Command range: 0 to 65535 (0000 hex to FFFF hex) |
| | a+11 | --- | Not used (Set value disabled.) |
| Option Command Value 2 | a+12 | --- | Linear interpolation deceleration time<br>Unit: ms<br>Command range: 0 to 65535 (0000 hex to FFFF hex) |
| | a+13 | --- | Not used. (Set value disabled.) |
| Interpolation Axis Designation | a+21 | 00 to 03 (Axis 1 to Axis 4)<br><br>04 to 07 (Axis 5 to Axis 8) | 0: Not designated as interpolation axis.<br>1: Designated as interpolation axis.<br>Designates axes for executing linear interpolation.<br>Combinations of axes 1 to 4 are designated in bits 00 to 03 (Axis 1 Operating Output Memory Area), and combinations of axes 5 to 8 are designated in bits 04 to 07 (Axis 5 Operating Output Memory Area).<br>Bits 00 to 03, and bits 04 to 07, correspond respectively to axes 1 to 4 and axes 5 to 8. |
| Interpolation Position Designation | a+22 | 00 to 03 (Axis 1 to Axis 4)<br><br>04 to 07 (Axis 5 to Axis 8) | 0: Execute interpolation operations using absolute position.<br>1: Execute interpolation operations using relative position.<br>Specifies, for axes designated by the interpolation axis designation, whether positioning in interpolation operations is to be executed using absolute or relative positions.<br>Positions for axes 1 to 4 are designated in bits 00 to 03 (Axis 1 Operating Output Memory Area), and positions for axes 5 to 8 are designated in bits 04 to 07 (Axis 5 Operating Output Memory Area). These bits correspond respectively to axes 1 to 4 and axes 5 to 8. |
| Interpolation Speed Command Value | a+23<br>a+24 | --- | Speed command value (rightmost word)<br>Speed command value (leftmost word)<br>Unit: Command units/s<br>Command range: 0 to 2,147,483,647 (00000000 hex to 7FFFFFFF hex)<br>For details on speeds for interpolation operations, refer to *Linear Interpolation Operation Speeds* on page 308. |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25



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**Settings for Interpolation Axis Operations: Axis Operating Output Memory Areas for Axes Designated by Interpolation Axis Designation**

| Name | | Word | Bits | Contents | W Series | SMARTSTEP Junior |
|---|---|---|---|---|---|---|
| Position Command Value | | a+2<br>a+3 | --- | Position command value (rightmost word)<br>Position command value (leftmost word)<br>Unit: Command unit<br>Command range: –2,147,483,648 to 2,147,483,647 (80000000 hex to 7FFFFFFF hex)<br>The command value is limited by the allowable positioning range.<br>(For details, refer to *9-4-1 Starting Direct Operation*.) | Supported | Supported |
| Speed Command Value (for Position Control) | | a+4<br>a+5 | --- | Speed command value (rightmost word)<br>Speed command value (leftmost word)<br>Unit: Command units/s<br>Command range: 0 to 2,147,483,647 (00000000 hex to 7FFFFFFF hex)<br>For details on speeds for interpolation operations, refer to *Linear Interpolation Operation Speeds* on page 308. | Supported | Supported |
| Acceleration/deceleration curve designation | Exponential curve designation | a+16 | 03 | 1: Use exponential acceleration/deceleration curve. | Supported | Not supported |
| | S-curve designation | | 04 | 1: Use S-curve acceleration/deceleration curve. | Supported | Not supported |
| Forward rotation current limit | | | 14 | 1: Use forward torque limit. | Supported | Not supported |
| Reverse rotation current limit | | | 15 | 1: Use reverse torque limit. | Supported | Not supported |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. –1) × 25

The SMARTSTEP Junior Servo Drivers do not support acceleration/deceleration filters and torque limits. When using a SMARTSTEP Junior Servo Driver, do not attempt to use an acceleration/deceleration curve designation or forward/reverse torque limit designation.

**Note**

(1) For interpolation acceleration and deceleration time settings, the upper and lower limits for axis acceleration and deceleration speeds are restricted to a range of 1 to 65,535 [×10,000 command units/s$^2$]. If the acceleration or deceleration speeds calculated from the linear interpolation operation settings for an interpolation axis are extremely low or high, the linear interpolation following may not be correct.

(2) The interpolation acceleration/deceleration times are converted using the unit for the second-step linear acceleration constant (Pn80B) and second-step linear deceleration constant (Pn80E) (10,000 command units/s$^2$). In operation, the actual acceleration and deceleration times are thus affected by the precision of the command unit.

(3) When executing linear interpolation with an S-curve, set in advance the same movement average time (Pn812) for all designated linear interpolation axes, and designate S-curve interpolation for all the interpolation axes when starting linear interpolation operation. If different movement average times (Pn812) are set for interpolation axes, and the S-curve



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designation does not match, operation will not be possible using the linear interpolation following.

(4) With linear interpolation operations, an exponential curve cannot be designated. In the acceleration/deceleration curve designation, the designation of an exponential curve will be disabled.

**Axis Operating Input Memory Areas (Monitoring)**

**Linear Interpolation Operation Status: Axis 1, Axis 5 Operating Input Memory Areas**

| Name | Word | Bits | Contents |
|---|---|---|---|
| Linear Interpolation Setting Completed Flag | b+24 | 00 | 0: Linear interpolation setting command reception enabled.<br>0 to 1: Linear interpolation setting completed.<br>1: Linear interpolation setting completed (setting command reception disabled). |
| Linear Interpolation Executing Flag | | 13 | 1: Linear interpolation operation executing |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

**Interpolation Axis Operation Status: Axis Operating Input Memory Areas for Axes Designated by Interpolation Axis Designation**

| Name | Word | Bits | Contents |
|---|---|---|---|
| Receiving Command Flag | b | 00 | 0: Command reception enabled.<br>0 to 1: Command reception started.<br>1: Receiving command (command reception disabled). |
| PCU Positioning Completed Flag | | 05 | 0 to 1: Positioning is completed. |
| No Origin Flag | | 06 | 0: Origin established. 1: No origin established. |
| Error Flag | | 12 | 0: No axis error. 1: Axis error has occurred. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing) |
| Feedback Present Position | b+6<br>b+7 | --- | Present position:<br>Feedback present position (rightmost word)<br>Feedback present position (leftmost word) |
| Command Present Position | b+8<br>b+9 | --- | Present position:<br>Command position (rightmost word)<br>Command position (leftmost word) |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

When a linear interpolation operation command (LINEAR INTERPOLATION SETTING or LINEAR INTERPOLATION START) is executed, the linear interpolation operation status can be checked in the Axis Operating Input Memory Area of the axis (Axis 1 or Axis 5) for which the command was executed. The operation status of axes designated by linear interpolation designation can be checked in the Axis Operating Input Memory Areas for individual interpolation axes.

## 9-7-4 Linear Interpolation Operation

After the data related to linear interpolation has been set, linear interpolation operation is started by means of the following two operations.

### Executing LINEAR INTERPOLATION SETTING

Turn ON the LINEAR INTERPOLATION SETTING Bit in the Axis 1 (or Axis 5) Operating Output Memory Area.



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When this bit is turned ON, the settings for linear interpolation operation that have been set in the Axis Operating Output Memory Area for axis 1 (or axis 5) are obtained, along with the position command values and position speed values for individual interpolation axes, and preparations will be executed for linear interpolation operation. Execute LINEAR INTERPOLATION SETTING when the Linear Interpolation Setting Completed Flag in the Axis Operating Input Memory Area for axis 1 (or axis 5), and the Busy Flag and Error Flag for the axes designated by the interpolation axis designation, are reset. If the Linear Interpolation Setting Completed Flag for axis 1 (or axis 5) is set, or if an axis designated by the interpolation axis designation is busy (i.e., Busy Flag ON), or if an error has occurred (i.e., Error Flag ON), the LINEAR INTERPOLATION SETTING command will be ignored and will not be executed.

When LINEAR INTERPOLATION SETTING has been successfully completed, the Linear Interpolation Setting Completed Flag for axis 1 (or axis 5) will be set.

**Note**

(1) LINEAR INTERPOLATION SETTING is automatically written from the PCU to the Servo Parameters. When executing LINEAR INTERPOLATION SETTING, do not execute any of the Servo Parameter transfer operations (WRITE, READ, or SAVE).

(2) When LINEAR INTERPOLATION SETTING is executed, the second-step linear acceleration (Pn80B) and second-step linear deceleration (Pn80E) parameters in the Servo Parameters are changed. Be careful of changes to acceleration and deceleration speed settings if interpolation axes are operated independently (by direct operation, JOG, etc.) after LINEAR INTERPOLATION SETTING has been executed (regardless of whether LINEAR INTERPOLATION START has been executed). Change Pn80B and Pn80E as required, by means of WRITE SERVO PARAMETERS.

## Executing LINEAR INTERPOLATION START

Turn ON the LINEAR INTERPOLATION START Bit in the Axis 1 (or Axis 5) Operating Output Memory Area. Linear interpolation operation will start, based on the settings from when the LINEAR INTERPOLATION SETTING Bit was turned ON just before. If the LINEAR INTERPOLATION SETTING Bit is OFF, LINEAR INTERPOLATION START will be disabled.

Execute LINEAR INTERPOLATION START when the Linear Interpolation Executing Flag in the Axis Operating Input Memory Area for axis 1 (or axis 5), and the Busy Flag and Error Flag for the axes designated by the interpolation axis designation, are reset. If the Linear Interpolation Setting Executing for axis 1 (or axis 5) is set, or if an axis designated by the interpolation axis designation is busy (i.e., Busy Flag ON), or if an error has occurred (i.e., Error Flag ON), the LINEAR INTERPOLATION START command will be ignored and will not be executed.

**Note**

(1) From the time that the LINEAR INTERPOLATION SETTING Bit turns ON until the LINEAR INTERPOLATION START Bit turns ON, do not make changes to any data related to linear interpolation operations. In addition, do not make any changes to speed command values for individual axes while linear interpolation operations are in progress (i.e., while the Busy Flag for any interpolation axis is ON).

(2) For an axis designated as 0 (absolute position) by the interpolation position designation, the origin must be established. If the origin is not established (i.e., if the No Origin Flag is ON), a Present Position Unknown Error (axis error code: 3030) will occur when LINEAR INTERPOLATION START is executed (i.e., when linear interpolation operation is started),



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and the axis will not be operated. At that time, the other interpolation axes will also be decelerated to a stop.

**Example: Linear Interpolation Operation.**

The basic flow of operations for linear interpolation is shown below.

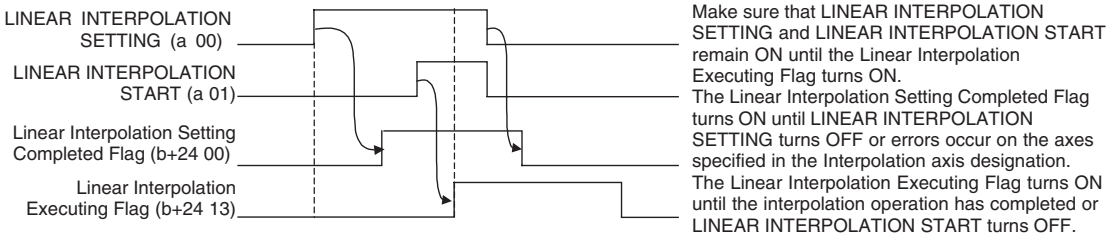
In this example, “a” indicates the beginning word of the Axis Operating Output Memory Area for axis 1 when a combination of axes 1 to 4 is used for linear interpolation, and axis 5 when a combination of axes 5 to 8 is used. Likewise, “b” indicates the beginning word of the Axis Operating Input Memory Area for axis 1 when a combination of axes 1 to 4 is used, and axis 5 when a combination of axes 5 to 8 is used.

***1,2,3...***

1. With the bits in the interpolation axis designation (word a+21), designate the axes to be combined for the linear interpolation operation.
2. With the bits in the interpolation position designation (word a+22), designate either absolute or relative position for the position command values for the axes designated as interpolation axes.
3. With the interpolation speed command value (words a+23, a+24), designate the interpolation speed (i.e., the integrated speed). With the speed command values for the axes designated as interpolation axes, designate the maximum speed for each axis.
   For details on the relation between linear interpolation operation speeds and interpolation speed command values and individual axis speed command values, refer to the *Linear Interpolation Operation Speeds* on page 308.
4. With option command value 1 (word a+10) and option command value 2 (word a+12), set the interpolation acceleration time and the interpolation deceleration time.
5. Turn ON the LINEAR INTERPOLATION SETTING Bit (word a, bit 00).
6. When the linear interpolation operation settings have been completed, the Linear Interpolation Setting Completed Flag (word b+24, bit 00) will turn ON.
7. After the above settings have been completed, turning ON the LINEAR INTERPOLATION START Bit (word a, bit 01) while the LINEAR INTERPOLATION SETTING Bit (word a, bit 00) is still ON will start positioning for the designated axes, to the position designated in the interpolation position designation.
   during the linear interpolation operation, the Linear Interpolation Executing Flag (word b+24, bit 13) will turn ON. When executing a linear interpolation operation, leave the LINEAR INTERPOLATION SETTING Bit and the LINEAR INTERPOLATION START Bit ON until the Linear Interpolation Executing Flag turns ON.

## Timing Charts

- When LINEAR INTERPOLATION START is Executed After Linear Interpolation Settings are Completed



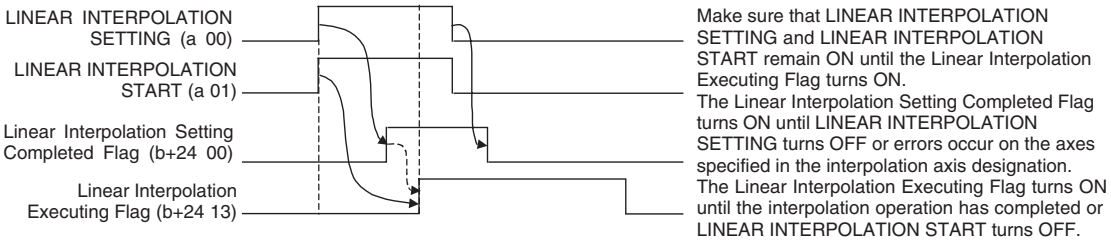

a = Beginning Word of Axis 1 (Axis 5) Operating Output Memory Areas
b = Beginning Word of Axis 1 (Axis 5) Operating Input Memory Areas



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If the LINEAR INTERPOLATION SETTING Bit turns OFF before LINEAR INTERPOLATION START is executed, LINEAR INTERPOLATION START is disabled.

- When LINEAR INTERPOLATION SETTING and LINEAR INTERPOLATION START are Executed Simultaneously




a = Beginning Word of Axis 1 (Axis 5) Operating Output Memory Areas
b = Beginning Word of Axis 1 (Axis 5) Operating Input Memory Areas

If the LINEAR INTERPOLATION SETTING and LINEAR INTERPOLATION START Bits are turned ON simultaneously, the linear interpolation operation is started after the linear interpolation settings are completed.

**Note**

(1) The same LINEAR INTERPOLATION START cannot be executed again with a new command while linear interpolation operation is in progress (i.e., while the Linear Interpolation Executing Flag is ON). If it is executed again, it is disabled. It is possible, however, to start an independent linear interpolation for a combination of axes 1 to 4, or of axes 5 to 8, while an operation involving the other combination is already in progress.

(2) While a linear interpolation operation is in progress, do not make changes to the speed command value for any axis involved in that operation (i.e., for any axis designated in the interpolation axis designation). If a speed command value is changed during operation, the operation will not be executed correctly.

If direct operation (absolute movement or relative movement) is executed for an axis designated in the interpolation axis designation while a linear interpolation operation is in progress, that axis will start operation separately from the linear interpolation operation. The acceleration and deceleration speeds at that time will follow the acceleration and deceleration speeds set by the execution of LINEAR INTERPOLATION SETTING (determined from the speed resolved with the interpolation acceleration and deceleration times). The Linear Interpolation Executing Flag will stay ON, however, until the operations of all the originally designated interpolation axes (including this axis) are completed, or until the LINEAR INTERPOLATION START Bit turns OFF.

If MECHATROLINK communications are interrupted while the Linear Interpolation Setting Completed Flag and the Linear Interpolation Executing Flag are ON, the flags will hold their status until MECHATROLINK communications are resumed, regardless of the status of the LINEAR INTERPOLATION SETTING and LINEAR INTERPOLATION START Bits.

## Linear Interpolation Operation Speeds

There are two types of settings related to linear interpolation operation speeds: interpolation speed command values and speed command values for individual axes designated by the interpolation axis designation.

The interpolation speed command value designates the integrated speed for linear interpolation. This command value is resolved for the individual interpolation axes and becomes the speed command value for each axis.



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The speed command values for individual axes at the time of linear interpolation operation, on the other hand, are the maximum speed settings for the individual axes. For all of the interpolation axes, the linear interpolation speed is lowered so that the speed resolved from the interpolation speed command value does not exceed this set value. (The axis with the longest movement time is operated at 100% of the speed command value, and the speeds for the other axes are lowered in order to perform the linear interpolation.)

**Example**

2-axis interpolation (axis 1 and axis 2), with target positions of 3,000 and 4,000 (command units) respectively, and with relative positioning designated and the following speed command values set:

Interpolation speed command value: 2,000 (command units/s)
Axis 1 speed command value: 600 (command units /s)
Axis 2 speed command value: 1,000 (command units /s)

The speeds resolved from the interpolation speed command value (in command units/s) are 1,200 for axis 1 and 1,600 for axis 2, but for linear interpolation operation the speeds are reduced to the following values in order for the maximum speeds set by the speed command values for individual axes to not be exceeded.

Interpolation speed command value: 1,000 (command units/s)
Axis 1 speed command value: 600 (command units/s)
Axis 2 speed command value: 800 (command units/s)

If a speed command value for an individual axis is set to 0, no maximum speed limit will set for that interpolation axis and the speed resolved from the interpolation speed command value will be used as is.

If the interpolation speed command value is set to 0, there is no interpolation speed designation and the interpolation speed is determined by the speed command values for the individual interpolation axes.

If either the interpolation speed command value or a speed command value for an individual interpolation axis is set to 0, the individual interpolation axes are operated at the same speed, at the minimum unit (1 command unit/s) for the speed command value.

If less than the minimum unit (1 command unit/s) for an individual axis speed command value results when the interpolation speed command value is resolved for individual interpolation axes, that axis will be operated at the minimum unit (1 command unit/s) for the speed command value.

**Note** Do not use an override during linear interpolation operation. The linear interpolation operation will not be executed correctly if an override is used.

## Stopping during Linear Interpolation

If a stop command, error, or Servo unlock command occurs for one of multiple axes for which linear interpolation is being performed, the operation of the axes will be as follows and the axes will not stop at the same time.

**Axis Error Occurs in One of the Interpolated Axes:**
The other interpolated axes will be decelerated to a stop when the Error Flag turns ON for the axis in which the error has occurred.

**Stop Command Given for One of the Interpolated Axes:**
The other interpolated axes will be decelerated to a stop when the Stop Execution Flag turns ON for the axis for which the stop command was given.

**Servo Unlock Command Given for One of the Interpolated Axes:**
The other interpolated axes will be decelerated to a stop when the Servo ON Flag turns OFF for the axis for which the servo unlock command was given.



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If a stop command is given for only one axis to stop a linear interpolation operations, the axes will not stop at the same time, as described above. To stop all of the interpolated axes at the same time, stop commands must be given for all interpolated axes at the same time.

If an alarm in the Servo Driver results in an axis error, the axis for which the error occurred will be stopped according to the stop method set in the Servo Driver, but the other interpolated axes will be decelerated to a stop. The distances required to stop will thus be different.



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# SECTION 10
# Other Operations

This section describes the following operations: servo lock/unlock, jogging, override, torque limits, speed control, torque control, backlash compensation, software limits, and stop functions.


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# 10-1 Servo Lock/Unlock

## 10-1-1 Overview

The Servo lock/unlock function either creates a Servo Driver position loop (SERVO LOCK) or releases the position loop (SERVO UNLOCK).

## 10-1-2 Servo Lock/Unlock Operation

The SERVO LOCK/UNLOCK operations start when the SERVO LOCK/UNLOCK Bit in the Axis Operating Output Memory Area turns ON.

When a Servomotor with absolute encoder is used, the absolute value data is read by executing SERVO LOCK. For details, refer to *8-6-6 Establishing Origin Using Absolute Encoder*.

**Axis Operating Output Memory Areas (Operating Commands)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| SERVO LOCK | a+1 | 00 | 0 → 1: Starts SERVO LOCK. |
| SERVO UNLOCK | | 01 | 0 → 1: Starts SERVO UNLOCK. |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Execute SERVO LOCK when the Busy Flag for the corresponding axis is OFF. If SERVO LOCK is executed while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and SERVO LOCK will not be executed. When executing SERVO LOCK, make sure that the SERVO LOCK Bit remains ON until the Receiving Command Flag or Busy Flag turns ON.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the SERVO LOCK command will be ignored. Be sure that all of these command bits are OFF before attempting to lock the Servo.

SERVO UNLOCK can be executed in any PCU status. When executing SERVO UNLOCK, make sure that the SERVO UNLOCK Bit remains ON until either the Receiving Command Flag turns ON, or the Busy Flag turns OFF after executing SERVO UNLOCK.

Other axis operation commands will be ignored while SERVO UNLOCK is being executed and while the SERVO UNLOCK Bit is ON.

**Note** When executing SERVO UNLOCK, the PCU executes DECELERATION STOP for the Servo Driver, followed immediately (without waiting for the axis to stop) by SERVO UNLOCK. If SERVO UNLOCK is executed during axis operation, the corresponding axis will be put in Servo free run state. Therefore, prevent the machine from moving due to momentum by using the dynamic brake or executing DECELERATION STOP before executing SERVO UNLOCK to stop axis operation. Movement of the machine due to momentum may result in damage to the machine or an accident. When executing SERVO UNLOCK during speed control or torque control, the Servo Driver will recover in the position control mode's Servo lock status the next time SERVO LOCK is executed.



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**Axis Operating Input Memory Areas (Monitoring)**

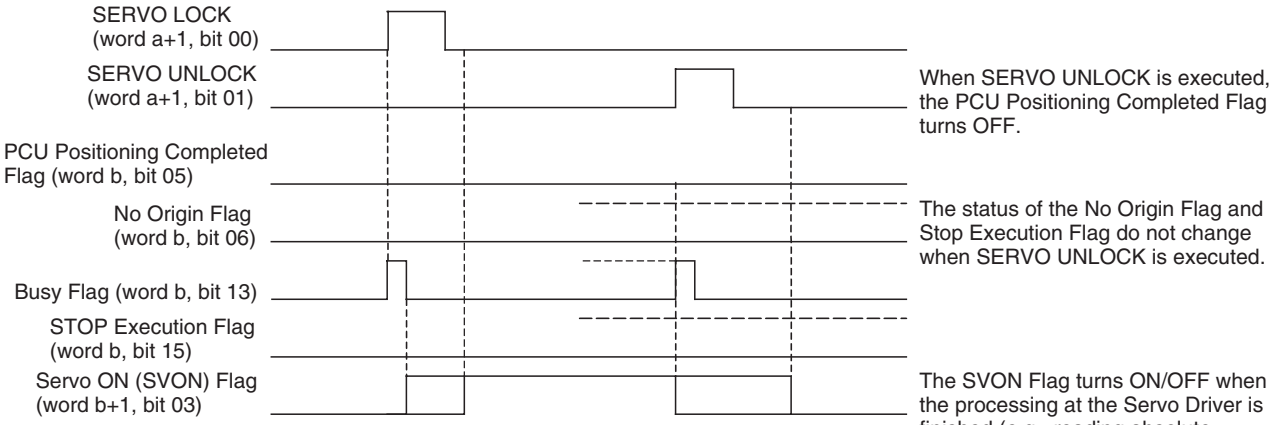
| Name | Word | Bits | Contents |
|---|---|---|---|
| Receiving Command Flag | b | 00 | 0: Command reception enabled.<br>0 → 1: Command reception started.<br>1: Receiving command (command reception disabled). |
| Error Flag | | 12 | 0: No axis error<br>1: Axis error has occurred. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing). |
| SVON (Servo ON) Flag | b+1 | 03 | 0: Servo unlocked.<br>1: Servo locked. |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. − 1) × 25

The Servo lock status of each axis can be confirmed by checking the SVON Flag in the Axis Operating Input Memory Areas.

## Timing Chart

The following timing chart is for when SERVO LOCK and SERVO UNLOCK are executed.




For details on the flag operations when using Servomotors with absolute encoders, refer to *8-6-6 Establishing Origin Using Absolute Encoder*.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

# 10-2 Jogging

## 10-2-1 Overview of Operation

The axis travels in the specified direction at the specified speed while the JOG Bit is ON, and decelerates to a stop when the JOG Bit turns OFF. Jogging operations can be executed even if the origin has not been established.

## 10-2-2 Procedure for Jogging Operations

The procedure for using jogging is as follows:

***1,2,3...***

1. Set the Common Parameters and save them.
2. Turn ON the PCU again or restart the Unit.
   The data for the Common Parameters set in step 1 above is enabled.
3. Start MECHATROLINK communications.



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4. Set the Servo Parameters and save them.
   Set the Servo Parameters required to execute direct operation.
   To set parameters permanently, execute SAVE SERVO PARAMETER (writes to the non-volatile memory).
   To enable changed offline parameters, turn ON the power to the Servo Driver again or execute DEVICE SETUP.
   For details, refer to *5-3 Transferring Servo Parameters*.
5. Execute SERVO LOCK.
6. Set the data used for the jogging operation.
   Set the jogging operation speed data in the speed command value of the Axis Operating Output Memory Area.
7. Start the jogging operation.

When using the PCU for the first time or to change the Common Parameter data, steps 1 and 2 must be performed. After executing SERVO LOCK, WRITE SERVO PARAMETER can be executed to set the acceleration/deceleration used each time the jogging operation is performed.

**Note** When specifying the Servo Parameters for acceleration/deceleration every time, make sure that the axis operation is stopped (Busy Flag = 0) while changing the acceleration/deceleration constants using WRITE SERVO PARAMETER. Do not change parameters during axis operation. Changing parameters while the axis is operating may result in displaced positioning or other malfunction.

## 10-2-3 PCU Data Settings for Jogging Operations

A simple explanation of the main parameters and data used to execute the jogging operation is provided here. To execute jogging operations, apart from the parameters explained here, the following parameters also need to be set as basic settings for operating the PCU.

- External I/O Signal Allocations
  Refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.
- Command Unit
  Refer to *7-2 Control Units*.
  The setting units for parameters and data depend on the specified command unit.



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**Servo Parameter Area** **Acceleration/Deceleration Constants**

| Type | Parameter No. | Parameter name | Unit | Setting range | Data length | Default setting | W Series | SMART STEP Junior |
|---|---|---|---|---|---|---|---|---|
| Acceleration/ deceleration constants | Pn80A | First-step linear acceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 | Supported | Not supported |
| | Pn80B | Second-step linear acceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 | Supported | Supported |
| | Pn80C | Acceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 | Supported | Not supported |
| | Pn80D | First-step linear deceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 | Supported | Not supported |
| | Pn80E | Second-step linear deceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 | Supported | Supported |
| | Pn80F | Deceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 | Supported | Not supported |
| Acceleration/ deceleration filters | Pn810 | Exponential acceleration/deceleration bias | Command units/s | 0 to 32767 | 2 | 0 | Supported | Not supported |
| | Pn811 | Exponential acceleration/deceleration time constant | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |
| | Pn812 | Movement average time | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |

First-step acceleration/deceleration curve operations require parameter settings for Pn80B and Pn80E only. For the acceleration/deceleration curve, Pn810 and Pn811 must be set when using an exponential curve, and Pn812 must be set when using an S-curve.

The SMARTSTEP Junior Servo Drivers do not support the following parameters: Pn80A, Pn80C, Pn80D, and Pn80F. They also do not support acceleration/deceleration filters, so the filters cannot be set. One-step linear acceleration/deceleration curves are set using only Pn80B and Pn80E.

For details on acceleration/deceleration curves, refer to *7-4 Acceleration and Deceleration Operations*.

**Axis Operating Output Memory Areas (Operating Commands)**

| Name | Word | Bits | Contents | W Series | SMART STEP Junior |
|---|---|---|---|---|---|
| JOG | a | 09 | 0 → 1: Starts jogging.<br>1 → 0: Stops jogging. | Supported | Supported |
| Direction designation | | 10 | 0: Forward rotation direction<br>1: Reverse rotation direction | Supported | Supported |



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| Name | | Word | Bits | Contents | W Series | SMART STEP Junior |
|---|---|---|---|---|---|---|
| Speed command value | | a+4<br>a+5 | --- | Speed command value (rightmost word)<br>Speed command value (leftmost word)<br>Unit: Command units/s<br>Command range: 0 to 2,147,483,647 (00000000 hex to 7FFFFFFF hex)<br>The upper limit setting of the speed command value depends on the specifications of the Servo Driver. | Supported | Supported |
| Acceleration/deceleration curve designation | Exponential curve designation | a+16 | 03 | 1: Use exponential acceleration/deceleration curve. | Supported | Not supported |
| | S-curve designation | | 04 | 1: Use S-curve acceleration/deceleration curve. | Supported | Not supported |
| Forward rotation current limit | | | 14 | 1: Use forward torque limit. | Supported | Not supported |
| Reverse rotation current limit | | | 15 | 1: Use reverse torque limit. | Supported | Not supported |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

The direction designation setting when the jogging operation starts (JOG Bit turns ON) is enabled. Even if the designation is changed during jogging, the direction will not change.

The settings for the Acceleration/Deceleration Curve Designation Bit, and Forward/Reverse Rotation Current Limit Designation Bit when jogging starts (JOG Bit turns ON) and stops (JOG Bit turns OFF) are enabled.

The speed command value can always be changed during operation. By overwriting the speed command value, the speed for the jogging operation can be changed.

The SMARTSTEP Junior Servo Drivers do not support acceleration/deceleration filters and torque limits. When using a SMARTSTEP Junior Servo Driver, do not attempt to use an acceleration/deceleration curve designation or forward/reverse torque limit designation.

**Note** Do not set both the exponential curve designation and S-curve designation to 1 (enabled) in the acceleration/deceleration curve designation. Enabling both settings may cause a malfunction.

### Axis Operating Input Memory Areas (Monitoring)

| Name | Word | Bits | Contents |
|---|---|---|---|
| Receiving Command Flag | b | 00 | 0: Command reception enabled.<br>0 → 1: Command reception started.<br>1: Receiving command (command reception disabled). |
| Error Flag | | 12 | 0: No axis error.<br>1: Axis error has occurred. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing). |
| Feedback present position | b+6<br>b+7 | --- | Present position<br>Feedback position (rightmost word)<br>Feedback position (leftmost word) |
| Command present position | b+8<br>b+9 | --- | Present position<br>Command position (rightmost word)<br>Command position (leftmost word) |



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b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

## 10-2-4 Starting Jogging

Jogging is performed according to the direction designation and speed command value set in the Axis Operating Output Memory Areas and started when the Jog Bit turns ON. Execute JOG when the Busy Flag for the corresponding axis is OFF. If the jogging operation is started while the axis's Busy Flag is ON, a Multistart Error (axis error code: 3050) will occur and JOG will not be executed.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the jog command will be ignored. Be sure that all of these command bits are OFF before attempting a jog operation.

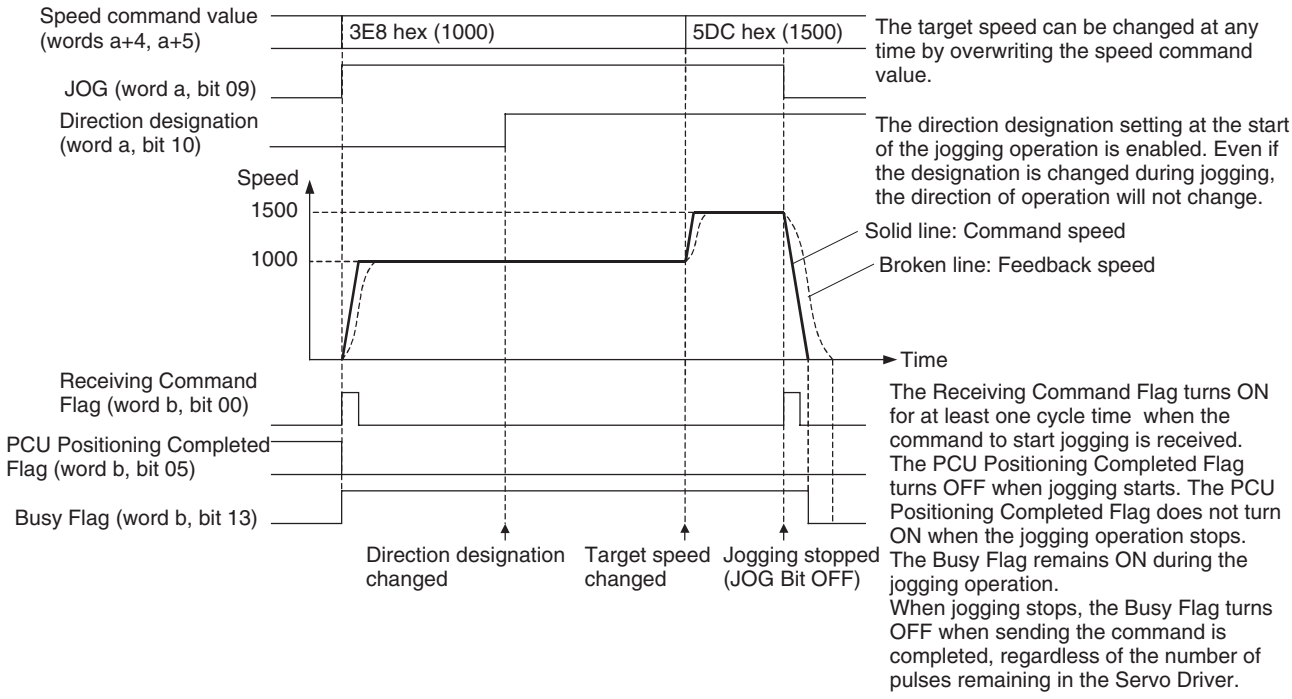
The jogging operation will continue while the Jog Bit is ON. To enable the PCU to receive the JOG command correctly, make sure that the Jog Bit remains ON while the Receiving Command Flag is ON.

The direction designation setting when the jogging operation starts (Jog Bit turns ON) is enabled. Even if the designation is changed during jogging, the direction will not change. Jogging decelerates to a stop when the Jog Bit turns OFF.

The Busy Flag remains ON during the jogging operation. The PCU Positioning Completed Flag does not turn ON when jogging stops.

### Timing Chart

The following timing chart is for when JOG is executed in the forward rotation direction.




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25



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# 10-3 Override

## 10-3-1 Overview

The override operation is used to change the speed of an active axis. While the Override Enable Bit is ON, the target speed is changed by applying the override value that is set in the Axis Operating Output Memory Area.

The override can be set from 0.01% to 327.67% in units of 0.01%. The speed command values (Speed command value for speed control in speed control mode) set for direct operation, origin return, jogging, and speed control operations are taken to be 100%.

The override function is disabled during origin search or torque control.

The target speed when override is enabled is as follows:

$$\text{Target speed} = \text{Speed command value} \times \frac{\text{Override}}{10000}$$

## 10-3-2 Override Operation

The override function can be used for the following operations.

- Enabling an Override for a Series of Operations

  Set the override beforehand, and execute each operating command with the Override Enable Bit turned ON. The target speed for the operation will be the initial speed command value multiplied by the override.

- Switching between Enabling and Disabling Override during Axis Operation

  When the Override Enable Bit is turned ON for an active axis performing direct operation, origin return, or jogging operation, the speed will change to the above target speed using the acceleration/deceleration set in the Servo Parameters for acceleration/deceleration (the acceleration/deceleration speed enabled for the present operation).

  When using speed control, the speed can be changed without using acceleration/deceleration by using the Override Enable Bit during axis operation, however, the linear acceleration/deceleration curve can be applied to the speed change by setting the *Soft Start Acceleration/Deceleration Time* in the Servo Parameters. (For details on the acceleration/deceleration curve, refer to *7-4 Acceleration and Deceleration Operations*. For details on speed control, refer to *10-5 Speed Control*.)

  If the Override Enable Bit is turned OFF, the speed is changed in the same way as when the Override Enable Bit was ON from the present target speed (speed command value multiplied by override value) to the speed set in the speed command value.

**Axis Operating Output Memory Areas (Operating Commands)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| Override Enable Bit | a | 14 | 0: Override disabled.<br>1: Override enabled. |
| Override | a+14 | --- | Override ratio<br>Unit: 0.01%<br>Command range: 1 to 32,767 (0001 hex to 7FFF hex) |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25



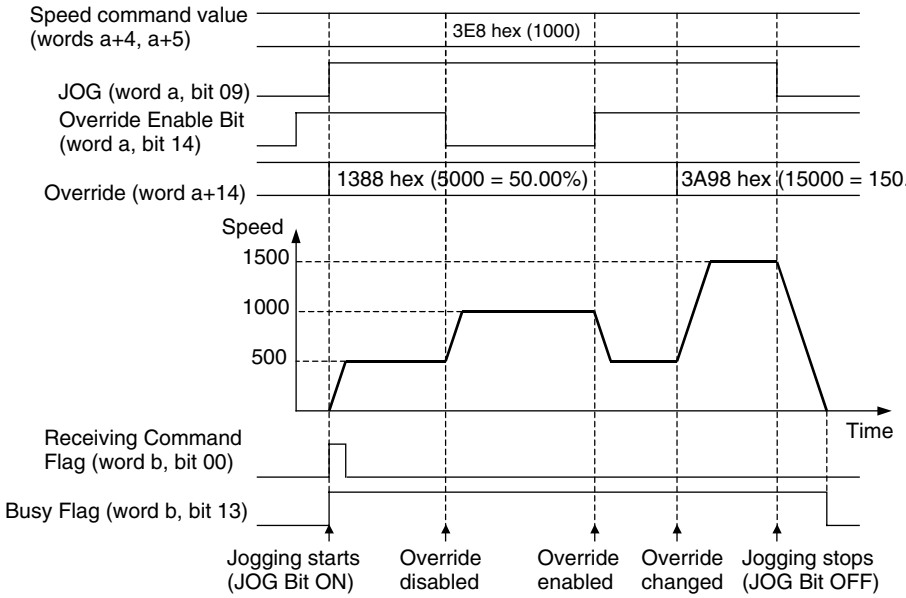
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The override can be set in the range 1 to 32767 (0.01% to 327.67%). The actual Servomotor speed control range and minimum control unit depend on the Servo Driver specifications.

While override is enabled, any changes to the override value are enabled immediately. While override is enabled, the override ratio can be changed during operation by setting a new override value in the Axis Operating Output Memory Area.

### Timing Chart

The following timing chart is for when the override function is executed during a jogging operation.




While override is enabled, the target speed is obtained by multiplying the speed command value by the override ratio. Changes to the override value while override is enabled are immediately effective in operations.
The acceleration/deceleration used to change the speed when switching between enabling and disabling override or changing the override value depends on the acceleration/deceleration operation setting for the operation being performed.

The Receiving Command Flag turns ON for at least one cycle time when the command to start axis operation is received. The status of this flag does not change when the override value is changed.
The status of the Busy Flag does not change when switching between enabling or disabling override, or when the override value is changed.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. − 1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

# 10-4 Torque Limits

## 10-4-1 Overview

When using a W-series Servo Driver, torque limits can be applied to Servomotor axis operation in position control functions (ABSOLUTE MOVEMENT, RELATIVE MOVEMENT), ORIGIN SEARCH, ORIGIN RETURN, JOG, SPEED CONTROL, TORQUE CONTROL, and Stop Functions (DECELERATION STOP, EMERGENCY STOP).

There are two types of torque limit, one that constantly functions for forward and reverse rotation and the other that can be disabled/enabled in operating commands. For speed control, torque limits can also be added to option command values. (For details, refer to *Option Command Value during Speed Control* in *10-5-2 Starting Speed Control*.)

When enabling multiple torque limit functions simultaneously, the Servomotor's output torque is limited by the minimum torque limit setting.



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The SMARTSTEP Junior Servo Drivers do not support torque control. The following settings and functions cannot be used.

## 10-4-2 Constant Torque Limits

To apply constant torque limits to axis operation, set the Servo Parameters *Forward Torque Limit* (Pn402) and *Reverse Torque Limit* (Pn403). By setting this parameter, the output torque of the operating Servomotor will always be limited by the set ratio of the rated torque.

**Servo Parameter Area** **Torque Limit Parameters**

| Type | Parameter No. | Parameter name | Unit | Setting range | Data length | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn402 | Forward torque limit | % | 0 to 800 | 2 | 350 |
| --- | Pn403 | Reverse torque limit | % | 0 to 800 | 2 | 350 |

**Note** The default settings correspond to those used for W-series Servo Drivers.

## 10-4-3 Torque Limits Set by Operating Commands

Torque limit functions set by operating commands are executed by turning ON the Forward/Reverse Rotation Current Limit Bit in the Axis Operating Output Area and starting the operating command. The *Forward/Reverse Rotation Current Limit* setting is enabled when the Start Bit for the operating command turns ON.

The output torque is limited when the Servomotor is operating according to the set values in the Servo Parameters *Forward Rotation External Current Limit* (Pn404) and *Reverse Rotation External Current Limit* (Pn405) by turning ON the Forward/Reverse Current Limit Designation Bit when using operating commands.

A torque limit that has been enabled will continue to function until the Forward/Reverse Current Limit Designation Bit is turned OFF and the next operating command is sent (the specified torque limits continue to be applied even in Servo lock status after positioning stops).

**Note** If the axis stops due to an error during axis operation with the torque limit function enabled, the torque limit when stopped will depend on the setting of the Forward/Reverse Current Limit Designation Bit. When the Current Limit Designation Bit is turned ON only at the start of axis operation, and turned OFF during axis operation, the torque limit will be disabled if the axis stops due to an error. Make sure that the Current Limit Designation Bit remains ON for the interval that the torque limit needs to be enabled.

The Torque Limit Status Flag in the Servo Status Flags in the Axis Operating Input Memory Area turns ON for the time the torque limit is functioning.

**Servo Parameter Area** **Torque Limit Parameters**

| Type | Parameter No. | Parameter name | Unit | Setting range | Data length | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn404 | Forward rotation external current limit | % | 0 to 800 | 2 | 100 |
| --- | Pn405 | Reverse rotation external current limit | % | 0 to 800 | 2 | 100 |



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### Axis Operating Output Memory Areas (Operating Commands)

| Name | Word | Bits | Contents |
|---|---|---|---|
| ABSOLUTE MOVEMENT | a | 03 | 0 → 1: Starts absolute movement. |
| RELATIVE MOVEMENT | | 04 | 0 → 1: Starts relative movement. |
| ORIGIN SEARCH | | 06 | 0 → 1: Starts origin search. |
| ORIGIN RETURN | | 07 | 0 → 1: Starts origin return. |
| JOG | | 09 | 0 → 1: Starts jogging.<br>1 → 0: Stops jogging |
| Direction designation | | 10 | 0: Forward rotation direction<br>1: Reverse rotation direction |
| DECELERATION STOP | | 15 | 0 → 1: Starts deceleration stop. |
| SPEED CONTROL | a+1 | 02 | 0 → 1: Starts speed control. |
| TORQUE CONTROL | | 03 | 0 → 1: Starts torque control. |
| EMERGENCY STOP | | 15 | 0 → 1: Starts emergency stop. |
| Forward rotation current limit designation | a+16 | 14 | 1: Use forward torque limit. |
| Reverse rotation current limit designation | | 15 | 1: Use reverse torque limit. |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

### Axis Operating Input Memory Areas (Monitoring)

| Name | Word | Bits | Contents |
|---|---|---|---|
| Torque Limit Status Flag | b+1 | 09 | 1: Torque limit in progress |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

While the torque limit function is enabled, the set values for Servo Parameters *Forward Rotation External Current Limit* (Pn404) and *Reverse Rotation External Current Limit* (Pn405) can be overwritten at any time to change the torque limit value. during ABSOLUTE MOVEMENT, RELATIVE MOVEMENT (except for INTERRUPT FEEDING), SPEED CONTROL, and TORQUE CONTROL execution, the Current Limit Designation Bit setting can be changed while the axis is active by turning ON the command's start bit again.

For ORIGIN SEARCH, ORIGIN RETURN, and JOG, torque limits can be specified only at the start of operation.

**Note** When executing movement commands sequentially, make sure that the movement command bit remains OFF for a minimum of either the PLC cycle time × 2 or the MECHATROLINK communications cycle × 2, whichever is longer. If the time that the movement command bit is OFF is too short, the PCU will not be able to detect the rising edge of the movement command bit, preventing reception of the command.

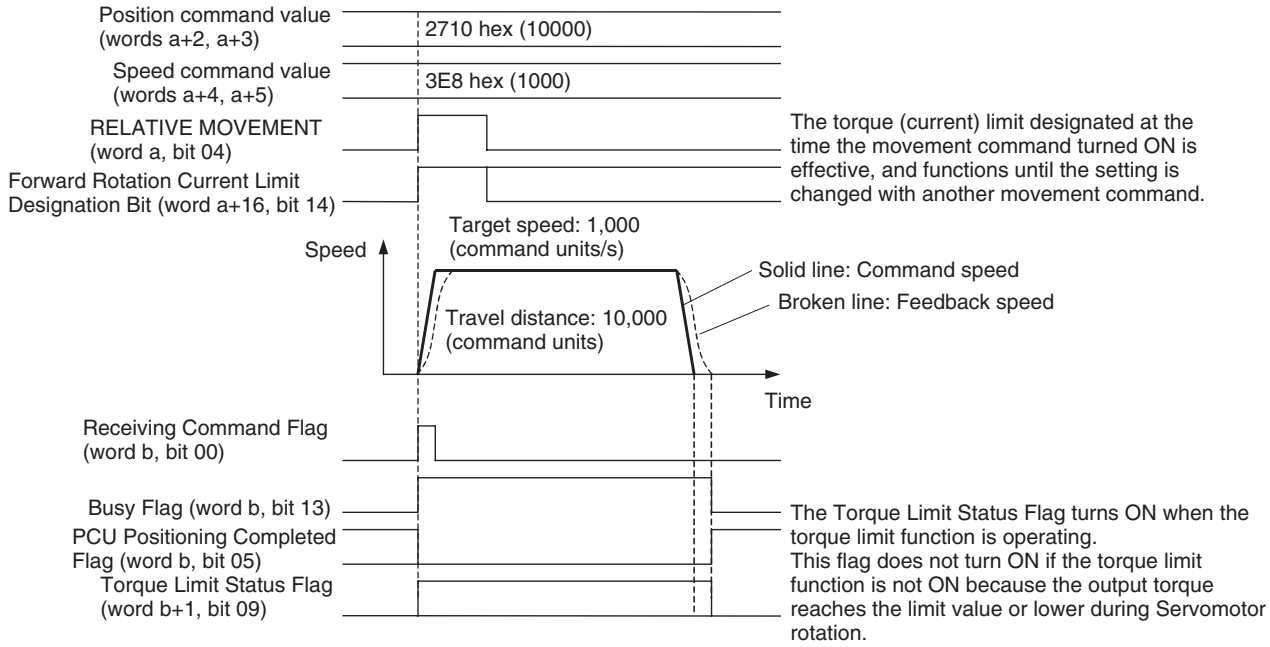


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## Timing Charts

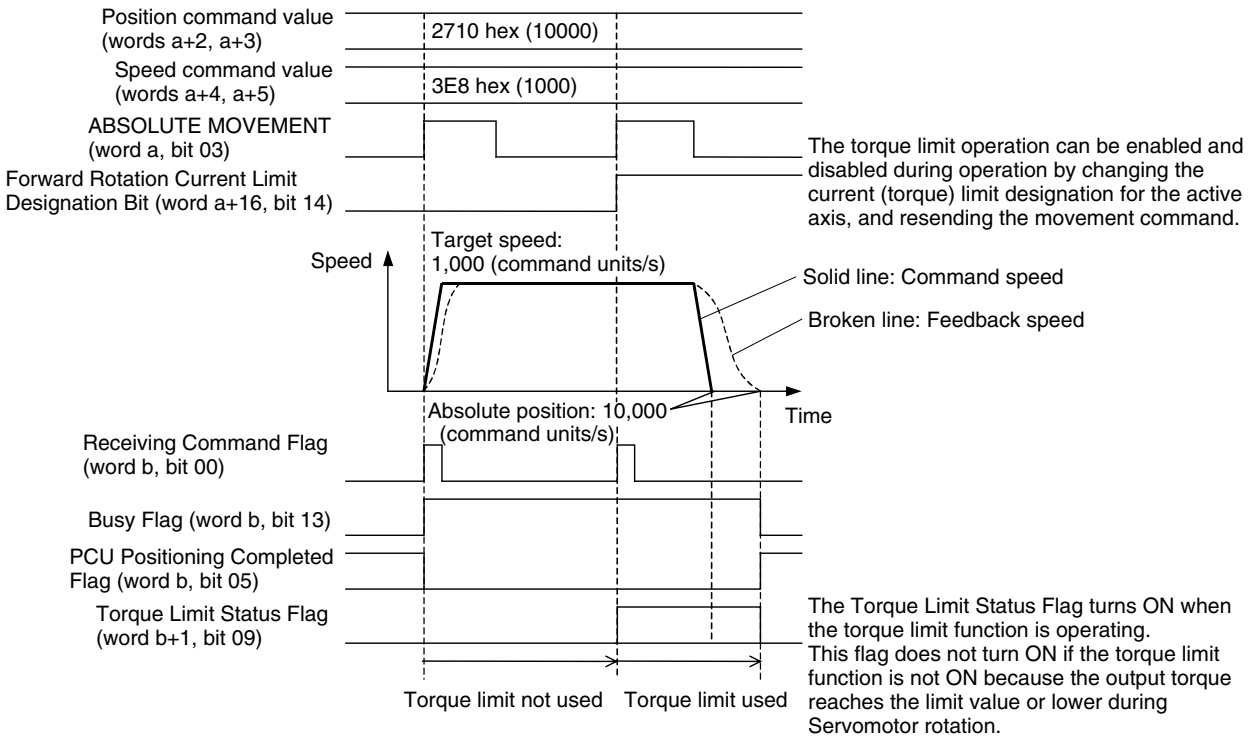
**Example: Using Torque Limit during Position Control Execution**

The following timing chart is for when RELATIVE MOVEMENT is executed. The timing chart for ABSOLUTE MOVEMENT is the same, except that positioning is executed with the absolute position.




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

### Example: Enabling Torque Limit during Positioning

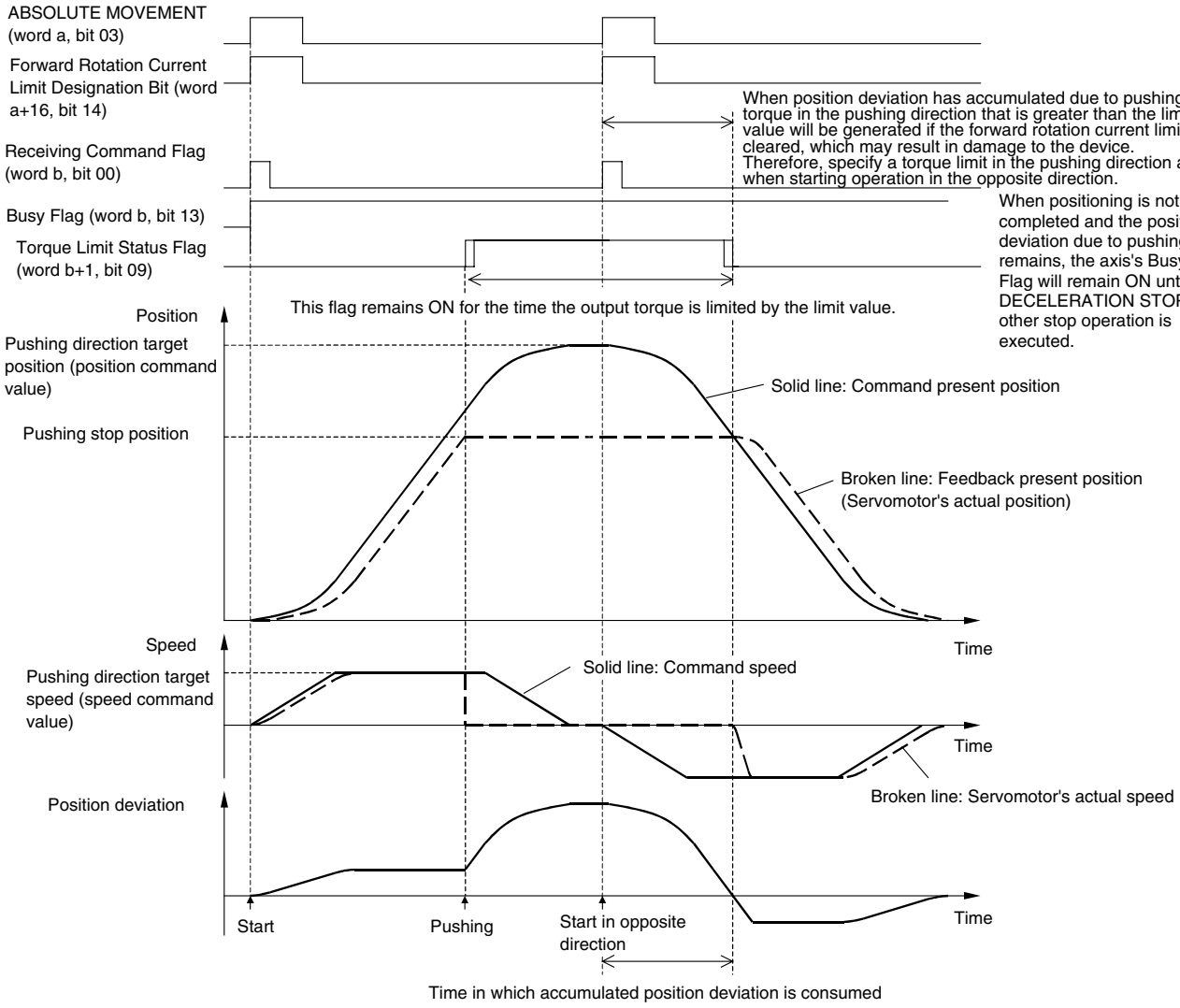



a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25



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### Positioning that Does Not Reach Target Position (Example: Pushing a Load)




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

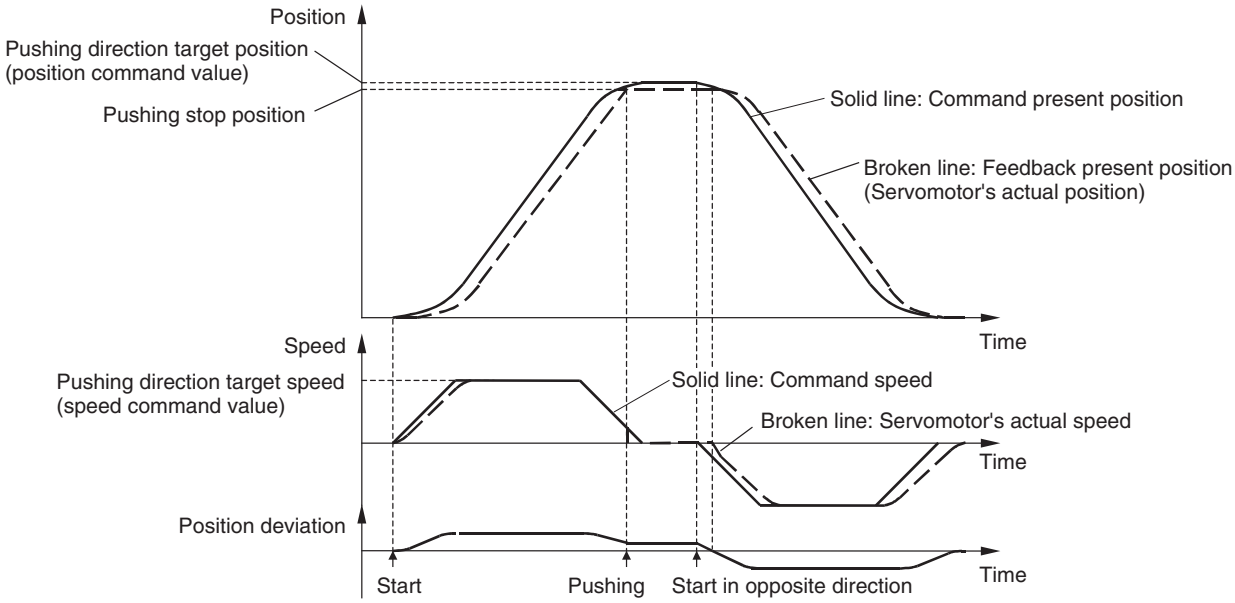
**Note** In applications such as pushing a load, when using the torque limit function to limit the output torque of the Servomotor and stop the machine, the command present position reaches the target position while the feedback present position does not, which causes the pulses to accumulate for the position deviation in the Servo Driver's deviation counter. To change movement to the opposite direction, send the operating command with the Current Limit Designation Bit setting enabled in the pushing direction.
If the Current Limit Designation Bit setting is disabled for the direction in which the load is being pushed when operation is started in the opposite direction (i.e., an operating command is sent without specifying the torque limit), torque will be generated in the pushing direction at the start of operation. This is due to the position deviation accumulated in the pushing direction and may result in damage to the machine or an accident.



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When performing an operation to return from the pushing position, the Servomotor will remain stopped for the movement command while the position deviation accumulated due to pushing is distributed. When the difference between the pushing operation target position and pushing stop position is large (the accumulated position deviation is large), the Servomotor will immediately accelerate to the target speed after the accumulated position deviation is distributed.

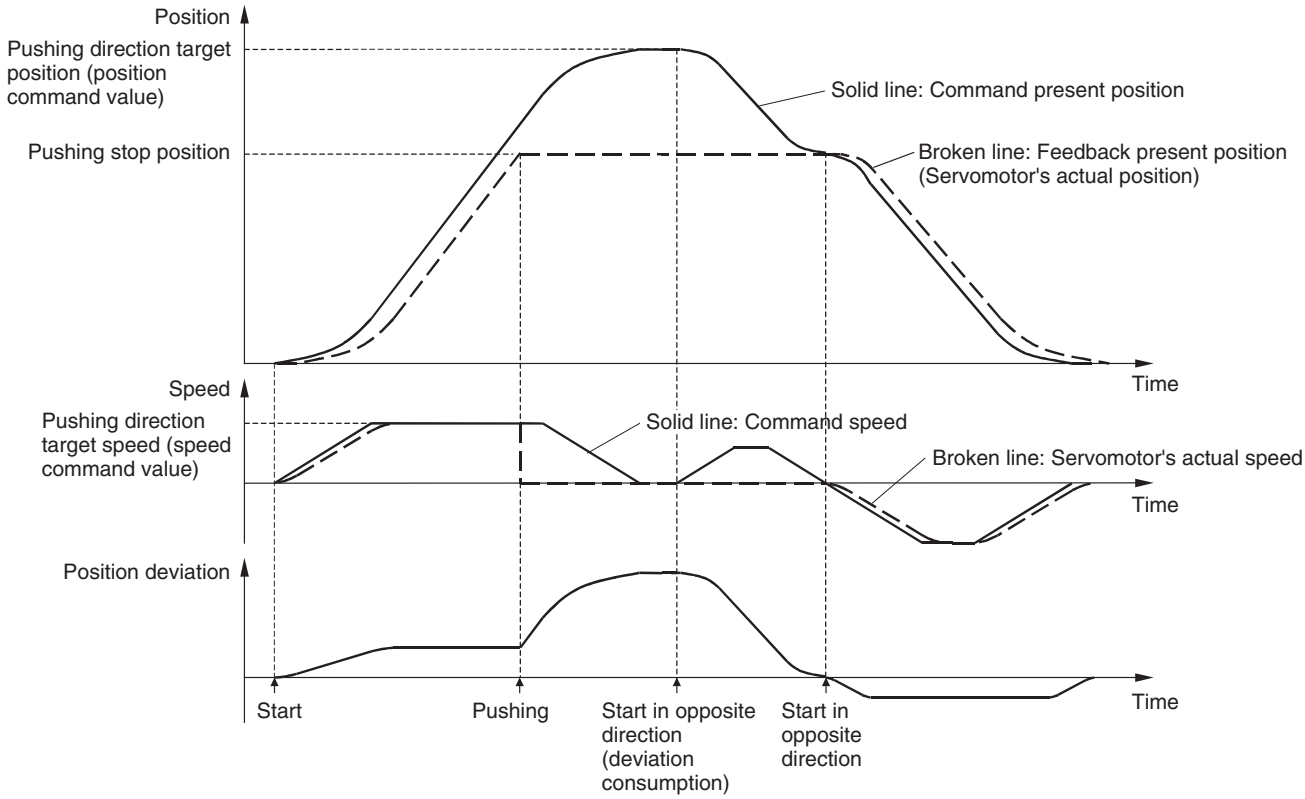
To prevent this from occurring, set the positioning target position as close to the pushing stop position as possible to minimize the accumulated position deviation during pushing. (See below.)




Alternatively, before performing the return operation, send a movement command to move the axis to the pushing stop position (feedback present position at pushing stop) and distribute the accumulated position deviation beforehand, as shown in the following diagram.



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**Note** The DEVIATION COUNTER RESET can be used to reset the remaining position deviation to 0 for PCUs with unit version 1.3 or later. Refer to *10-10 DEVIATION COUNTER RESET* for details on DEVIATION COUNTER RESET.

# 10-5 Speed Control

## 10-5-1 Overview

In Speed control, the PCU controls the rotation speed of the Servomotor by directly executing speed commands in a speed loop without using the Servo Driver's position loop.

Speed control can be used when a W-series Servo Driver is connected.

With the SMARTSTEP Junior Servo Drivers, speed commands cannot be given directly for a speed loop. When using a SMARTSTEP Junior Servo Driver, position control can be performed while changing the speed using jogging or direct operation to achieve feeding at desired speeds.

## 10-5-2 Starting Speed Control

Speed control is performed by setting the target speed in the speed command value for speed control in the Axis Operating Output Memory Areas and started when the SPEED CONTROL Bit turns ON. When starting speed control, make sure that the SPEED CONTROL Bit remains ON until the Receiving Command Flag or Busy Flag in the Axis Operating Input Memory Area turns ON.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the SPEED CONTROL command will be ignored. Be sure that all of these command bits are OFF before executing speed control.



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The speed command value for speed control is set in units of 0.001% as a ratio of the Servomotor's momentary maximum rotation speed. (The unit is different from that used for the speed command value for position control (command units/s).) The speed command value is specified in the range −199.999% to 199.999%, and the rotation direction is determined by the sign (positive or negative) of the speed command value.

The actual Servomotor speed control range and minimum control unit depend on the Servo Driver specifications.

To stop speed control, execute DECELERATION STOP or EMERGENCY STOP. (For details on stop functions, refer to *10-9 Stop Functions*.)

**Servo Parameter Area** **Speed Control Parameters**

| Type | Parameter No. | Parameter name | Unit | Setting range | Data length | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn002.0 | Function selection application switch 2<br>Torque command input change | --- | 0 to 3 | 2 | 0 |
| --- | Pn502 | Rotation speed for motor rotation detection | r/min | 1 to 10000 | 2 | 20 |
| --- | Pn503 | Speed conformity signal output width | r/min | 0 to 100 | 2 | 10 |

Pn002.0 is used to select the function of the option command value for speed control. The option command value for speed control is described in the following pages.

The data length for Pn002.0 is the set value specified to transfer Pn002 (including Pn002.0) when transferring Servo Parameters.

Pn502 is set as the detection threshold of the Zero Speed Flag (word b+1, bit 08) in the Axis Operating Input Memory Area. Pn503 is set as the detection width of the Speed Conformity Flag (word b+1, bit 07) in the Axis Operating Input Memory Area.

**Axis Operating Output Memory Areas (Operating Commands)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| DECELERATION STOP | a | 15 | 0 → 1: Starts deceleration stop. |
| SPEED CONTROL | a+1 | 02 | 0 → 1: Starts speed control. |
| EMERGENCY STOP | | 15 | 0 → 1: Starts emergency stop. |
| Speed command value (for speed control) | a+6<br>a+7 | --- | Speed command value (rightmost word)<br>Speed command value (leftmost word)<br>Unit: 0.001%<br>(percentage of Servomotor's momentary maximum rotation speed)<br>Command range: −199.999% to 199.999%<br>(FFFCF2C1 to 00030D3F hex)<br>**Note** The rotation direction is determined by the sign. |
| Option command value 1 | a+10<br>a+11 | --- | Torque limit/torque feed forward (rightmost word)<br>Torque limit/torque feed forward (leftmost word)<br>Unit: %<br>(percentage of Servomotor's momentary maximum torque)<br>Command range: 0% to 399% (See note.)<br>(00000000 to 0000018F hex)<br>The option command value 1 can be used as the torque limit command value or torque feed forward command value by setting *Torque Command Input Change* in Servo Parameter *Function Selection Application Switch 2* (Pn002.0). |



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| Name | Word | Bits | Contents |
|---|---|---|---|
| Option command value 2 | a+12<br>a+13 | --- | Torque limit (rightmost word)<br>Torque limit (leftmost word)<br>Unit: %<br>(percentage of Servomotor's momentary maximum torque)<br>Command range: 0 to 399% (See note.)<br>(00000000 to 0000018F hex)<br>The option command value 2 can be used as the torque limit command value by setting *Torque Command Input Change* in Servo Parameter *Function Selection Application Switch 2* (Pn002.0). |
| Forward rotation current limit designation | a+16 | 14 | 1: Use forward torque limit. |
| Reverse rotation current limit designation | | 15 | 1: Use reverse torque limit. |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. − 1) × 25

**Note** The torque limit for option command values during speed control can be specified between 0 and 399 for the PCU, but the effective command value depends on Servo Driver specifications. The following command range restrictions are for W-series Servo Drivers.

R88D-WT□ + JUSP-NS115

Command range: 0% to 199% (00000000 to 000000C7 hex)
Torque limits will not be set correctly for command values between 200% ad 399%. Use values between 0% and 199%.

R88D-WN□-ML2 (built-in MECHATROLINK-II Communications)

Command range: 0% to 199% (00000000 to 000000C7 hex)
Torque limits will not be set correctly for command values between 200% ad 399%. Use values between 0% and 199%.

A command range check (0 to 399) is performed for the option command value for speed control when the speed control command is given. If the option command value is out of range, an option command value error (error code: 3064 or 3065) will occur. The command range check will be performed even if the Speed Command Input Change parameter in the Function Selection Application Switches 2 is set to disable using the option command value. Always set the option command value to 0 when it is not being used.

**Note** The same option command value parameter is used for both speed and torque control. The allowable setting ranges for speed and torque control, however, are different. When switching between speed and torque control, be sure that the option command value is set within the proper range for the current type of control.

Changes to the speed command value for speed control during operation are always effective. During speed control, by setting a new speed command value for speed control in the Axis Operating Output Memory Area, the target speed for speed control can be changed.

The settings for option command values 1 and 2 (torque limit/torque feed forward command values) and Forward/Reverse Rotation Current Limit Designation Bits are enabled when the SPEED CONTROL Bit turns ON. Changing these command values while speed control is being executed and then turning ON the SPEED CONTROL Bit again enables the option command values and Current Limit Designation Bits to be changed during operation.



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It is necessary to pay attention to the change of output torque when switching from the speed control mode to the position control mode with deceleration stop. For details, refer to *10-5-3 Switching Control Mode*.

**Note** When executing movement commands sequentially, make sure that the movement command bit remains OFF for a minimum of either the PLC cycle time × 2 or the MECHATROLINK communications cycle × 2, whichever is longer. If the time that the movement command bit is OFF is too short, the PCU will not be able to detect the rising edge of the movement command bit, preventing reception of the command.

**Axis Operating Input Memory Areas (Monitoring)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| Receiving Command Flag | b | 00 | 0: Command reception enabled.<br>0 → 1: Command reception started.<br>1: Receiving command (command reception disabled). |
| Error Flag | | 12 | 0: No axis error.<br>1: Axis error has occurred. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing). |
| Speed Conformity Flag | b+1 | 07 | 1: Speed matches the speed command value for speed control. |
| Zero Speed Flag | | 08 | 1: Detecting zero speed. |
| Torque Limit Status Flag | | 09 | 1: Torque limit in progress. |
| Feedback present position | b+6<br>b+7 | --- | Present position<br>Feedback position (rightmost word)<br>Feedback position (leftmost word) |
| Command present position | b+8<br>b+9 | --- | Present position<br>Command position (rightmost word)<br>Command position (leftmost word) |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The Receiving Command Flag turns ON for at least one cycle time when the command to start speed control is received by the PCU. Use the Receiving Command Flag when starting and changing option commands to control the ON/OFF timing for SPEED CONTROL.

During speed control, bits 07 and 08 in the Servo Status Flags (word b+1) of the Axis Operating Input Memory Area function as the Speed Conformity Flag and Zero Speed Flag respectively.

The command present position that is output during speed control is calculated from the feedback position and the position deviation that is inferred from the current speed.

## Acceleration and Deceleration during Speed Control

When SPEED CONTROL is executed, the Servo Driver performs stepped speed control from the present feedback speed to the target speed specified in the speed command value for speed control. Apart from smoothly increasing/decreasing the speed command value (for speed control) when starting speed control, shock in acceleration/deceleration when performing speed control can also be minimized by setting the Servo Parameters *Soft Start Acceleration Time* (Pn305) and *Soft Start Deceleration Time* (Pn306) to create a trapezoidal speed curve.



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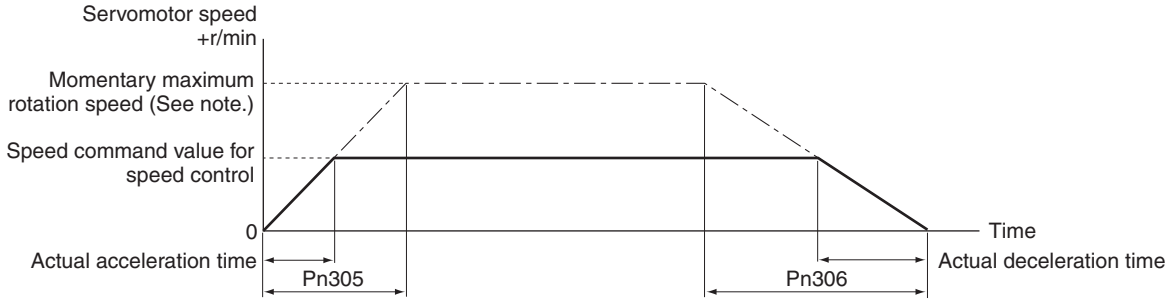
**Acceleration/Deceleration Constants for Speed Control**

| Type | Parameter No. | Parameter name | Unit | Setting range | Data length | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn305 | Soft start acceleration time | ms | 0 to 10000 | 2 | 0 |
| --- | Pn306 | Soft start deceleration time | ms | 0 to 10000 | 2 | 0 |

The *Soft Start Acceleration Time* and *Soft Start Deceleration Time* are set respectively as the acceleration time and deceleration time between speed 0 (speed command value for speed control: 0%) and the momentary maximum rotation speed of the Servomotor (speed command value for speed control: 100%).

The acceleration time and deceleration time for the actual target speed are as follows:

$$\text{Actual acceleration (deceleration) time} = \frac{\text{Speed command value for speed control (r/min)}}{\text{Momentary maximum rotation speed (r/min)}} \times \text{Soft start acceleration (deceleration) time}$$




**Note** The momentary maximum rotation speed depends on the Servomotor used. Refer to the momentary maximum rotation speed for the Servomotor used. The following values apply to W-series Servomotors.

3,000-r/min Servomotor (cylinder type or flat type): 5,000 r/min
1,000-r/min Servomotor: 2,000 r/min
1,500-r/min Servomotor (450 W to 7.5 kW): 3,000 r/min
1,500-r/min Servomotor (11 to 15 kW): 2,000 r/min

## Option Command Value during Speed Control

When speed control is used, the torque limit and torque feed forward functions can be applied during speed control by setting Servo Parameter *Torque Command Input Change* of *Function Selection Application Switch 2* (Pn002.0) and the Current Limit Designation Bits and option command values in the Axis Operating Output Memory Area.



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When an R88D-WT□ W-series Servo Driver equipped with a JUSP-NS115 MECHATROLINK-II Application Module or an R88D-WN□-ML2 W-series Servo Driver with built-in MECHATROLINK-II communications is connected to the PCU, the torque limit/torque feed forward function depends on the Servo Parameter and output bit combinations, as follows:

| Torque command input change (Pn002.0) | Forward rotation current limit designation (word a+16, bit 14 | Reverse rotation current limit designation (word a+16, bit 15) | R88D-WT□ + JUSP-NS115 | R88D-WN□-ML2 with built-in MECHATROLINK-II communications |
|---|---|---|---|---|
| 0 | --- | --- | Option command values 1 and 2 are disabled. Use set value 0. | Option command values 1 and 2 are disabled. Use set value 0. |
| 1 | --- | --- | Option command value 1 (words a+10, a+11) functions as a torque limit value and the torque limit function is enabled in both directions. | Option command value 1 (words a+10, a+11) functions as a forward torque limit value, option command value 2 (words a+12, a+13) functions as a reverse torque limit value and the torque limit function is enabled. |
| 2 | --- | --- | Option command value 1 (words a+10, a+11) functions as a torque feed forward command value and torque feed forward is enabled. | Option command value 1 (words a+10, a+11) functions as a torque feed forward command value and torque feed forward is enabled. |
| 3 | 0 | 0 | Option command values 1 and 2 are disabled. Use set value 0. | Option command values 1 and 2 are disabled. Use set value 0. |
| | 0 | 1 | Option command value 2 (words a+12, a+13) functions as a reverse torque limit value and the torque limit function is enabled. | Option command value 2 (words a+12, a+13) functions as a reverse torque limit value and the torque limit function is enabled. |
| | 1 | 0 | Option command value 1 (words a+10, a+11) functions as a forward torque limit value and the torque limit function is enabled. | Option command value 1 (words a+10, a+11) functions as a forward torque limit value and the torque limit function is enabled. |
| | 1 | 1 | Option command value 1 (words a+10, a+11) functions as a torque limit value and the torque limit function is enabled in both directions. | Option command value 1 (words a+10, a+11) functions as a forward torque limit value, option command value 2 (words a+12, a+13) functions as a reverse torque limit value and the torque limit function is enabled. |

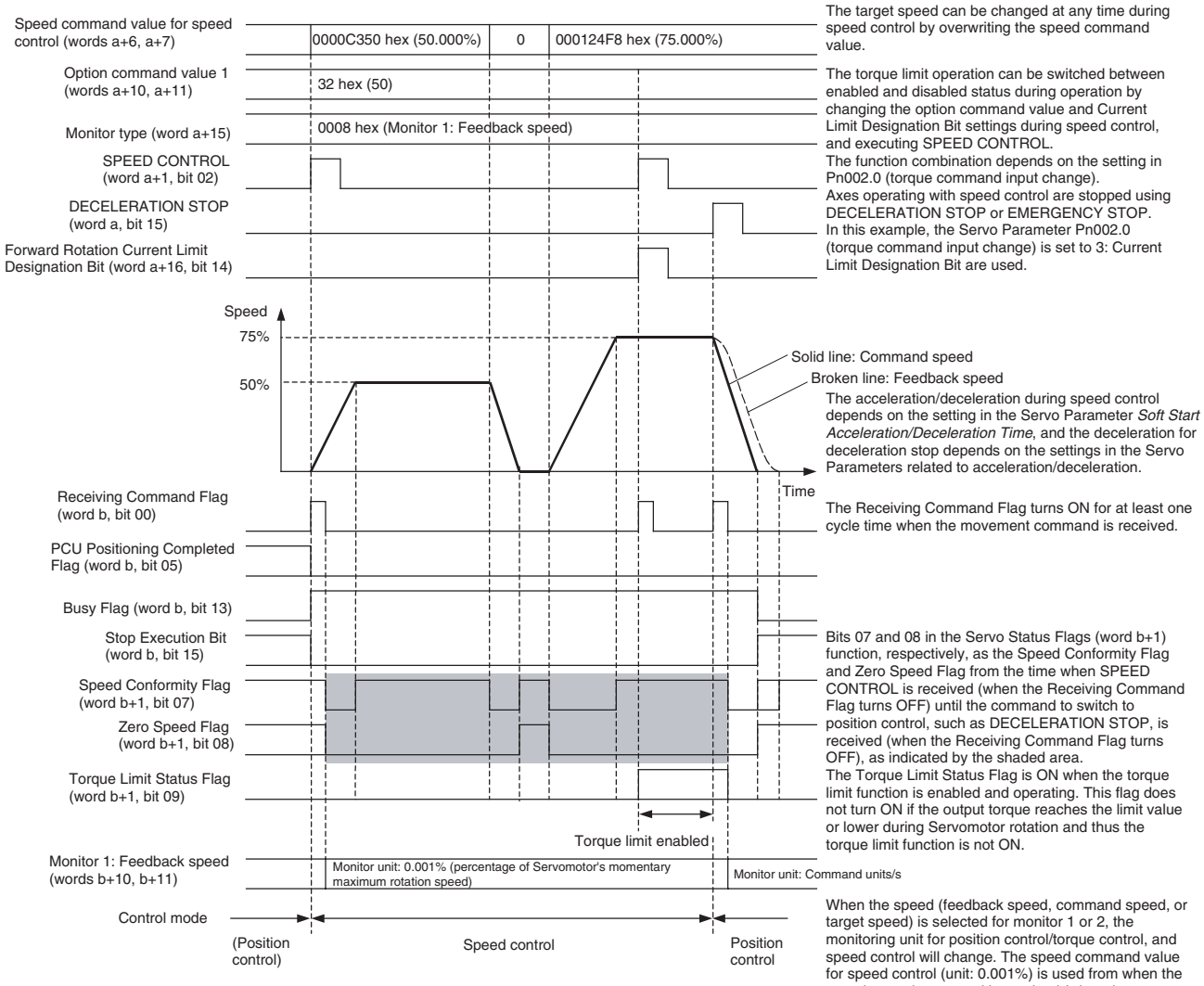
The settings for option command values 1 and 2 (torque limit/torque feed forward command values) and Forward/Reverse Rotation Current Limit Designation Bits are enabled when the SPEED CONTROL Bit turns ON. Changing these command values while speed control is being executed and then turning ON the SPEED CONTROL Bit again enables the option command values and Current Limit Designation Bits to be changed during operation.

The torque limit for speed control set in the option command values can be used together with the torque limit function (refer to *10-4 Torque Limits*). When enabling multiple torque limit functions simultaneously, the Servomotor's output torque is limited by the minimum torque limit setting.



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## Example Timing Chart for Speed Control




The target speed can be changed at any time during speed control by overwriting the speed command value.

The torque limit operation can be switched between enabled and disabled status during operation by changing the option command value and Current Limit Designation Bit settings during speed control, and executing SPEED CONTROL.
The function combination depends on the setting in Pn002.0 (torque command input change).
Axes operating with speed control are stopped using DECELERATION STOP or EMERGENCY STOP.
In this example, the Servo Parameter Pn002.0 (torque command input change) is set to 3: Current Limit Designation Bit are used.

The acceleration/deceleration during speed control depends on the setting in the Servo Parameter *Soft Start Acceleration/Deceleration Time*, and the deceleration for deceleration stop depends on the settings in the Servo Parameters related to acceleration/deceleration.

The Receiving Command Flag turns ON for at least one cycle time when the movement command is received.

Bits 07 and 08 in the Servo Status Flags (word b+1) function, respectively, as the Speed Conformity Flag and Zero Speed Flag from the time when SPEED CONTROL is received (when the Receiving Command Flag turns OFF) until the command to switch to position control, such as DECELERATION STOP, is received (when the Receiving Command Flag turns OFF), as indicated by the shaded area.
The Torque Limit Status Flag is ON when the torque limit function is enabled and operating. This flag does not turn ON if the output torque reaches the limit value or lower during Servomotor rotation and thus the torque limit function is not ON.

When the speed (feedback speed, command speed, or target speed) is selected for monitor 1 or 2, the monitoring unit for position control/torque control, and speed control will change. The speed command value for speed control (unit: 0.001%) is used from when the speed control command is received (when the Receiving Command Flag turns OFF) and the speed command value for position control (command units/s) is used from when the command to switch to position control or torque control is received.

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25



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## Status and Monitoring during Speed Control

When SPEED CONTROL is executed, some of the Status Flags, monitoring functions, and display units change.

### Servo Status Flags in Axis Operating Input Memory Area (Word b+1)

The functions of bits 07 and 08 in the Servo Status Flags of the Axis Operating Input Memory Area change depending on whether position control or speed control is used.

| Word | Bits | Control mode | Flag name | Function | Function change timing |
|---|---|---|---|---|---|
| b+1 | 07 | Position control | Positioning Completed (PSET) Flag | Sending the position control command to the Servo Driver completed and the position is within *Positioning Completion Range 1* (in position). | The function changes when the command to switch to position control has been received (when the Receiving Command Flag turns OFF). |
| | | Speed control | Speed Conformity (V-CMP) Flag | Speed matches the speed command value for speed control. | The function changes when SPEED CONTROL has been received (when the Receiving Command Flag turns OFF). |
| | 08 | Position control | Distribution Completed (DEN) Flag | Sending the position control command to the Servo Driver completed (operating for the number of pulses remaining in the deviation counter). | The function changes when the command to switch to position control has been received (when the Receiving Command Flag turns OFF). |
| | | Speed control | Zero Speed (ZSPD) Flag | Speed control with zero speed in progress. | The function changes when SPEED CONTROL has been received (when the Receiving Command Flag turns OFF). |

### Monitors 1 and 2 in Axis Operating Input Memory Areas

When the speed (feedback speed, command speed, or target speed) is selected for monitor 1 or 2, the monitoring unit for position control/torque control, and speed control will change, as follows:

| Control mode | Speed monitoring unit | Unit change timing |
|---|---|---|
| Position control/Torque control | Command units/s | The unit changes when the command to switch to position control/torque control has been received (when the Receiving Command Flag turns OFF). |
| Speed control | 0.001% (percentage of Servomotor's momentary maximum rotation speed) | The unit changes when SPEED CONTROL has been received (when the Receiving Command Flag turns OFF). |

## 10-5-3 Switching Control Mode

The PCU's operating commands can be used to switch between position control, speed control, and torque control of active axes, as follows:

| Operating command | Control mode | Operation when operating command is executed |
|---|---|---|
| ABSOLUTE MOVEMENT | Position control | Switches to position control from any control mode when the command starts and executes positioning with an absolute position. |
| RELATIVE MOVEMENT | Position control | Switches to position control from any control mode when the command starts and executes positioning with a relative position. |
| ORIGIN SEARCH | Position control | A multistart error occurs when the command starts from any control mode, and deceleration stop is executed in position control mode. |
| ORIGIN RETURN | Position control | A multistart error occurs when the command starts from any control mode, and deceleration stop is executed in position control mode. |



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| Operating command | Control mode | Operation when operating command is executed |
|---|---|---|
| JOG | Position control | A multistart error occurs when the command starts from any control mode, and deceleration stop is executed in position control mode. |
| DECELERATION STOP | Position control | Switches to position control when the command starts from any control mode, and deceleration stop is executed. |
| SPEED CONTROL | Speed control | Switches to speed control when the command starts from any control mode. |
| TORQUE CONTROL | Torque control | Switches to torque control when the command starts from any control mode. |
| EMERGENCY STOP | Position control | Switches to position control when the command starts from any control mode, and emergency stop is executed. |
| SERVO UNLOCK | Position control | When executing SERVO UNLOCK, the PCU executes DECELERATION STOP for the Servo Driver, followed immediately (without waiting for the axis to stop) by SERVO UNLOCK. When SERVO UNLOCK is executed during speed control or torque control, the Servo Driver will recover in the position control mode's Servo lock status the next time the SERVO LOCK command is executed. |
| DEVICE SETUP | Position control | Switches to position control when the command starts, and recovers in position control mode when SERVO LOCK is executed. |

If operation stops due to an error (except stopping that puts Servo in free run state), the Servomotor stops in position control mode (deceleration stop or emergency stop) and remains in position control mode (Servo lock status) after stopping. After turning ON the power to the PCU or restarting the Unit and executing CONNECT or SERVO LOCK, the PCU will be put in the position control mode and in Servo lock status.

**Note** When SERVO UNLOCK is executed during speed control or torque control, the Servo Driver will recover in the position control mode and in Servo lock status the next time the SERVO LOCK command is executed. If MECHATROLINK communications are stopped (connection released) or the power to the PCU is interrupted during speed control or torque control, the Servo Driver will be put in Servo free run state in the previous control mode. While in this state, if MECHATROLINK communications are started (connection established) and SERVO LOCK is executed, the Servomotor starts operating immediately in the previous command state. The speed monitor and torque monitor in the PCU's expanded monitoring functions will also not function properly. To stop MECHATROLINK communications while in speed control or torque control mode, use DECELERATION STOP or another command that will switch the Servo Driver to position control, and execute the next SERVO LOCK command in position control mode. If the Servo is in a free run state during speed control or torque control (due to an error or other cause), execute DEVICE SETUP before the next SERVO LOCK and switch the Servo Driver to position control mode.

When switching to position control from speed control or torque control, the feedback speed for executing operating commands in position control is used as the start speed. Movement to the position control target speed or stop operation is then performed using the acceleration/deceleration set in the Servo Parameters for acceleration/deceleration.



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**Changes in Torque when Switching Control Modes**

When switching to another control mode during torque control, position control with the torque limit enabled, or speed control, the torque in the control mode to be switched to must be considered. For example, if DECELERATION STOP is executed with the torque limit disabled during speed control with the torque limit enabled, position control will be used without the output torque limit during the time deceleration stop is executed.

When switching from the control mode that requires a constant torque limit, such as for pushing or pulling a load, make sure that the torque limit is also enabled for the next operating command to be executed to prevent a sudden change in output torque.

**Note** In speed control mode, axis stop operations due to errors are executed after switching to position control. The torque limit for these stop operations depends on the setting of the Current Limit Designation Bit at when the error occurred. When executing speed control with the torque limit enabled using the option command value, if the Current Limit Designation Bit is not set to ON, the axis stop operation due to error will be executed with the torque limit disabled. To enable the torque limit for axis stop operations due to errors, turn ON the Current Limit Designation Bit and set Servo Parameters *Forward Rotation External Current Limit* (Pn404) or *Reverse Rotation External Current Limit* (Pn405).

# 10-6 Torque Control

## 10-6-1 Overview

In torque control, the PCU controls the output torque of the Servomotor by directly executing torque commands in a torque (current) loop without using the Servo Driver's position loop or speed loop.

Torque control can be used when a W-series Servo Driver is connected. The SMARTSTEP Junior Servo Drivers do not support torque control.

## 10-6-2 Starting Torque Control

Torque control is performed according to the target torque set in the torque command value in the Axis Operating Output Memory Areas and started when the TORQUE CONTROL Bit turns ON. When starting torque control, make sure that the TORQUE CONTROL Bit remains ON until the Receiving Command Flag or Busy Flag in the Axis Operating Input Memory Area turns ON.

If the SERVO UNLOCK, DEVIATION COUNTER RESET, EMERGENCY STOP, OR DECELERATION STOP command bit is turned ON, the TORQUE CONTROL command will be ignored. Be sure that all of these command bits are OFF before executing torque control.

The torque command value is set in units of 0.001% as a percentage of the Servomotor's momentary maximum torque. The torque command value is specified in the range −199.999% to 199.999%, and the rotation direction is determined by the sign (positive or negative) of the torque command value. The actual Servomotor torque control range and minimum control unit depend on the Servo Driver specifications.

To stop torque control, execute DECELERATION STOP or EMERGENCY STOP. (For details on stop functions, refer to *10-9 Stop Functions*.)



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**Servo Parameter Area** **Torque Control Parameters**

| Type | Parameter No. | Parameter name | Unit | Setting range | Data length | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn002.1 | Function selection application switch 2<br>Speed command input switching | --- | 0, 1 | 2 | 0 |
| --- | Pn407 | Speed limit | r/min | 0 to 10000 | 2 | 3000 |

**Note** The default settings correspond to those used for W-series Servo Drivers.

Pn002.1 is used to select the function of the option command value for torque control. The option command value for torque control is described in the following pages.

The data length for Pn002.1 is the set value specified to transfer Pn002 (including Pn002.1) when transferring Servo Parameters. Pn407 is used to set the fixed speed limit for torque control.

**Axis Operating Output Memory Areas (Operating Commands)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| DECELERATION STOP | a | 15 | 0 → 1: Starts deceleration stop. |
| TORQUE CONTROL | a+1 | 03 | 0 → 1: Starts torque control. |
| EMERGENCY STOP | | 15 | 0 → 1: Starts emergency stop. |
| Torque command value | a+8<br>a+9 | --- | Torque command value (rightmost word)<br>Torque command value (leftmost word)<br>Unit: 0.001%<br>(percentage of Servomotor's momentary maximum torque)<br>Command range: −199.999 to 199.999%<br>(FFFCF2C1 hex to 00030D3F hex)<br>**Note** The rotation direction is determined by the sign. |
| Option command value 1 | a+10<br>a+11 | --- | Speed limit value (rightmost word)<br>Speed limit value (leftmost word)<br>Unit: 0.001%<br>(percentage of Servomotor's momentary maximum rotation speed)<br>Command range: 0 to 100.000% (See note 1.)<br>(00000000 hex to 000186A0 hex)<br>The option command value 1 can be used as the speed limit value during torque control by setting *Speed Command Input Change* in Servo Parameter *Function Selection Application Switch 1* (Pn002.1). |
| Forward rotation current limit designation | a+16 | 14 | 1: Use forward torque limit. |
| Reverse rotation current limit designation | | 15 | 1: Use reverse torque limit. |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

**Note**

(1) A command range check (0 to 10,000) is performed for the option command value for torque control when the torque control command is given. If the option command value is out of range, an option command value error (error code: 3064) will occur. The command range check will be performed even if the Torque Command Input Change parameter in the Function Selection Application Switches 2 is set to disable using the option command value. Always set the option command value to 0 when it is not being used.

(2) The same option command value parameter is used for both speed and torque control. The allowable setting ranges for speed and torque control, however, are different. When switching between speed and torque con-



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trol, be sure that the option command value is set within the proper range for the current type of control.

Changes to the torque command value during operation are always effective. during torque control, by setting a new torque command value in the Axis Operating Output Memory Area, the target torque for torque control can be changed.

The data for option command value 1 (speed limit value) is enabled when the start bit for TORQUE CONTROL turns ON. Changing these set values while torque control is being executed and then turning ON the TORQUE CONTROL Bit again enables the speed limit value to be changed during operation.

The torque limit can also be applied by turning ON the Forward/Reverse Rotation Current Limit Designation Bit when executing TORQUE CONTROL. (For details, refer to *10-4-3 Torque Limits Set by Operating Commands*.)

**Axis Operating Input Memory Areas (Monitoring)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| Receiving Command Flag | b | 00 | 0: Command reception enabled.<br>0 → 1: Command reception started.<br>1: Receiving command (command reception disabled). |
| Error Flag | | 12 | 0: No axis error.<br>1: Axis error has occurred. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing). |
| Torque Limit Status Flag | b+1 | 09 | 1: Torque limit in progress. |
| Speed Limit Status Flag | | 11 | 1: Speed limit in progress. |
| Feedback present position | b+6<br>b+7 | --- | Present position<br>Feedback position (rightmost word)<br>Feedback position (leftmost word) |
| Command present position | b+8<br>b+9 | --- | Present position<br>Command position (rightmost word)<br>Command position (leftmost word) |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The Receiving Command Flag turns ON for at least one cycle time when the command to start torque control is received by the PCU. Use the Receiving Command Flag when starting and changing option commands to control the ON/OFF timing for TORQUE CONTROL.

During torque control, bit 11 in the Servo Status Flags (word b+1) of the Axis Operating Input Memory Area functions as the Speed Limit Status Flag.

The command present position that is output during torque control is calculated from the feedback position and the position deviation that is inferred from the current speed.

Changes in output torque may affect operation when switching to speed control or position control with deceleration stop, while torque control is being performed. For details, refer to *10-5-3 Switching Control Mode*.

**Note** When executing movement commands sequentially, make sure that the movement command bit remains OFF for a minimum of either the PLC cycle time × 2 or the MECHATROLINK communications cycle × 2, whichever is longer. If the time that the movement command bit is OFF is too short, the PCU will not be able to detect the rising edge of the movement command bit, preventing reception of the command.



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## Option Command Value during Torque Control

A speed limit can be applied during torque control by setting *Speed Command Input Change* in Servo Parameter *Function Selection Application Switch 2* (Pn002.1) and the option command value.

The speed limit functions depend on the Servo Parameter and output bit combinations, as follows:

| Speed command input change (Pn002.1) | Function |
|---|---|
| 0 | Option command values 1 and 2 are disabled. Use set value 0. |
| 1 | Limits speed during torque control, using option command value 1 (words a+10, a+11) as the speed limit value.<br>Option command value 2 is not used. Use set value 0. |

The data for option command value 1 (speed limit value) is enabled when the bit for TORQUE CONTROL turns ON. Changing option command value 1 while torque control is being executed and then turning ON the TORQUE CONTROL Bit again enables the speed limit value to be changed during operation.

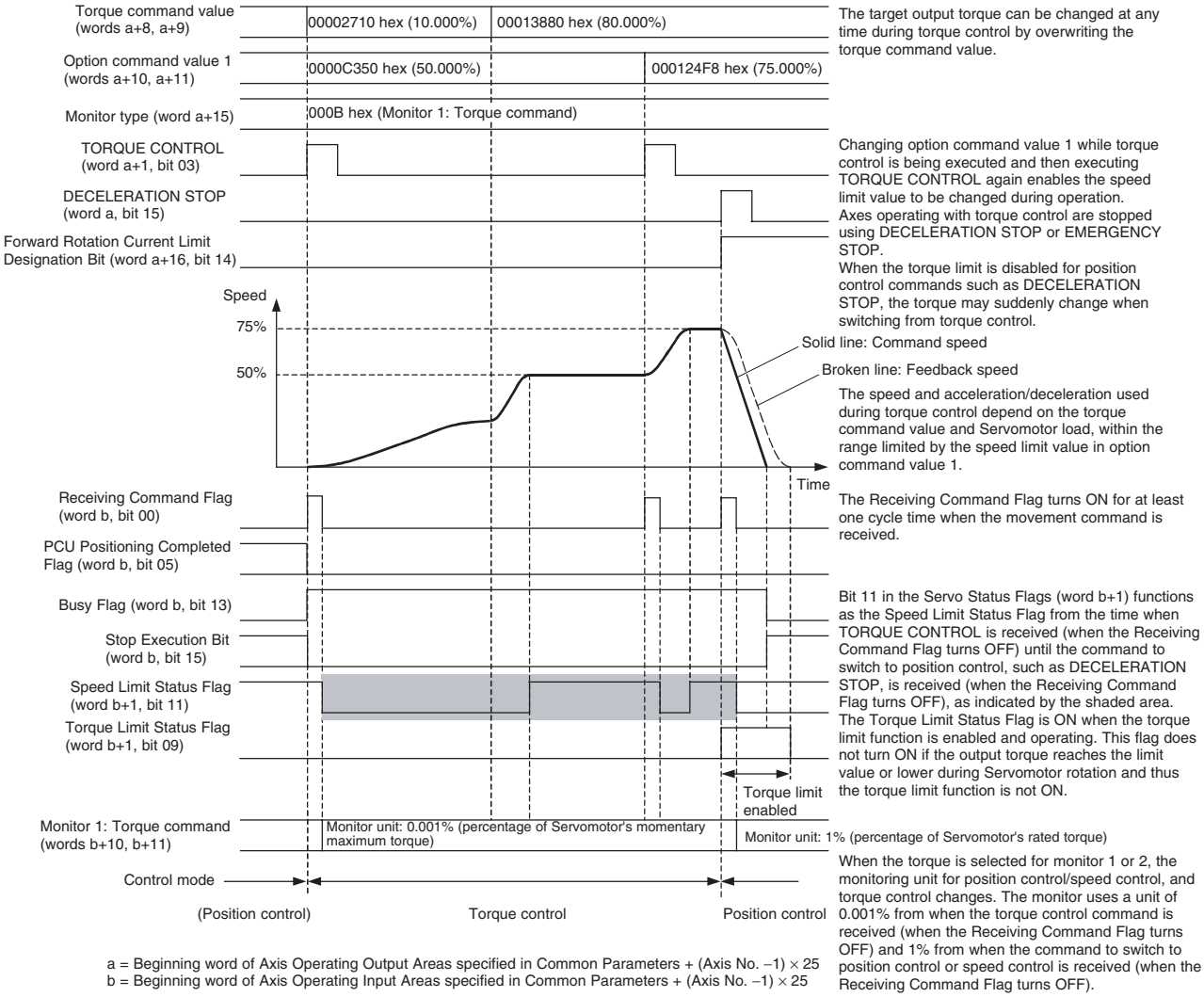
The speed limit for torque control set in the option command value can be used together with Servo Parameter Pn407 (speed limit). When both speed limit functions are enabled at the same time, the Servomotor's rotation speed is limited by the lowest speed limit setting.

**Note** The speed limit functions for torque control are used to limit the Servomotor's rotation speed in a steady state, and not the upper limit (maximum value) of the Servomotor's rotation speed. Transitional overshooting may occur in the Servomotor's rotation speed and the speed limit value may be exceeded due to conditions such as the torque command value, Servomotor load, and inertia.



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## Example Timing Chart for Torque Control




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

For details on switching to torque control from position control or speed control, refer to *10-5-3 Switching Control Mode*.

**Note** (1) When SERVO UNLOCK is executed during speed control or torque control, the Servo Driver will recover in the position control mode and in Servo lock status the next time SERVO LOCK is executed. If MECHATROLINK communications are stopped (connection released) or the power to the PCU is interrupted during speed control or torque control, the Servo Driver will be put in Servo free run state in the previous control mode. While in this state, if MECHATROLINK communications are started (connection established) and SERVO LOCK is executed, the Servomotor starts operating immediately in the previous command state. The speed monitor and torque monitor in the PCU's expanded monitoring functions will also not function properly. To stop MECHATROLINK communications while in speed control or torque control mode, use DECELERATION STOP or other command that will switch the Servo Driver to position control, and execute the next SERVO LOCK in position control mode. If the Servo is in a free run state during speed control or torque control (due to an error or other cause), execute DEVICE SETUP before the next SERVO LOCK and switch the Servo Driver to position control mode.



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(2) In torque control mode, axis stop operations due to errors are executed after switching to position control. The output torque for these stop operations depends on the setting for error operation in the Current Limit Designation Bit. during torque control execution, if the Current Limit Designation Bit is not set to ON, the axis stop operation due to error will be executed with the torque limit disabled. To enable the torque limit for axis stop operations due to errors, turn ON the Current Limit Designation Bit while torque control is being executed and set Servo Parameters *Forward Rotation External Current Limit* (Pn404) or *Reverse Rotation External Current Limit* (Pn405).

## Status and Monitoring during Torque Control

When TORQUE CONTROL is executed, some of the Status Flags, monitoring functions, and display units change.

### Servo Status Flags in Axis Operating Input Memory Area (Word b+1)

The function of bit 11 in the Servo Status Flags of the Axis Operating Input Memory Area depends on whether position control or torque control is used.

| Word | Bits | Control mode | Flag name | Function | Function change timing |
|---|---|---|---|---|---|
| b+1 | 11 | Position control | Positioning Proximity (NEAR) Flag | ON when within *Positioning Completion Range 2* | The function changes when the command to switch to position control has been received (when the Receiving Command Flag turns OFF). |
| | | Torque control | Speed Limit (V_LIM) Status Flag | ON when speed limit in progress using speed limit value specified in option command value 1. | The function changes when TORQUE CONTROL has been received (when the Receiving Command Flag turns OFF). |

### Monitors 1 and 2 in Axis Operating Input Memory Areas

When the torque is selected for monitor 1 or 2, the monitoring unit for position control/speed control, and torque control changes, as follows:

| Control mode | Speed monitoring unit | Unit change timing |
|---|---|---|
| Position control/speed control | % (1% unit) (percentage of Servomotor's rated torque) | The unit changes when the command to switch to position control or speed control has been received (when the Receiving Command Flag turns OFF). |
| Torque control | 0.001% (percentage of Servomotor's momentary maximum torque) | The unit changes when TORQUE CONTROL has been received (when the Receiving Command Flag turns OFF). |

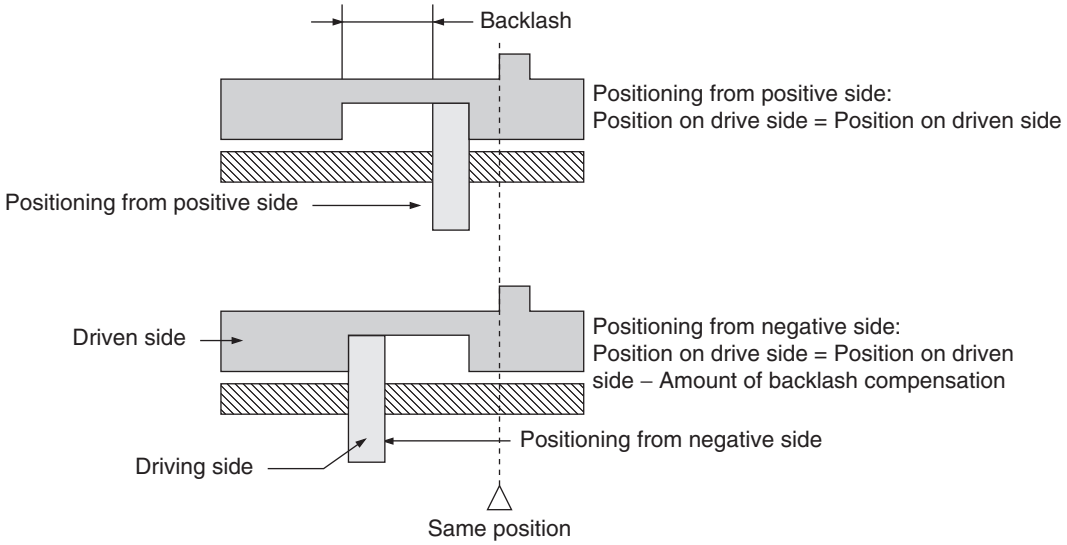


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# 10-7 Backlash Compensation

## 10-7-1 Overview

"Backlash" is the play between the driving axis and the mechanical system being driven. If there is backlash in positioning from the positive or negative direction, it will cause a discrepancy of the same extent in the positioning. When using a W-series Servo Driver, backlash compensation can be used to make this discrepancy as small as possible.




In the above diagram, after positioning from the positive side, backlash is compensated for up to the amount of the output of pulses set for the backlash compensation either when positioning in the negative direction or when the positioning direction is reversed.

The SMARTSTEP Junior Servo Drivers do not support backlash compensation.

## 10-7-2 Backlash Compensation Procedure

The PCU uses the Servo Driver's backlash compensation function. The Servo Parameters for backlash compensation must be set to enable the backlash compensation function. After setting the Servo Parameters, execute SERVO LOCK, and then perform backlash compensation with the following position control operations.

ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, ORIGIN SEARCH, ORIGIN RETURN, and JOG

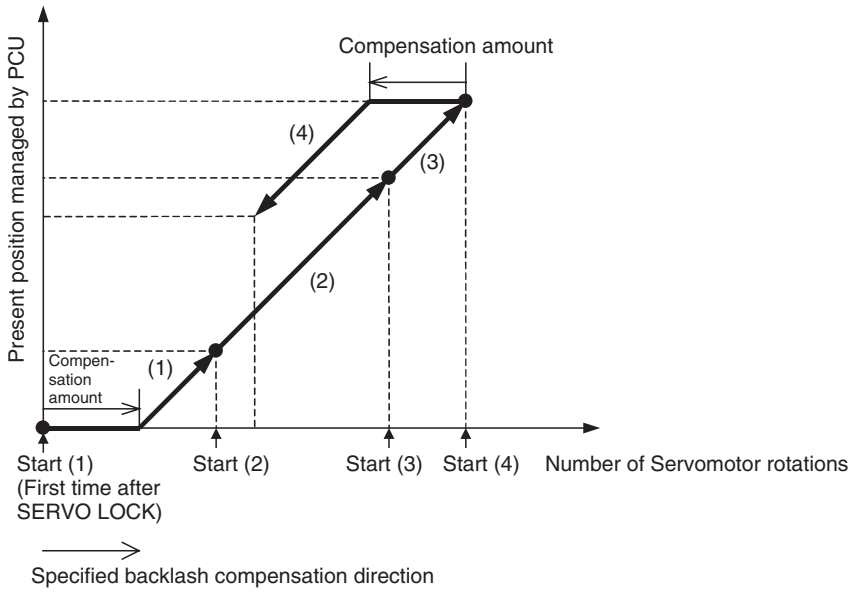
Backlash compensation is disabled when executing SPEED CONTROL or TORQUE CONTROL. Backlash compensation operation functions as follows:

- After SERVO LOCK (First Position Control Operating Command)
  Compensation is applied to the first operating command that operates in the specified backlash compensation direction. Compensation is not applied to operations prior to this that moved axes in the opposite direction to backlash.



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- After Backlash Compensation
  Backlash compensation is applied for the first operating command that operates in the opposite direction from which backlash compensation was previously applied. Once backlash compensation has been applied, it will not be applied again as long as operation is continued in the same direction.




**Note** The PCU's present position compensation according to the backlash compensation function is applied to both the feedback present position and command present position.

## 10-7-3 Backlash Compensation Data Settings

When a W-series Servo Driver is connected, the data settings for backlash compensation are as follows:

**Servo Parameter Area** **Backlash Compensation Parameters (R88D-WT□ + JUSP-NS115)**

| Type | Parameter No. | Parameter name | Unit | Setting range | Data length | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn81B | Backlash compensation amount | 0.1 command unit | –32,768 to 32,767 | 2 | 0 |
| --- | Pn81D.0 | Compensation function selection | --- | 0, 1 | 2 | 0 |

The backlash compensation amount is set in Pn81B in 0.1 command units. The minimum setting unit for the backlash compensation amount, however, depends on the encoder resolution.

**Backlash Compensation Parameters (R88D-WN□-ML2)**

| Type | Parameter No. | Parameter name | Unit | Setting range | Data length | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn207.2 | Backlash compensation selection | --- | 0 to 2 | 2 | 0 |
| --- | Pn214 | Backlash compensation amount | Command unit | –32,768 to 32,767 | 2 | 0 |
| --- | Pn215 | Backlash compensation constant | 0.01 ms | 0 to 65535 | 2 | 0 |



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The backlash compensation function is set in Pn214 in command units. The minimum setting unit for the backlash compensation amount, however, depends on the encoder resolution.

The direction in which backlash compensation is first applied after execution of SERVO LOCK using the backlash compensation function is set in Servo Parameter for backlash compensation direction (Pn81D.0) when using R88D-WT□ and in the Servo Parameter for backlash compensation selection (Pn207.2) when using R88D-WN□-ML2, as follows:

| R88D-WT□ + JUSP-NS115 | R88D-WN□-ML2 | Function |
|---|---|---|
| Pn81D.0 | Pn207.2 | |
| --- | 0 | No backlash compensation |
| 0 | 1 | Compensates in the forward direction. The first backlash compensation direction is forward. |
| 1 | 2 | Compensates in the reverse direction. The first backlash compensation direction is forward. |

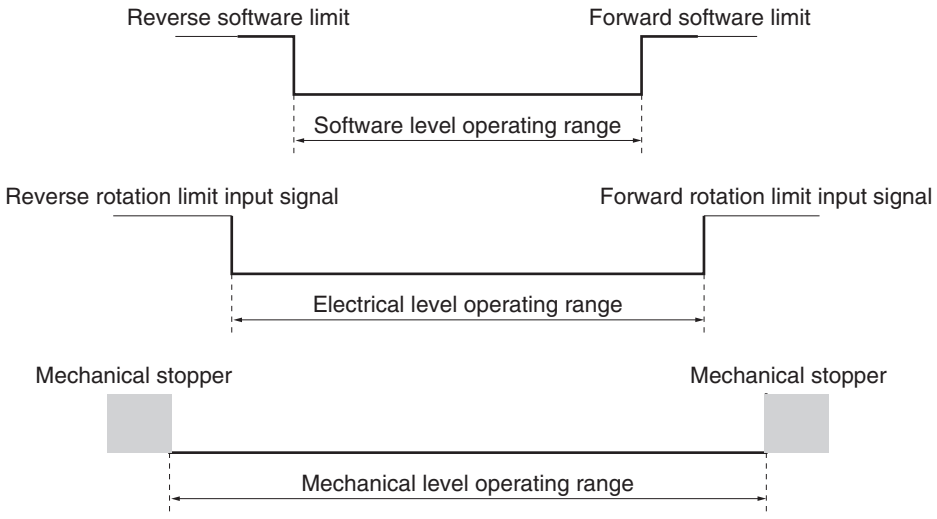
**Note** When using R88D-WT□ + JUSP-NS115 without backlash compensation, set the backlash compensation amount to (Pn81B) to 0.

# 10-8 Software Limits

## 10-8-1 Overview

To prevent or reduce damage to external devices due to unexpected positioning operations when there is a malfunction, in addition to the forward rotation and reverse rotation limit input signals, the PCU also has a function that monitors positioning at a software level. This function is called the “software limit” function.

The range in which the software limit function monitors the position is determined by the values of two settings: the forward software limit and the reverse software limit. Normally, positioning is only possible within the range determined by these software limit settings. The relationship between the forward rotation and reverse rotation limit input signals, the software limits, and the mechanical stoppers used in the system is shown below.






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The software limit function is enabled if an origin has been established (i.e., the No Origin Flag is OFF). The software limit function is disabled when the origin has not been established.

When the Servo Driver power is turned ON, the PCU's present position is set to 0, and the origin is not established. RELATIVE MOVEMENT can be executed under these conditions, but the positioning range (present position range possible for positioning) will be –2,147,483,648 to 2,147,483,647 (command units), and the present position will be refreshed by adding the travel distance without an established origin.

If RELATIVE MOVEMENT is executed using a position command value that exceeds the positioning range, a Position Designation Error (error code: 3060) will occur when the command is executed.

When a command such as JOG continues to be executed, the present position will be repeated between –2,147,483,648 and 2,147,483,647 (command units). (Refer to *7-3 Coordinate System and Present Position*.)

## 10-8-2 Procedure for Using Software Limits

The PCU uses the Servo Driver's software limit function. The Servo Parameters for software limits must be set to enable the software limit function. After setting the Servo Parameters, the software limit function is enabled by executing ORIGIN SEARCH and PRESENT POSITION PRESET, or detecting the origin using the absolute encoder.

## 10-8-3 Software Limit Data Settings

**Servo Parameter Area Software Limit Parameters**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| --- | Pn801.0 | Software limit function | --- | 0 to 3 | 2 (See note 1.) | (See note 2.) |
| --- | Pn801.2 | Software limit check using references | --- | 0 (Do not change the setting.) | | 0 |
| --- | Pn804 | Forward software limit | Command unit | –1,073,741,823 to 1,073,741,823 | 4 | 819,191,808 |
| --- | Pn806 | Reverse software limit | Command unit | –1,073,741,823 to 1,073,741,823 | 4 | –819,191,808 |

**Note** (1) The data length for Pn801.0 and Pn801.2 is that specified when Servo Parameter Pn801 is transferred.

(2) The default setting for Pn801.0 is 0 when using R88D-WT□, and 3 when using the R88D-WN□-ML2 or a SMARTSTEP Junior Servo Driver.

The software limit settings are provided in the following pages. Set the software limits so that the reverse software limit is less than the forward software limit. If the forward software limit is less than or equal to the reverse software limit, the software limit will always be enabled.

When the software limit function is enabled, the status is indicated by the Forward/Reverse Software Limit Flags in the Axis Operating Input Memory Area, as follows:



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**Axis Operating Input Memory Areas (Monitoring)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| Forward Software Limit Flag | b+1 | 12 | 0: Within forward software limit range<br>1: Forward software limit range exceeded |
| Reverse Software Limit Flag | | 13 | 0: Within reverse software limit range<br>1: Reverse software limit range exceeded |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

## 10-8-4 Software Limit Operation

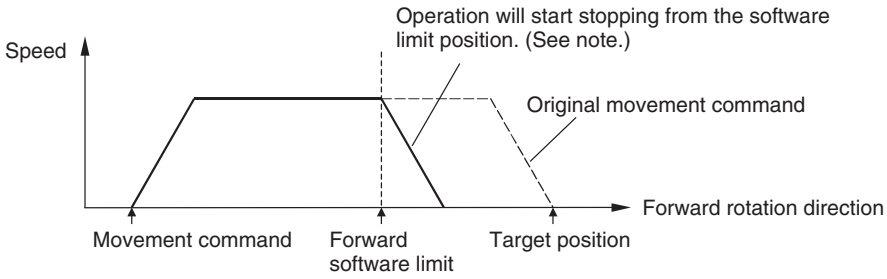
The software limit function operates as described in the following table for the present position when the software limits are set.

| Pn801.0 | | Pn801.2 | |
|---|---|---|---|
| | | **0: No software limit check using references. (Default setting)** | **1: Software limit check using references.** |
| 0 | Software limit enabled | When the feedback present position for the active axis reaches the forward/reverse software limit, in the same way as when forward/reverse rotation limit input signals are input, the axis will stop and a Forward/Reverse Software Limit Error (error code: 3002/3003) will occur. | Do not use this setting. Otherwise, the axis operation will not be performed properly. |
| 1 | Forward software limit disabled | The forward software limit is disabled.<br>When the feedback present position for the active axis reaches the reverse software limit, the axis will stop and a Reverse Software Limit Error (error code: 3003) will occur in the same way as when a reverse rotation limit input signal is input. | |
| 2 | Reverse software limit disabled | The reverse software limit is disabled.<br>When the feedback present position for the active axis reaches the forward software limit, the axis will stop and a Forward Software Limit Error (error code: 3002) will occur in the same way as when a forward rotation limit input signal is input. | |
| 3 | Software limit disabled in both directions | The software limits are disabled in both directions.<br>The refresh range and positioning range for the present position is –2,147,483,647 to 2,147,483,647 (command units), and the possible operating range is within the forward/reverse rotation limit input signal range. | |

When a movement command is executed using direct operation for which the target position will exceed the software limit range, the operation when the software limit is reached will be as shown in the following diagram.



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If RELATIVE MOVEMENT is executed using a position command value that exceeds the positioning range (–2,147,483,647 to 2,147,483,647 command units), a Position Designation Error (error code: 3060) will occur when the command is executed.

**Note** The stop operations when the software limit is reached is the same as when limit input signals are input. For details, refer to *7-5 Limit Input Operations*.

When the axis movement command is executed (after alarm reset) from the position at which the software limit is exceeded (software limit has been detected), the operation will depend on the direction in which the software limit is detected, as follows:

| Movement command | Opposite direction of software limit | Direction of software limit |
|---|---|---|
| ABSOLUTE MOVEMENT<br>RELATIVE MOVEMENT | Operation is possible.<br>Even if the target position is still beyond the software limit in the direction that has been detected, positioning will be performed to the target position and a Software Limit Error will not be detected even after positioning is completed.<br>If the target position is beyond the software limit in the other direction, a Software Limit Error will occur when the other software limit is reached.<br>If, however, RELATIVE MOVEMENT is executed using a position command value that exceeds the positioning range (–2,147,483,647 to 2,147,483,647), a Position Designation Error (error code: 3060) will occur when the command is executed. | A Software Limit Error will occur when the command is executed. |
| INTERRUPT FEEDING | Operation depends on ABSOLUTE MOVEMENT or RELATIVE MOVEMENT.<br>If the interrupt feeding direction after an interrupt input is opposite to the starting movement direction (reversal operation), the operation is as follows:<br>• If interrupt feeding is performed after passing the software limit in the direction that has been detected. When the interrupt feeding position does not reach the software limit, positioning will be completed. If the software limit will be exceeded due to interrupt feeding, a Software Limit Error will occur when the software limit position is reached again.<br>• If interrupt feeding is executed without passing the software limit in the direction that has been detected, positioning will stop at the reversal position and reverse operation will not be executed due to the Driver's drive prohibited status. In this state, a Software Limit Error will not be detected. | A Software Limit Error will occur when the command is executed. |
| ORIGIN RETURN | Origin return operations are possible when performed in the opposite direction of the software limit that has been detected. If the origin position exceeds the other software limit, however, a Software Limit Error will occur when the other software limit is reached. | A Software Limit Error will occur when the command is executed. |



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| Movement command | Opposite direction of software limit | Direction of software limit |
|---|---|---|
| JOG | Operation is possible.<br>A Software Limit Error will not be detected even if jogging is stopped, or if DECELERATION STOP or EMERGENCY STOP is executed, at a position that is still beyond the software limit in the direction that has been detected.<br>If operation is not stopped, a Software Limit Error will occur when the other software limit is reached. | A Software Limit Error will occur when the command is executed. |
| SPEED CONTROL<br>TORQUE CONTROL | Operation is possible.<br>A Software Limit Error will not be detected even if DECELERATION STOP or EMERGENCY STOP is executed at a position that is still beyond the software limit in the direction that has been detected.<br>If operation is not stopped, a Software Limit Error will occur when the other software limit is reached. | A Software Limit Error will occur when the command is executed. |
| PRESENT POSITION PRESET | If PRESENT POSITION PRESET is executed for a position beyond the software limit in the present travel direction, the present position will change and a Software Limit Error will not be detected. If PRESENT POSITION PRESET is executed for a position beyond the software limit in the direction opposite to the travel direction, the present position will change and a Software Limit Error will occur for the software limit in the opposite direction. | |
| SERVO LOCK | SERVO LOCK can be executed regardless of software limit detection status when using an Incremental Encoder or when using an Absolute Encoder as an Incremental Encoder. When using an Absolute Encoder, operation depends on the unit version of the PCU as follows:<br>PCUs with Unit Version 1.2 or Earlier<br>A software limit error will be detected when SERVO LOCK is executed and the SERVO LOCK operation will be cancelled. Disable the software limit to enable executing SERVO LOCK.<br>PCUs with Unit Version 1.3 or Later<br>SERVO LOCK can be executed regardless of software limit detection status in the same way as when using an Incremental Encoder. | |

# 10-9 Stop Functions

## 10-9-1 Overview

The stop function is used to stop active axes operated by position control, speed control, or torque control. Axis operation can be stopped using the deceleration stop method, which stops the axis using a specified deceleration, or the emergency stop method, which cancels the operating command immediately and stops operation after moving for the remaining pulses in the Servo Driver's deviation counter. Axis operations are also stopped by the PCU if an error occurs.

For details on PCU operations when errors occur, refer to *SECTION 12 Troubleshooting*.

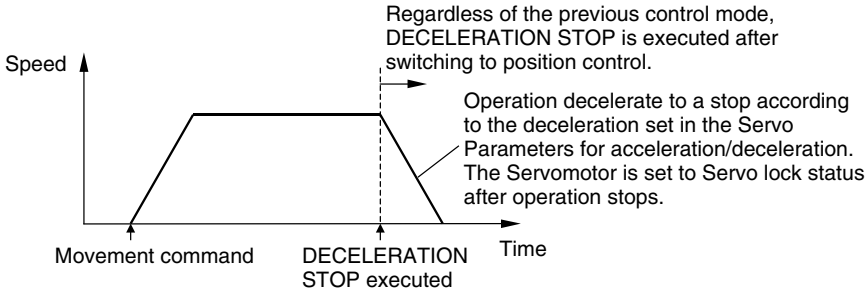
## 10-9-2 Deceleration Stop

Deceleration stop stops the active axis using the deceleration set in the Servo Parameters when the DECELERATION STOP Bit turns ON in the Axis Operating Output Memory Area. The deceleration stop operation is executed using position control with the specified deceleration curve.

When DECLARATION STOP is executed during speed control or torque control, the feedback speed at that point is used as the start speed, the control mode switches to position control, and operation decelerates to a stop.



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DECELERATION STOP can be executed for an axis that is servo-locked as long as SERVO UNLOCK, DEVIATION COUNTER RESET, or EMERGENCY STOP is not being executed and the command bits for these commands are not ON and as long as an axis error has not occurred.

When executing DECELERATION STOP, make sure that the DECELERATION STOP Bit remains ON until the Receiving Command Flag or Stop Execution Flag in the Axis Operating Input Memory Area turns ON.

All axis operation commands except for SERVO UNLOCK, DEVIATION COUNTER RESET, and EMERGENCY STOP will be ignored during DECELERATION STOP execution or while the DECELERATION STOP Bit is ON.

**Servo Parameter Area** **Acceleration/Deceleration Constants**

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting | W Series | SMART STEP Junior |
|---|---|---|---|---|---|---|---|---|
| Acceleration/ deceleration constants | Pn80D | First-step linear deceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 | Supported | Not supported |
| | Pn80E | Second-step linear deceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 | Supported | Supported |
| | Pn80F | Deceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 | Supported | Not supported |
| Acceleration/ deceleration filters | Pn810 | Exponential acceleration/deceleration bias | Command units/s | 0 to 32767 | 2 | 0 | Supported | Not supported |
| | Pn811 | Exponential acceleration/deceleration time constant | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |
| | Pn812 | Movement average time | 0.1 ms | 0 to 5100 | 2 | 0 | Supported | Not supported |

First-step deceleration curve operations require parameter settings for Pn80E only. For the acceleration/deceleration curve, Pn810 and Pn811 must be set when using an exponential curve, and Pn812 must be set when using an S-curve.

The SMARTSTEP Junior Servo Drivers do not support the following parameters: Pn80D and Pn80F. They also do not support acceleration/deceleration filters, so the filters cannot be set. A one-step linear deceleration curve is set using only Pn80E.

**Axis Operating Output Memory Areas (Operating Commands)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| DECELERATION STOP | a | 15 | 0 → 1: Starts deceleration stop. |



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a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

**Axis Operating Input Memory Areas (Monitoring)**

| Name | Word | Bits | Contents |
|---|---|---|---|
| Receiving Command Flag | b | 00 | 0: Command reception enabled.<br>0 → 1: Command reception started.<br>1: Receiving command (command reception disabled). |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing). |
| Stop Execution Flag | | 15 | 0 → 1: Stop operation completed. |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

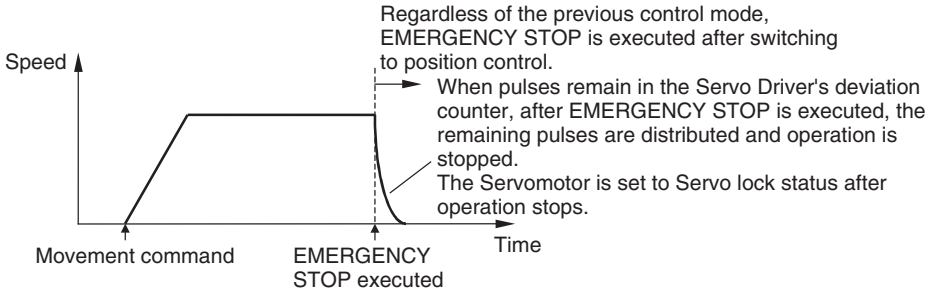
The Stop Execution Flag turns ON when DECELERATION STOP or EMERGENCY STOP is received, but does not check whether the remaining pulses in the Servo Driver are within the positioning completion range, unlike the PCU Positioning Completed Flag in direct operation.

The Stop Execution Flag turns OFF when direct operation, jogging, speed commands or other movement commands are executed.

## 10-9-3 Emergency Stop

The emergency stop operation cancels the operating command immediately and stops the active axis when the EMERGENCY STOP Bit turns ON in the Axis Operating Output Memory Area.

When EMERGENCY STOP is executed, axis operation switches to position control mode, and stops in Servo locked status. When EMERGENCY STOP is executed during position control, the axis operation distributes the pulses remaining in the Servo Driver's deviation counter and then stops.




EMERGENCY STOP can be executed for an axis that is servo-locked as long as SERVO UNLOCK or DEVIATION COUNTER RESET is not being executed and the command bits for these commands are not ON and as long as an axis error has not occurred.

When executing EMERGENCY STOP, make sure that the EMERGENCY STOP Bit remains ON until the Receiving Command Flag or Stop Execution Flag in the Axis Operating Input Memory Area turns ON.

All axis operation commands except for SERVO UNLOCK and DEVIATION COUNTER RESET will be ignored during EMERGENCY STOP execution or while the EMERGENCY STOP Bit is ON.



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### Axis Operating Output Memory Areas (Operating Commands)

| Name | Word | Bits | Contents |
|---|---|---|---|
| EMERGENCY STOP | a+1 | 15 | 0 → 1: Starts emergency stop. |

a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

### Axis Operating Input Memory Areas (Monitoring)

| Name | Word | Bits | Contents |
|---|---|---|---|
| Receiving Command Flag | b | 00 | 0: Command reception enabled.<br>0 → 1: Command reception started.<br>1: Receiving command (command reception disabled). |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing). |
| Stop Execution Flag | | 15 | 0 → 1: Stop operation completed. |

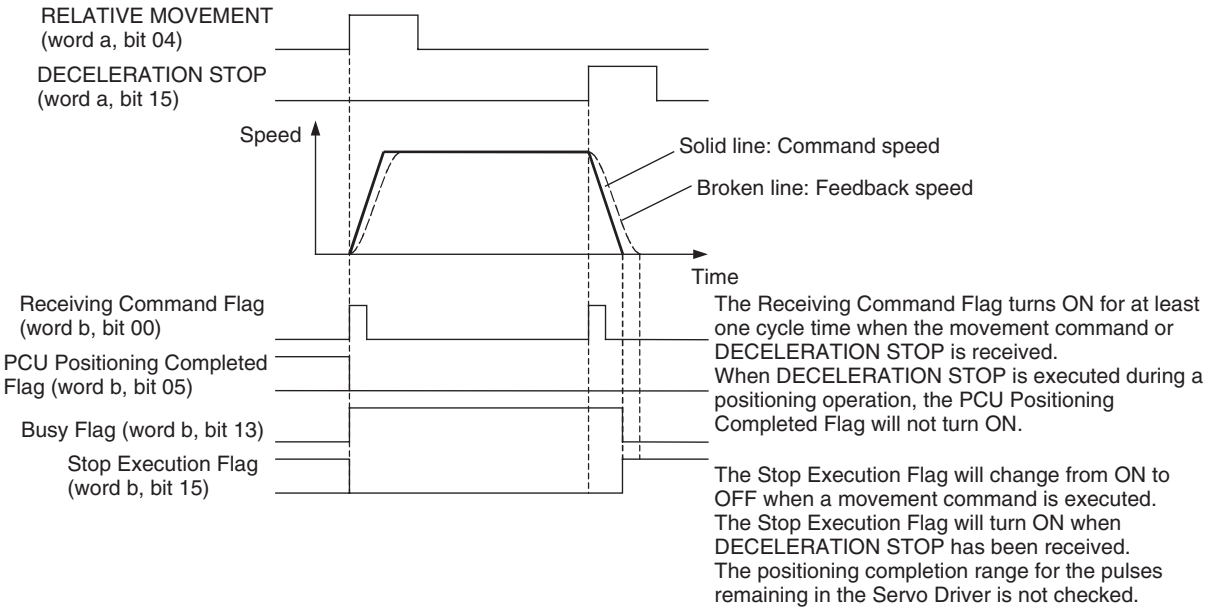
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

The Stop Execution Flag turns ON when DECELERATION STOP or EMERGENCY STOP is received, but does not check whether the remaining pulses in the Servo Driver are within the positioning completion range, unlike the PCU Positioning Completed Flag in direct operation.

The Stop Execution Flag turns OFF when direct operation, jogging, speed commands or other movement commands are executed.

## 10-9-4 Stop Function Timing Chart

The following timing chart is for when DECELERATION STOP is executed. The timing chart for EMERGENCY STOP is the same, except that operation is stopped after distributing the pulses remaining in the Servo Driver.




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25



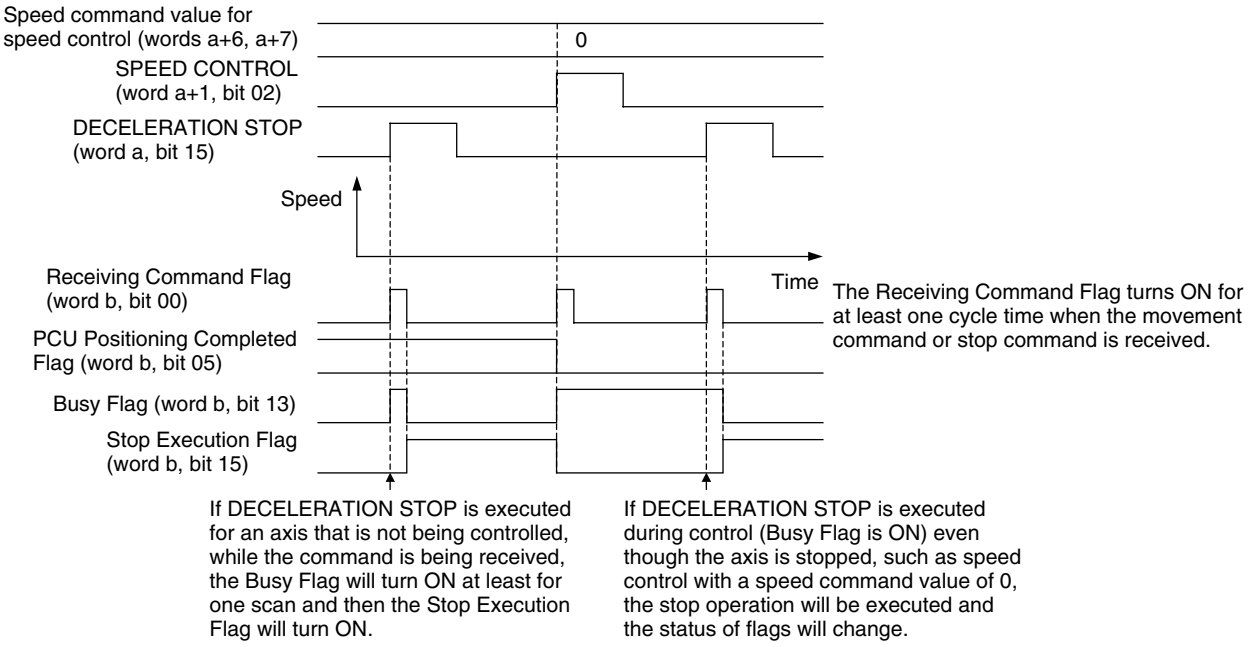
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When DECELERATION STOP or EMERGENCY STOP is executed during direct operation (ABSOLUTE MOVEMENT/RELATIVE MOVEMENT) or ORIGIN SEARCH, the PCU Positioning Completed Flag will not turn ON when operation stops. Even if the stop position for DECELERATION STOP/EMERGENCY STOP is within the positioning completion range of the target position for the initial positioning operation, the PCU Positioning Completed Flag will not turn ON.

The status of the Receiving Command Flag, Busy Flag, and Stop Execution Flag will change if DECELERATION STOP or EMERGENCY STOP is executed when an axis operating command is not being executed.

The stop operation will also be performed in the same way as for an active axis if still in the controlled status while the axis is being stopped (Busy Flag is ON), such as during direct operation, jogging, when the speed command value is set to 0 for speed control, or when the axis is being stopped during torque control.

Example: Executing DECELERATION STOP for Speed Control with a Speed Command Value of 0




a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25



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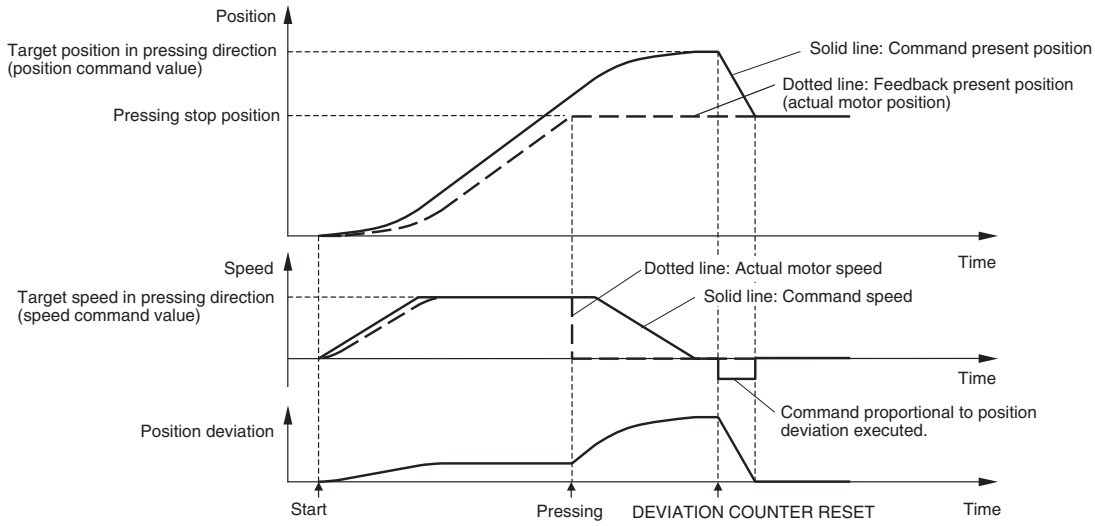
# 10-10 DEVIATION COUNTER RESET

## 10-10-1 Overview of DEVIATION COUNTER RESET

The deviation counter can be reset during position control for PCUs with unit version 1.3 or later.

The deviation counter reset function resets to 0 the position deviation accumulating in the Servo Driver's position loop deviation counter during position control. When pressing using torque control, when the machine catches and stops moving, or in other cases when the command present position and the feedback present position vary greatly, the positioning operation may not finished because the position deviation never becomes less than the completion width. DEVIATION COUNTER RESET can be used in such cases to reset the accumulated position deviation to 0 and thus complete the positioning operation.

With this function, the PCU's deviation counter reset function uses a movement command in the direction opposite to and the same size as the accumulated position deviation so that the command present position will match the feedback present position.




DEVIATION COUNTER RESET is valid only during position control after the servo has been locked and will be ignored if executed during speed control or torque control, or when the servo is unlocked.

**Note** Execute the PCU's DEVIATION COUNTER RESET only while the motor axis (machine) is stopped, by being pressed against something for example. This function executes a movement command in the direction opposite to and of the same size as the accumulated position deviation, so the machine may be subjected to shock if a movement command in the opposite direction is suddenly executed for a rotating axis. Also, do not execute DEVIATION COUNTER RESET for a vertical axis that is stopped by a servo lock only, without being held mechanically. While the vertical axis is servo-locked, the axis is controlled so that the vertical position is held using the accumulated position deviation. Therefore, executing a deviation counter reset may cause the motor load to fall.



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## 10-10-2 Using DEVIATION COUNTER RESET

DEVIATION COUNTER RESET is executed by turning ON the DEVIATION COUNTER RESET Bit in the Axis Operating Output Area to execute a movement command that effectively cancels the position deviation.

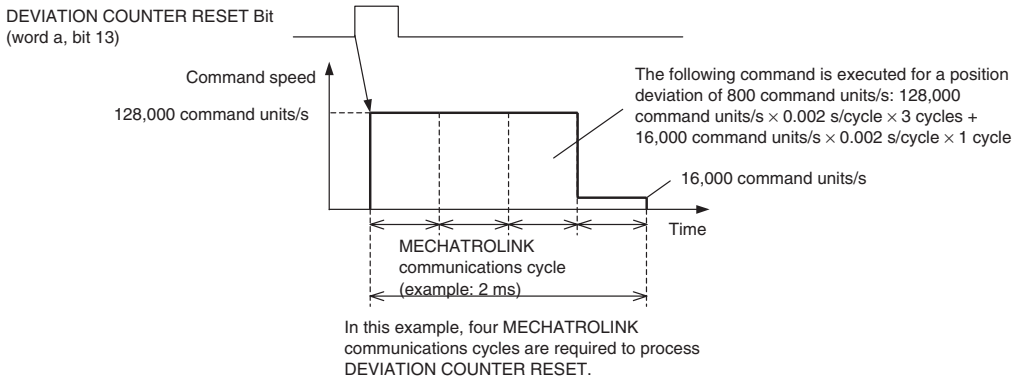
DEVIATION COUNTER RESET executes position control according to the position deviation at a maximum speed of 128,000. If the accumulated position deviation is large, processing time equivalent to several MECHATROLINK communications cycles will be required to complete resetting the deviation counter.

**Example**

MECHATROLINK communications cycle: 2 ms

Position deviation: 800 (command units)

The movement command executed for DEVIATION COUNTER RESET will be as shown below for the above conditions. The direction will be so that the position deviation is eliminated.




In this example, the movement command to eliminate the position deviation of 800 command units exceeds the movement possible in one MECHATROLINK communications cycle at a speed of 128,000 command units/s, so the command is executed over multiple cycles (four total).

When DEVIATION COUNTER RESET is executed, the torque limit does not depend on the setting of the Torque Limit Designation Bit, but on the status in the previous axis operation. (The previous torque limit status is continued, and DEVIATION COUNTER RESET is executed.)

**Axis Operating Output Area (Operation Commands)**

| Name | Word | Bit | Description |
|---|---|---|---|
| DEVIATION COUNTER RESET Bit | a | 13 | 0 → 1: Deviation counter reset started. |

a = Beginning word of Axis Operating Output Area specified in Common Parameters + (Axis No. − 1) x 25

A deviation counter reset can be executed for any axis for which position control that includes a Servo lock is being executed, as long as there is no axis error, the Servo is locked, and the Servo Unlock Bit is not ON. The command is invalid if executed during speed control or torque control, or when the Servo is unlocked.

When executing a deviation counter reset, keep the Deviation Counter Reset Bit ON until Receiving Command Flag turns ON in the Axis Operating Output Area or until the Busy Flag is turned OFF.



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While the Deviation Counter Reset Bit is ON and a deviation counter reset is being executed, all operation commands other than SERVO UNLOCK are disabled.

**Axis Operating Input Area (Monitoring)**

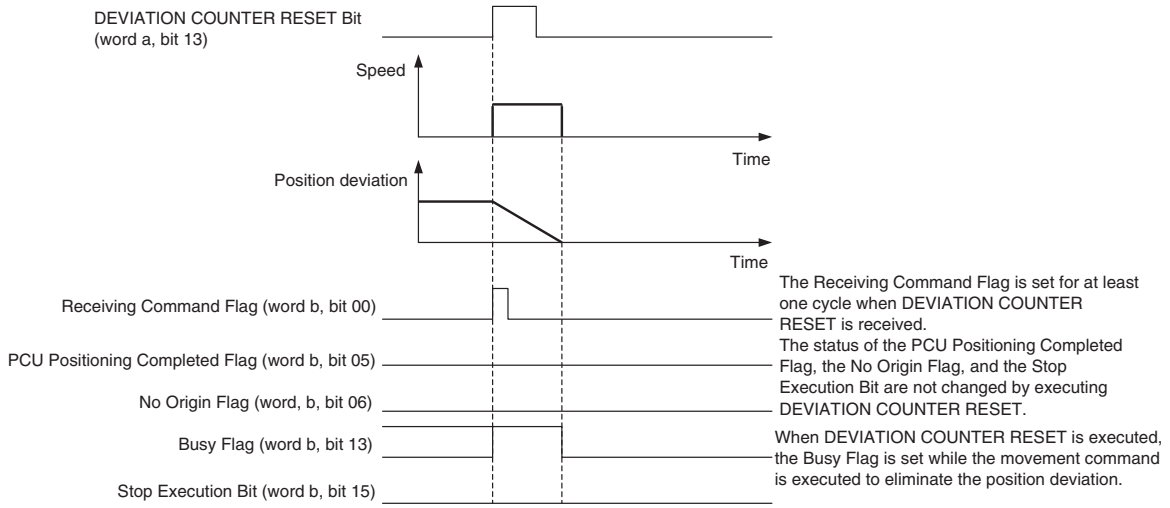
| Name | Word | Bits | Contents |
|---|---|---|---|
| Receiving Command Flag | b | 00 | 0: Command reception enabled.<br>0 → 1: Command reception started.<br>1: Receiving command (command reception disabled). |
| Error Flag | | 12 | 0: No axis error<br>1: Axis error has occurred. |
| Busy Flag | | 13 | 1: Axis busy (axis operation executing). |

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. − 1) × 25

The status of the PCU Positioning Completed Flag, the No Origin Flag, and the Stop Execution Bit are not changed by turning ON the DEVIATION COUNTER RESET Bit. When the DEVIATION COUNTER RESET is executed, the Busy Flag is held.

## Timing Chart

The timing chart for DEVIATION COUNTER RESET is shown below.




a = Beginning word of Axis Operating Output Area specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Area specified in Common Parameters + (Axis No. −1) × 25



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# SECTION 11
# Sample Programs

This section provides basic program examples and application examples for using the Position Control Unit.


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# 11-1 Overview

This section shows sample programs that execute the various PCU functions from the ladder program.

Refer to *11-2 Basic Program Examples* for descriptions of the sample ladder program sections containing the functions. Refer to *11-3 Application Examples* for sample programs that combine those various program sections.

This section explains the example system and conditions used for the sample programs.

**Note** The sample programs shown in this section use the PCU's functions and are configured only with ladder programs related to the interface between the PLC and PCU.
When creating the program for the actual equipment in the system, add program sections to perform tasks such as interlocking the equipment's movement, managing I/O from other equipment, and controlling operation so that the program will provide the required operating commands to the PCU.
In addition, always test the new program thoroughly to verify proper operation before switching to full-scale operation in the system.

## Devices in the Sample System

**Position Control Unit**

CJ1W-NCF71
Unit number: 0 (Beginning word of Common Operating Memory Area: CIO 1500)

Only one PCU is used in the PLC.

When a different unit number is required, use the following equation to determine the beginning word of Common Operating Memory Area.

Beginning word of Common Operating Memory Area: n = 1500 + (unit number × 25)

**MECHATROLINK Devices (Servo Drivers)**

W-series Servo Driver (R88D-WT□)
JUSP-NS115 MECHATROLINK-II Application Module mounted to Servo Driver

Axis 1 (MECHATROLINK-II station address 1) is used to demonstrate axis operation in these sample ladder programs.

When a different number of axes or station number is required, use the following equation to determine the beginning CIO word addresses for each axis.

Beginning word of Axis Operating Output Memory Area for Axis N:
Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25

Beginning word of Axis Operating Input Memory Area for Axis N:
Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Refer to *11-3-1 Initial PCU Settings* for an example that shows how to set the beginning words of Axis Operating Input/Output Areas.

The standard settings are used for the Servo Driver's I/O signals; for details on the standard settings, refer to *6-4 Standard Settings for Servo Drivers Using MECHATROLINK*.

**CPU Unit**

Model number: CJ1H-CPU□□

In *11-3 Application Examples*, the CPU Unit's EM Area is used to store the PCU's Common Parameter, Axis Parameter, and Servo Parameter data.

If the CJ1H-CPU□□ CPU Unit being used is not equipped with an EM Area, change the storage area to an unused section of the DM Area.



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### Installation and Wiring

Install and wire the devices according to the directions in *SECTION 3 Installation and Wiring*.

Connect a 24-VDC control input power supply for the Servo Driver's I/O signals and connect normally closed switches/sensors for the positive and negative overtravel inputs (forward drive prohibited and reverse drive prohibited signals).

Also, when an origin search operation is to be executed, connect a normally open switch/sensor for the origin proximity input signal (origin return deceleration LS).

## 11-2 Basic Program Examples

This section provides sample ladder programs related to the PCU's basic functions.

### 11-2-1 Transferring PCU Parameters

#### Overview

The parameters set in the PCU (Common Parameters and Axis Parameters) can be transferred to and from the CPU Unit's EM Area using the READ DATA Bit and WRITE DATA Bit.

Also, the parameters that have been written to the PCU can be saved to the PCU's internal flash memory using the SAVE DATA Bit.

These sample programs use the following parts of the CPU Unit's I/O memory.

**CPU Bus Unit Area**

CIO 1500 to CIO 1524

These word addresses are contained in the CPU Bus Unit Area words allocated to unit number 0.

**Data Memory Area (DM Area)**

D10000 to D10039

These words contain the write data when writing or the read data when reading.

In this sample program, 40 words of data are written and read, and D10000 is specified as the starting word, so D10000 to D10039 are used.

**Work Area (WR Area)**

Writing data: W300.00 to W300.06
Reading data: W301.00 to W301.06
Saving data: W302.00 to W302.06

These Work Area bits are used to show the progress of function execution and the execution status.

#### Writing Data

Use the WRITE DATA Bit in the Common Operating Memory Area to write the write data prepared in the DM Area of the CPU Unit to the PCU.

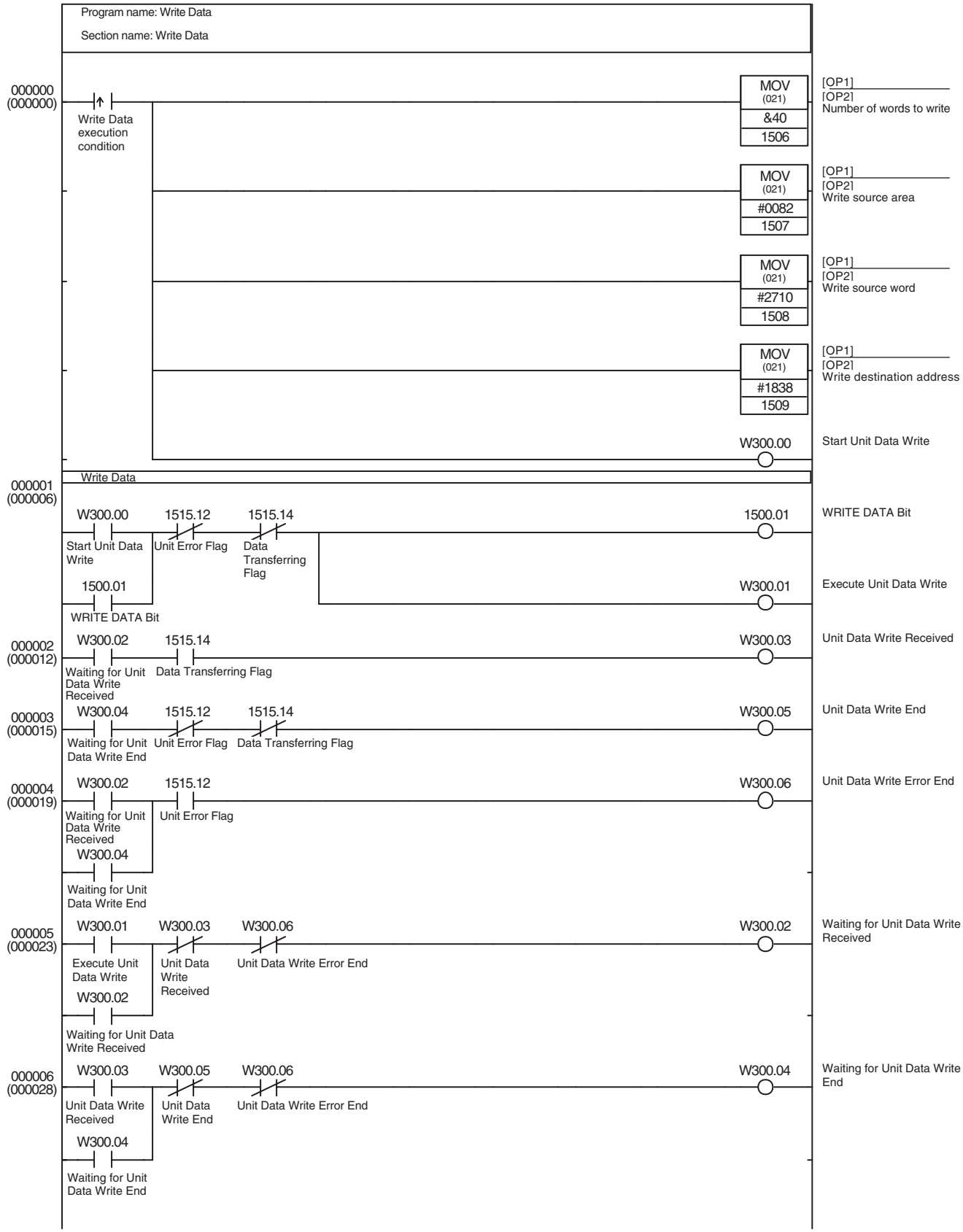
When the execution condition for the write operation goes ON, the 40 words of write data (preset in the CPU Unit's DM Area starting at D10000) are transferred to the PCU's internal memory starting at address 1838 hex.

When the data has been written, W300.05 is turned ON for one cycle.



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## Sample Ladder Program






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## Reading Data

Use the READ DATA Bit in the Common Operating Memory Area to read the read data from the PCU's internal memory to the CPU Unit's DM Area.

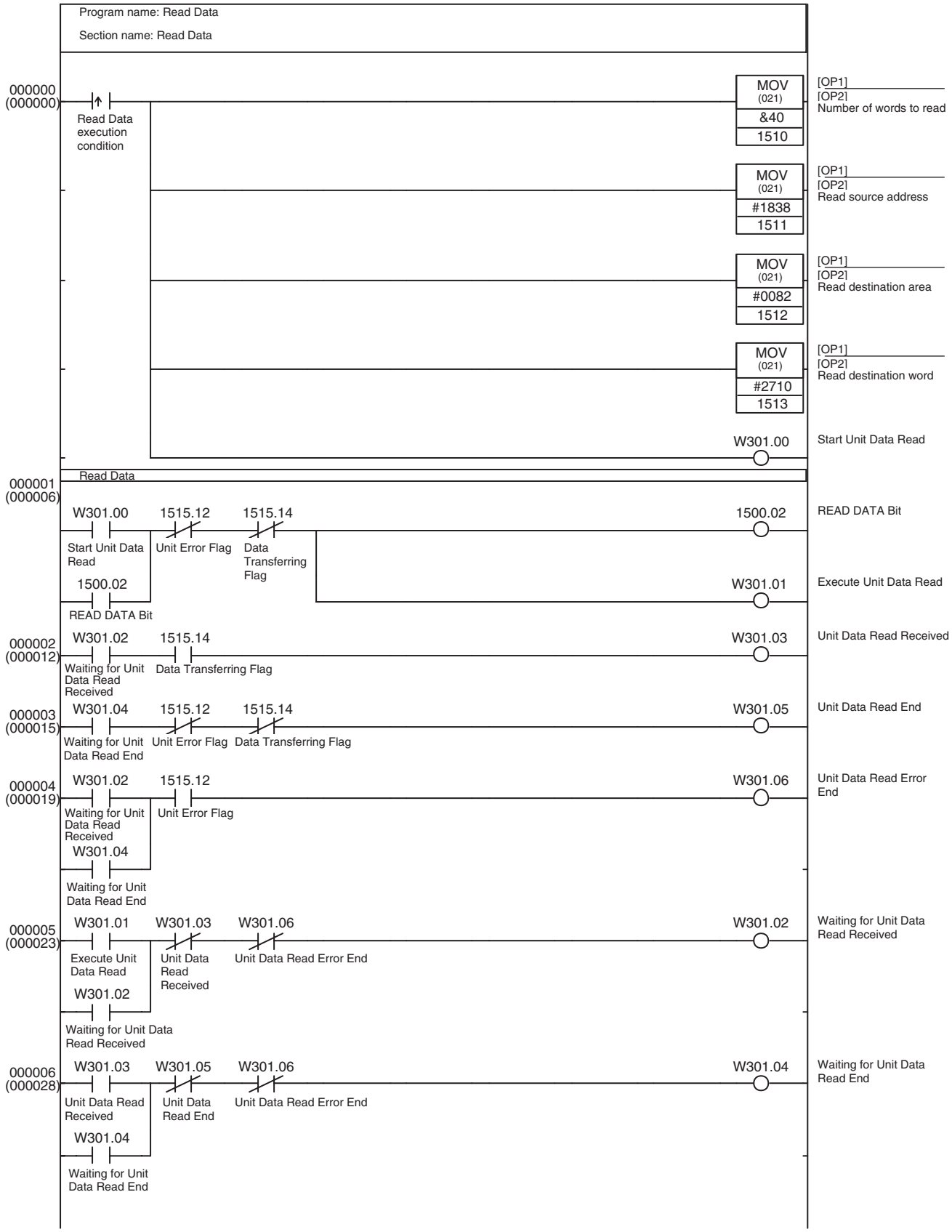
When the execution condition for the read operation goes ON, the 40 words of read data are read from the PCU's internal memory (starting at address 1838 hex) to the CPU Unit's DM Area (starting at D10000).

When the data has been read, W301.05 is turned ON for one cycle.



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### Sample Ladder Program






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## Saving Data

Use the SAVE DATA Bit in the Common Operating Memory Area to save the PCU's Common Parameters and Axis Parameters to the PCU's flash memory.

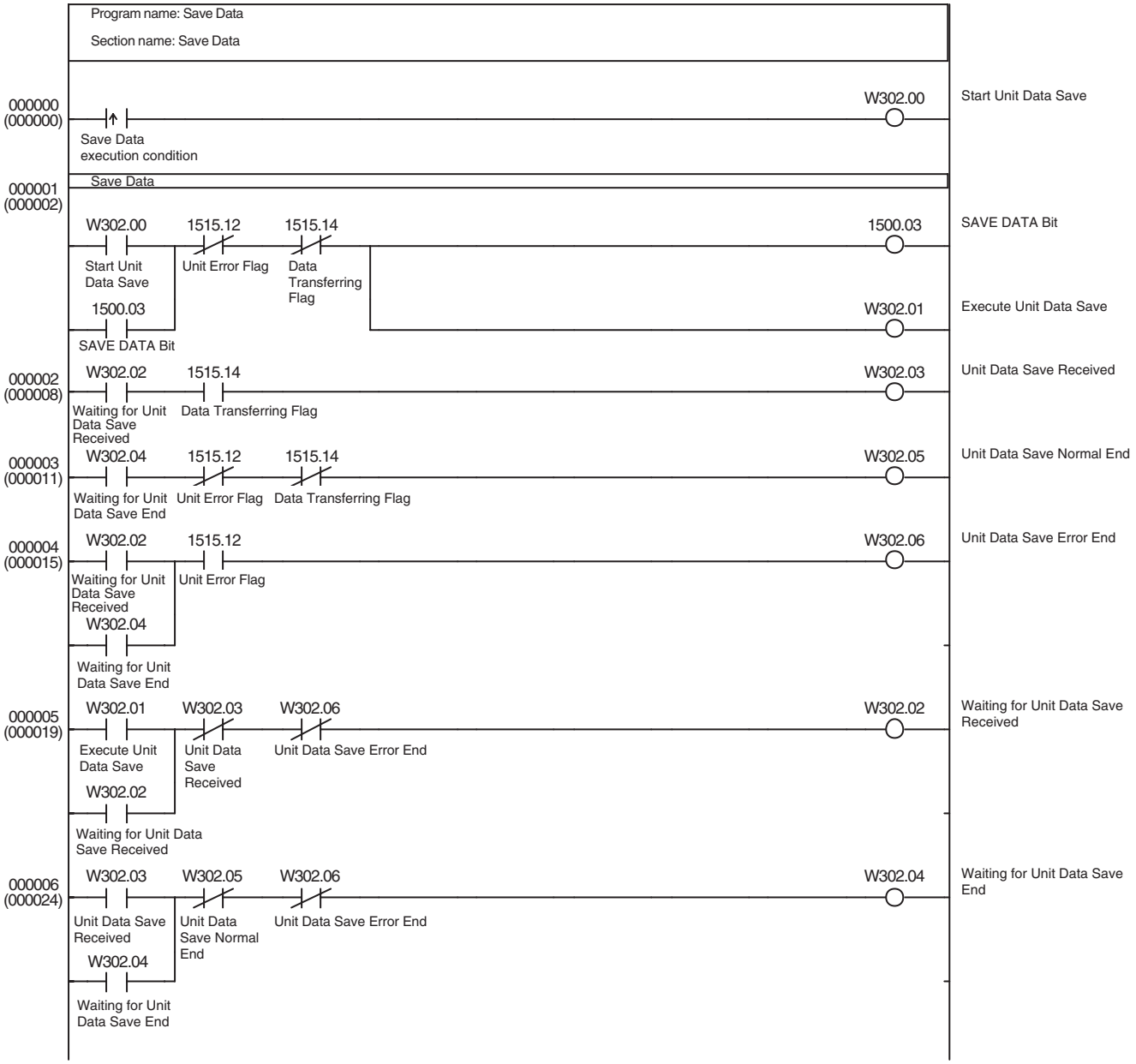
The PCU's Save Data operation is executed when the Save Data execution condition goes from OFF to ON.

When the data has been saved, W302.05 is turned ON for one cycle.

The Save Data operation cannot be executed while MECHATROLINK communications are active. If the Save Data is executed during MECHATROLINK communications, a Multi-start Error (Unit error code: 0021).

Execute this sample program only when MECHATROLINK communications are stopped.

### Sample Ladder Program






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## 11-2-2 Starting and Stopping MECHATROLINK Communications

### Overview

This program starts MECHATROLINK communications (establishes a connection) based on the MECHATROLINK communications settings and the scan list set in the PCU's Common Parameters; the program can also stop communications (release the connection).

While the PCU connection is established, MECHATROLINK communications will be stopped automatically if normal communications are not established with all of the axes registered in the scan list within the preset timeout time.

(If the PCU cannot start communications with an axis registered in the scan list within 10 seconds, an MLK Initialization Error will occur. This sample program contains a timer function that stops communications before the MLK Initialization Error is detected.)

This program uses the MECHATROLINK communications settings and the scan list that are already set in the PCU's Common Parameters.

This sample program uses the following parts of the CPU Unit's I/O memory.

**CPU Bus Unit Area**

CIO 1500 to CIO 1524

These word addresses are contained in the CPU Bus Unit Area words allocated to unit number 0.

**Work Area (WR Area)**

W303.00 to W303.04

These Work Area bits are used to show the progress of function execution and the execution status.

**Timer Area**

TIM0000

Used as a watchdog timer to monitor the establishment of a connection.

This program uses the CONNECT Bit in the Common Operating Memory Area to start and stop MECHATROLINK communications.

When the Start Communications condition goes ON, MECHATROLINK communications are started (a connection is established). Likewise, when the Stop Communications condition goes ON, MECHATROLINK communications are stopped (the connection is released).

In this sample program, only Axis 1 is registered in the scan list.

If MECHATROLINK communications start normally with Axis 1, Work Area bit W303.03 will be turned ON.

The connection will be stopped and Work Area bit W303.04 will be turned ON if MECHATROLINK communications do not start with Axis 1 5 seconds after execution of CONNECT.

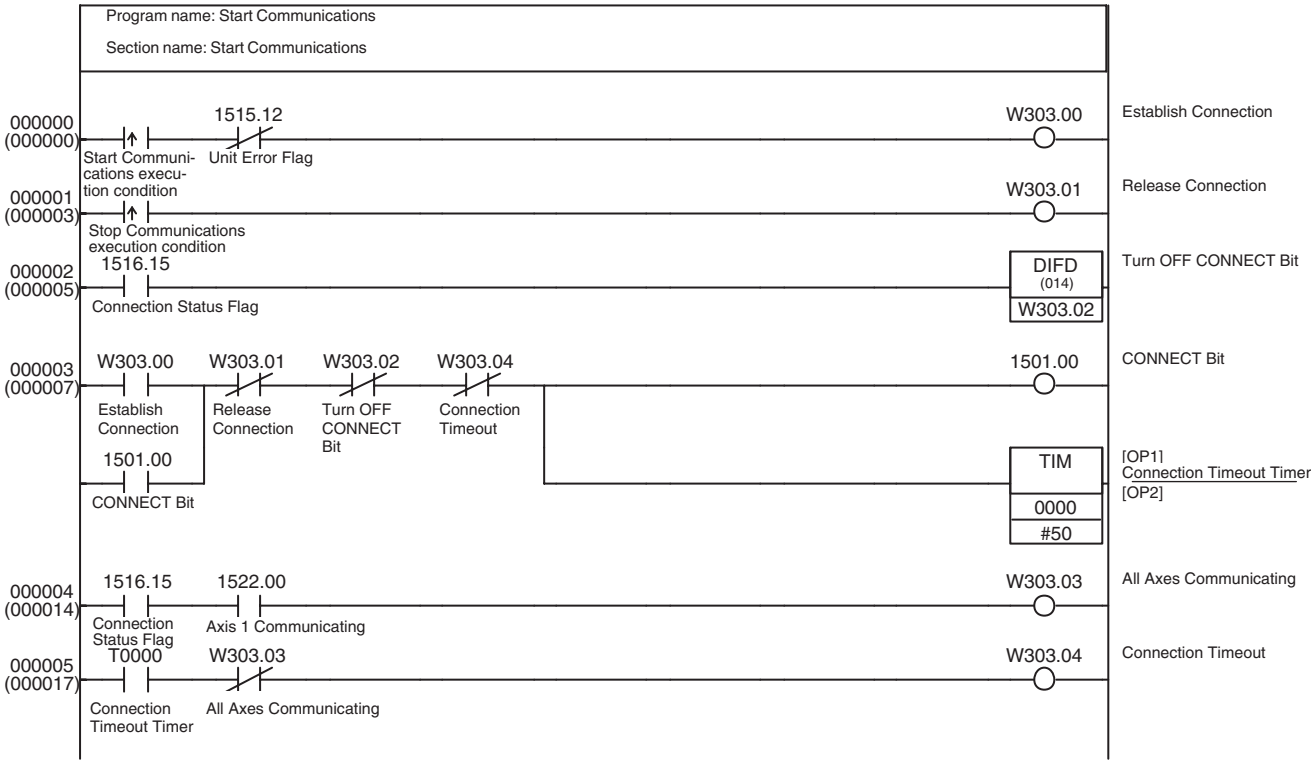
Since the PCU will continue MECHATROLINK communications while the CONNECT Bit (CIO 1501.00) is ON, the CONNECT Bit is programmed as a self-holding bit in the ladder program. If an error occurs that stops communications, such as a communications error, the PCU will release the connection regardless of the status of the CONNECT Bit.

To reestablish the connection after eliminating the cause of the error, the CONNECT Bit must be turned OFF and then ON again. When releasing the connection after an error occurs, use W303.02 to turn OFF the self-holding circuit that holds the CONNECT Bit.



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## Sample Ladder Program




## 11-2-3 Transferring Servo Parameters

### Overview

The Servo Parameters in Servo Drivers connected through MECHATROLINK communications can be transferred to and from the CPU Unit's DM Area with the PCU's WRITE SERVO PARAMETER Bit, READ SERVO PARAMETER Bit, and SAVE SERVO PARAMETER Bit.

The application example shown in *11-3-2 Servo Parameter Backup* incorporates this sample program to transfer all the W-series Servo Driver's Servo Parameters at once between the Servo Driver (equipped with a JUSP-NS115 Application Module) and the CPU Unit's EM Area.

Execute these sample programs only after starting MECHATROLINK communications (establishing a connection).

In these examples, the Servo Parameters are transferred to and from the Servo Driver registered as axis 1.

The Axis Operating Output/Input Memory Areas for the axis are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.



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**Data Memory Area (DM Area)**

D10500 to D10503

These words are used to store the data required for a single Servo Parameter transfer, including the Servo Parameter number, parameter size, and transfer data (2 words).

**Work Area (WR Area)**

Writing Servo Parameters: W400.00 to W400.06
Reading Servo Parameters: W401.00 to W401.06
Saving Servo Parameters: W402.00 to W402.06

These Work Area bits are used to show the progress of function execution and the execution status.

## Writing Servo Parameters

Use the WRITE SERVO PARAMETER Bit in the Axis Operating Output Memory Area to write the Servo Parameter data (preset in the CPU Unit's DM Area) to the Servo Driver.

When the Servo Parameter transfer operation's execution condition goes ON, the Servo Parameters preset in the following DM Area words will be transferred to the Servo Driver.

| Word | Details |
|---|---|
| D10500 | Servo Parameter No. |
| D10501 | Parameter size (Unit: bytes) |
| D10502 | Write data (rightmost word) |
| D10503 | Write data (leftmost word) |

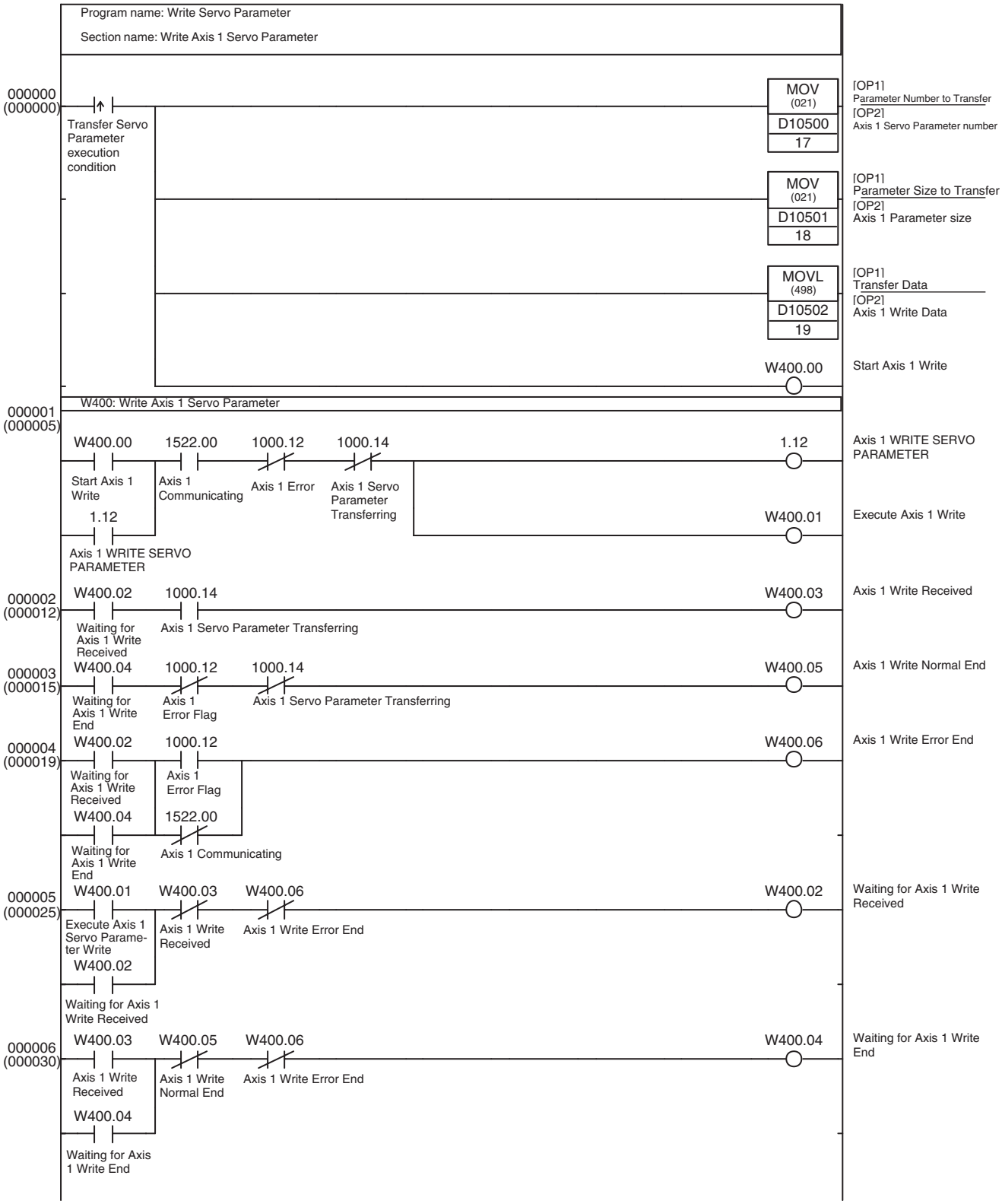
When the Servo Parameter data has been written, W400.05 is turned ON for one cycle.

When the write operation was not completed normally, i.e., an error occurred during the transfer, W400.06 will be turned ON for one cycle. (There must be no axis error before execution of this sample program.)



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## Sample Ladder Program






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## Reading Servo Parameters

Use the READ SERVO PARAMETER Bit in the Axis Operating Output Memory Area to read the Servo Parameters from the Servo Driver to the CPU Unit's DM Area.

When the Servo Parameter transfer operation's execution condition goes ON, the Servo Parameter (specified in the DM Area as shown below) will be read.

| Word | Details |
|---|---|
| D10500 | Servo Parameter No. |
| D10501 | Parameter size (Unit: bytes) |

When the Servo Parameter data has been read normally, W401.05 is turned ON for one cycle and the parameter is stored in the DM Area as shown in the following table.

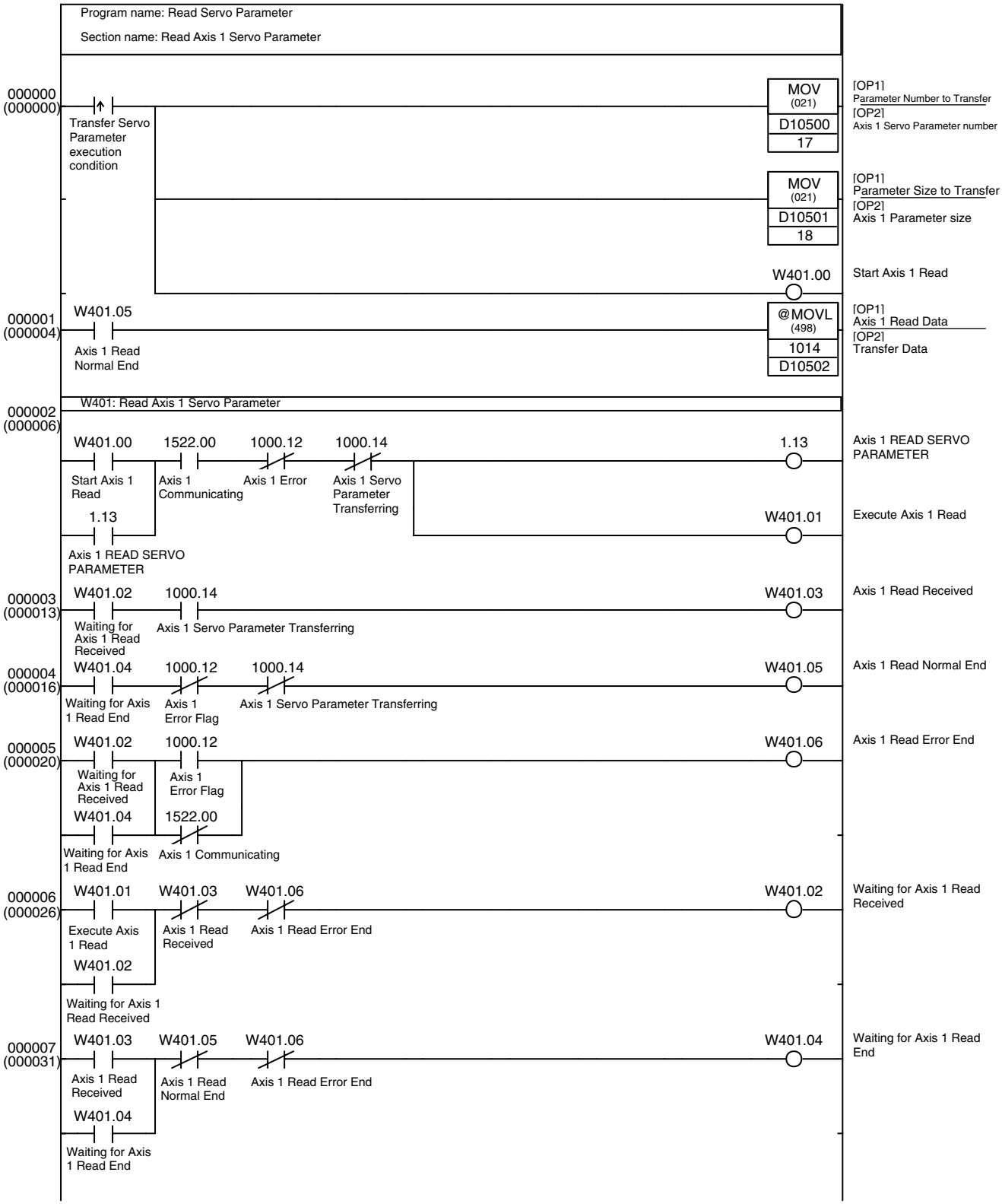
| Word | Details |
|---|---|
| D10502 | Read data (rightmost) |
| D10503 | Read data (leftmost) |

When the read operation was not completed normally, i.e., an error occurred during the transfer, W401.06 will be turned ON for one cycle. (There must be no axis error before execution of this sample program.)



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## Sample Ladder Program






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## Saving Servo Parameters

Use the SAVE SERVO PARAMETER Bit in the Axis Operating Output Memory Area to write the transfer data (preset in the CPU Unit's DM Area) to the Servo Driver's non-volatile flash memory.

When the Servo Parameter transfer operation's execution condition goes ON, the Servo Parameters preset in the following DM Area words will be transferred to the Servo Driver and written to the Servo Driver's non-volatile flash memory at the same time.

| Word | Details |
|---|---|
| D10500 | Servo Parameter No. |
| D10501 | Parameter size (Unit: bytes) |
| D10502 | Write data (rightmost word) |
| D10503 | Write data (leftmost word) |

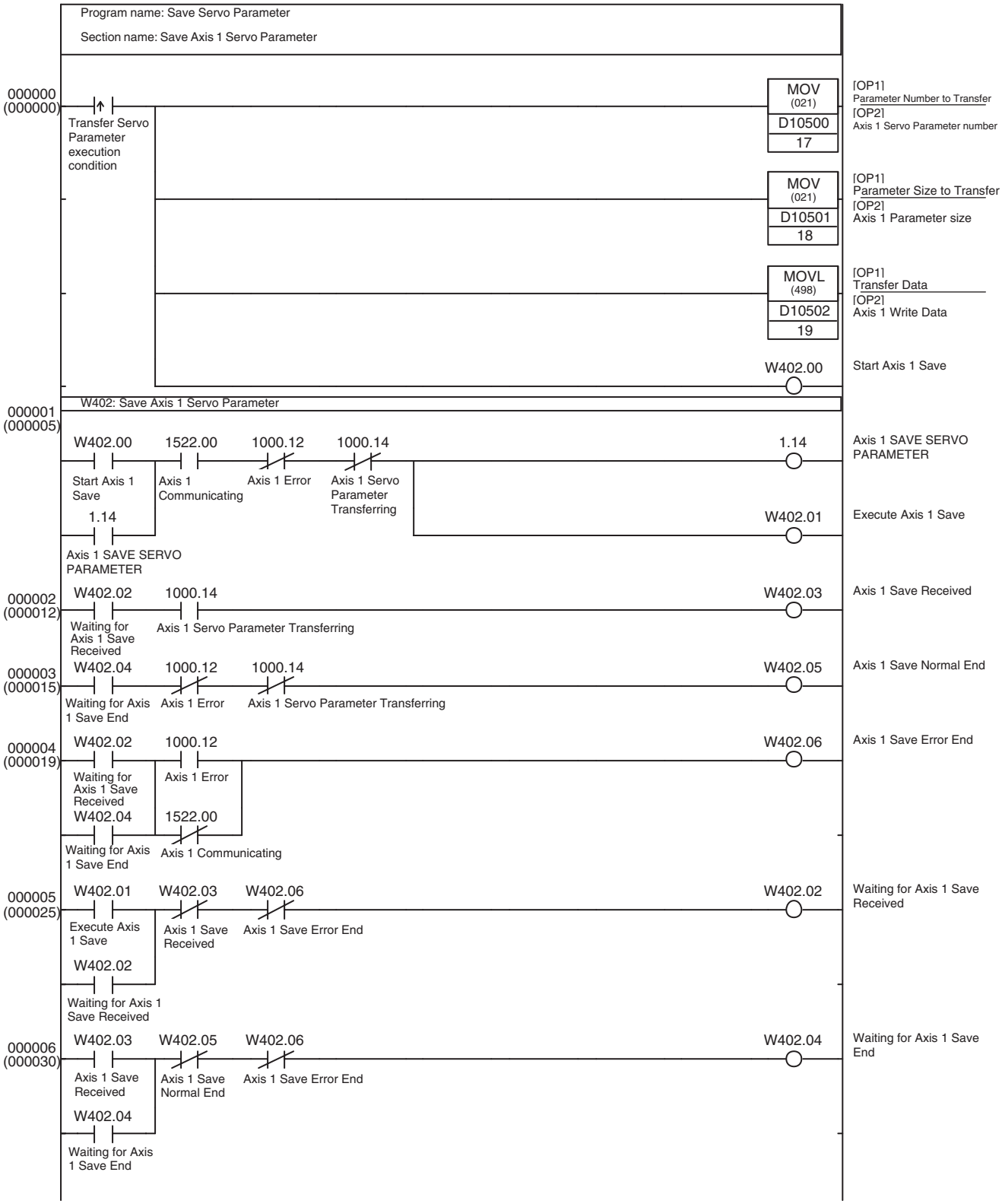
When the Servo Parameter data has been saved normally, W402.05 is turned ON for one cycle.

When the save operation was not completed normally, i.e., an error occurred during the transfer, W402.06 will be turned ON for one cycle. (There must be no axis error before execution of this sample program.)



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### Sample Ladder Program






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## 11-2-4 Servo Lock/Unlock

### Overview

This sample program executes the Servo Lock/Unlock function on a Servo Driver connected through MECHATROLINK communications.

Also, timeout processing will be performed when the Servo Lock function has been executed but the Servo Lock did not engage for the axis within a preset time.

Execute this sample program only after starting MECHATROLINK communications (establishing a connection).

In this example, the Servo Lock/Unlock function is executed on the Servo Driver registered as axis 1 using the SERVO LOCK Bit or SERVO UNLOCK Bit in the Axis Operating Output Memory Area.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

#### Work Area (WR Area)

W305.00 to W305.05

These Work Area bits are used to show the progress of function execution and the execution status.

#### Timer Area

TIM0001

Used as a watchdog timer to monitor the execution of the Servo Lock function.

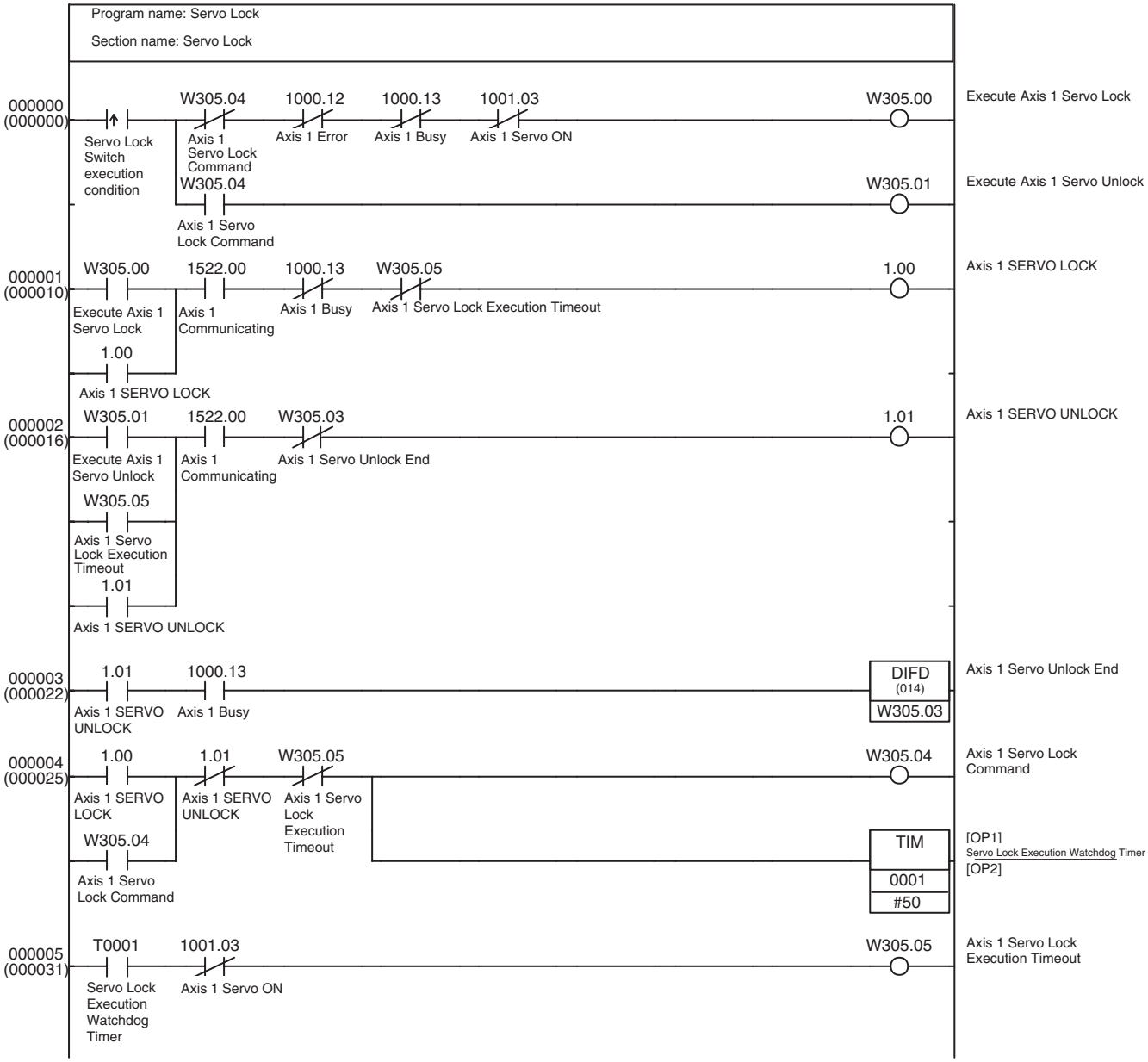
This sample program alternately executes the Servo Lock and Servo Unlock functions each time that the Servo Lock Switch execution condition goes from OFF to ON.

If the Axis 1 Servo Lock is not engaged within 5 seconds after the Servo Lock function is executed, a Servo Lock Execution Timeout will occur, bit W305.05 will be turned ON for one cycle, and the Servo Unlock function will be executed.



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## Sample Ladder Program




**Note** With the above programming example, if the Servo is unlocked by any means other than the SERVO UNLOCK command bit (e.g., if a Driver main circuit OFF error occurs), the status of the work bit will be held. When using this programming example as reference for actual programming, add interlocks suitable for the operating conditions of the equipment.

## 11-2-5 Origin Search

### Overview

This sample program executes an origin search on a Servo Driver connected through MECHATROLINK communications.

Execute this sample program only after starting MECHATROLINK communications (establishing a connection), executing the Servo Lock function, and verifying that the Servo Lock is engaged.



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In these examples, the origin search is performed on the Servo Driver registered as axis 1.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

**Work Area (WR Area)**

W350.00 to W350.02

These Work Area bits are used to show the progress of function execution and the execution status.

**Timer Area**

TIM0002

Used as a watchdog timer to detect an origin search timeout error.

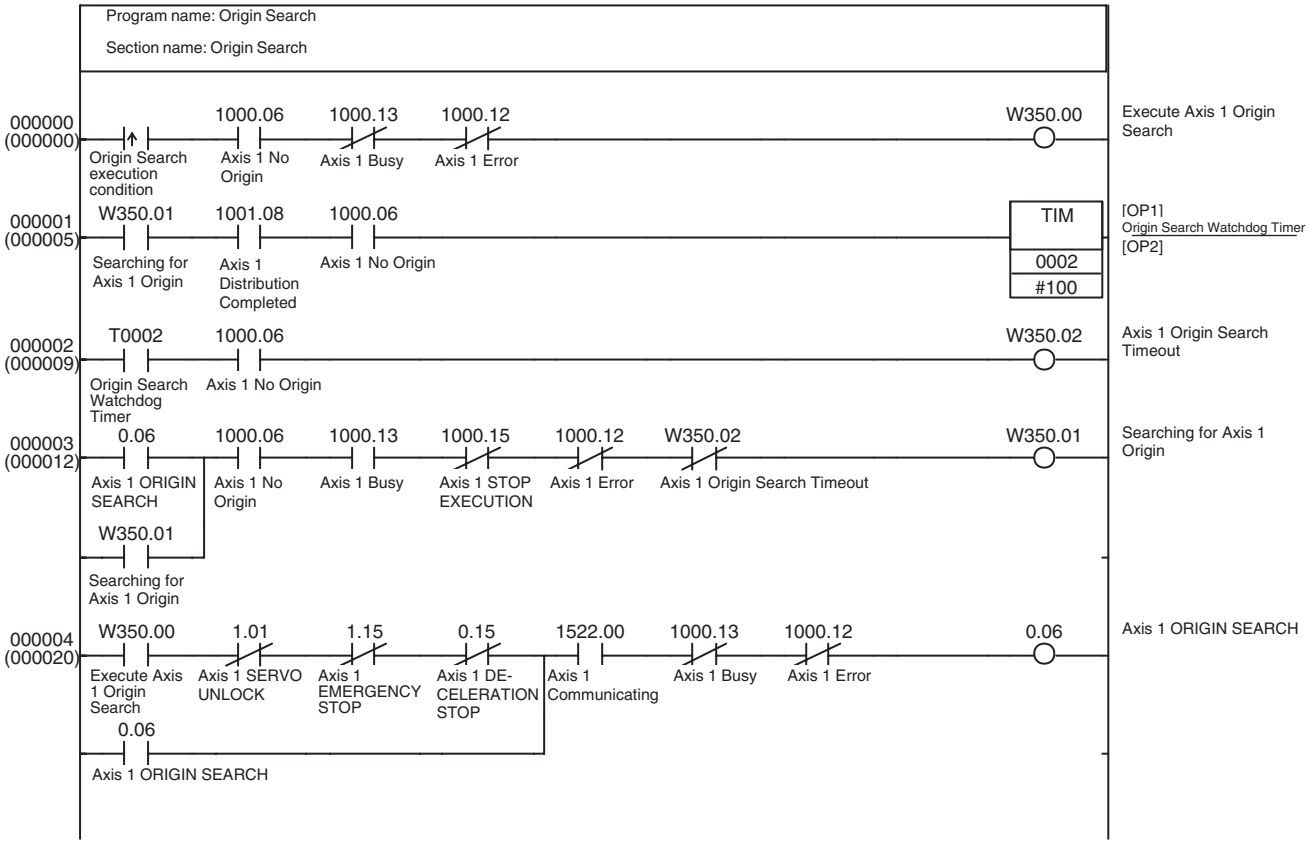
This sample program starts an origin search on axis 1 when the Origin Search execution condition goes from OFF to ON. The speed command value and origin search speed must be set in advance in the Axis 1 Operating Output Memory Area before executing this sample program.

If the Axis 1 origin is not established within 10 seconds after the origin input signal is detected and the *Final Travel Distance to Return to Zero Point* positioning is performed, the Origin Search Timeout will occur and W305.02 will be turned ON for one cycle.



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## Sample Ladder Program




## 11-2-6 Positioning (Absolute Movement or Relative Movement)

### Overview

This sample program sends a positioning command to a Servo Driver connected through MECHATROLINK communications.

Execute this sample program only after starting MECHATROLINK communications (establishing a connection), executing the Servo Lock function, and verifying that the Servo Lock is engaged.

In addition, when executing ABSOLUTE MOVEMENT, establish the origin by performing an origin search before sending the position command.

In this example, positioning is performed on the Servo Driver registered as axis 1 using the ABSOLUTE MOVEMENT Bit or RELATIVE MOVEMENT Bit in the Axis Operating Output Memory Area.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Areas: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Areas: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

#### Work Area (WR Area)

W201.00 to W201.03



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These Work Area bits are used to show the progress of function execution and the execution status.

**Holding Area (HR Area)**

H1.00

This bit is used as a switch to indicate whether positioning is performed with ABSOLUTE MOVEMENT or RELATIVE MOVEMENT.

**Timer Area**

TIM0003

Used as a watchdog timer to monitor the positioning operation.

This sample program starts Axis 1 positioning when the Positioning execution condition goes ON.

The position command value must be set to the target position and the speed command value must be set to the target speed in the Axis Operating Output Memory Area before executing this sample program.

At this point, the ON/OFF status of HR1.00 determines whether the positioning is executed with RELATIVE MOVEMENT (HR1.00 OFF) or ABSOLUTE MOVEMENT (HR1.00 ON).

If axis 1 positioning is not completed within 10 seconds after completion of sending the positioning command, i.e., after pulse distribution is completed, a Positioning Timeout will occur and bit W201.03 will be turned ON for one cycle.

The target position can be changed during an Absolute Movement or Relative Movement positioning operation by setting a new position command value and turning ON the ABSOLUTE or RELATIVE MOVEMENT Bit. Torque limits can also be enabled/disabled during positioning by turning ON/OFF the forward and reverse rotation current limit bits in the Axis Operating Output Memory Area and turning ON the ABSOLUTE or RELATIVE MOVEMENT Bit.

This sample program allows the target position to be changed during an operation by turning the execution condition OFF and then ON again.

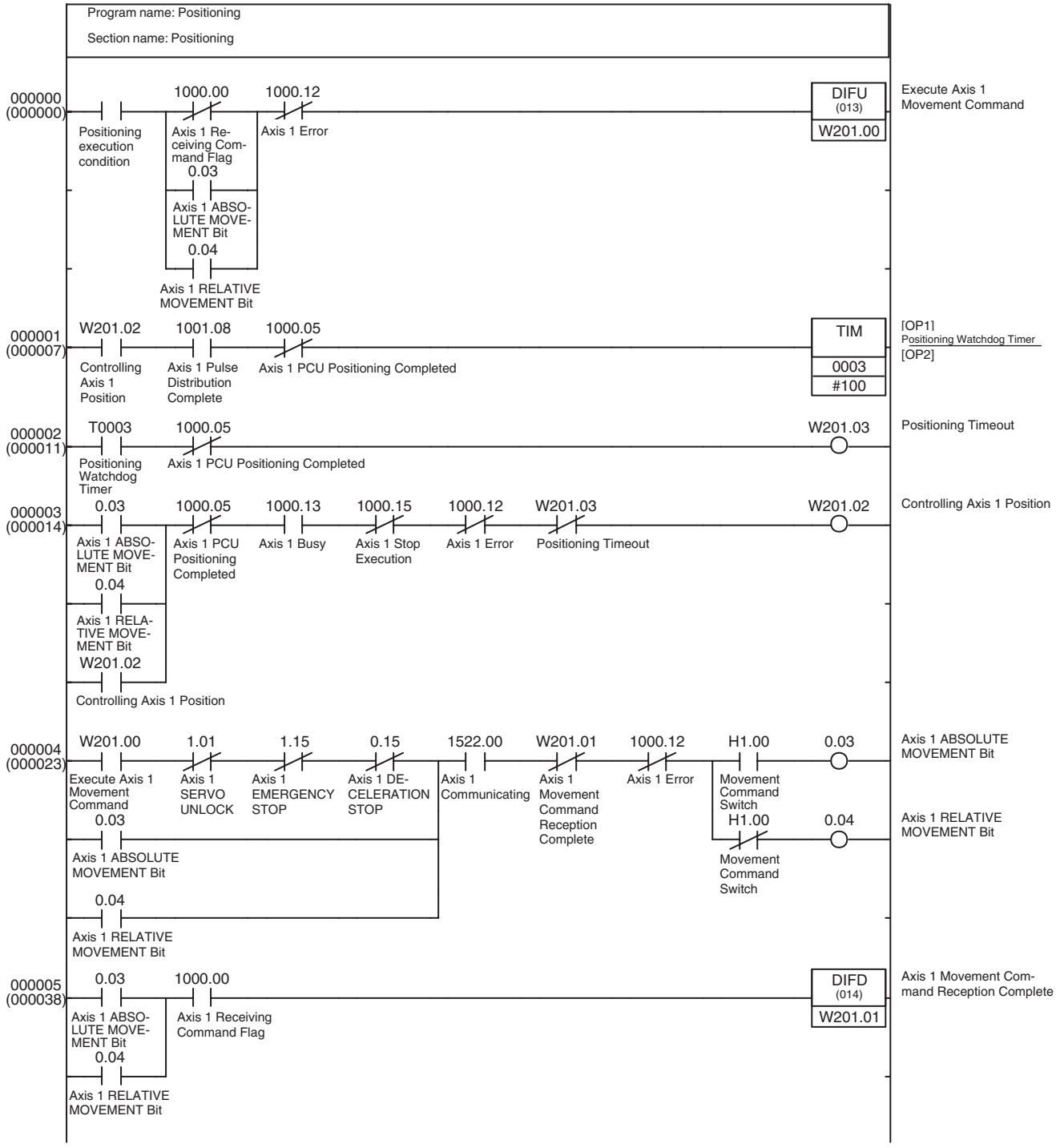
A Multistart Error will occur if a Movement command is sent while the PCU's Receiving Command Flag is already ON, so the Receiving Command Flag is ANDed with the Positioning execution condition (in the W201.00 output circuit). An OR circuit containing the ABSOLUTE MOVEMENT Bit and RELATIVE MOVEMENT Bit has been added so that the W201.00 is not output again when the Receiving Command Flag goes from ON to OFF.

The target speed can be changed sequentially during operation by overwriting the speed command value in the Axis Operating Output Memory Area.



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## Sample Ladder Program






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## 11-2-7 Speed Control

### Overview

This sample program performs speed control on a Servo Driver connected through MECHATROLINK communications.

Execute this sample program only after starting MECHATROLINK communications (establishing a connection), executing the Servo Lock function, and verifying that the Servo Lock is engaged.

In this example, speed control is performed on the Servo Driver registered as axis 1 using the SPEED CONTROL Bit in the Axis 1 Operating Output Memory Area.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

**Work Area (WR Area)**

W202.00 to W202.02

These Work Area bits are used to show the progress of function execution and the execution status.

This sample program starts Axis 1 speed control when the Speed Control execution condition goes ON.

The speed command value in the Axis 1 Operating Output Memory Area must be set to the target speed in advance before executing this sample program.

The target speed can be changed sequentially during operation by overwriting the speed command value for speed control in the Axis Operating Output Memory Area.

Torque limits can be enabled/disabled and the torque limits can be changed during operation by turning ON/OFF the forward and reverse rotation current limit bits and changing the option command values in the Axis Operating Output Memory Area and then turning ON the SPEED CONTROL Bit.

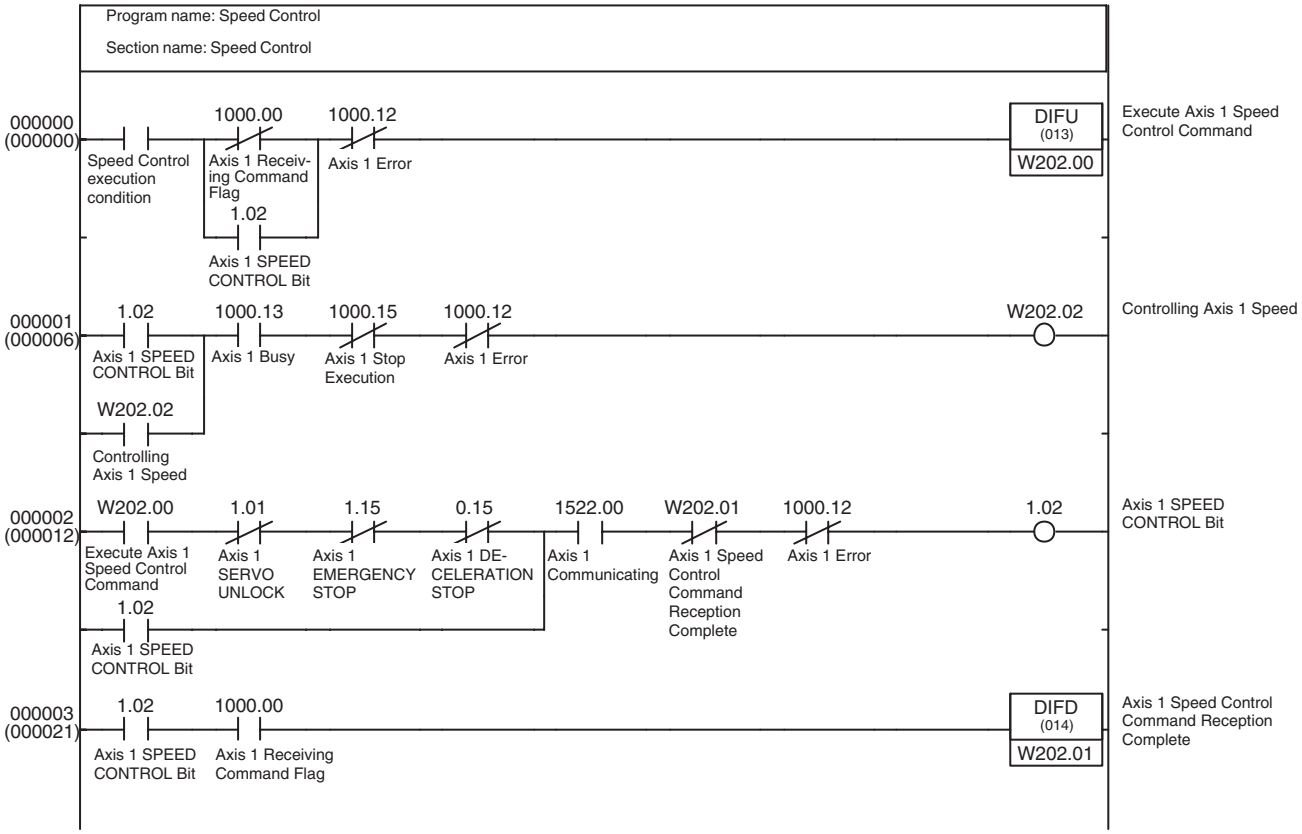
This sample program allows the speed control command to be sent again during an operation by turning the Speed Control execution condition OFF and then ON again.

A Multistart Error will occur if a Speed Control command is sent while the PCU's Receiving Command Flag is already ON, so the condition that the Receiving Command Flag is OFF is ANDed with the Speed Control execution condition (in the W202.00 output circuit). The Axis 1 SPEED CONTROL Bit has been added as an OR condition so that the W202.00 is not output again when the Receiving Command Flag goes from ON to OFF.



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## Sample Ladder Program




# 11-2-8 Torque Control

## Overview

This sample program performs torque control on a Servo Driver connected through MECHATROLINK communications.

Execute this sample program only after starting MECHATROLINK communications (establishing a connection), executing the Servo Lock function, and verifying that the Servo Lock is engaged.

In this example, torque control is performed on the Servo Driver registered as axis 1 using the TORQUE CONTROL Bit in the Axis 1 Operating Output Memory Area.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

### Work Area (WR Area)

W203.00 to W203.02

These Work Area bits are used to show the progress of function execution and the execution status.



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This sample program starts Axis 1 torque control when the Torque Control execution condition goes ON.

The torque command value in the Axis 1 Operating Output Memory Area must be set to the desired output torque in advance before executing this sample program.

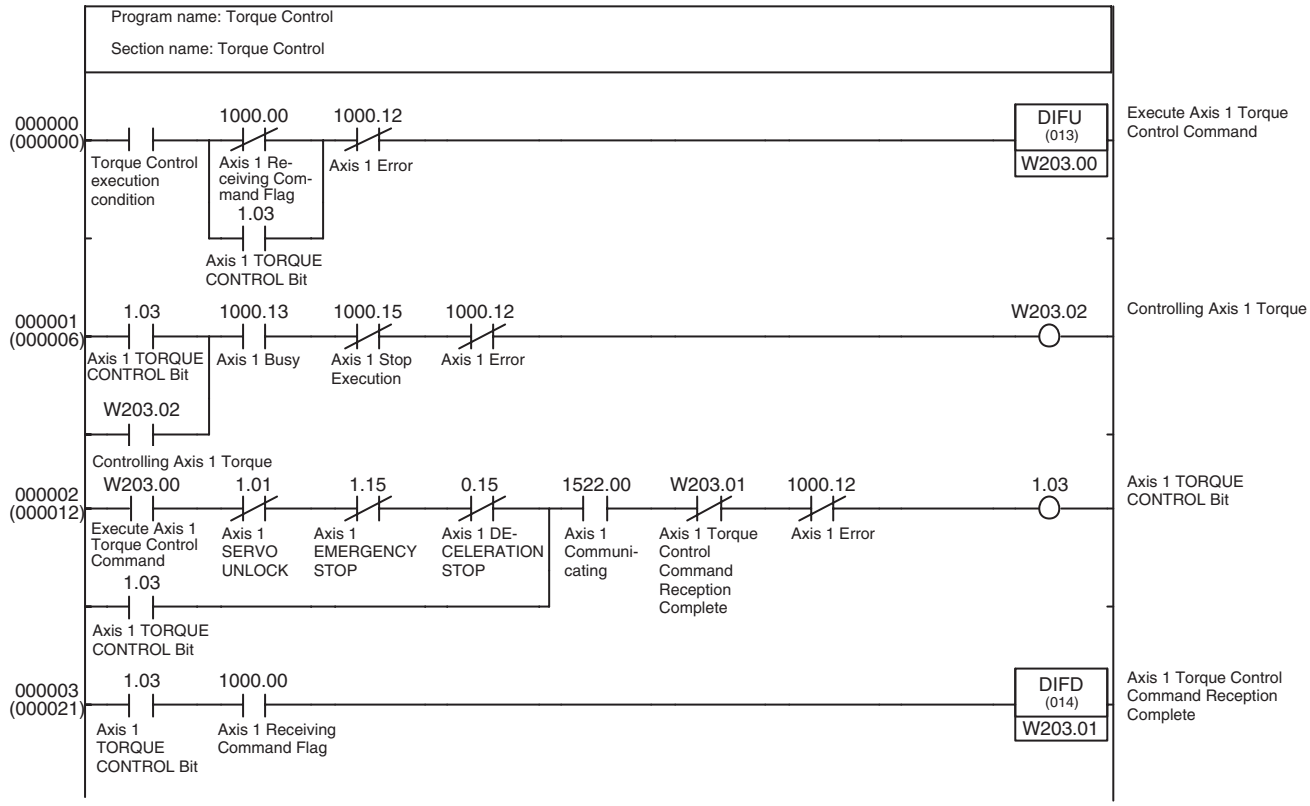
The torque control's output torque can be changed sequentially during operation by overwriting the torque command value in the Axis Operating Output Memory Area.

Torque limits can be enabled/disabled and the speed limit value can be changed during operation by turning ON/OFF the forward and reverse rotation current limit bits and changing the option command values in the Axis Operating Output Memory Area and then turning ON the TORQUE CONTROL Bit.

This sample program allows the TORQUE CONTROL command to be sent again during an operation by turning the Torque Control execution condition OFF and then ON again.

A Multistart Error will occur if a TORQUE CONTROL command is sent while the PCU's Receiving Command Flag is already ON, so include an AND of the Receiving Command Flag OFF in the execution condition for Torque Control execution (i.e. from the W203.00 output in the following example). The TORQUE CONTROL Bit has been added as an OR condition so that the W203.00 is not output again when the Receiving Command Flag goes from ON to OFF.

## Sample Ladder Program






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## 11-2-9 Deceleration Stop or Emergency Stop

### Overview

This sample program performs a deceleration stop or emergency stop on a Servo Driver connected through MECHATROLINK communications. Execute this sample program only after starting MECHATROLINK communications with the servo locked (i.e., after establishing a connection).

In this example, a deceleration stop or emergency stop is performed on the Servo Driver registered as axis 1 using the DECELERATION STOP Bit or EMERGENCY STOP Bit in the Axis 1 Operating Output Memory Area.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000
(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000
(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory in addition to the CIO Area words listed above.

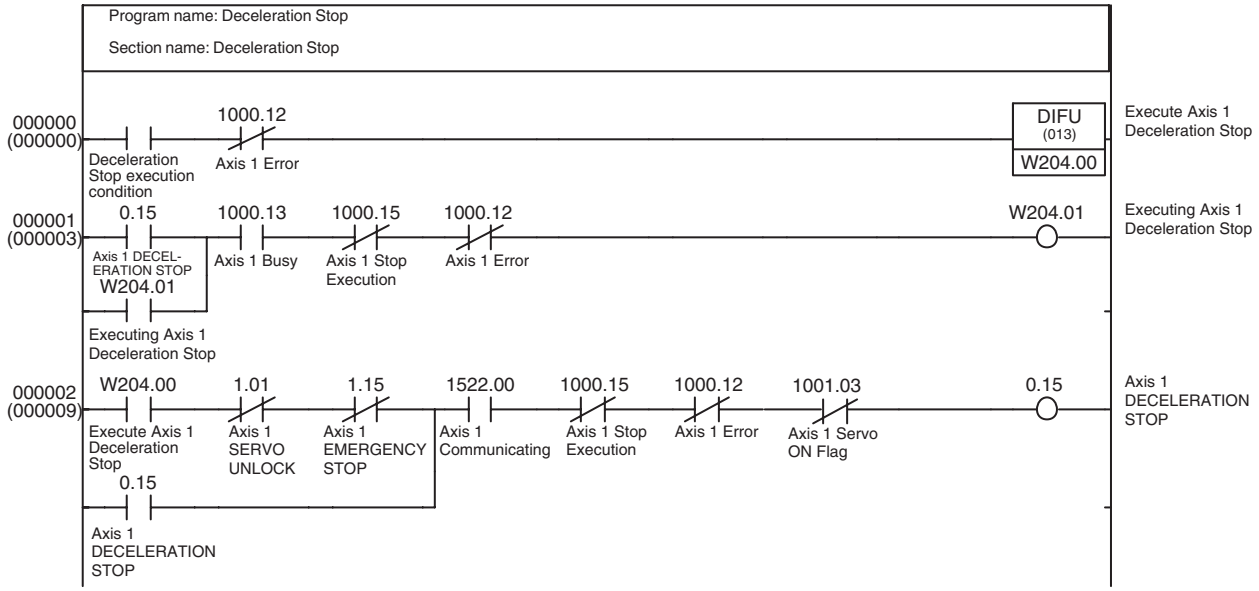
**Work Area (WR Area)**

Deceleration Stop: W204.00 and W204.01
Emergency Stop: W205.00 and W205.01

These Work Area bits are used to show the progress of function execution and the execution status.

This sample program executes a deceleration stop or emergency stop on Axis 1 when the Deceleration Stop or Emergency Stop execution condition goes ON.

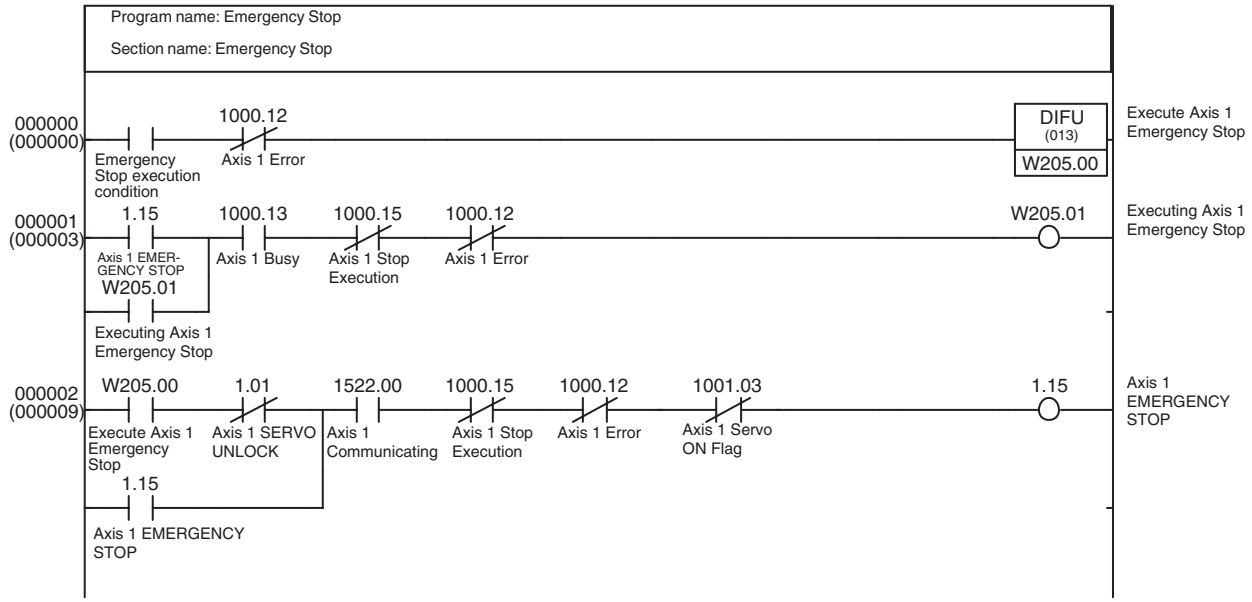
### Sample Ladder Program (Deceleration Stop)






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## Sample Ladder Program (Emergency Stop)




**Note** Deceleration and emergency stops are possible only when the Servo is locked. If the Servo is unlocked, these stop commands will be ignored. In the above programming example, the Servo ON Flag is inserted as an output condition so that DECELERATION STOP, EMERGENCY STOP, and work bits do not remain ON even if a deceleration stop or emergency stop is executed when the Servo is not locked.

## 11-2-10 Jogging

**Overview**

This sample program performs jogging with the Servo Driver connected via MECHATROLINK communications. MECHATROLINK communications start (i.e., a connection is established), and after executing SERVO LOCK, jogging is executed while the Servomotor is in a servo locked state.

In this programming example, jogging is executed for the Servo Driver registered at axis 1 when the Jog Bit turns ON in the Axis Operating Output Memory Area. The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000

(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000

(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory.

**Work Area (WR Area)**

W206.00 to W206.01

These Work Area bits are used to create the operation timing for function execution.



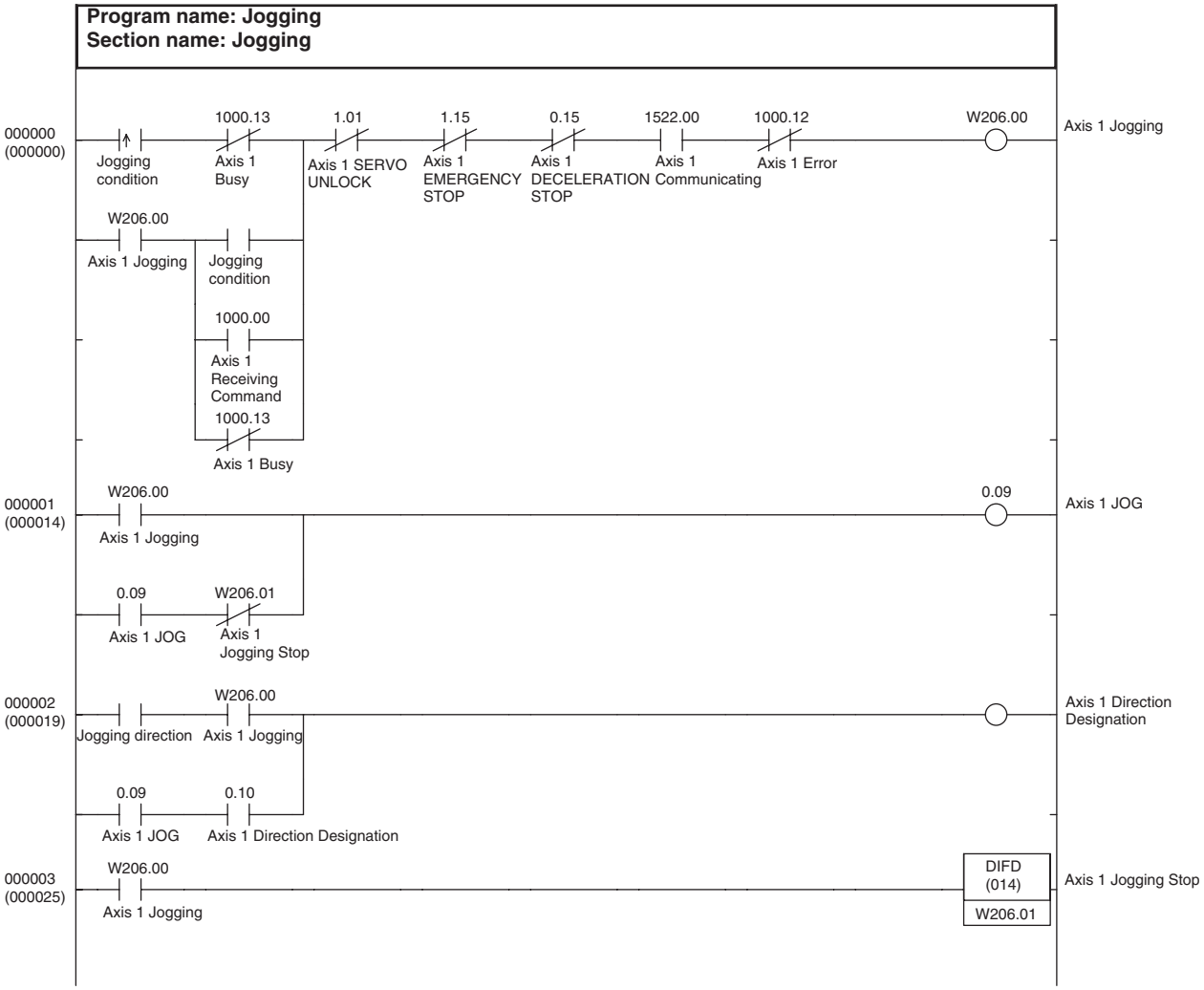
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In this program example, jogging starts when the jogging condition turns ON, and stops when the jogging condition turns OFF. Jogging is performed in the forward direction when the jogging direction is OFF at the start of jogging. Jogging is performed in the reverse direction when the jogging direction is ON at the start of jogging.

When executing this programming example, the target speed must be set in the speed command value of the Axis 1 Operating Output Memory Area. The target speed for jogging can be changed successively during operation by writing the speed command value to the Axis Operating Output Memory Area.

In this programming example, application in combination with the PCU jogging (adjustment operation) Smart Active Parts Library provided in the OMRON NS-series Programmable Terminals has been considered and thus the program is constructed with self-holding bits for the Jog Bit and Direction Designation Bit in the Axis Operating Output Memory Area. Therefore, the command for the jogging condition is sent via the Work Area bit W206.00.
The output circuit of Work Area bit W206.00 is also provided with a self-holding circuit that operates according to the Receiving Command Flag and Busy Flag to enable the JOG command to be received correctly at the PCU.

### Ladder Programming Example






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# 11-3 Application Examples

This section shows sample application programs created by combining the basic sample programs introduced in the previous section.

To make the basic sample programs easier to understand, the basic sample programs reused in this section's application examples keep the same Work Area word and bit addresses that were allocated in the previous section.

## 11-3-1 Initial PCU Settings

### Overview

This application combines the data-writing and data-saving functions from *11-2-1 Transferring PCU Parameters* with the communications function from *11-2-2 Starting and Stopping MECHATROLINK Communications* to make the Initial PCU Settings. The 80 words of parameter data (including unused words) must be preset in EM Area words E0_00000 to E0_00079 with the 40 words of Common Parameters and 40 words of Axis Parameters (20 words each for axes 1 and 2).

In this program, the initial PCU settings are made when H0.00 is OFF and the task switches from INI to RUN status. After the initial settings are made, the PCU is restarted. The transferred and saved parameters are enabled and H0.00 is turned ON (Set) at the same time so that the initial settings are not made again.

To make the initial settings again, reset H0.00 and execute the program again.

When H0.00 is reset, the Initial Task Execution Flag is used as the Write Data execution condition and the Unit Data Write End Flag (W300.05) is used as the Save Data execution condition. When the Save Data operation is completed (W302.05 ON), the Unit is restarted and H0.00 is turned ON.

MECHATROLINK communications will be controlled by the new Common Parameters in the PCU either after the Unit restart at the end of initial settings if H0.00 is OFF, or after starting the program (task) if H0.00 is ON.

This sample program uses the following parts of the CPU Unit's I/O memory.

**CPU Bus Unit Area**

CIO 1500 to CIO 1524

These word addresses are contained in the CPU Bus Unit Area words allocated to unit number 0.

**EM Area bank 0**

E0_00000 to E0_00079

These 80 EM words are used to transfer to the PCU the 40 words of Common Parameters and 40 words of Axis Parameters (20 words each for axes 1 and 2).

**Work Area (WR Area)**

| | |
|---|---|
| Writing Data: | W300.00 to W300.06 |
| Saving Data: | W302.00 to W302.06 |
| Starting Communications: | W303.00 to W303.04 |
| Restarting the Unit: | W304.00 to W304.03 |

These Work Area bits are used to show the progress of function execution and the execution status.

The following parts of I/O memory are used in the combined program example.



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**Holding Area (HR Area)**

H0.00

Used as a switch to enable/disable the initial PCU settings function.

**I/O Bits**

Restart Communications:400.00
Stop Communications: 400.01

When the corresponding I/O bit goes ON, stopped MECHATROLINK communications are restarted or established MECHATROLINK communications are stopped.

This sample program writes the following Common Parameters and Axis Parameters (initial settings).

**Common Parameters**

Scan List: Registers Servo Drivers to axes 1 and 2 (station numbers 1 and 2).

Beginning word of Axis Operating Output Memory Area: CIO 0000

Beginning word of Axis Operating Input Memory Area: CIO 1000

MECHATROLINK communications settings:

Transfer cycle: 1 ms
Communications cycle: × 2 (1 ms × 2 = 2 ms)
Number of communications retries: 0 (1 retry)
C2 Master connection: 0 (No C2 Master)

**Axis Parameters for Axes 1 and 2 (Shared by both Axes.)**

Origin input signal selection: 00 (Phase Z)

Interrupt input signal selection: 01 (External latch signal 1 input)

Origin search direction: 0 (Forward)

Origin search operation mode: 1 (Reversal mode 2)

Encoder type: 0 (Incremental encoder)

The following parameter settings must be written in advance to the CPU Unit's EM Area words E0_00000 to E0_00079.

| EM word | Set value | Item | Details |
|---|---|---|---|
| E0_00000 | 00B0 hex | Common Parameters<br>Axis Operating Output Memory Area designation | Sets the beginning word of the Axis Operating Output Memory Areas to CIO 0000.<br>Axis 1 output words: CIO 0000 to CIO 0024<br>Axis 2 output words: CIO 0025 to CIO 0049 |
| E0_00001 | 0000 hex | Common Parameters<br>Beginning word of Axis Operating Output Memory Areas | |
| E0_00002 | 00B0 hex | Common Parameters<br>Axis Operating Input Memory Area designation | Sets the beginning word of the Axis Operating Input Memory Areas to CIO 1000.<br>Axis 1 input words: CIO 1000 to CIO 1024<br>Axis 2 input words: CIO 1025 to CIO 1049 |
| E0_00003 | 03E8 hex | Common Parameters<br>Beginning word of Axis Operating Input Memory Areas | |
| E0_00004 | 4040 hex | Common Parameters<br>Scan list setting (axes 1 and 2) | Allocates axes 1 and 2 to the Servo Driver. |
| E0_00005 to E0_00011 | 0000 hex | Common Parameters<br>Scan list setting (axes 3 to 16) | |
| E0_00012 to E0_00029 | 0000 hex | Not used. | This part of the Common Parameters is unused.<br>Set all words to 0000 hex. |



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| EM word | Set value | Item | Details |
|---|---|---|---|
| E0_00030 | 0102 hex | Common Parameters<br>MECHATROLINK communications settings<br>Transfer cycle and communications cycle | Transfer cycle: 01 (1 ms)<br>Communications cycle: 02 (×2) |
| E0_00031 | 0000 hex | Common Parameters<br>MECHATROLINK communications settings<br>Number of communications retries and C2 Master connection | Number of communications retries: 0 (1 retry)<br>C2 Master connection: 0 (No C2 Master) |
| E0_00032 to E0_00039 | 0000 hex | Not used. | This part of the Common Parameters is unused.<br>Set all words to 0000 hex. |
| E0_00040 | 0001 hex | Axis 1 Parameters<br>Origin input signal selection and Interrupt input signal selection | Origin input signal selection: 00 (Phase Z)<br>Interrupt input signal selection: 01 (External latch signal 1 input) |
| E0_00041 | 0010 hex | Axis 1 Parameters<br>Origin search direction and Origin search operation | Origin search direction: 0 (Forward)<br>Origin search operation mode: 1 (Reversal mode 2) |
| E0_00042 | 0000 hex | Axis 1 Parameters<br>Encoder type | Encoder type: 0 (Incremental encoder) |
| E0_00043 to E0_00059 | 0000 hex | Not used. | This part of the Common Parameters is unused.<br>Set all words to 0000 hex. |
| E0_00060 | 0001 hex | Axis 2 Parameters<br>Origin input signal selection and Interrupt input signal selection | Origin input signal selection: 00 (Phase Z)<br>Interrupt input signal selection: 01 (External latch signal 1 input) |
| E0_00061 | 0010 hex | Axis 2 Parameters<br>Origin search direction and Origin search operation | Origin search direction: 0 (Forward)<br>Origin search operation mode: 1 (Reversal mode 2) |
| E0_00062 | 0000 hex | Axis 2 Parameters<br>Encoder type | Encoder type: 0 (Incremental encoder) |
| E0_00063 to E0_00079 | 0000 hex | Not used. | This part of the Common Parameters is unused.<br>Set all words to 0000 hex. |

The PCU does not use regions E0_00012 to E0_00029, E0_00032 to E0_00039, E0_00043 to E0_00059, and E0_00063 to E0_00079 in the Common Parameter Area and Axis Parameter Areas.

These unused areas are reserved because this program transfers all 80 words (40 words of Common Parameters and 40 words of Axis Parameters for axes 1 and 2) to the PCU's internal addresses at once.

Set all words in the unused addresses to 0000 hex.

When Axis Parameters are being transferred for axis 3 or higher axes, prepare the parameter settings in 20-word regions for each axis (starting from E0_00080) with the same data configuration as axis 1. This sample program can be used to make the initial settings for multi-axis operation by changing the number of write words to 40 words (Common Parameters) + 20 words × Number of axes (Axis Parameters).

Conversely, when only axis 1 is being used, set the number of write words to 60 words and prepare only EM words E0_00000 to E0_00059 from the table above. (Change the scan list in the Common Parameters so that only axis 1 is used.)



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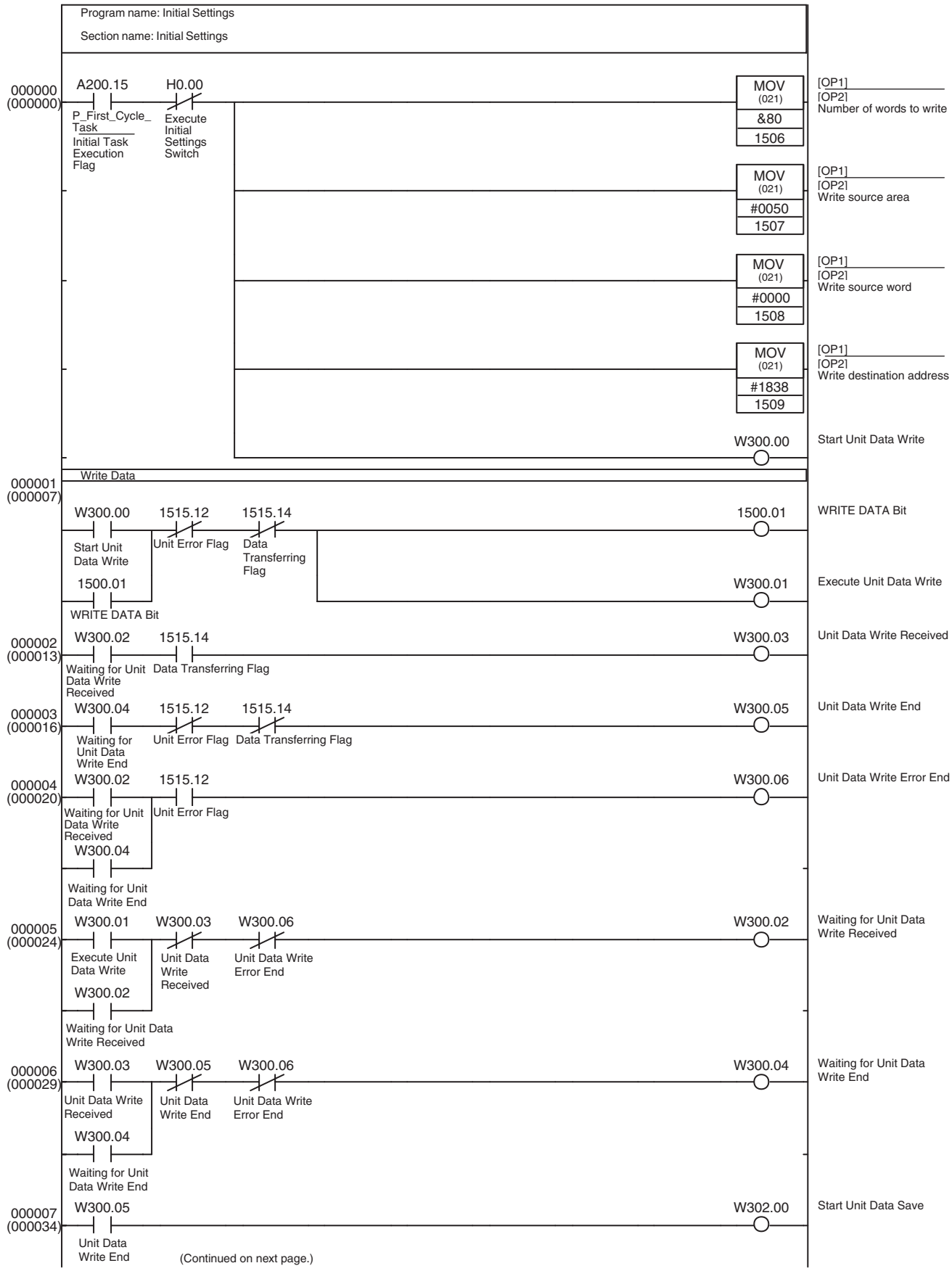
When the initial PCU settings have been made, W304.03 is turned ON for one cycle.

Also, W303.03 will be turned ON when MECHATROLINK communications have started and all axes (axes 1 and 2 in this case) are communicating normally.



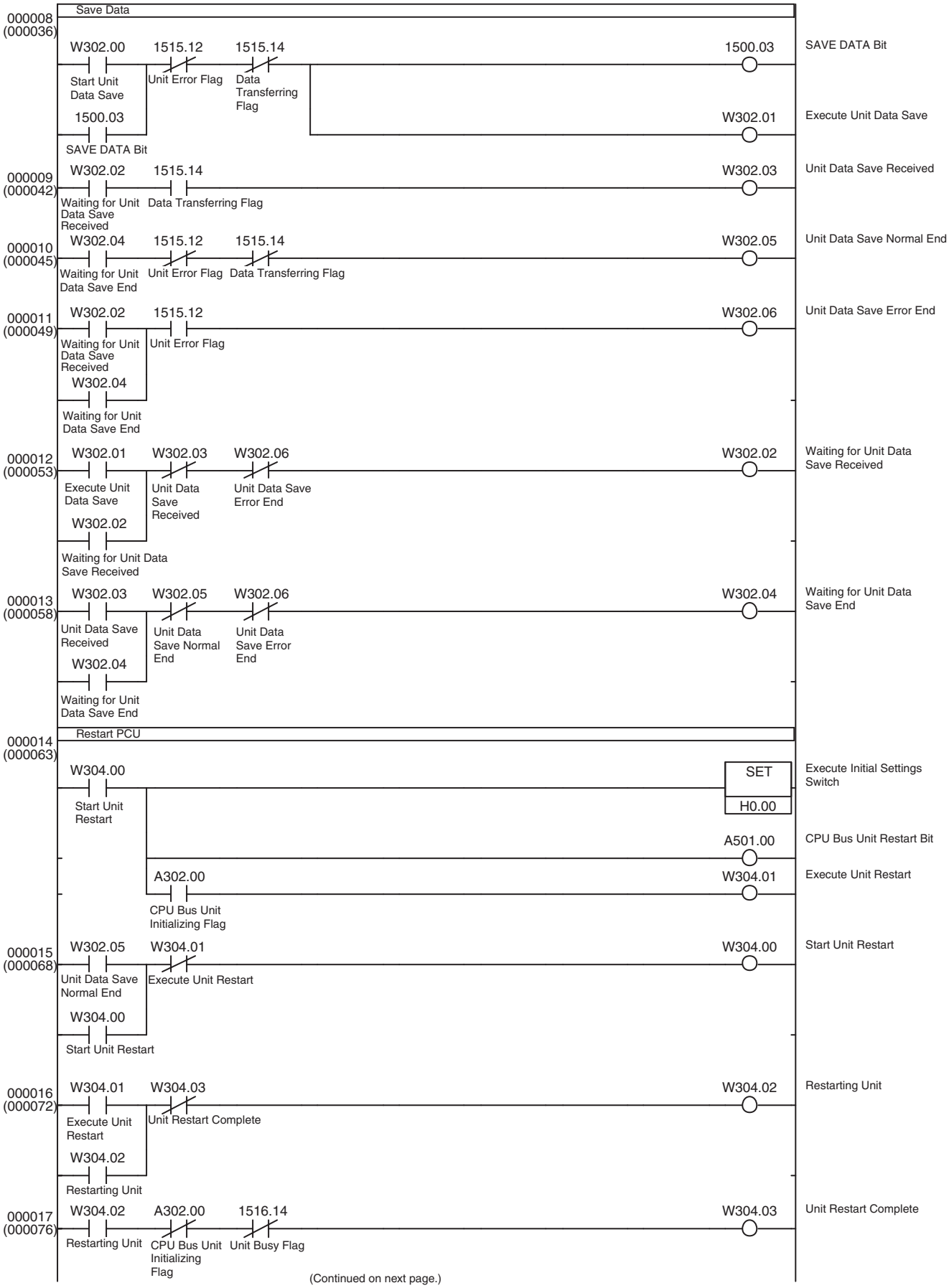
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## Sample Ladder Program





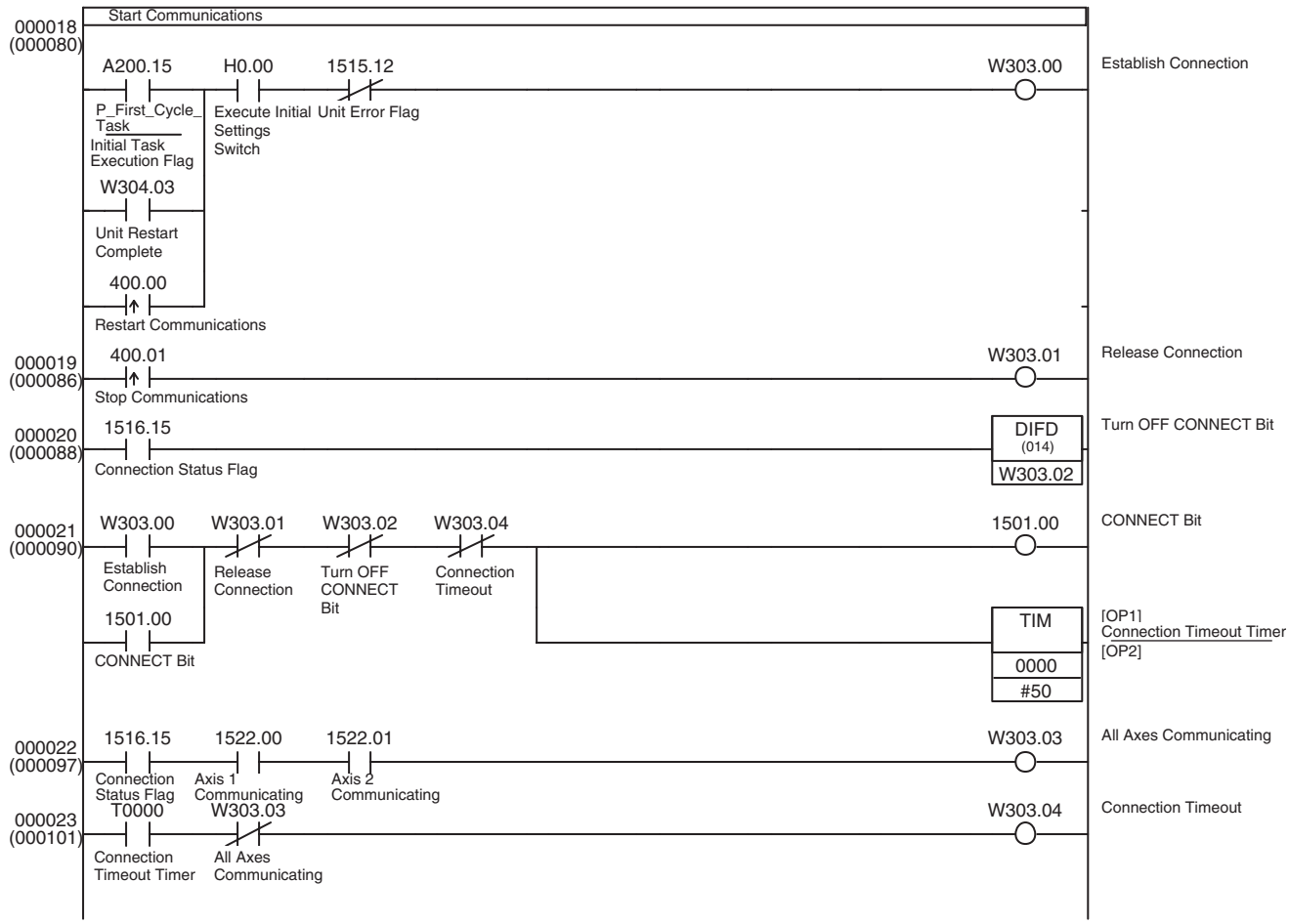

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## 11-3-2 Servo Parameter Backup

### Overview

This application incorporates the Servo Parameter transfer functions from *11-2-3 Transferring Servo Parameters* to transfer (write, read, or save) all of the Servo Driver's Servo Parameters at one time with the CPU Unit's EM Area.

This application example is normally executed after the initial PCU settings application shown in *11-3-1 Initial PCU Settings*.

The Servo Parameters to be transferred are set in the CPU Unit's EM Area as a parameter list.

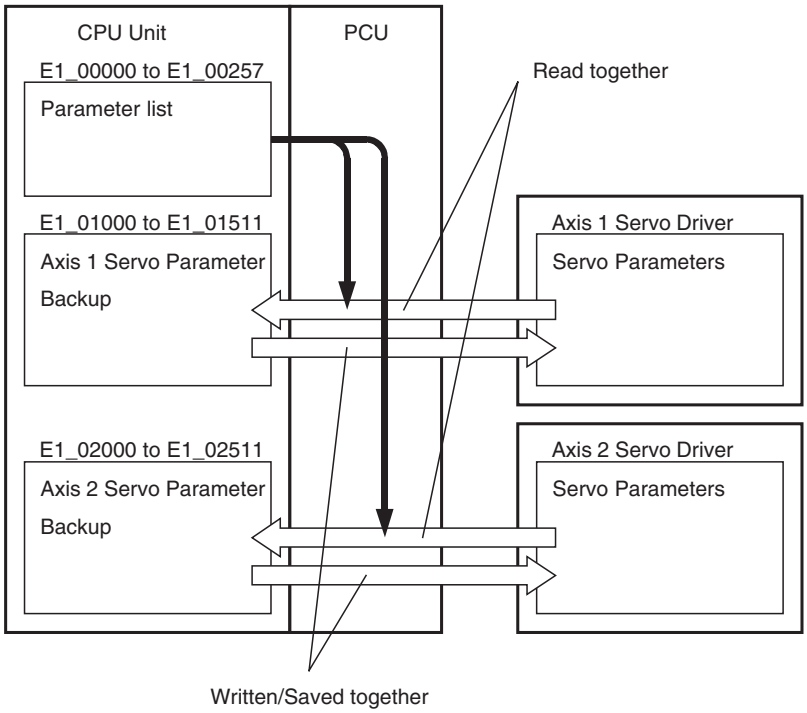
When reading Servo Parameters, the parameter data read from the Servo Driver is stored in the specified EM words based on this parameter list.

When writing/saving Servo Parameters, the parameter data is stored in the EM Area in the prescribed format and written to the Servo Drivers in order.

In this program example, the Servo Drivers connected as axes 1 and 2 are both W-series Servo Drivers and the same Servo Parameter list is transferred to both.



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The Axis Operating Output/Input Memory Areas for axes 1 and 2 are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000

(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

(Axis 2 Operating Output Memory Area: CIO 0025 to CIO 0049)

Beginning word of Axis Operating Input Memory Area: CIO 1000

(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

(Axis 2 Operating Input Memory Area: CIO 1025 to CIO 1049)

This sample program uses the following parts of the CPU Unit's I/O memory.

**CPU Bus Unit Area**

CIO 1500 to CIO 1524

These word addresses are contained in the CPU Bus Unit Area words allocated to unit number 0.

**Data Memory Area (DM Area)**

Axis 1 Servo Parameter words: D10500 to D10503
Axis 2 Servo Parameter words: D10600 to D10603

These words are used to store the data required for a single Servo Parameter transfer, including the Servo Parameter number, parameter size, and transfer data (2 words).

**EM Area bank 1**

Servo Parameter list: E1_00000 to E1_00257
Axis 1 Servo Parameter words: E1_01000 to E1_01511
Axis 2 Servo Parameter words: E1_02000 to E1_02511



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When the Servo Parameters are being read, these EM words are used to store the parameter list read from the Servo Driver. These words are also used to store the Servo Parameters that were read and set the Servo Parameters that will be written.

**Index Registers (IR)**

IR6 to IR8

The Index Registers are used to reference the Servo Parameter list and reference the EM Area addresses that contain the parameter data being read/written.

**Work Area (WR Area)**

Write Axis 1 Servo Parameters: W400.00 to W400.06
Read Axis 1 Servo Parameters: W401.00 to W401.06
Save Axis 1 Servo Parameters: W402.00 to W402.06
Write Axis 2 Servo Parameters: W410.00 to W410.06
Read Axis 2 Servo Parameters: W411.00 to W411.06
Save Axis 2 Servo Parameters: W412.00 to W412.06
Batch transfer sequence stepping: W500.00 to W500.10

These Work Area bits are used to show the progress of function execution and the execution status.

**Holding Area (HR Area)**

Axis 1 Transfer Function Selection: H10.00 to H10.02
Axis 2 Transfer Function Selection: H11.00 to H11.02

These bits are used to select the Servo Parameter transfer function for each axis.

The following table shows how the status of bits H10.00 to H10.02 and H11.00 to H11.02 specify the Servo Parameter transfer function in this sample program.

| Transfer function | Axis 1 | | | Axis 2 | | |
|---|---|---|---|---|---|---|
| | H10.00 | H10.01 | H10.02 | H11.00 | H11.01 | H11.02 |
| Write Servo Parameter | 1 | 0 | 0 | 1 | 0 | 0 |
| Read Servo Parameter | 0 | 1 | 0 | 0 | 1 | 0 |
| Save Servo Parameter | 0 | 0 | 1 | 0 | 0 | 1 |

A different transfer function can be selected for each axis and executed for 2 axes simultaneously.

Different transfer functions cannot be performed at the same time on a single axis. If bits 00 to 02 are all OFF or more than one bit is ON, the transfer function will not be executed for that axis.

Also, when executing this sample program, always transfer the Servo Parameters for 2 axes.

CIO 0510.00 is used as the Servo Parameter Batch Transfer Start Switch.

**Parameter List**

In this program, the parameter list for the Read Servo Parameters function is stored in the CPU Unit's EM Area as follows.

The beginning words of the parameter list specify the parameter number and parameter size of each parameter.

+0: Parameter number (hex)
+1: Parameter size

The parameter number and size are specified in order for all of the parameters being transferred.

At the end of the parameter list, the parameter size is set to 0000 hex.



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The following table shows a setting example for the parameter list in this program.

The Servo Parameters listed here are for an OMRON W-series Servo Driver with a JUSP-NS115 MECHATROLINK-II Application Module mounted. All 256 parameter numbers and parameter sizes shown in the table in *4-5 Servo Parameter Area* are included even if the parameters are not being used.

When the two-word end code (0000 0000) at the end of the parameter list is included, a total of 256 words (including unused words) are used, from E1_00000 to E1_00257.

| Word | +0 | +1 | +2 | +3 | +4 | +5 | +6 | +7 | +8 | +9 |
|---|---|---|---|---|---|---|---|---|---|---|
| E1_00000 | 0000 | 0002 | 0001 | 0002 | 0002 | 0002 | 0003 | 0002 | 0004 | 0002 |
| E1_00010 | 0005 | 0002 | 0100 | 0002 | 0101 | 0002 | 0002 | 0002 | 0103 | 0002 |
| E1_00020 | 0104 | 0002 | 0105 | 0002 | 0106 | 0002 | 0107 | 0002 | 0108 | 0002 |
| E1_00030 | 0109 | 0002 | 010A | 0002 | 010B | 0002 | 010C | 0002 | 010D | 0002 |
| E1_00040 | 010E | 0002 | 010F | 0002 | 0110 | 0002 | 0111 | 0002 | 0112 | 0002 |
| E1_00050 | 0113 | 0002 | 0114 | 0002 | 0115 | 0002 | 0116 | 0002 | 0117 | 0002 |
| E1_00060 | 0118 | 0002 | 0119 | 0002 | 0120 | 0002 | 0121 | 0002 | 0122 | 0002 |
| E1_00070 | 0123 | 0002 | 0124 | 0002 | 0125 | 0002 | 0200 | 0002 | 0201 | 0002 |
| E1_00080 | 0202 | 0002 | 0203 | 0002 | 0204 | 0002 | 0205 | 0002 | 0206 | 0002 |
| E1_00090 | 0207 | 0002 | 0208 | 0002 | 0212 | 0002 | 0217 | 0002 | 0218 | 0002 |
| E1_00100 | 0300 | 0002 | 0301 | 0002 | 0302 | 0002 | 0303 | 0002 | 0304 | 0002 |
| E1_00110 | 0305 | 0002 | 0306 | 0002 | 0307 | 0002 | 0308 | 0002 | 0309 | 0002 |
| E1_00120 | 0400 | 0002 | 0401 | 0002 | 0402 | 0002 | 0403 | 0002 | 0404 | 0002 |
| E1_00130 | 0405 | 0002 | 0406 | 0002 | 0407 | 0002 | 0408 | 0002 | 0409 | 0002 |
| E1_00140 | 040A | 0002 | 040B | 0002 | 040C | 0002 | 0500 | 0002 | 0501 | 0002 |
| E1_00150 | 0502 | 0002 | 0503 | 0002 | 0504 | 0002 | 0505 | 0002 | 0506 | 0002 |
| E1_00160 | 0507 | 0002 | 0508 | 0002 | 0509 | 0002 | 050A | 0002 | 050B | 0002 |
| E1_00170 | 050C | 0002 | 050D | 0002 | 050E | 0002 | 050F | 0002 | 0510 | 0002 |
| E1_00180 | 0511 | 0002 | 0512 | 0002 | 0513 | 0002 | 051A | 0002 | 051B | 0002 |
| E1_00190 | 051C | 0002 | 051E | 0002 | 0600 | 0002 | 0601 | 0002 | 0800 | 0002 |
| E1_00200 | 0801 | 0002 | 0802 | 0002 | 0803 | 0002 | 0804 | 0004 | 0806 | 0004 |
| E1_00210 | 0808 | 0004 | 080A | 0002 | 080B | 0002 | 080C | 0002 | 080D | 0002 |
| E1_00220 | 080E | 0002 | 080F | 0002 | 0810 | 0002 | 0811 | 0002 | 0812 | 0002 |
| E1_00230 | 0813 | 0002 | 0814 | 0004 | 0816 | 0002 | 0817 | 0002 | 0818 | 0002 |
| E1_00240 | 0819 | 0004 | 081B | 0002 | 081C | 0002 | 081D | 0002 | 081E | 0002 |
| E1_00250 | 081F | 0002 | 0820 | 0004 | 0822 | 0004 | 0000 | 0000 | 0000 | 0000 |

**Read/Write Parameter Format**

This program stores the Servo Parameters with the following format (read according to the parameter list above) in the specified part of the EM Area.

The parameter number, parameter size, and set value of each parameter are stored in four-word sets.

+0: Parameter number (hex)
+1: Parameter size
+2: Servo Parameter set value (rightmost word)
+3: Servo Parameter set value (leftmost word)

These four-word sets are stored in the order that the parameters appear in the parameter list.

When the parameter size is 2 bytes (0002 hex), the leftmost word of the set value in “+3: Servo Parameter set value” will be set to 0000 hex.



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Example: First Part of Default Settings Read from an OMRON W-series Servo Driver

| Word | +0 | +1 | +2 | +3 | +4 | +5 | +6 | +7 |
|---|---|---|---|---|---|---|---|---|
| E1_01000 | 0000 | 0002 | 0010 | 0000 | 0001 | 0002 | 1002 | 0000 |
| E1_01008 | 0002 | 0002 | 0000 | 0000 | 0003 | 0002 | 0002 | 0000 |
| E1_01016 | 0004 | 0002 | 0200 | 0000 | 0005 | 0002 | 0000 | 0000 |
| E1_01024 | 0100 | 0002 | 0050 | 0000 | 0101 | 0002 | 07D0 | 0000 |
| E1_01032 | 0102 | 0002 | 0028 | 0000 | 0103 | 0002 | 012C | 0000 |
| E1_01040 | 0104 | 0002 | 0050 | 0000 | 0105 | 0002 | 07D0 | 0000 |
| E1_01048 | 0106 | 0002 | 0028 | 0000 | 0107 | 0002 | 0000 | 0000 |
| E1_01056 | 0108 | 0002 | 0007 | 0000 | 0109 | 0002 | 0000 | 0000 |
| E1_01064 | 010A | 0002 | 0000 | 0000 | 010B | 0002 | 0004 | 0000 |
| : | | | | | | | | |

**Note** All of the data is expressed in hexadecimal.
For example, the data in E1_01024 to E1_01027 indicates parameter Pn100, a parameter size of 2 bytes, and a set value of 0050 hex (80 decimal).

This data format is also used in the sample program when writing or saving data from the CPU Unit's EM Area to the Servo Driver. (The parameter size at the end of the transfer data is 0000 hex, which is the end code.)

Consequently, this program can be used to read the Servo Parameters to the CPU Unit's EM Area to back up the Servo Parameters and those Servo Parameters can be transferred to a new Servo Driver if it is necessary to replace the Servo Driver in the future.

This sample program will start transferring the Servo Parameters when the Servo Parameter Batch Transfer Bit (CIO 510.00) is ON and W303.03 has been turned ON (indicating that axes 1 and 2 are both communicating normally) by the application example shown in *11-3-1 Initial PCU Settings*.

When this program is completed (Servo Parameter Transfer Complete), W500.05 is turned ON for one cycle. If an error occurs while the Servo Parameters are being transferred (Error Flag ON), the transfer will be cancelled at that point and W500.10 will be turned ON for one cycle.

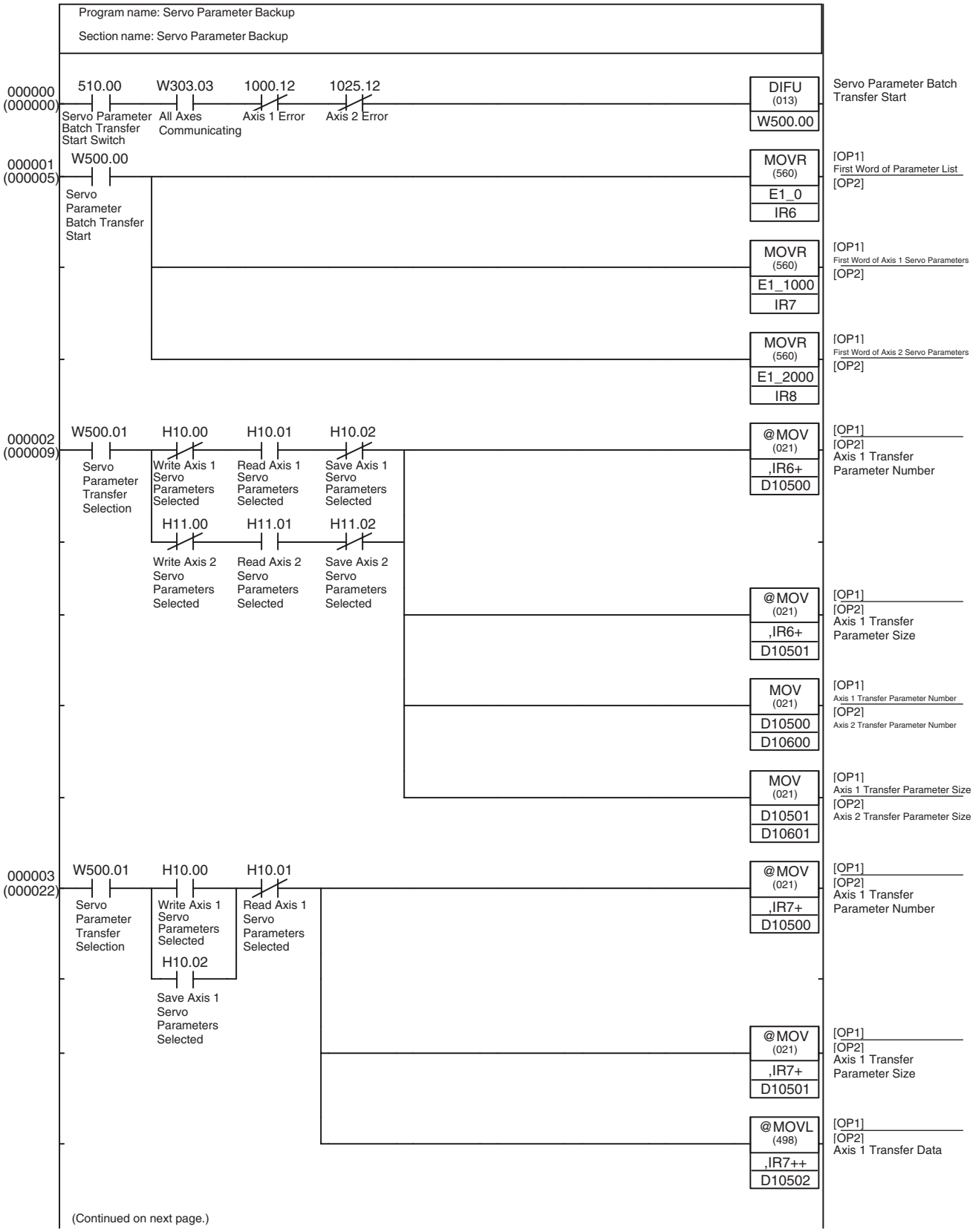
## Sample Ladder Program

The Write Servo Parameters, Read Servo Parameters, and Save Servo Parameters functions for axis 1 (program steps 000016 to 000033) are the same as the functions described in *11-2-3 Transferring Servo Parameters*.

The functions for axis 2 (program steps 000034 to 000051) are the same as the functions for axis 1, except for the different I/O words. To prevent duplications, be sure to change the axis 1 output words (CIO 0000 to CIO 0024) to the corresponding axis 2 output words (CIO 0025 to CIO 0049) and change the axis 1 input words (CIO 1000 to CIO 1024) to the corresponding axis 2 input words (CIO 1025 to CIO 1049).

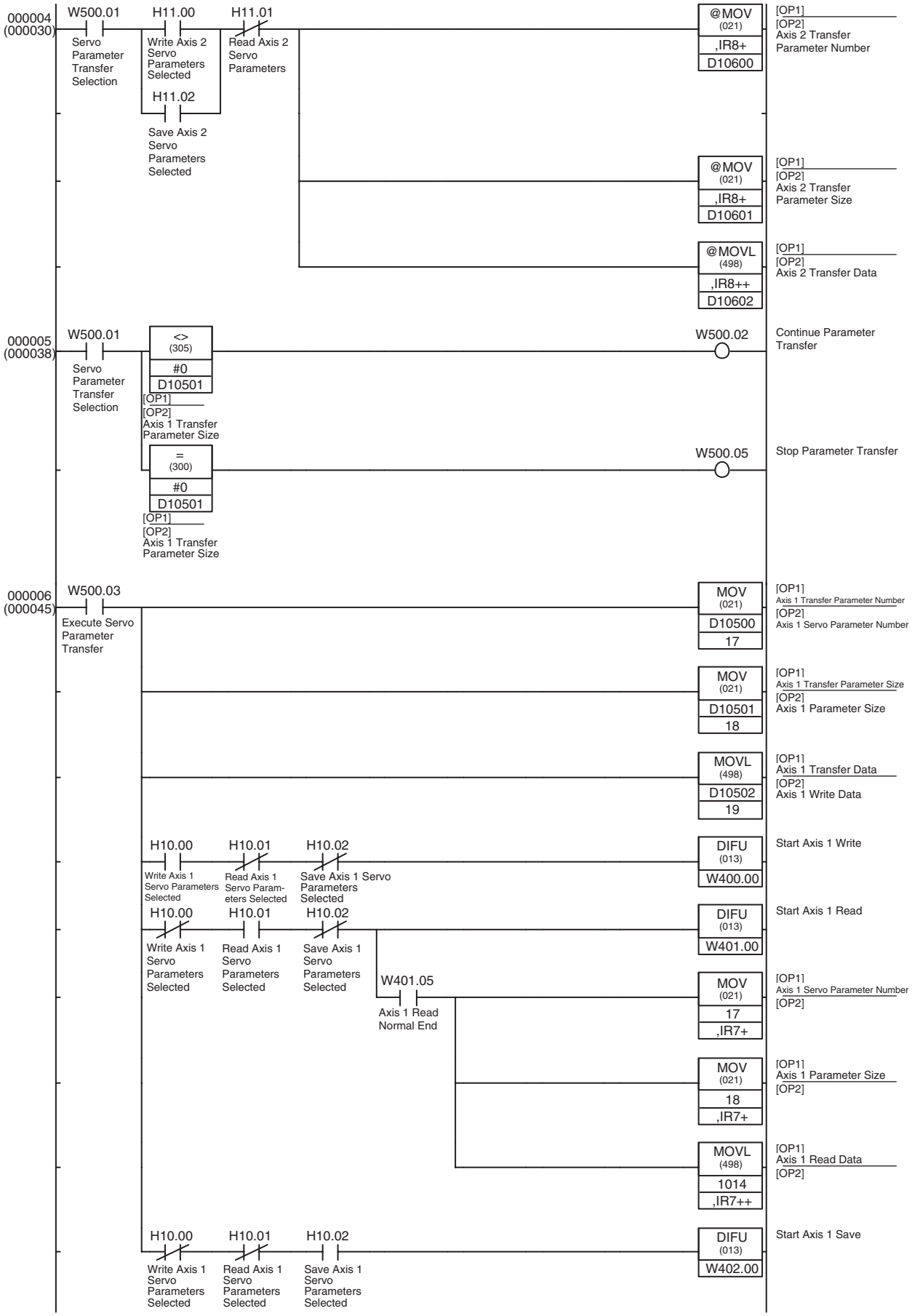


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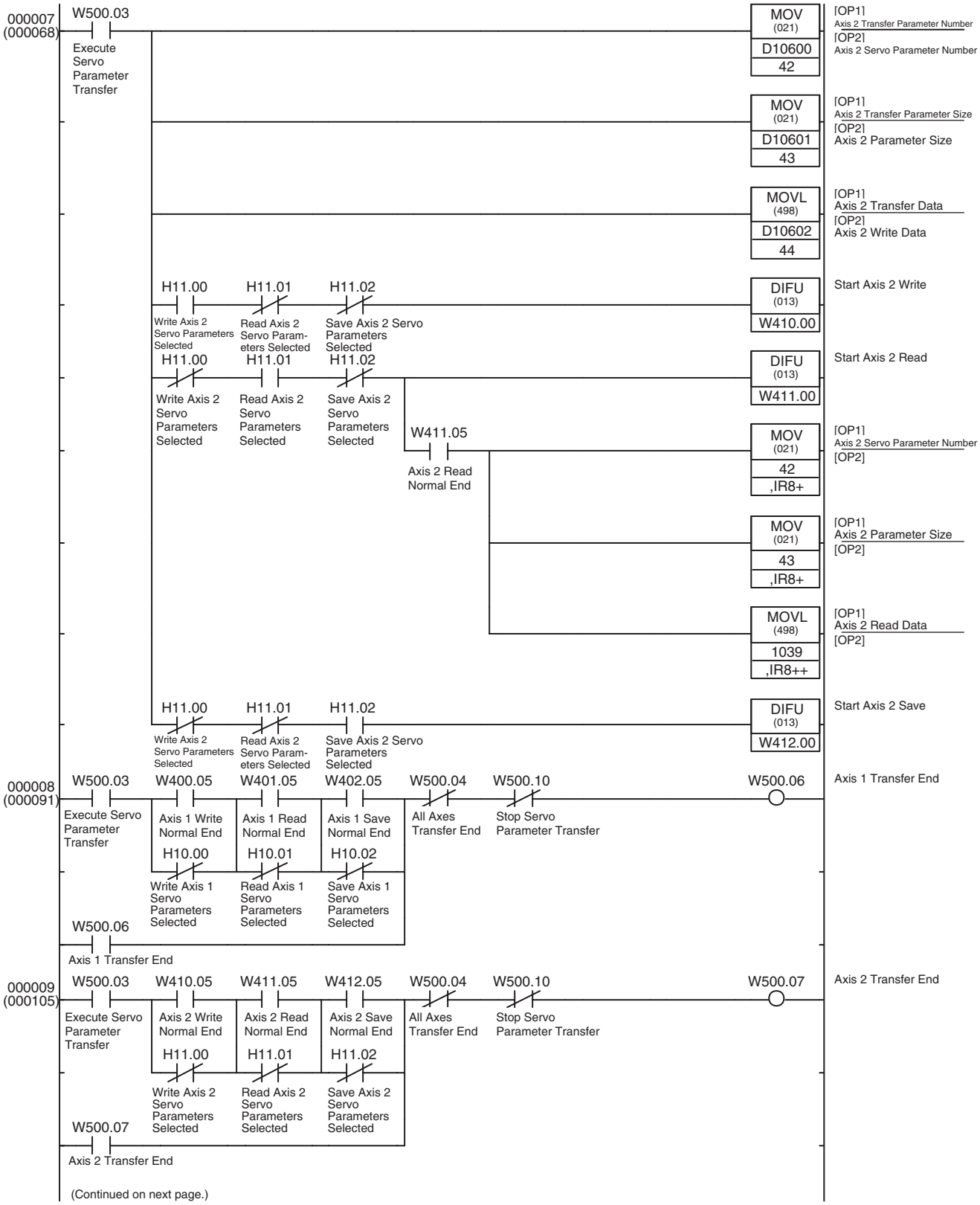

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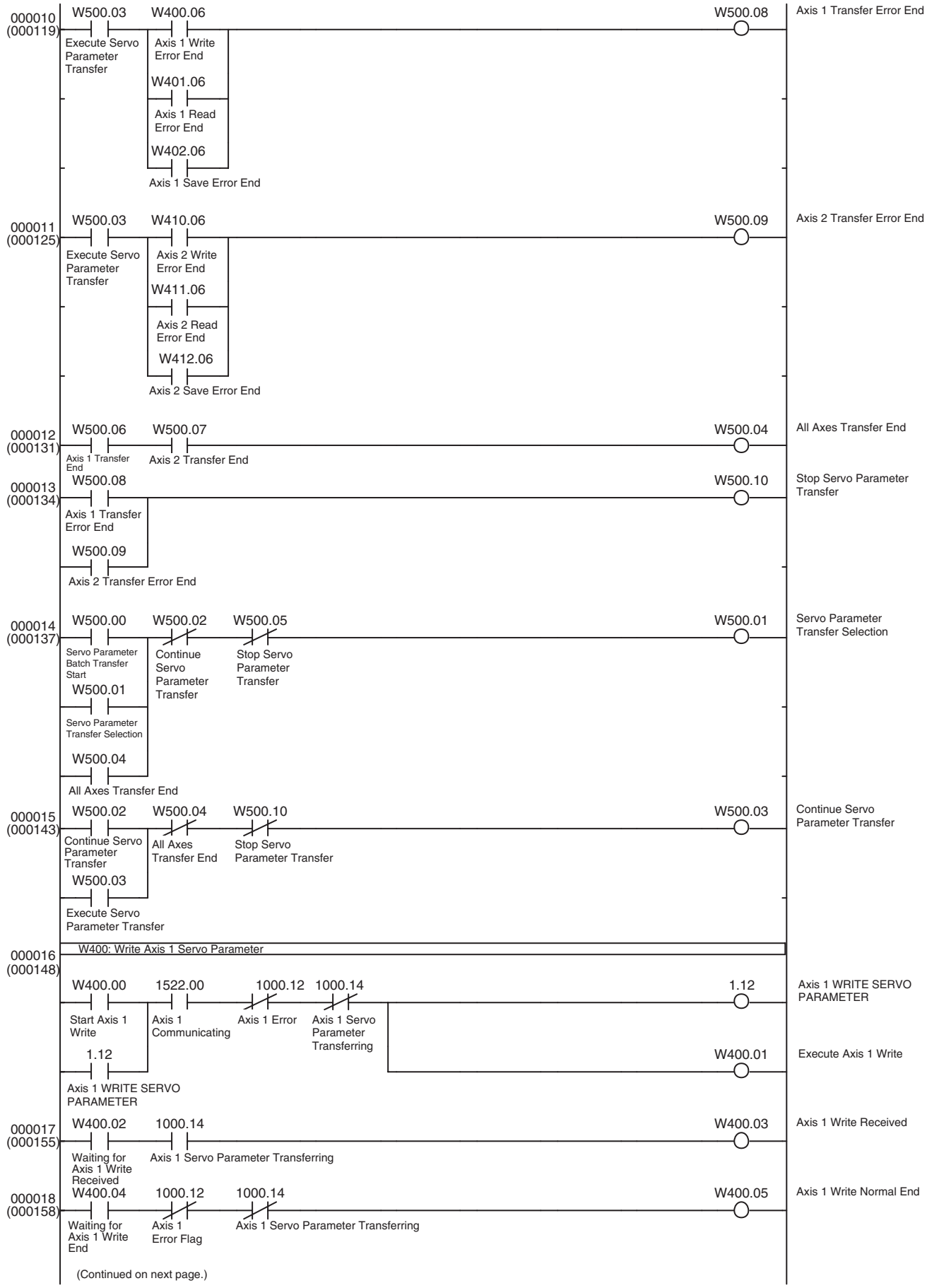


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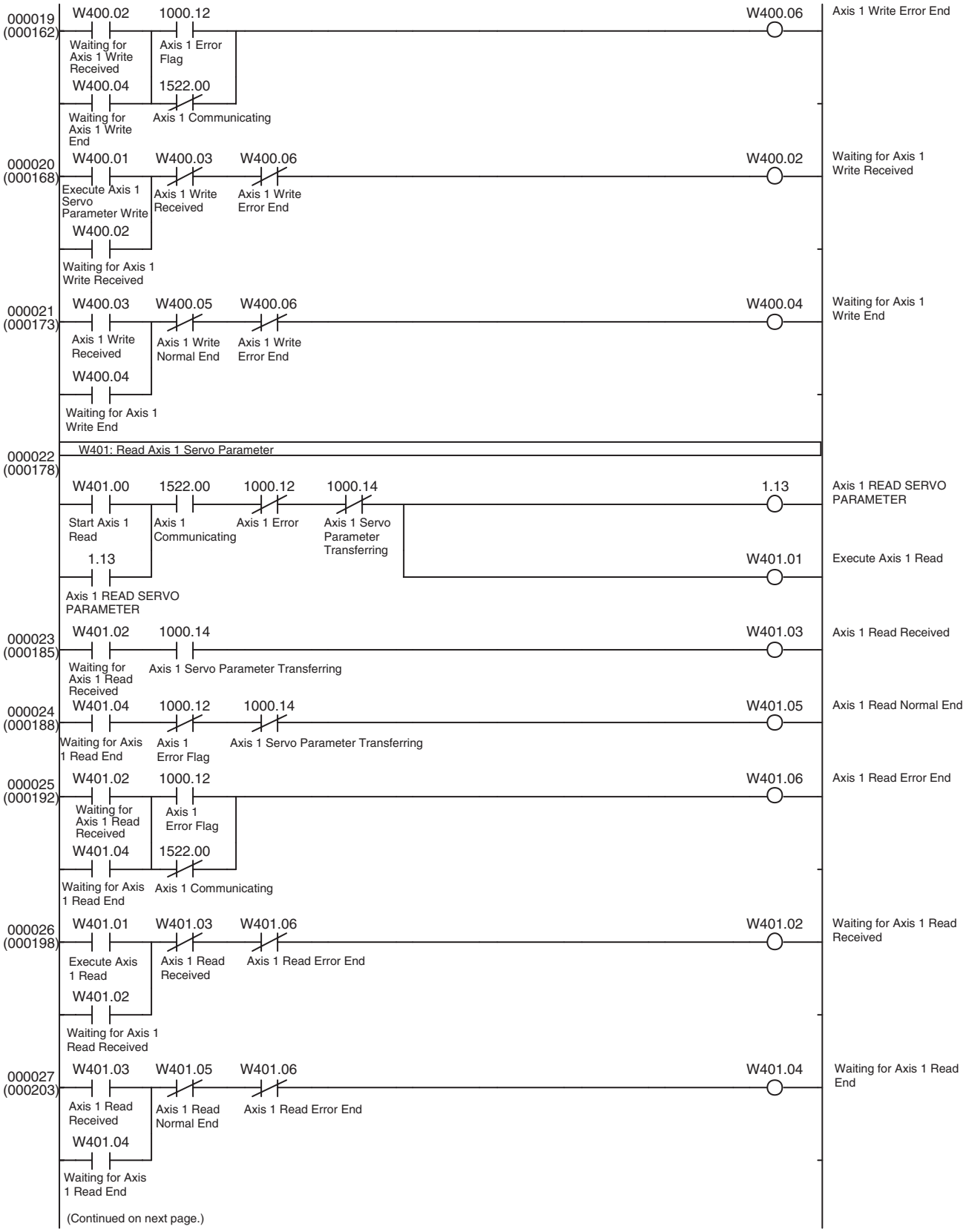



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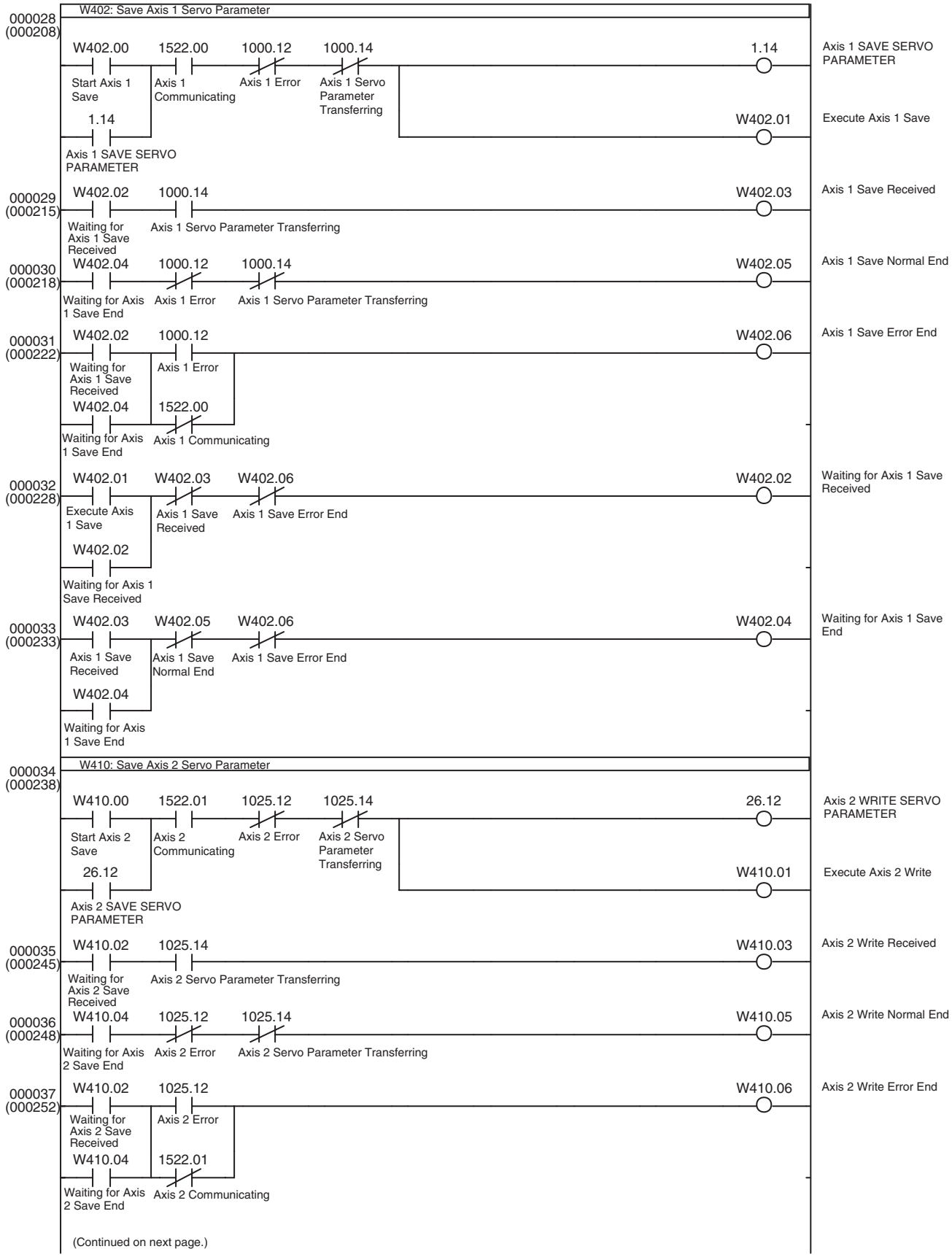

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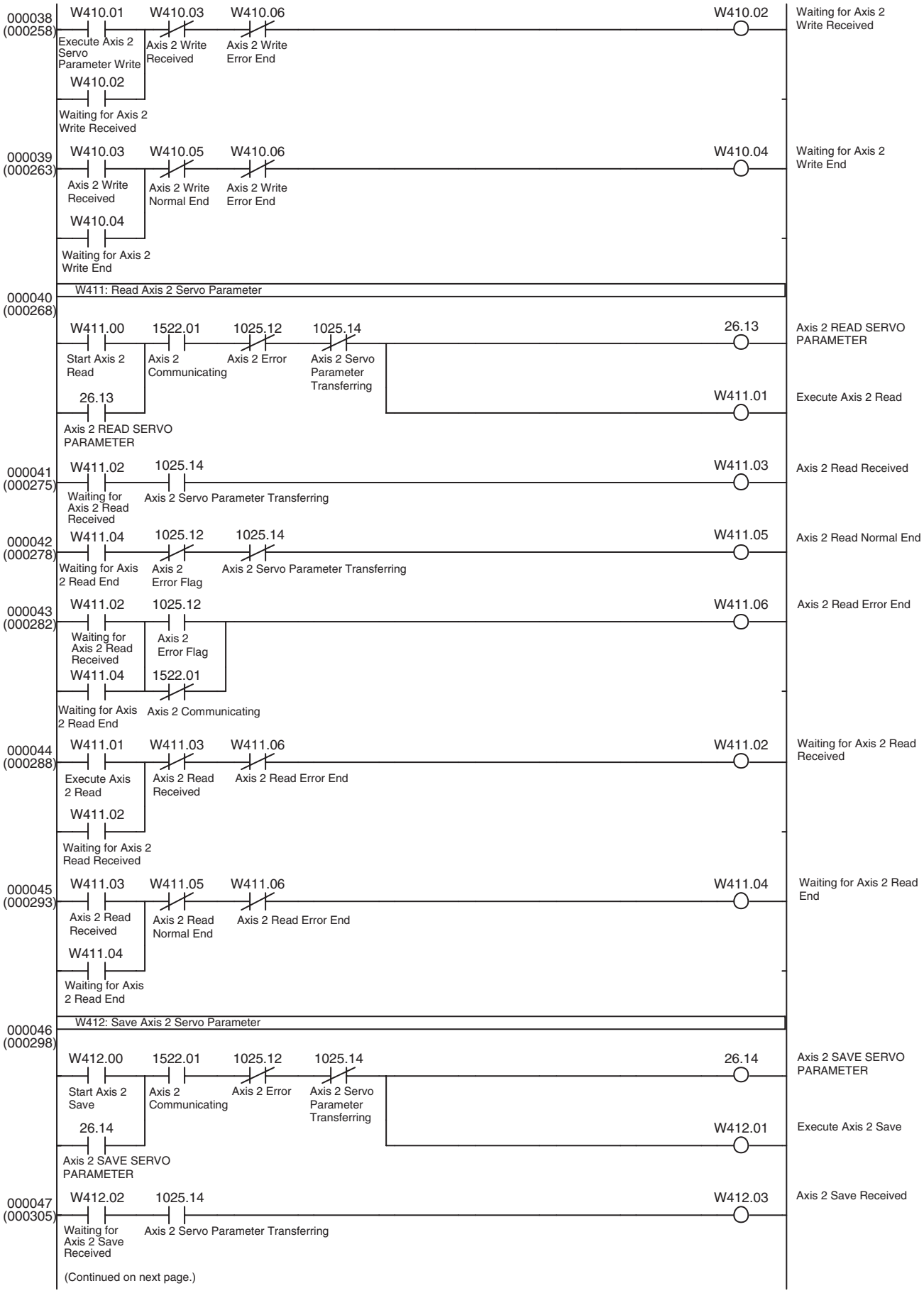


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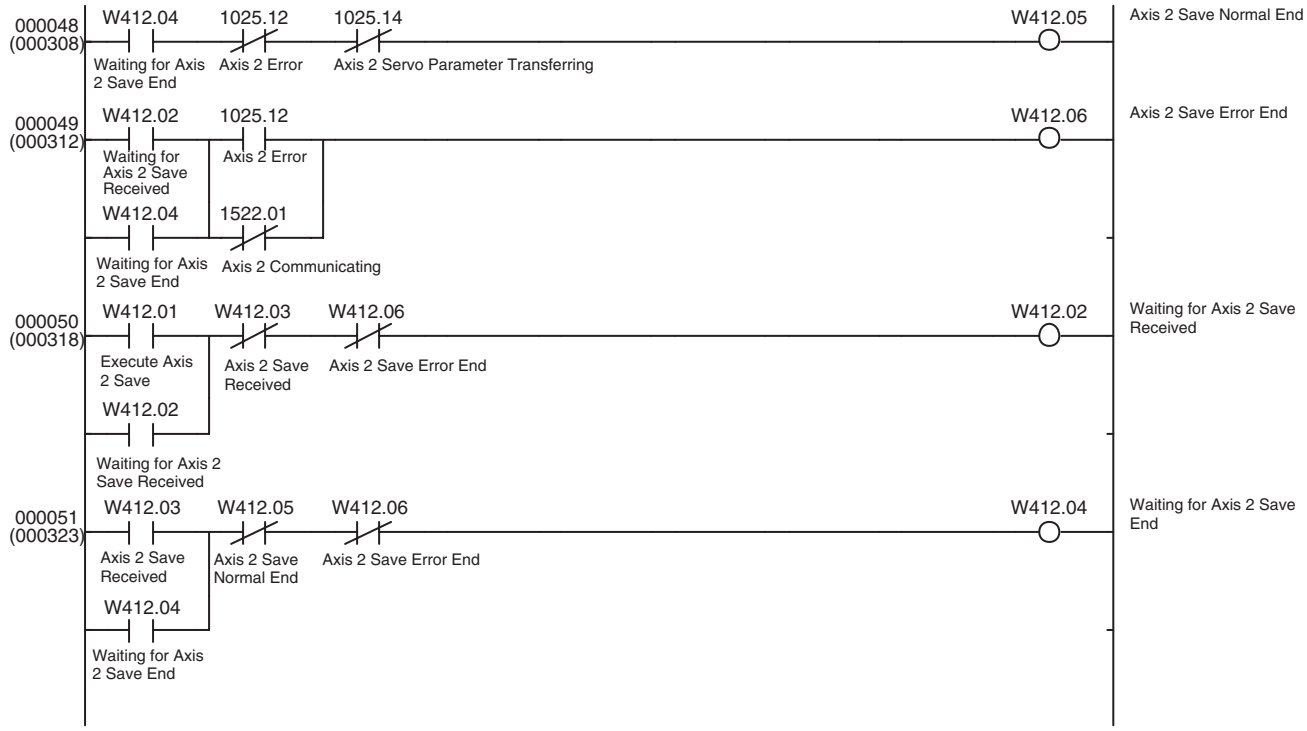



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## 11-3-3 Switching among Position, Speed, and Torque Control

### Overview

The basic program examples introduced in the following sections are combined to perform position, speed, and torque control.

*11-2-3 Transferring Servo Parameters* (Used to transfer acceleration/deceleration constants for positioning.)
*11-2-4 Servo Lock/Unlock*
*11-2-6 Positioning (Absolute Movement or Relative Movement)*
*11-2-7 Speed Control*
*11-2-8 Torque Control*
*11-2-9 Deceleration Stop or Emergency Stop*

This program uses I/O bits to execute the Servo Lock/Unlock function, start controlling an axis (positioning, speed control, or torque control), or switch the control status of an operating axis.

In this example, only axis 1 is controlled.

This application example is normally executed after the initial PCU settings application shown in *11-3-1 Initial PCU Settings*.

The Axis Operating Output/Input Memory Areas are based on the settings of the Common Parameter Area, as shown below. The application example in *11-3-1 Initial PCU Settings* shows a sample program that can be used to make the following settings.

Beginning word of Axis Operating Output Memory Area: CIO 0000

(Axis 1 Operating Output Memory Area: CIO 0000 to CIO 0024)

Beginning word of Axis Operating Input Memory Area: CIO 1000

(Axis 1 Operating Input Memory Area: CIO 1000 to CIO 1024)

This sample program uses the following parts of the CPU Unit's I/O memory.



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**CPU Bus Unit Area**

CIO 1500 to CIO 1524

These word addresses are contained in the CPU Bus Unit Area words allocated to unit number 0.

**Data Memory Area (DM Area)**

| | |
|---|---|
| Axis operation command settings: | D1000 to D1011 |
| Units conversion calculation: | D1500 to D1515 |
| Expanded Monitoring: | D1020 to D1023 |
| Axis 1 Servo Parameter transfer: | D10500 to D10503 |

These words are used to store the axis operation command values, calculate the command's units, store expanded monitoring values, and store the Servo Parameter transfer information (parameter number, parameter size, and two-word transfer data).

**Work Area (WR Area)**

| | |
|---|---|
| Servo Lock/Unlock: | W305.00 to W305.06 |
| Positioning: | W201.00 to W201.03 |
| Speed Control: | W202.00 to W202.02 |
| Torque Control: | W203.00 to W203.02 |
| Deceleration Stop: | W204.00 and W204.01 |
| Emergency Stop: | W205.00 and W205.01 |
| Expanded Monitoring Switch: | W210.00 to W210.02 |
| Axis 1 Write Servo Parameters: | W400.00 to W400.06 |
| Change Acceleration/Deceleration Constant: | W501.00 to W501.06 |

These Work Area bits are used to show the progress of function execution and the execution status.

**Holding Area (HR Area)**

H1.00

This bit is used as a switch to indicate whether the positioning command is ABSOLUTE MOVEMENT or RELATIVE MOVEMENT.

**Timer Area**

TIM0003

Used as a watchdog timer to monitor the positioning operation.

**I/O Bits**

CIO 500.00 to CIO 500.05 and CIO 500.14 to CIO 500.15



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The following table shows the axis 1 operations that can be started by this program as well as the I/O bit operations and command values (in the DM Area), which start that axis 1 operation.

| Word/bit | Function | Explanation |
|---|---|---|
| CIO 050000 | Axis 1 Servo Lock/ Unlock Switch | Each time this bit is turned ON, it switches axis 1 between Servo Lock and Servo Unlock.<br>When the Servo Unlock is executed during speed control or torque control, the Servo Unlock is executed after executing an Emergency Stop. |
| CIO 050001 | Start Axis 1 Positioning | When this bit goes from OFF to ON, positioning starts according to the position command value in D1000 and D1001 or the speed command value in D1002 and D1003.<br>The positioning method can be switched between absolute/relative movement by turning H1.00 ON/OFF.<br>H1.00 ON: ABSOLUTE MOVEMENT<br>H1.00 OFF: RELATIVE MOVEMENT<br>Also, the acceleration constant (deceleration constant) can be set to the value in D1010 (D1011) before starting the positioning operation if CIO 0500.14 (CIO 0500.15) is turned ON before turning this bit from OFF to ON.<br>When positioning is started with CIO 0500.14 and/or CIO 0500.15 OFF, positioning will be performed with the acceleration constant and/or deceleration constant set in the Servo Driver. |
| CIO 050002 | Start Axis 1 Speed Control | When this bit goes from OFF to ON, speed control starts according to the speed command value in D1002 and D1003. |
| CIO 050003 | Start Axis 1 Torque Control | When this bit goes from OFF to ON, torque control starts according to the torque command value in D1004 and D1005, with the speed command value in D1002 and D1003 as the speed limit value. |
| CIO 050004 | Start Axis 1 Deceleration Stop | A Deceleration Stop is executed when this bit goes from OFF to ON. |
| CIO 050005 | Start Axis 1 Emergency Stop | An Emergency Stop is executed when this bit goes from OFF to ON. |
| CIO 050014 | Specify Axis 1 Acceleration Constant | If CIO 0500.01 (Axis 1 Start Positioning) is turned from OFF to ON while this bit is ON, positioning will be executed with the acceleration constant specified in D1010. (Before positioning is started, the new constant is written to the acceleration constant Servo Parameter.) |
| CIO 050015 | Specify Axis 1 Deceleration Constant | If CIO 0500.01 (Axis 1 Start Positioning) is turned from OFF to ON while this bit is ON, positioning will be executed with the deceleration constant specified in D1011. (Before positioning is started, the new constant is written to the deceleration constant Servo Parameter.) |
| D1000<br>D1001 | Axis 1 Position Command Value | These words contain the position command value used in positioning. Set in the “command units.” |
| D1002<br>D1003 | Axis 1 Speed Command Value | These words contain the speed command value used in positioning and speed control.<br>This value is also used as the speed limit value during torque control.<br>Set in “command units/s.”<br>Speed command value for speed control and speed limit value for torque control are calculated in this program from this set value and the Servomotor's momentary maximum rotation speed, encoder resolution, and electronic gear ratio. |
| D1004<br>D1005 | Axis 1 Torque Command Value | This is the torque command value used in torque control.<br>Set the torque command value as a percentage of the Servomotor's momentary maximum torque, in units of 0.001%. |



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| Word/bit | Function | Explanation |
|---|---|---|
| D1010 | Axis 1 Acceleration Constant | This word contains the acceleration constant for positioning.<br>If CIO 0500.14 is ON when positioning is started, the contents of this word are written to the Servo Parameter to change the acceleration rate.<br>Set in units of "×10,000 command units/$s^2$." |
| D1011 | Axis 1 Deceleration Constant | This word contains the deceleration constant for positioning.<br>If CIO 0500.15 is ON when positioning is started, the contents of this word are written to the Servo Parameter to change the deceleration rate.<br>Set in units of "×10,000 command units/$s^2$." |

The setting value in D1002 and D1003 is used as the speed command value in position and speed control. In torque control, it is used as the speed limit value.

The PCU's speed command value for speed control and the speed limit value for torque control (option command value 1) are set as a percentage of the Servomotor's momentary maximum rotation speed (units: 0.001%), so they are calculated as follows in this program.

Use the following equation as a template and change the equation in this program when the Servomotor's momentary maximum rotation speed, encoder resolution, or electronic gear ratio are different.

Speed command value for speed control and speed limit value for torque control = Speed command value (command units/s) × 60 (s) / (Servomotor momentary maximum rotation speed (r/min) × Encoder resolution (pulses/rotation) × 4/Electronic gear ratio)/0.001%

An R88M-W10030L W-series Servomotor is used in this sample program. In this case,

Momentary maximum rotation speed:5,000 r/min
Encoder resolution: 2,048 pulses/rotation

The electronic gear ratio is contained in Servo Parameters (Pn202/Pn203) and the default setting is 4 (Pn202 = 4 and Pn203 = 1).

Consequently, the units calculation is as follows:

Speed command value for speed control and speed limit value for torque control
= Speed command value (command units/s) × 60/ (5,000 × 2,048 × 4/4) × 100,000
= Speed command value (command units/s) × 6,000,000 / 10,240,000

In this program, the fraction is reduced to 1,200/2,048 to prevent the multiplication or division from overflowing.

**Note** When torque control is being performed, option command value 1 is used as the speed limit value, so set parameter Pn002.1 (Speed command input change) to 1 to select option command value 1.

If the Servo Unlock function is executed during speed control or torque control, this program will output the Servo Unlock command after executing an Emergency Stop (see the output circuit for W305.06).

In addition, the feedback speed and torque command are monitored in this program with the PCU's Expanded Monitoring function.

Since the speed and torque units used for monitoring depend on the control mode (position control, speed control, or torque control), the monitoring units are converted in this program and output to D1020 to D1021 and D1022 to D1023. Refer to *4-8-6 Expanded Monitoring* for details on the monitoring units used in each control mode.



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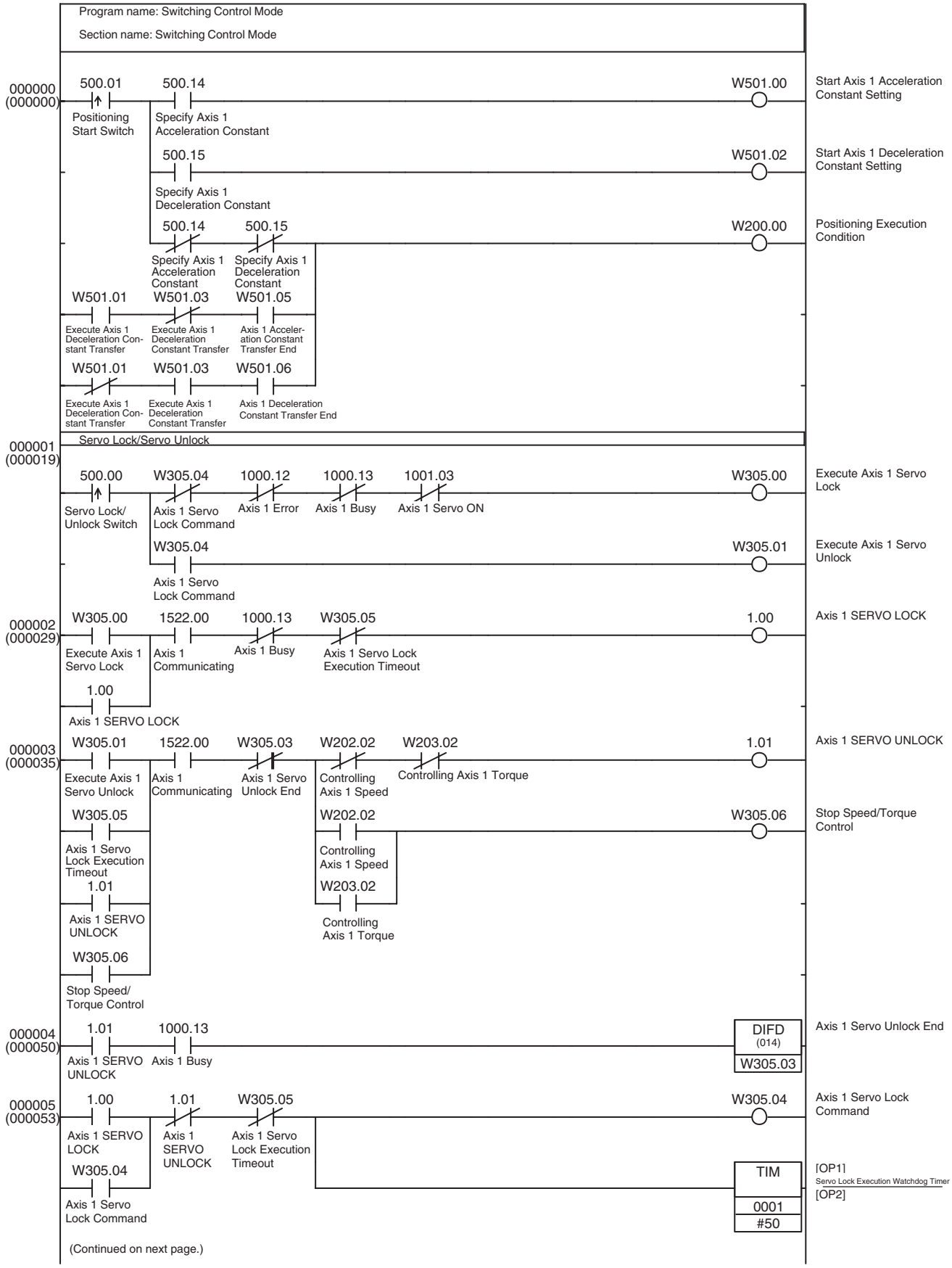
In this program, the unit conversion methods are switched at the start of axis operation. The speed monitoring units are converted (0.001% → command units/s) during speed control and the torque monitoring units are converted (0.001% →%) during torque control.

(The conversion of speed monitoring units is performed by reversing the equation used to convert the speed command value for speed control.)



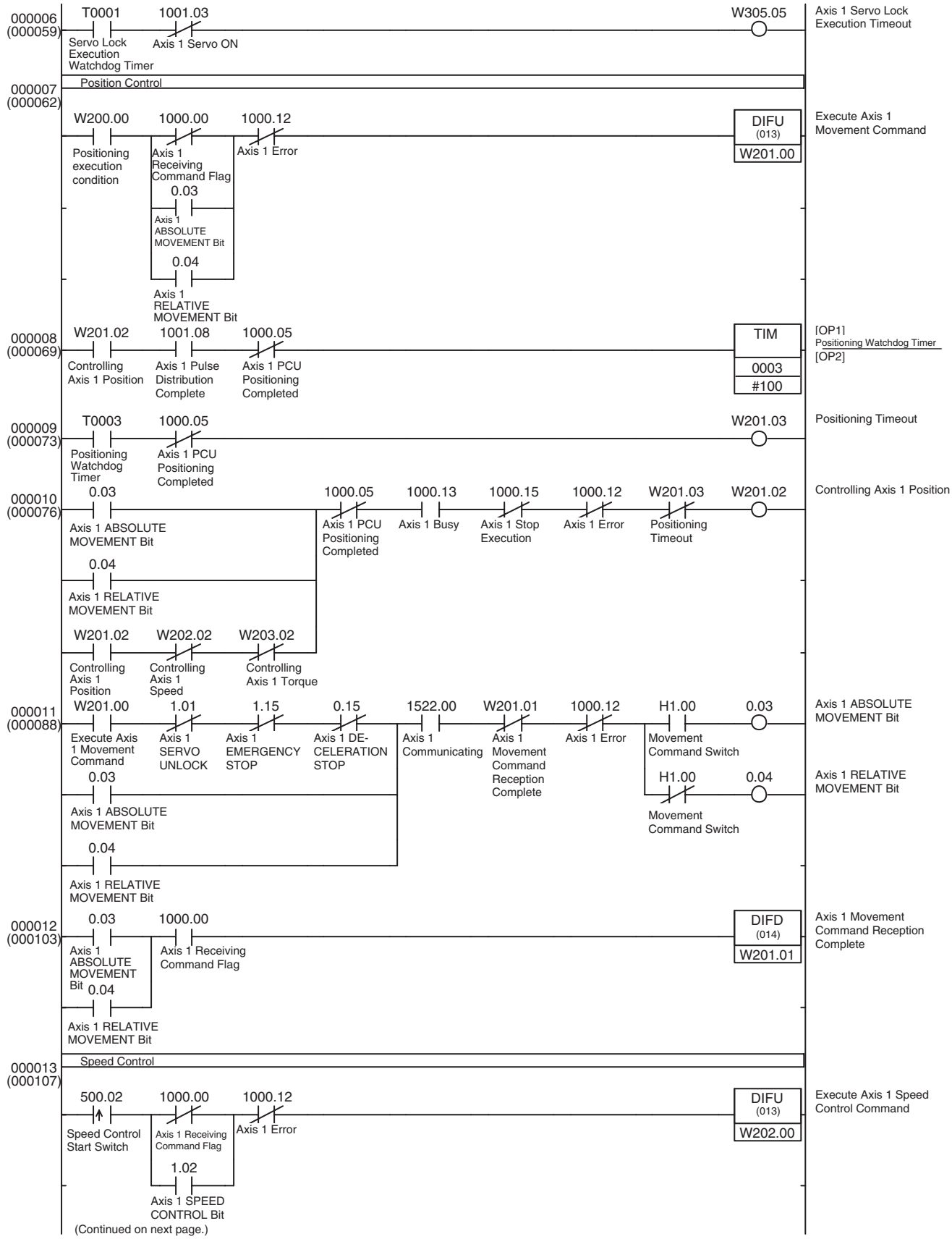
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## Sample Ladder Program



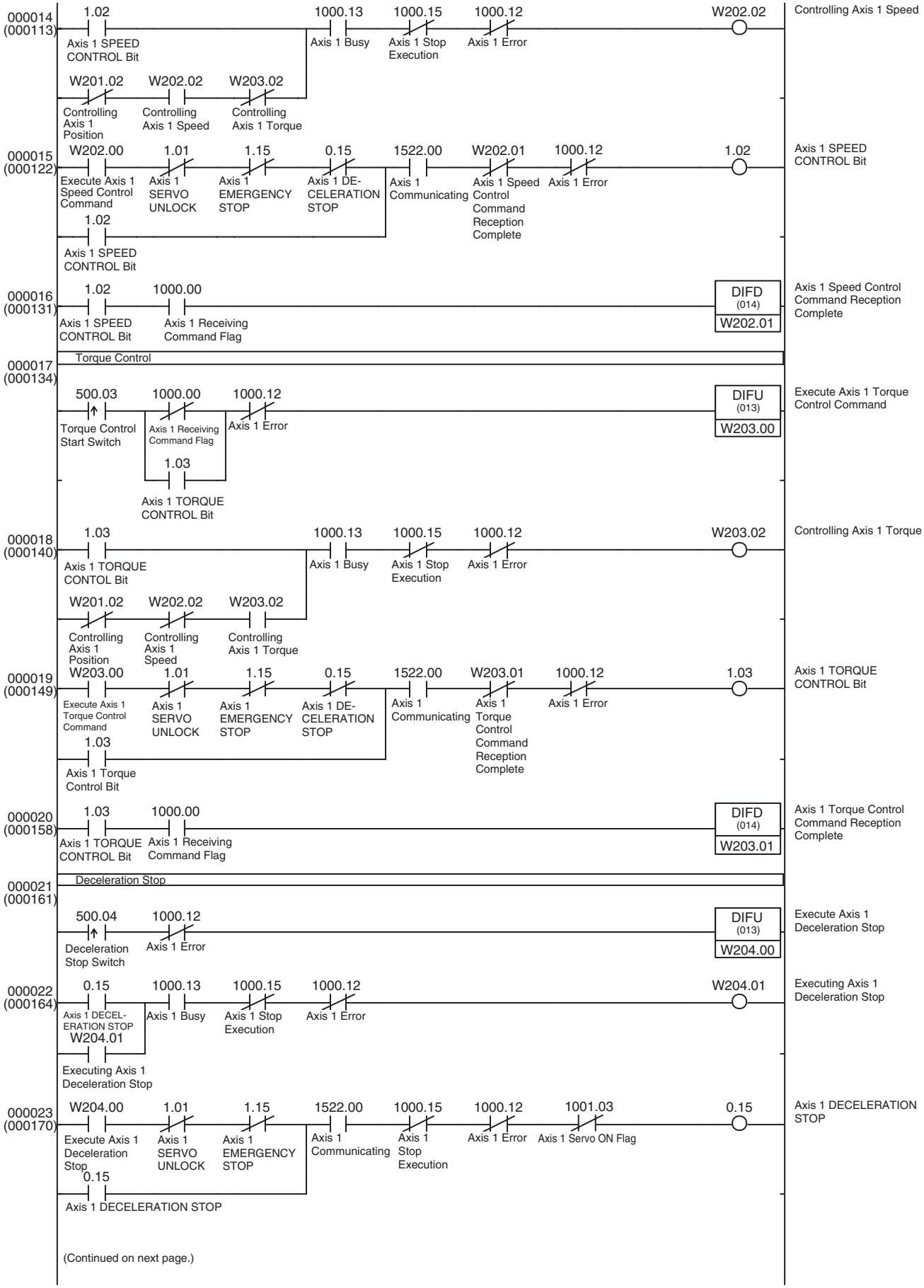



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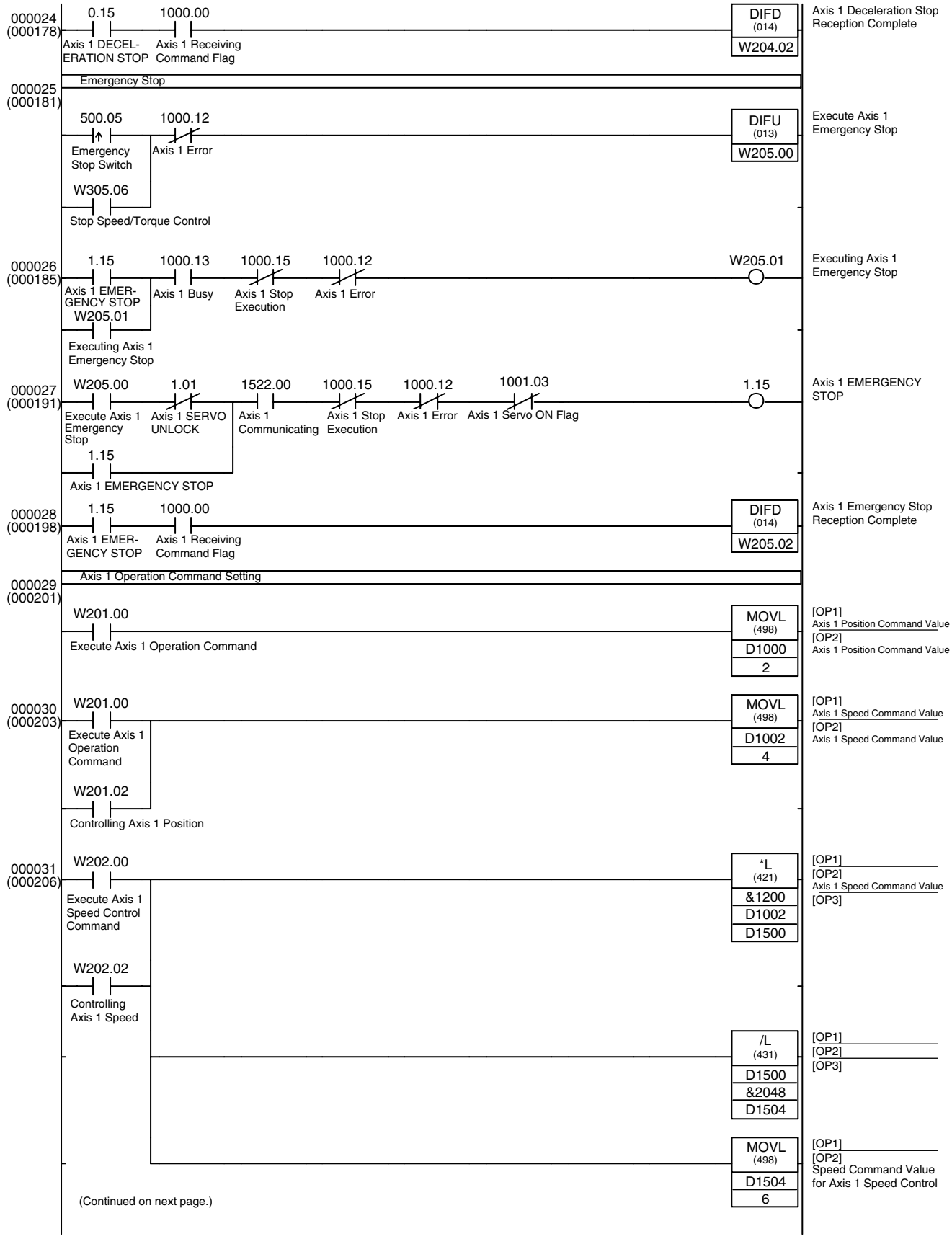



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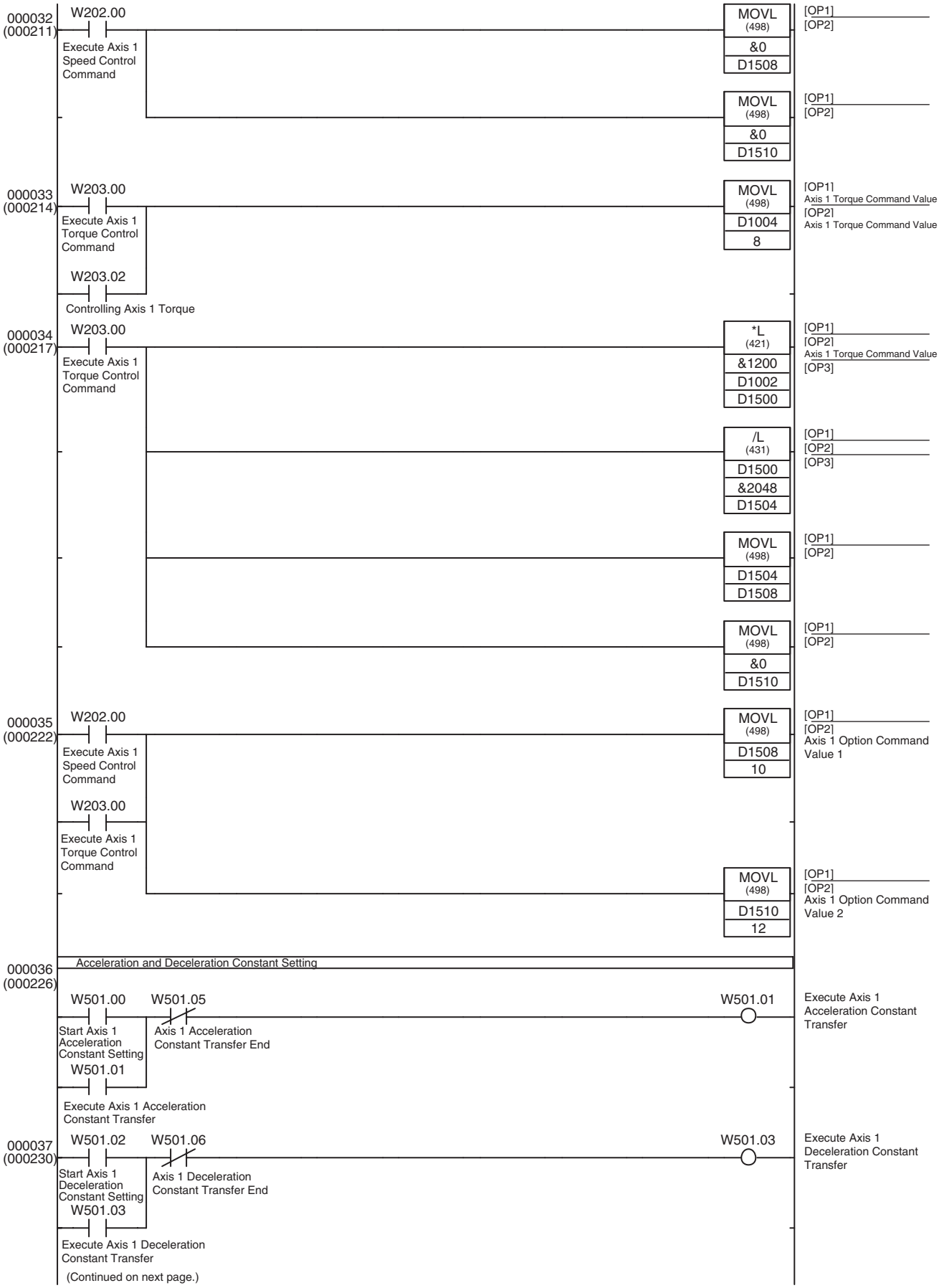



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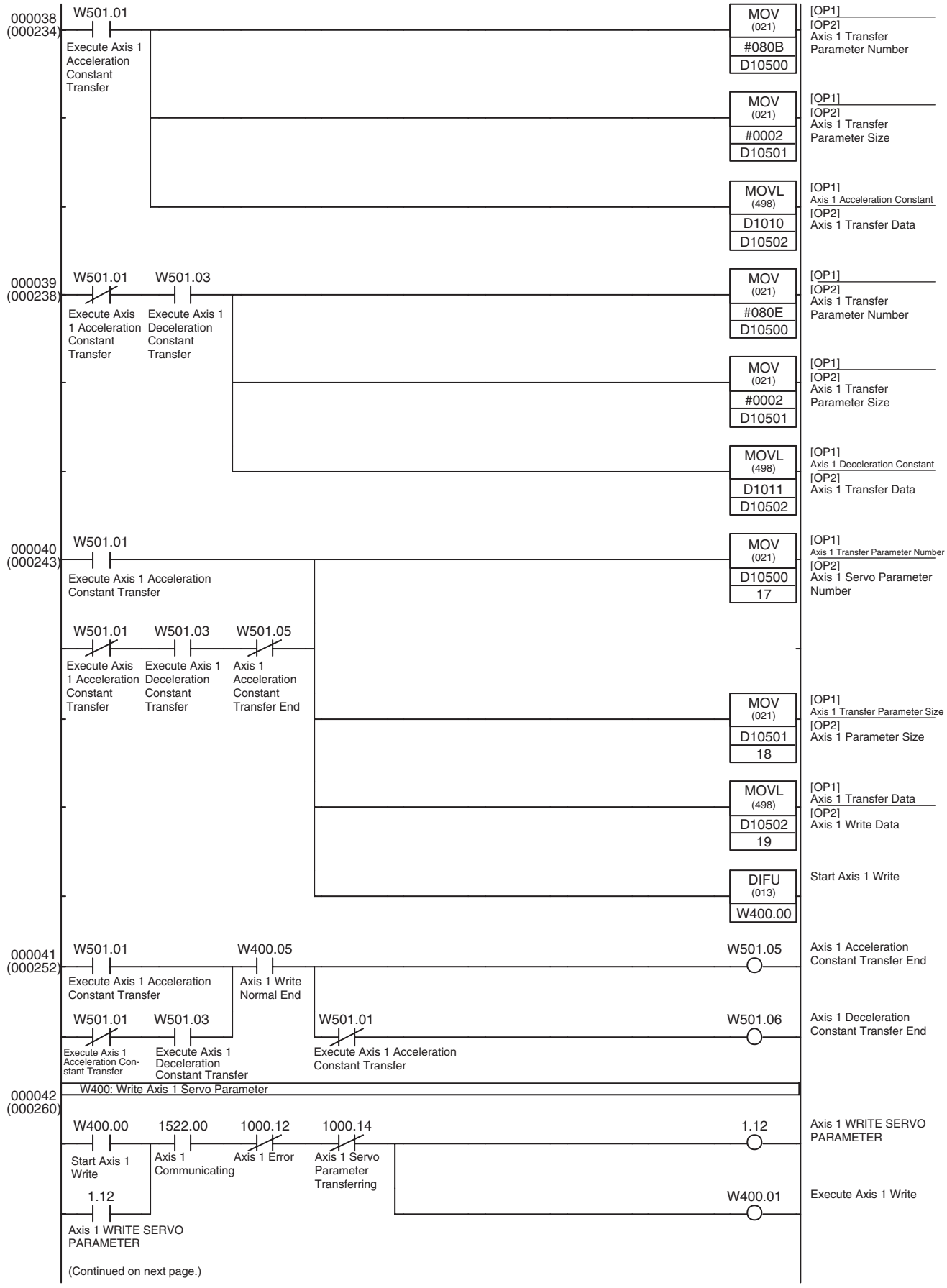



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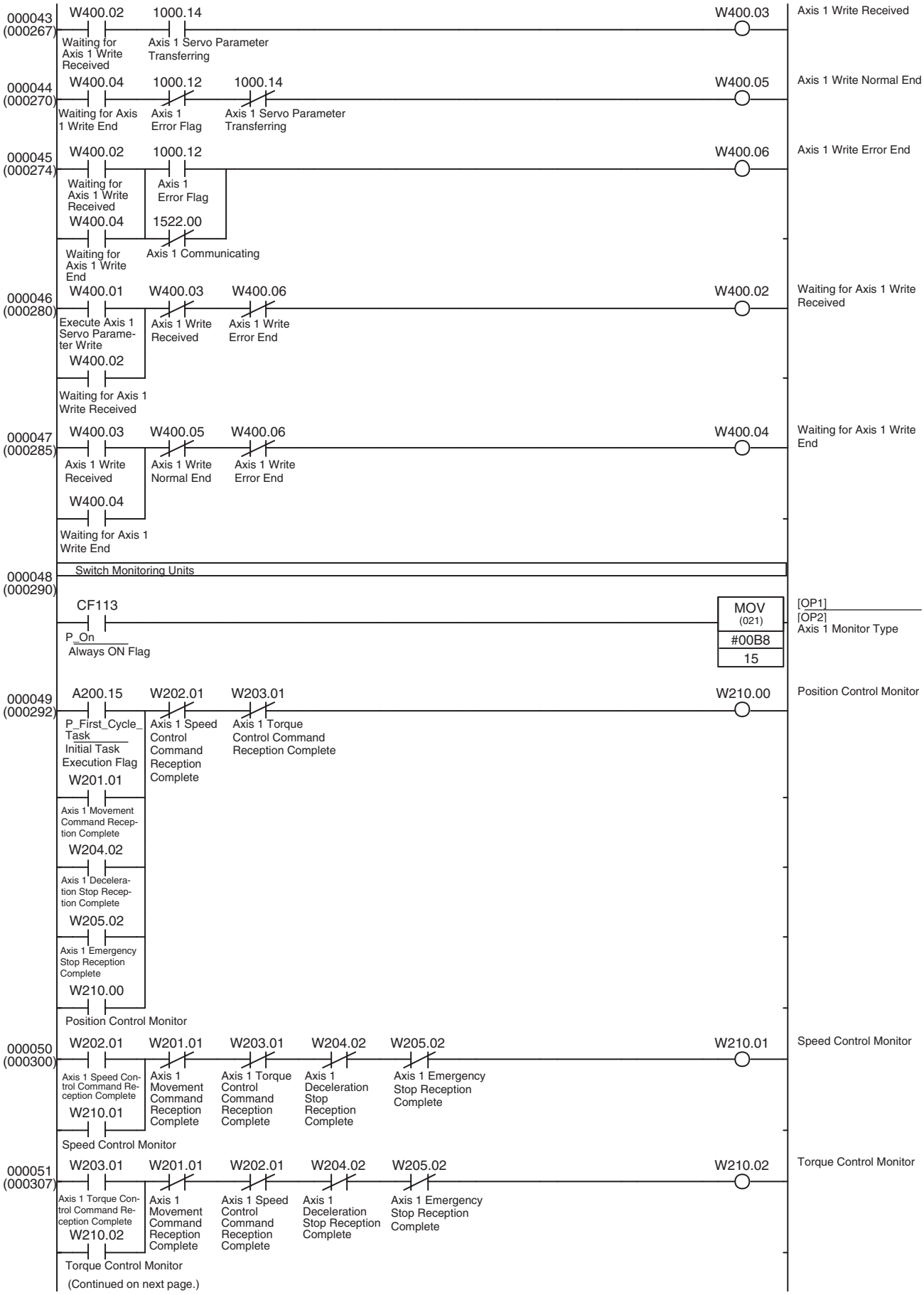



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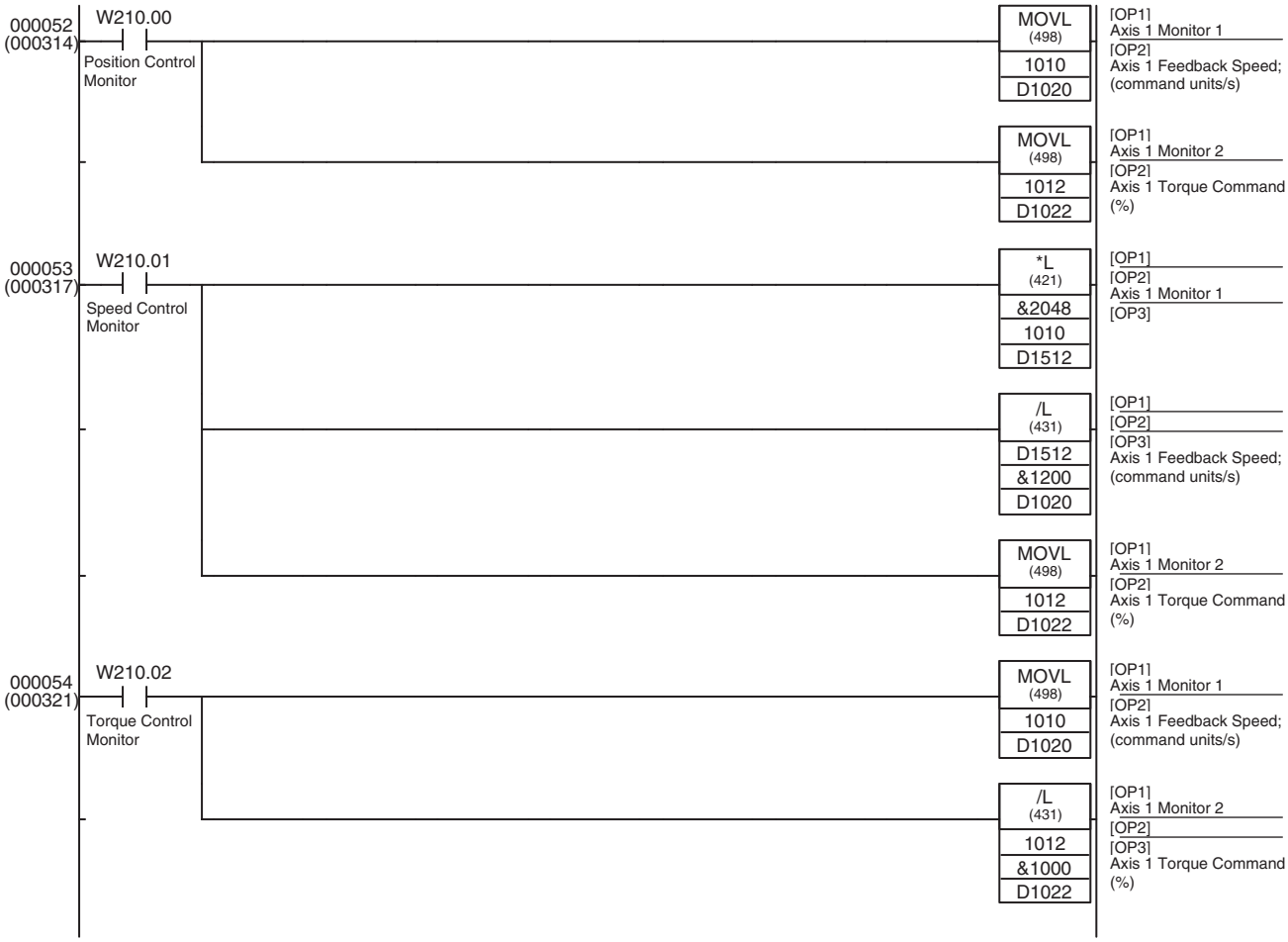



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# SECTION 12
# Troubleshooting

This section provides information on troubleshooting errors that may occur, including details on the meaning of indicator displays and error codes, and the procedures required to reset errors in the Unit or axes.


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# 12-1 Overview of PCU Errors

The PCU detects errors that occur in the PCU, MECHATROLINK communications, or the MECHATROLINK slave device and sends notification of the error to the CPU Unit.

The errors that are detected by the PCU can be divided broadly into problems common to the PCU and those in each of the controlled axes. The CPU Unit is notified of any errors according to the cause of the detected error and its location, as shown in the following table.

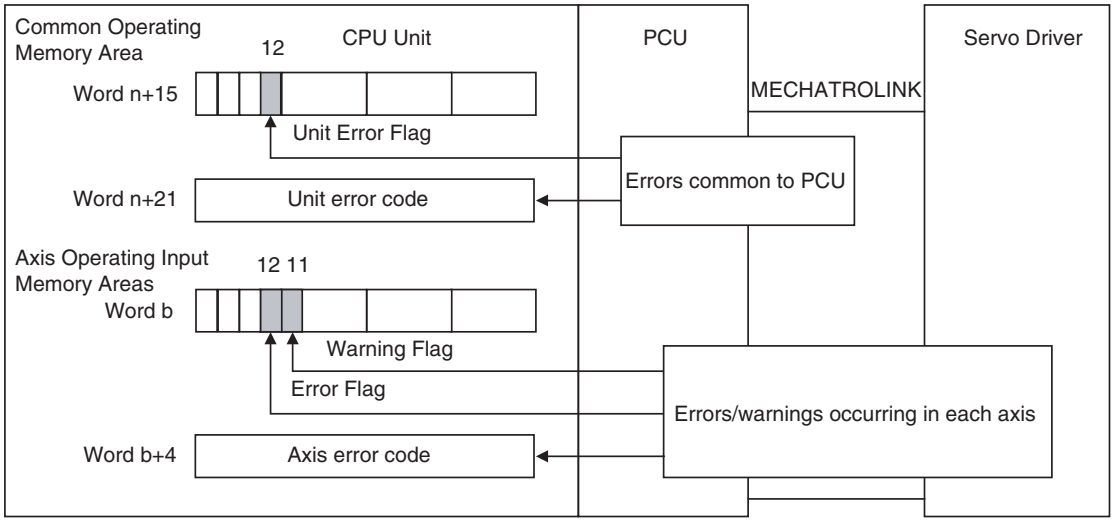
| Category | Source of error | Error/ warning | Cause of error | | | | | | Notification from PCU | Interface area |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Errors at powerup (initialization errors) | CPU Unit errors | PCU internal errors | MECHATROLINK communications errors | PCU settings/ operation errors | MECHATROLINK slave device errors | | |
| Unit common | PCU | Error | Causes Unit common error | Causes Unit common error | Causes Unit common error | Causes Unit common error | Causes Unit common error | Does not cause Unit common error | Unit Error Flag, Unit error code | Common Operating Memory Area |
| Axis errors | PCU | Error | Does not cause axis error | Does not cause axis error | Does not cause axis error | Causes axis error | Causes axis error | Does not cause axis error | (Axis) Error Flag, Axis error code | Axis Operating Input Memory Areas |
| | MECHATROLINK slave device | Error | Does not cause axis error | Does not cause axis error | Does not cause axis error | Causes axis error | Causes axis error | Causes axis error | | |
| | | Warning | Does not cause axis error | Does not cause axis error | Does not cause axis error | Does not cause axis error | Does not cause axis error | Causes axis error | (Axis) Warning Flag, Axis error code | |

**Note**

(1) MECHATROLINK communications errors are either related to all communications or occur in individual axes, and are notified either as Unit common errors or as axis errors.

(2) The PCU settings/operation errors are caused due to operations either common to the PCU or in each axis, and are notified either as Unit common errors or as axis errors.

The following diagram shows the operation error notification.




n = CIO 1500 + (unit number × 25)
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. − 1) × 25

If an error occurs, the PCU operates according to the following table depending on the cause of the detected error.



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The errors common to the PCU can be cleared by setting the UNIT ERROR RESET Bit in the Common Operating Memory Area, and errors that occur in axes are cleared by setting the ERROR RESET Bit in the Axis Operating Output Memory Areas.

| Operation after error | Cause of error | | | | | | Status after error | | ERROR RESET |
|---|---|---|---|---|---|---|---|---|---|
| | Errors at powerup (initialization errors) | CPU Unit errors | PCU internal errors | MECHATROLINK communications errors | PCU Settings/operation errors | MECHATROLINK slave device errors | MECHATROLINK communications | Servomotor carrying current | |
| System stopped | Causes PCU operation on the left | Does not cause PCU operation on the left | Causes PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Connection released. | Servomotor not carrying current (See note 2.) (Servo OFF) | Not possible |
| Connection released suddenly | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Causes PCU operation on the left | Causes PCU operation on the left | Does not cause PCU operation on the left | Connection released. | Servomotor not carrying current (See note 2.) (Servo OFF) | Not possible |
| Connection released after deceleration stop | Does not cause PCU operation on the left | Causes PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Connection released. | Servomotor not carrying current (See note 2.) (Servo OFF) | Possible only for CPU Unit monitor errors. |
| Servo OFF | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Causes PCU operation on the left | Connection not released. | Servomotor not carrying current (Servo OFF) | Possible |
| Emergency stop | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Causes PCU operation on the left | Connection not released. | Maintains previous status | Possible |
| Deceleration stop | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Causes PCU operation on the left | Causes PCU operation on the left | Causes PCU operation on the left | Connection not released. | Maintains previous status | Possible (See note 4.) |
| Maintains | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Does not cause PCU operation on the left | Causes PCU operation on the left | Causes PCU operation on the left | See note 1. | Maintains previous status | Maintains previous status | Possible |

**Note**

(1) If a warning occurs in a MECHATROLINK slave device, the Warning Flag will turn ON and operation will continue.

(2) When a connection is released by the PCU, the Servo Driver will be put in the Servo OFF state.

(3) The operations and status for MECHATROLINK slave device errors above indicate the PCU operation (i.e., the command sent to the slave device when an error occurs). The operation of the MECHATROLINK slave device in which the error occurred depends on the device's specifications.

(4) MECHATROLINK communications errors that occur in individual axes cannot be cleared by setting the AXIS ERROR RESET Bit in the Axis Operating Output Memory Areas. (For details, refer to *Errors in MECHATROLINK Communications* in this section.)

If two or more errors occur at the same time, the errors are processed in the order of priority starting from the most important error, as shown in the following table, and the error codes are refreshed.



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If two or more errors of the same priority level occur at the same time, the error status of the error that was detected first will be maintained (the error code for the error that was detected first will be held).

| Category | PCU operation if error occurs | Priority level | Details |
|---|---|---|---|
| Unit common errors | System stopped<br>Connection released suddenly<br>Connection released after deceleration stop | High<br>↑<br>↓<br>Low | |
| Individual axis error | MECHATROLINK communications error (See note.)<br>Servo OFF<br>Emergency stop<br>Deceleration stop<br>Operation continues | | If a Unit common error occurs while an individual axis error has occurred, the status of the Error Flag and axis error code for the axis error will be held. |

**Note** MECHATROLINK communications errors that occur in individual axes are processed in order of highest priority among the errors that occur in each axis. (For details, refer to *Errors in MECHATROLINK Communications* in this section.)

The PCU functions are limited when an error occurs, as follows:

| Error | Functions that can be performed | Functions that cannot be performed |
|---|---|---|
| Unit common errors (Unit Error Flag ON in the Common Operating Memory Area) | • UNIT ERROR RESET<br>• WRITE DATA<br>• READ DATA<br>• SAVE DATA<br>• Releasing connection (CONNECT Bit OFF) | • Establishing connection (CONNECT Bit ON) |
| Axis error (Error Flag ON in the Axis Operating Input Memory Area) | • ERROR RESET<br>• SERVO UNLOCK<br>• WRITE SERVO PARAMETER (See note.)<br>• READ SERVO PARAMETER (See note.)<br>• SAVE SERVO PARAMETER (See note.)<br>• Switching between Monitor type 1 and 2.<br>For details on MECHATROLINK communications errors, refer to *Errors in MECHATROLINK Communications* in this section. | • ABSOLUTE/RELATIVE MOVEMENT (with INTERRUPT FEEDING)<br>• ORIGIN SEARCH<br>• ORIGIN RETURN<br>• PRESENT POSITION PRESET<br>• JOG<br>• DEVIATION COUNTER RESET<br>• Changing override<br>• DECELERATION STOP<br>• SERVO LOCK<br>• SPEED CONTROL<br>• TORQUE CONTROL<br>• DEVICE SETUP<br>• WRITE SERVO PARAMETER (See note.)<br>• READ SERVO PARAMETER (See note.)<br>• SAVE SERVO PARAMETER<br>• EMERGENCY STOP (See note.) |

**Note** For PCUs with unit version 1.2 or earlier, parameters cannot be read, written, or saved when there is an axis error. Attempts to execute these commands



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will be ignored. For PCUs with unit version 1.3 or later, parameters can be read, written, or saved even when there is an axis error.

Functions that cannot be performed during errors can be performed after executing ERROR RESET to clear the error.

## Errors in MECHATROLINK Communications

The following errors are MECHATROLINK communications errors that occur in individual axes.

- Synchronous Communications Alarm (axis error code: 3010 hex)
- Communications Alarm (axis error code: 3011 hex)
- Command timeout (axis error code: 3012 hex)

These errors cannot be cleared using the AXIS ERROR RESET Bit in the Axis Operating Output Memory Areas.

These errors are related to the interface between the PCU and Servo Driver and are, therefore, given the highest priority in error processing of individual axis errors.

If these errors occur, the PCU will execute DECELERATION STOP for the corresponding axis (Servo Driver operation will depend on the stop method that is specified to be used when alarms occur in the Servo Driver) and operation of the axis will be prohibited.

To clear this error, stop MECHATROLINK communications (release connection) and then execute CONNECT again.

## PCU Operation when CPU Unit Load Is Turned OFF

When the CPU Unit turns OFF the load, the PCU decelerates the active axis to a stop and releases the MECHATROLINK communications connection.

After recovering from the load OFF status, reestablish the MECHATROLINK communications connection by turning the CONNECT Bit OFF and then ON again.

## Warnings

The MECHATROLINK slave device warnings that occur indicate that an error will occur if operation is continued without correcting the problem.

The type of warning and detection conditions depend on the connected MECHATROLINK slave device (Servo Driver).

When the PCU detects a warning for the MECHATROLINK slave station device, the PCU notifies the CPU Unit, by turning ON the Warning Flag for the corresponding axis, and stores the warning code in the axis error code.

When a warning is detected, the Unit continues operation unchanged.

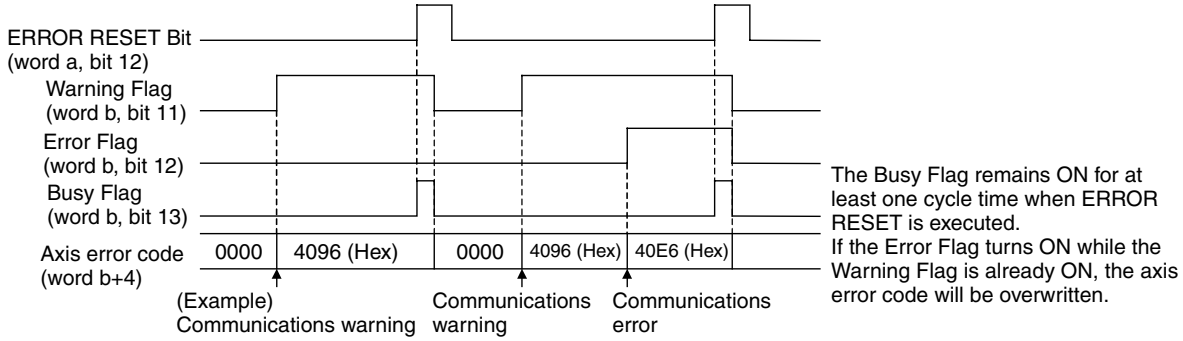
When a warning is detected and then the associated error occurs for the same axis, the Error Flag turns ON and the PCU performs error processing.

The axis error code will be overwritten by the error code for the error that has occurred.



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**Timing Chart for Axis Errors and Warnings**

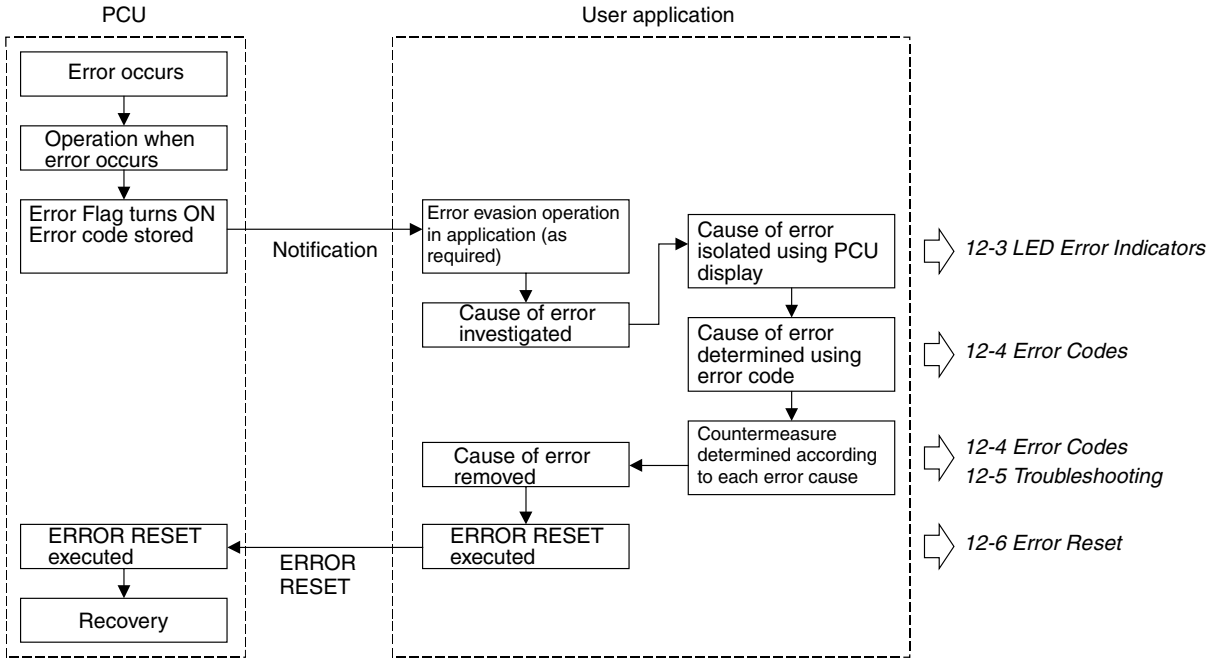



a = Beginning word of Axis Operating Output Areas specified in Common Parameters + (Axis No. −1) × 25
b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

**Note** If an axis warning occurs (Warning Flag = 1), the PCUs' command response time will be delayed due to the warning processing. The PCU processing time required from receiving a command from the CPU Unit until the command is sent using MECHATROLINK communications is one MECHATROLINK communications cycle if an axis warning has not occurred, and three MECHATROLINK communications cycles if an axis warning has occurred. If the machine's operation is affected by the PCU's command response time, clear the axis warning status using ERROR RESET or disable the warnings using the Servo Driver settings.
For details on the PCU's command response time, refer to *Command Response Time* in *Appendix A Performance Characteristics*.

# 12-2 Troubleshooting Procedure

The basic flow of troubleshooting errors that occur in the PCU is as follows:






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# 12-3 LED Error Indicators

The status of the LED indicators on the front of the PCU can be used to diagnose the following errors.




RUN: The PCU is operating.
ERC: An error has occurred in the PCU.
ERH: An error has occurred in the CPU Unit.
ERM: An error has occurred in the MECHATROLINK device.
MLK: Indicates MECHATROLINK communications status

The indicator displays indicate the first error that is detected.

If the cause of an error has been cleared using ALARM RESET when two or more errors have occurred at the same time, the PCU will detect the next error with the highest priority and the indicator display will switch to show the new error. If multiple errors occur with the same priority level, the error for the smaller axis number will be displayed first.

## 12-3-1 Error Indicators at Powerup

| Indicator status | | | | | Category | Probable cause of error | Countermeasure |
|---|---|---|---|---|---|---|---|
| RUN | ERC | ERH | ERM | MLK | | | |
| Not lit | Not lit | Not lit | Not lit | Not lit | CPU Unit power interruption | Power is not being supplied correctly to the CPU Unit. | Check the power supply voltage being supplied to the CPU Unit and make sure the correct power is being supplied. |
| | | | | | Unit system error | The PCU system is not operating correctly. | Make sure that the PCU is installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the PCU. |
| Not lit | Not lit | Lit | Not lit | Not lit | Setting error | The PCU's unit number is the same as another Unit. | After changing the unit number, cycle the power and create the I/O tables from the CPU Unit. |
| | | | | | | The PCU is not registered in the CPU Unit's I/O tables, or the registered status does not match. | Create the I/O tables for the CPU Unit again. |
| | | | | | Data transfer error | The transfer of data between the PCU and CPU Unit could not be executed correctly. | Make sure that the PCU is installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the PCU or CPU Unit. |



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| Indicator status | | | | | Category | Probable cause of error | Countermeasure |
|---|---|---|---|---|---|---|---|
| RUN | ERC | ERH | ERM | MLK | | | |
| Not lit | Lit | Not lit | Not lit | Not lit | Unit malfunction | The internal circuits of the PCU have malfunctioned. | Replace the PCU. |
| Not lit | Lit | Lit | Not lit | Not lit | Unit recognition error | The CPU Unit has not recognized the PCU correctly. | Replace the PCU. |

## 12-3-2 Error Display for CPU Unit Errors

| Indicator status | | | | | Category | Probable cause of error | Countermeasure |
|---|---|---|---|---|---|---|---|
| RUN | ERC | ERH | ERM | MLK | | | |
| Lit | Flashing | Lit | Not lit | Not lit | CPU Unit error | The CPU Unit system is not operating correctly. | Make sure that the CPU Unit and PCU are installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the CPU Unit. |
| | | | | | | A PLC bus operation error has occurred. | |
| | | | | | | A fatal error has occurred in the CPU Unit. | Remove the cause of the CPU Unit stopping. |

The indicator displays shown in the above table indicate errors that have occurred in the CPU Unit. Check the Unit's installation status and causes for the errors in the CPU Unit.

## 12-3-3 Error Display for PCU Errors

| Indicator status | | | | | Category | Probable cause of error | Countermeasure |
|---|---|---|---|---|---|---|---|
| RUN | ERC | ERH | ERM | MLK | | | |
| Lit | Lit | Not lit | Not lit | Not lit | Data corrupted | The data saved in the PCU is corrupted. | Transfer and save the PCU data again, and then restart the Unit or turn the power OFF and ON again. |
| | | | | | Unit error | An error has occurred in the internal circuits of the PCU. | Replace the PCU. |

The indicator displays shown in the above table indicate that data in the PCU is corrupted or the PCU's internal circuits have malfunction.

Data may be corrupted if the PCU power is interrupted while data is being saved to the PCU's internal flash memory. Use PCU's SAVE DATA or the CPU Unit's simple backup function to restore (read) data saved in the Memory Card or perform another process to recover saved data.

If the error occurs again, the probable cause is a faulty PCU. Replace the PCU.



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## 12-3-4 Error Display for MECHATROLINK Communications Errors

| Indicator status | | | | | Category | Probable cause of error | Countermeasure |
|---|---|---|---|---|---|---|---|
| RUN | ERC | ERH | ERM | MLK | | | |
| Lit | Flashing | Not lit | Lit | Undetermined | Communications error | MECHATROLINK communications cannot be performed correctly. | Check the connection of the MECHATROLINK communications cable. |
| | | | | | Scan list mismatch | The MECHATROLINK slave station device corresponding to the axis number registered in the PCU scan list is not connected. | Check whether the settings for the MECHATROLINK communications line connection or slave device's station address match the settings in the scan list. |

This display occurs when MECHATROLINK communications are started (connection established), or during communications when MECHATROLINK communications are not connected correctly.

Check for disconnected, broken, or faulty contact in the MECHATROLINK communications cables, and check the status (power interruption, etc.) of the connected MECHATROLINK slave station devices.

Also check whether the actual connection status matches the connections registered in the scan list.

Communications errors, scan list mismatches, or other error types, and the axis in which the error has occurred can be checked using the PCU Error Flags and error codes.

## 12-3-5 Error Display for PCU Settings and Operations

| Indicator status | | | | | Category | Probable cause of error | Countermeasure |
|---|---|---|---|---|---|---|---|
| RUN | ERC | ERH | ERM | MLK | | | |
| Lit | Flashing | Not lit | Not lit | Undetermined | Illegal operation | An operation command that cannot be executed has been sent to the PCU. | Check the timing of the last command and change the operation sequence. |
| | | | | | Illegal data | Illegal parameters have been set for the PCU, or an operation command has been sent with illegal parameters. | Check the contents of the last command, and correct the contents of the data. |

The indicator display shown in the above table indicates that illegal data is set in the PCU parameters or an illegal operation has been attempted, such as multistart.

This error will occur if a problem has occurred in the use of the PCU, which requires the PCU settings or user program to be corrected.

The error types, and the axis in which the error has occurred can be checked using the PCU Error Flags and error codes.



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### 12-3-6 Error Display for MECHATROLINK Slave Station Device Errors

| Indicator status | | | | | Category | Probable cause of error | Countermeasure |
|---|---|---|---|---|---|---|---|
| RUN | ERC | ERH | ERM | MLK | | | |
| Lit | Flashing | Not lit | Flashing | Lit | External sensor input | An error has occurred due to external sensor input detection. | Check the machine status and remove the cause of the error. |
| | | | | | Servo Driver error | The main circuit power of the Servo Driver has been turned OFF. | Check the power supply voltage being supplied to the Servo Driver's main circuit power supply and make sure the correct power is being supplied. |

The indicator display shown in the above table indicates that the limit input has been detected, Servo Driver's main circuit power supply is OFF, or an error specific to the Servo Driver or another error in the machine or Servo Driver has occurred.

Check whether the cause of the error is a machine error, a faulty sensor, disconnection, or Servo Driver error.

The error types, and the axis in which the error has occurred can be checked using the PCU Error Flags and error codes.

## 12-4 Error Codes

### 12-4-1 Overview

When an error occurs in the PCU, an Error Flag is turned ON and an error code is input in the Common Operating Memory Area or the Axis Operating Input Memory Areas.

The area in which the Error Flag is turned ON and the input error code indicate the type of error and in which axis the error occurred.

**Common Operating Memory Area**

| Name | Word | Bit | Contents |
|---|---|---|---|
| Unit Error Flag | n+15 | 12 | 0: Unit common error has not occurred.<br>1: Unit common error has occurred. |
| Unit error code | n+21 | --- | Stores the error code when a Unit common error occurs. |

n = CIO 1500 + (unit number × 25)

Error information in this area indicates errors that occur in the PCU or that are not specific to a particular axis.

The Unit common error code is indicated as 00□□ hex.

If the Unit Error Flag turns ON, error processing must be performed for the PCU or the whole system including the PCU.

**Axis Operating Input Memory Areas**

| Name | Word | Bit | Contents |
|---|---|---|---|
| Error Flag | b | 12 | 0: No error<br>1: Error has occurred |
| Axis error code | b+4 | --- | Stores the error code for the error that occurred in an individual axis. |



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b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

Error information in this area indicates errors that have occurred in individual axes.

The Axis error code is indicated as 3□□□ hex or 4□□□ hex.

If an Axis Error Flag turns ON, error processing must be performed for the corresponding axis.

Determine the cause of the error using the indicator display and error code, isolating the location of the error as either in the PCU or in the Servo Driver/ Machine.

## 12-4-2 List of Error Codes

### PCU Common Errors

| | Indicator status | | | | | Category | Error name | Error code | Probable cause | Clearing method | Operation after error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | | | | |
| Errors at powerup | Not lit | Not lit | Not lit | Not lit | Not lit | CPU Unit power interruption | Power interruption | --- | Power is not being supplied correctly to the CPU Unit. | Check the power supply voltage being supplied to the CPU Unit and make sure the correct power is being supplied. | --- |
| | | | | | | Unit system error | Watchdog timer operation | --- | The PCU system is not operating correctly. | Make sure that the PCU is installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the PCU. | System stopped |
| | Not lit | Not lit | Lit | Not lit | Not lit | Setting error | Unit number error | --- | The PCU's unit number is the same as another Unit. | After changing the unit number, cycle the power and create the I/O tables from the CPU Unit. | System stopped |
| | | | | | | | Unit recognition incomplete | --- | The PCU is not registered in the CPU Unit's I/O tables, or the registered status does not match. | Create the I/O tables for the CPU Unit again. | System stopped |
| | | | | | | Data transfer error | Data transfer error | --- | The transfer of data between the PCU and CPU Unit at initialization of the PCU could not be executed correctly. | Make sure that the PCU is installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the PCU or CPU Unit. | System stopped |
| | Not lit | Lit | Not lit | Not lit | Not lit | Unit malfunction | Common memory error | --- | The internal circuits of the PCU have malfunctioned. | Replace the PCU. | System stopped |
| | Not lit | Lit | Lit | Not lit | Not lit | Unit recognition error | Unit recognition error | --- | The CPU Unit has not recognized the PCU correctly. | Replace the PCU. | System stopped |

The above errors for which the RUN indicator is not lit occur when starting PCU operations, such as turning ON the power or restarting the Unit. The PCU system does not start correctly if any of these errors occurs, so the Error Flags and error codes cannot be checked from the CPU Unit.



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| | Indicator status | | | | | Category | Error name | Error code | Probable cause | Clearing method | Operation after error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | | | | |
| CPU Unit errors | Lit | Flashing | Lit | Not lit | Not lit | CPU Unit error | CPU fatal error | 000A | An error causing the CPU Unit to stop has occurred. | Remove the cause of the CPU Unit stopping. | Connection released after deceleration stop |
| | | | | | | | CPU Unit watchdog timer error | 000B | The CPU Unit system is not operating correctly. | Make sure that the CPU Unit and PCU are installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the CPU Unit. | Connection released after deceleration stop |
| | | | | | | | CPU Unit monitor error | 000C | The cyclic refresh from the CPU Unit to the PCU has stopped. | Check the error status of the CPU Unit and perform appropriate error processing. After restarting the cyclic refresh with the CPU Unit, execute PCU's ERROR RESET. | Connection released after deceleration stop |
| | | | | | | | Bus error | 000D | PLC bus operation error | Make sure that the CPU Unit and PCU are installed correctly, and turn the power OFF and ON again. If the error occurs again, replace the CPU Unit. | Connection released after deceleration stop |
| PCU internal errors | Lit | Lit | Not lit | Not lit | Not lit | Unit error | MLK device error | 0026 | An error has occurred in the internal circuits of the PCU. | Replace the PCU. | System stopped |
| | | | | | | | MLK device initialization error | 0030 | An error has been detected in the MECHATROLINK communications part during PCU initialization processing. | Check the MECHATROLINK communications settings in the Common Parameters, and then restart the Unit or turn the power OFF and ON again. If the error occurs again, replace the PCU. | System stopped |
| | | | | | | Data corrupted | Memory error | 00F1 | The data saved in the PCU is corrupted. | Transfer and save the PCU data again, and then restart the Unit or turn the power OFF and ON again. If the error occurs again, replace the PCU. | System stopped |



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| | Indicator status | | | | | Category | Error name | Error code | Probable cause | Clearing method | Operation after error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | | | | |
| MECHATROLINK communications errors | Lit | Flashing | Not lit | Lit | Undetermined | Scan list mismatch | MLK initialization error | 0020 | The MECHATROLINK slave station device corresponding to the axis number registered in the PCU scan list is not connected. | Check whether the settings for the MECHATROLINK communications line connection or slave device's station address match the settings in the scan list, and then execute CONNECT again. | Maintains (Axes that have a connection established cannot be operated for PCUs with unit version 1.2 or earlier.) |
| | | | | | | Communications error | MLK communications error | 0025 | MECHATROLINK communications cannot be performed correctly, or two or more MECHATROLINK slave station devices are using the same station number. | Check the connection of the MECHATROLINK communications cable. After removing the noise or other the cause preventing communications, restart the PCU. | Connection released suddenly |



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| | Indicator status | | | | | Category | Error name | Error code | Probable cause | Clearing method | Operation after error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | | | | |
| PCU settings and operations errors | Lit | Flashing | Not lit | Not lit | Undetermined | Illegal operation | Multistart error | 0021 | An operation command that cannot be executed has been sent to the PCU. | The operation command that was sent cannot be executed. Check the last command timing and change the operation sequence. | Maintains |
| | | | | | | | FINS command time monitoring error | 0024 | Communications between the computer and PCU were interrupted for more than 5 s after switching the CX-Motion-NCF to an operation monitor window. | Check the communications path between the computer and PLC and remove any problems.<br>The Position Control Unit is set to continue monitoring communications with the computer. Restart the PCU to clear the communications monitoring status. | Connection released after deceleration stop |
| | | | | | | Illegal data | Write transfer error | 0022 | An attempt has been made for the PCU to write data to an illegal address, or to write data using an illegal data size. | The data transfer for the command cannot be executed. Check the contents of the last command, and correct the data transfer settings. | Maintains |
| | | | | | | | Read transfer error | 0023 | An attempt has been made for the PCU to read data from an illegal address, or to read data with an illegal data size. | The data transfer for the command cannot be executed. Check the contents of the last command, and correct the data transfer settings. | Maintains |
| | | | | | | | Transfer cycle setting error | 0027 | The set value for the transfer cycle set in the PCU's Common Parameters is too small for the number and type of connected MECHATROLINK devices or the maximum axis number. | Set and save a transfer cycle set value in the Common Parameters that is suitable for the number and type of connected MECHATROLINK devices and the maximum axis number, and then restart the PCU. | Connection released suddenly |
| | | | | | | | Initialization common parameter check error | 0028 | An illegal set value has been detected in the Common Parameters during PCU initialization. | When this error occurs, the corresponding setting in the Common Parameters is set to the default value (0). After executing ERROR RESET, transfer and save the correct Common Parameter setting and restart the PCU. | Maintains |
| | | | | | | | Data transfer common parameter check error | 0029 | An illegal set value in the Common Parameters was transferred to the PCU using WRITE DATA. | The transferred set value is discarded and the set value in the Common Parameters before the transfer is restored. After executing ERROR RESET, transfer the correct Common Parameters setting. | Maintains |



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## Individual Axis Errors

| | Indicator status | | | | | Category | Error name | Error code | Probable cause | Clearing method | Operation after error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | | | | |
| MECHATROLINK communications errors | Lit | Flashing | Not lit | Lit | Undetermined | Communications error | Synchronous communications alarm | 3010 | MECHATROLINK communications cannot be performed correctly with the corresponding axis. | Check the connection of the MECHATROLINK communications cable. After removing the cause preventing communications, such as breaks or noise in the connection, execute CONNECT again. | Operation stops according to the method used when the Servo Driver alarm occurs. (The PCU executes DECELERATION STOP.) Operation of the corresponding axis is prohibited. |
| | | | | | | | Communications alarm | 3011 | MECHATROLINK communications cannot be performed correctly with the corresponding axis. | Check the connection of the MECHATROLINK communications cable. After removing the cause preventing communications, such as breaks or noise in the connection, execute CONNECT again. | Operation stops according to the method set in the Servo Driver for alarms. (The PCU executes DECELERATION STOP.) Operation of the corresponding axis is prohibited. |
| | | | | | | | Command timeout | 3012 | No MECHATROLINK communications response has been received from the corresponding axis.<br>When connected to an R88D-WN□-ML2 Servo Driver, this error will occur if a Servo Parameter is transferred with an illegal parameter size. | After checking that no error has occurred in the MECHATROLINK device connected to the corresponding axis, execute CONNECT again.<br>If this error occurs when transferring a Servo Parameter to the R88D-WN□-ML2 Servo Driver, check whether the Servo Parameter is being transferred with an illegal parameter size. | Operation stops according to the method used when the Servo Driver alarm occurs. (The PCU executes DECELERATION STOP.) Operation of the corresponding axis is prohibited. |



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| | Indicator status | | | | | Category | Error name | Error code | Probable cause | Clearing method | Operation after error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **RUN** | **ERC** | **ERH** | **ERM** | **MLK** | | | | | | |
| PCU settings and operation errors | Lit | Flashing | Not lit | Not lit | Lit | Illegal operation | Present position unknown error | 3030 | ABSOLUTE MOVEMENT or ORIGIN RETURN was executed before the origin was established. | Execute ORIGIN SEARCH or PRESENT POSITION PRESET and after defining the origin, execute the previously unsuccessful command again. | Deceleration stop |
| | | | | | | | Servo unlock error | 3040 | A command to start the axis was executed while in Servo unlock status. | Execute the SERVO LOCK and then execute the previously unsuccessful command again. | The command to start the axis is ignored and the Servo Driver remains in Servo unlock status. |
| | | | | | | | Multistart error | 3050 | An attempt was made to execute two or more of the following commands at the same time for the same axis.<br>ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, ORIGIN SEARCH, ORIGIN RETURN, PRESENT POSITION PRESET, JOG, SPEED CONTROL, TORQUE CONTROL, or DEVICE SETUP | After editing the ladder program so that multiple command bits do not turn ON at the same time for the same axis, execute the previously unsuccessful command again. | Deceleration stop |
| | | | | | | | | | An attempt was made to execute one of the following commands for a busy axis.<br>ORIGIN SEARCH, ORIGIN RETURN, PRESENT POSITION PRESET, JOG, or DEVICE SETUP | After editing the ladder program so that command bits do not turn ON for a busy axis, execute the previously unsuccessful command again. | |



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| | Indicator status | | | | | Category | Error name | Error code | Probable cause | Clearing method | Operation after error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | | | | |
| PCU settings and operation errors | Lit | Flashing | Not lit | Not lit | Lit | Illegal data | Position designation error | 3060 | An attempt was made to execute RELATIVE MOVEMENT using a position command value for the target position that is outside the positioning range. | Edit the position command value to be within the positioning range and execute the command again. | Deceleration stop |
| | | | | | | | Speed designation error | 3061 | An attempt was made to execute one of the following commands with a negative value as the speed command value.<br>ABSOLUTE MOVEMENT, RELATIVE MOVEMENT, ORIGIN SEARCH, ORIGIN RETURN, and JOG | Edit the speed command value to be within the setting range and execute the command again. | Deceleration stop |
| | | | | | | | | | An attempt was made to execute ORIGIN SEARCH with a speed command value of 0. | Edit the speed command value to be within the setting range and execute the command again. | |
| | | | | | | | Speed control speed designation error | 3062 | An attempt was made to execute SPEED CONTROL using a command value that exceeds the speed command range. | Edit the speed command value to be within the setting range and execute the command again. | Deceleration stop |
| | | | | | | | Torque command value error | 3063 | An attempt was made to execute TORQUE CONTROL using a command value that exceeds the torque command range. | Edit the torque command value to be within the setting range and execute the command again. | Deceleration stop |



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| | Indicator status | | | | | Category | Error name | Error code | Probable cause | Clearing method | Operation after error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | | | | |
| PCU settings and operation errors | Lit | Flashing | Not lit | Not lit | Lit | Illegal data | Option command value 1 error | 3064 | An attempt was made to execute SPEED/ TORQUE CONTROL using a command value that exceeds the command range in option command value 1. | Edit the option command value to be within the setting range and execute the command again. | Deceleration stop |
| | | | | | | | Option command value 2 error | 3065 | An attempt was made to execute SPEED CONTROL using a command value that exceeds the command range in option command value 2. | Edit the option command value to be within the setting range and execute the command again. | Deceleration stop |
| | | | | | | | Override | 3070 | An attempt was made to execute the override using an override value outside the setting range. | Edit the override value to be within the setting range and execute the command again. | Deceleration stop |
| | | | | | | | Initialization axis parameter check error | 3090 | An illegal set value has been detected in the Axis Parameters during PCU initialization. | When this error occurs, the corresponding setting in the Axis Parameters is set to the default value (0). After executing ERROR RESET, transfer the correct Axis Parameter. | Deceleration stop |
| | | | | | | | Data transfer axis parameter check error | 3091 | An illegal set value in the Axis Parameters was transferred to the PCU using WRITE DATA. | The transferred set value is discarded and the set value in the Axis Parameters before the transfer is restored. After executing ERROR RESET, transfer the correct Axis Parameter. | Deceleration stop |
| | | | | | | | Data setting error | 3099 | An attempt was made to transfer data for an illegal parameter number and outside the setting range using SERVO PARAMETER TRANSFER. | The transferred set value is discarded and the set value for the Servo Parameter before the transfer is restored. After executing ERROR RESET, transfer the correct Servo Parameter. | Deceleration stop |
| | | | | | | | | | A function not supported by SMARTSTEP Junior Servo Drivers (e.g., torque control commands) was executed. | Check the commands for the relevant axis and correct the ladder program so that only supported functions are used. | |



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| | Indicator status | | | | | Category | Error name | Error code | Probable cause | Clearing method | Operation after error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | | | | |
| MECHATROLINK Slave Station Device Errors | Lit | Flash-ing | Not lit | Flash-ing | Lit | External sensor input | Forward rotation limit input | 3000 | A forward rotation limit input signal was detected. | After executing ERROR RESET, perform movement in the reverse rotation direction. | Operation stops according to the Servo Driver's specified stop method for limit inputs. (The PCU executes EMERGENCY STOP.) |
| | | | | | | | Reverse rotation limit input | 3001 | A reverse rotation limit input signal was detected. | After executing ERROR RESET, perform movement in the forward rotation direction. | Operation stops according to the Servo Driver's specified stop method for limit inputs. (The PCU executes EMERGENCY STOP.) |
| | | | | | | | Forward software limit | 3002 | The forward software limit was reached or exceeded during axis movement. | After checking the position command value and executing ERROR RESET, execute a movement command to move the axis to a correct position within the software limit range. | Operation stops according to the Servo Driver's specified stop method for limit inputs. (The PCU executes EMERGENCY STOP.) |
| | | | | | | | Reverse software limit | 3003 | The reverse software limit was reached or exceeded during axis movement. | After checking the position command value and executing ERROR RESET, execute a movement command to move the axis to a correct position within the software limit range. | Operation stops according to the Servo Driver's specified stop method for limit inputs. (The PCU executes EMERGENCY STOP.) |
| | | | | | | | Emergency stop signal input | 3004 | The emergency stop input signal (an external control input signal) was detected when the Servo was locked or an attempt was made to lock the Servo while the emergency stop input signal was ON. | Turn OFF the emergency stop input signal, reset the axis error, and repeat the operation from locking the Servo. (This error will not occur if the EMERGENCY STOP command in the Axis Operating Memory Area is used.) | Servo OFF |



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| | Indicator status | | | | | Category | Error name | Error code | Probable cause | Clearing method | Operation after error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | | | | |
| MECHATROLINK Slave Station Device Errors | Lit | Flashing | Not lit | Flashing | Lit | Origin search error | No origin proximity or origin input signal | 3020 | The origin proximity input signal could not be detected within the range of both limit input signals during an origin search. | Check the origin proximity input signal wiring and the signal's allocation setting in the Servo Parameters. Check that the dog width of the origin proximity input signal is no shorter than the communications cycle. | Operation stops according to the Servo Driver's specified stop method for limit inputs. (The PCU executes EMERGENCY STOP.) |
| | | | | | | | | | After detecting the origin proximity input signal during an origin search operation, a limit input signal was detected before detecting the origin input signal. | Check that the origin input signal selection in the PCU's Axis Parameters is correct. When the external latch signal is selected as the origin input signal, check the external latch signal wiring and the allocation setting in the Servo Parameters. | |
| | | | | | | | Limit input already ON | 3021 | The limit input signal in the origin search direction has already been input during a single-direction origin search. | Check the limit input signal wiring for the corresponding direction and check the limit input signal's allocation setting in the Servo Parameters. | Emergency stop (the operation command is not executed) |
| | | | | | | | Limit input signal ON in both directions | 3022 | Origin search cannot be executed due to limit input signals being input in both directions. | Check the limit input signal wiring in both directions and check the limit input signal allocation settings in the Servo Parameters. | Emergency stop (the operation command is not executed) |
| | | | | | | Servo Driver error | Drive main circuit OFF error (See note.) | 3080 | The main circuit power of the Servo Driver has been turned OFF. | Check the power supply voltage being supplied to the Servo Driver's main circuit power supply and make sure the correct power is being supplied. | Servo OFF |
| | | | | | | MECHATROLINK device alarm | --- | 4000 + Alarm code for each device | The error processing depends on the device. | | Operation stops according to the specified method when the Servo Driver alarm occurs. (The PCU executes DECELERATION STOP.) |

**Note** For PCUs with unit version 1.2 or earlier, driver main circuit OFF errors can be detected regardless of whether the axis is servo-locked. For PCUs with unit version 1.3 or later, driver main circuit OFF errors will be detected only when the axis is servo-locked and will not be detected when the axis is not servo-locked.



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## Individual Axis Warnings

| | Indicator status | | | | | Category | Error name | Error code | Probable cause | Clearing method | Operation after error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | | | | |
| MECHATROLINK slave station device | Lit | Not lit | Not lit | Not lit | Lit | MECHA-TROLINK device warning | --- | 4000 + Warn-ing code for each device | The error processing depends on the device. | | Operation continues |

### MECHATROLINK Device Alarms (Alarm Code 4□□□ Hex)

When an alarm or warning occurs for one of the connected MECHATROLINK slave station devices, the PCU turns ON the Error Flag or Warning Flag and returns the following error code.

Error code: 40□□ hex

The boxes (□□) indicate the alarm/warning display number for the Servo Driver.

When using an R88D-WN□-ML2 W-series Servo Driver with built-in MECHATROLINK-II communications, however, only the upper two digits of the display number's three digits will be displayed.

Example: Position deviation overflow alarm (deviation counter overflow)

R88D-WT□ W-series Servo Driver:
Servo Driver alarm display: A.D0

The PCU's error code in this example is 40D0 hex.

R88D-WN□-ML2 W-series Servo Driver:
Position deviation overflow alarm: A.D00
Servo ON position deviation overflow alarm: A.D01
Servo ON speed limit position deviation overflow alarm: A.D02

With the R88D-WN□-ML2 W-series Servo Drivers, more detailed information is provided for position deviation overflow alarms, as shown above, but only the upper two digits of the alarm code (40D0 hex) are displayed as the PCU's error code for any of these alarms.

For details on alarm displays and warning displays in Servo Drivers, refer to the list in *Appendix D List of Error Codes*.

For details on alarm/warning contents, refer to the operation manual for the Servo Driver being used.



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# 12-5 Troubleshooting

This section provides troubleshooting flowcharts when Servo Driver communications cannot be established or movement is not possible even when movement commands are sent from the ladder program.

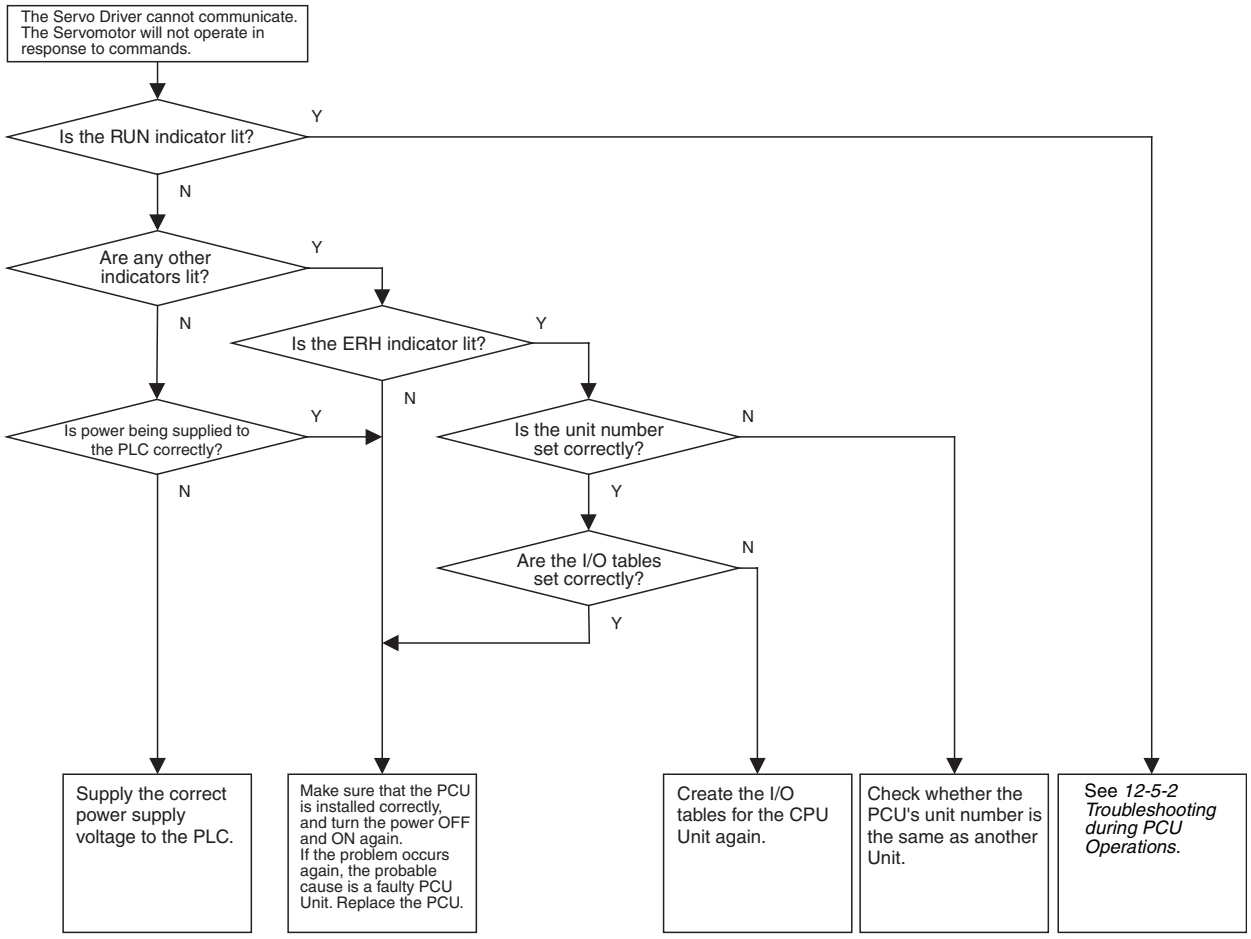


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## 12-5-1 Initial Troubleshooting

The following troubleshooting flowchart is for errors that occur during initial checking.

This flowchart can be used to determine whether the PCU is faulty and cannot be started.



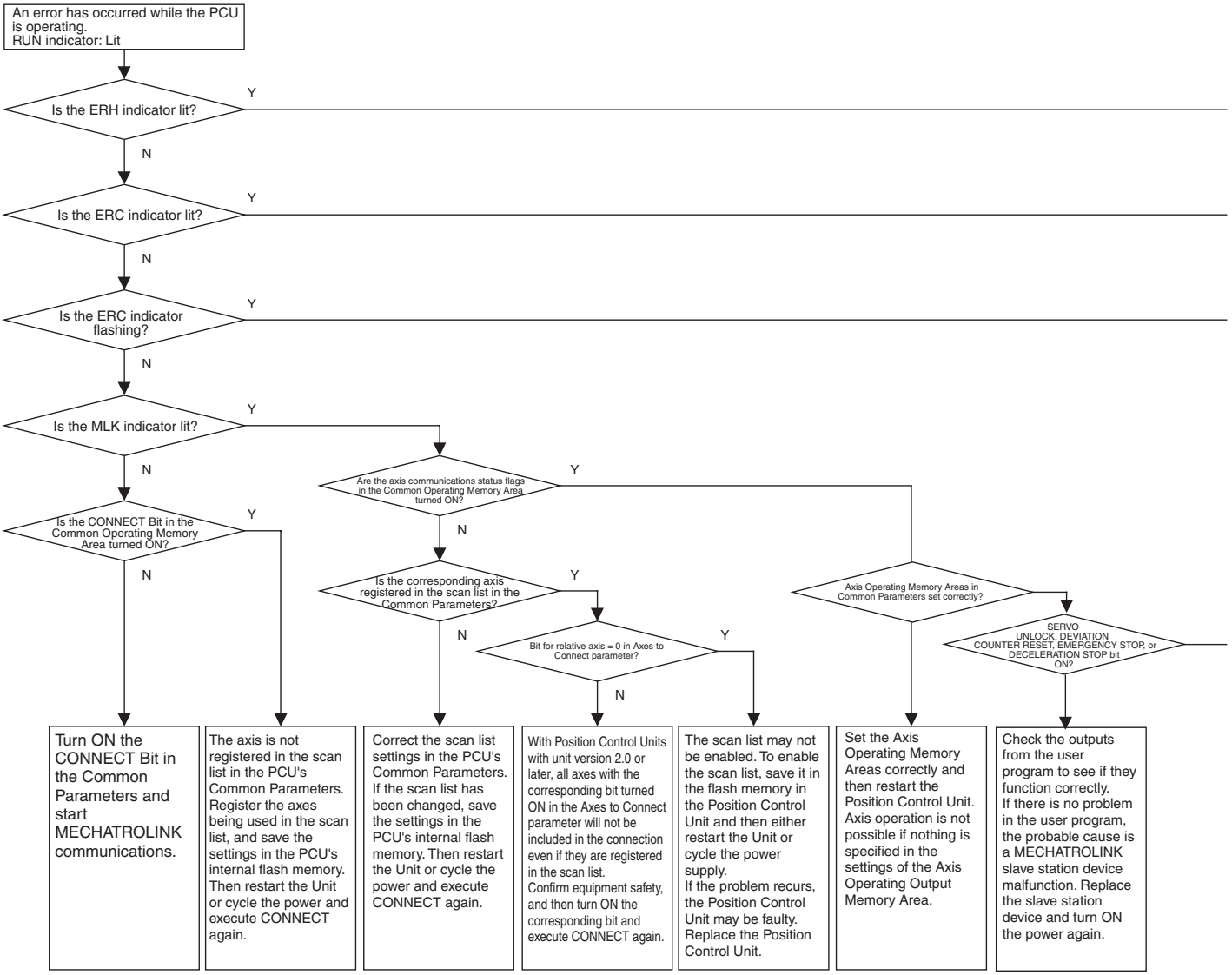



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## 12-5-2 Troubleshooting during PCU Operations

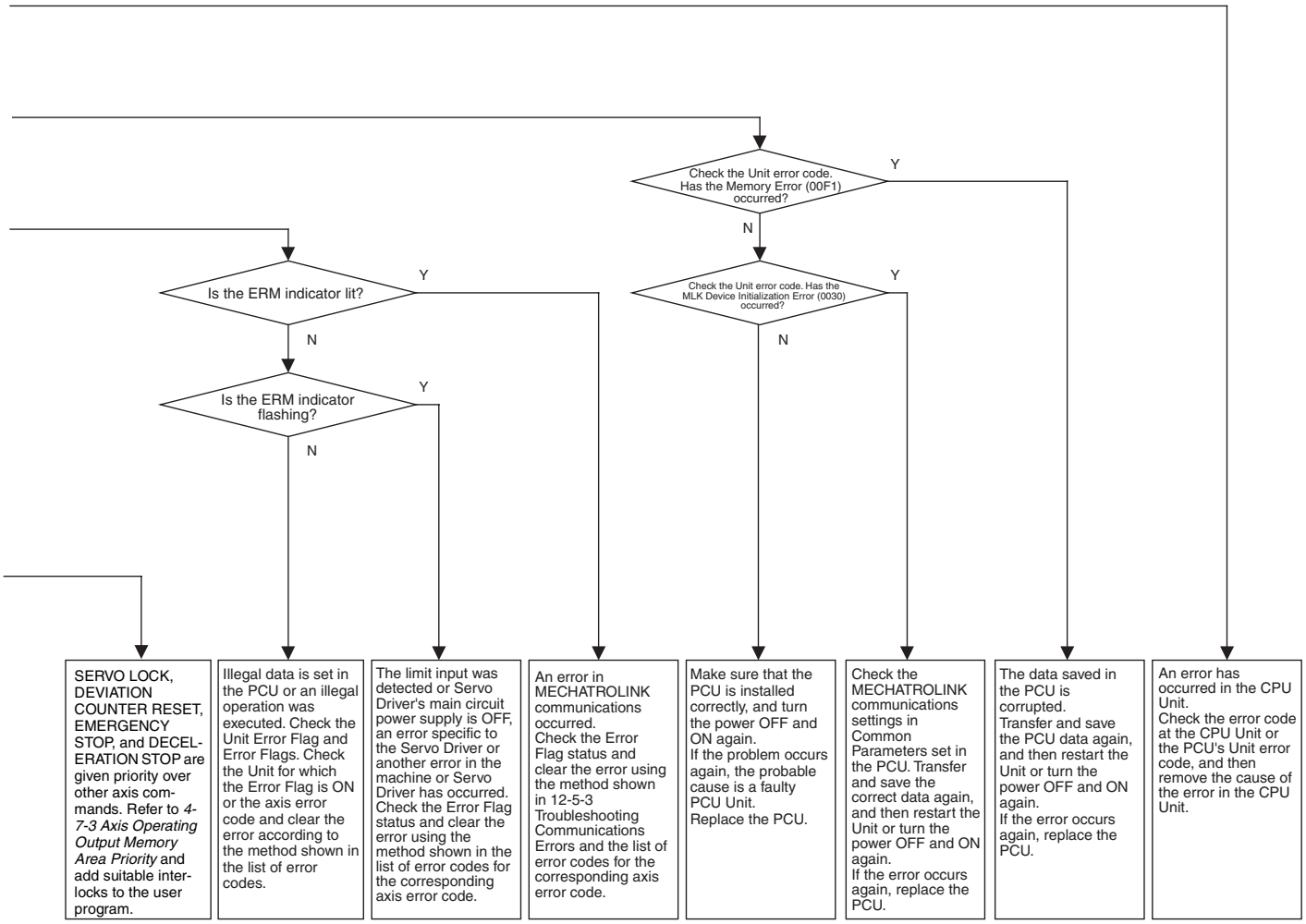
The following troubleshooting flowchart is for problems that occur after the PCU has been started (RUN indicator is lit).

Use this flowchart to determine whether the error is a CPU Unit error, a setting or usage problem, or a MECHATROLINK communications error.






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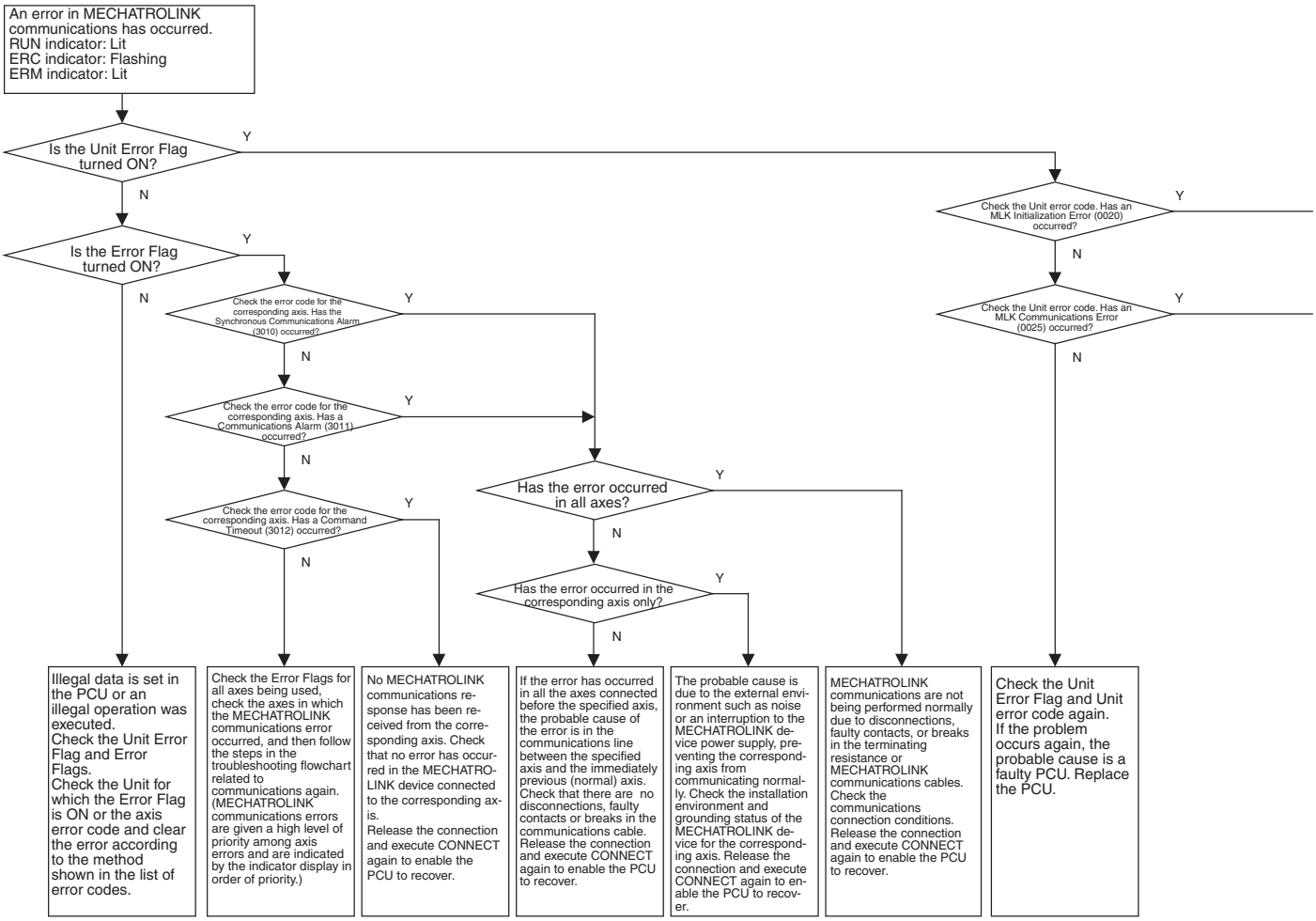



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## 12-5-3 Troubleshooting Communications Errors

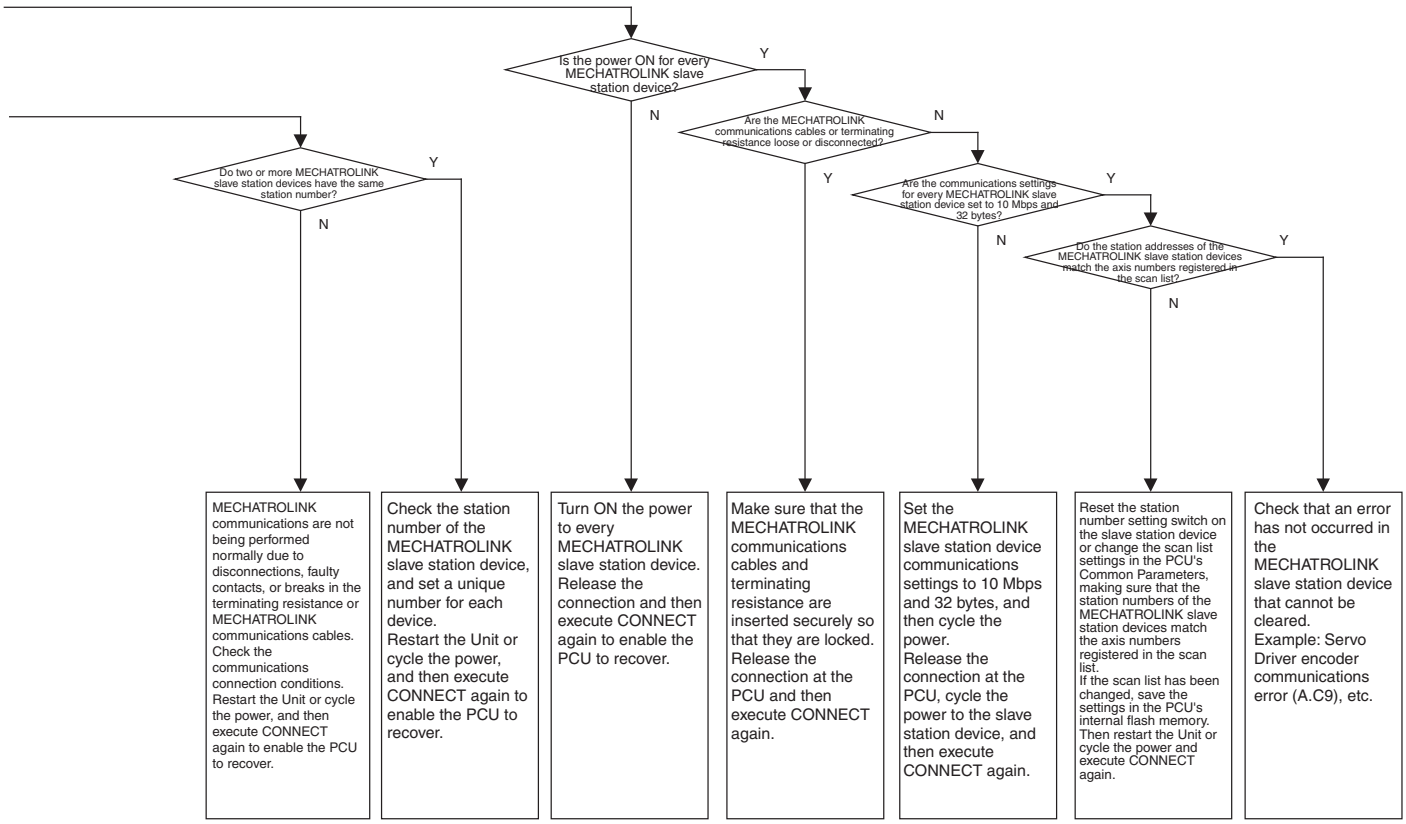
The following troubleshooting flowchart is for when MECHATROLINK communications errors occur.

Use this flowchart to determine the cause, such as whether the error is due to MECHATROLINK communications settings or installation.






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# 12-6 Error Reset

The PCU indicates Unit common errors and individual axis errors in the Common Operating Memory Area and Axis Operating Input Memory Areas, respectively, using Error Flags and error codes.

These errors can be cleared by removing the cause of the error and executing ERROR RESET.

The methods for resetting Unit common errors and individual axis errors are different.

## 12-6-1 Resetting Unit Common Errors

Unit common errors are cleared by turning ON (↑) the UNIT ERROR RESET Bit in the Common Operating Memory Area.

Reset Unit common errors when the Unit Busy Flag for the Position Control Unit is OFF. If errors are reset when the Unit Busy Flag is ON, a multistart error (Unit error code: 0021) will occur and it will not be possible to reset Unit common errors.

When clearing Unit common errors, make sure that the UNIT ERROR RESET Bit in the Common Operating Memory Area remains ON until the Unit Busy Flag turns ON.

**Common Operating Memory Area (Output)**

| Name | Word | Bit | Contents |
|---|---|---|---|
| UNIT ERROR RESET Bit | n | 00 | ↑: Resets Unit common error |

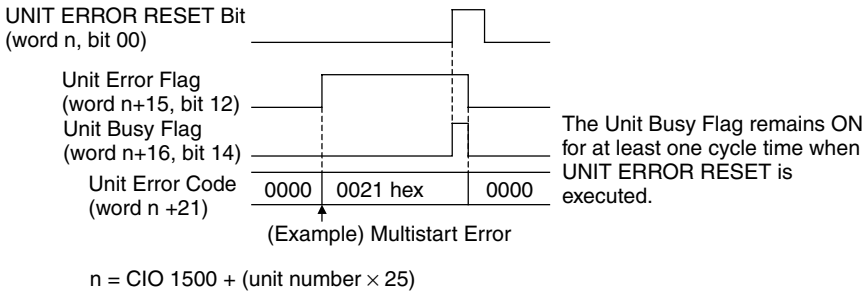
n = CIO 1500 + (unit number × 25)

**Common Operating Memory Area (Input)**

| Name | Word | Bit | Contents |
|---|---|---|---|
| Unit Error Flag | n+15 | 12 | 0: Unit common error has not occurred.<br>1: Unit common error has occurred. |
| Unit Busy Flag | n+16 | 14 | 0: PCU is not busy<br>1: PCU is busy |
| Unit error code | n+21 | --- | Stores the error code when a Unit common error occurs. |

n = CIO 1500 + (unit number × 25)

**Timing Chart Example for UNIT ERROR RESET**






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## 12-6-2 Resetting Individual Axis Errors and Warnings

Individual axis errors/warnings are cleared by turning ON (↓) the ERROR RESET Bits in the Axis Operating Output Memory Areas.

Reset individual axis errors and warning when the Axis Busy Flag for the Axis is OFF. If errors are reset when the Axis Busy Flag is ON, a multistart error (Axis error code: 3050) will occur and it will not be possible to reset errors/warnings.

When clearing individual axis errors/warnings, make sure that the ERROR RESET Bit remains ON until the Busy Flag in the Axis Operating Input Memory Areas turns ON.

### Axis Operating Output Memory Areas

| Name | Word | Bit | Contents |
|---|---|---|---|
| ERROR RESET Bit | a | 12 | ↓: Resets axis error |

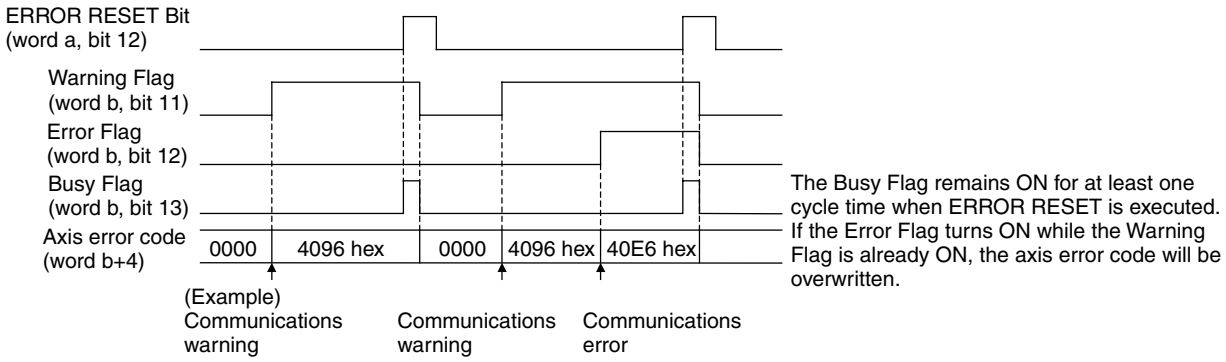
a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

### Axis Operating Input Memory Areas

| Name | Word | Bit | Contents |
|---|---|---|---|
| Warning Flag | b | 11 | 0: No warning<br>1: Warning has occurred |
| Error Flag | | 12 | 0: No error<br>1: Error has occurred |
| Busy Flag | | 13 | 1: Axis busy (AXIS ERROR RESET executing) |
| Axis error code | b+4 | --- | Stores the error code for the error that occurred in an individual axis. |

b = Beginning word of Axis Operating Input Memory Areas specified in Common Parameters + (Axis No. −1) × 25

### Timing Chart Example for ERROR RESET




a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. − 1) × 25
b = Beginning word of Axis Operating Input Memory Areas specified in Common Parameters + (Axis No. − 1) × 25



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### 12-6-3 Restarting the PCU

For errors that cannot be cleared using ERROR RESET, remove the cause of the error and either cycle the power to the CPU Unit or restart the CPU Bus Unit to enable the PCU to recover from the error.

| Name | Word | Details | Read/write |
|---|---|---|---|
| CPU Bus Unit Restart Flag | A50100 to A50115 | The CPU Bus Unit is restarted when this flag is set from 0 to 1. Each bit corresponds to the unit number. Bits 00 to 15: Unit numbers 0 to F | Read/write possible |

## 12-7 CPU Unit Error Display

The CPU Unit monitors the PCU, which is a CPU Bus Unit, as follows:

- Monitors PCU for hardware errors
- Monitors unit number duplication
- Monitors refreshing between the CPU Unit and PCU.

If an error is detected during the above monitoring operations, the corresponding flag in the Auxiliary Area of the CPU Unit will turn ON (for details on each flag, refer to the CPU Unit's operation manual). The flags are as follows:

- CPU Bus Unit Number Duplication Flags (A41000 to A41015)
- CPU Bus Unit Error, Unit Number Flags (A41700 to A41715)
- CPU Bus Unit Setting Error, Unit Number Flags (A42700 to A42715)
- CPU Bus Unit Setting Error Flag (A40203)
- CPU Bus Unit Error Flag (A40207)

Perform error processing according to the tables provided in *12-3 LED Error Indicators* and *12-4-2 List of Error Codes*.



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# SECTION 13
# Maintenance and Inspection

This section describes methods for inspecting and maintaining the Position Control Unit and the procedure required to replace a Position Control Unit.


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13-2 Inspection Points . . . . . 444
13-3 Handling Precautions . . . . . 445
13-4 Procedure for Replacing a PCU . . . . . 445
13-4-1 Procedure for Replacing a PCU . . . . . 445
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# 13-1 Inspection

Perform daily or periodic inspections to make sure that the PCU continues operating in its optimum condition.

# 13-2 Inspection Points

The main components of the PCU are semiconductors, which have a long service life. These components may deteriorate faster, however, due to factors such as the operating environment. Therefore, routine inspection is required.

The standard inspection schedule is once every six months to one year. More frequent inspections may be advisable depending on the operating environment.

Maintain the inspection schedule once it has been set.

**Routine Inspection Points**

| No. | Inspection point | Details | Criteria | Remarks |
|---|---|---|---|---|
| 1 | I/O Power Supply | Measure the voltage variations at the I/O power supply terminal block. Do they meet the standards? | 24 V DC:<br>21.6 to 26.4 V DC | Using a voltage tester, check between the terminals adjusting to make sure that the power supply is within the acceptable range. |
| 2 | Environment conditions | Is the ambient temperature within the acceptable range? (When used in a panel, the ambient temperature of the PCU inside the panel must be checked.) | 0 to 55°C | Using a thermometer, check the ambient temperature inside the panel and make sure that it is within the acceptable range. |
| | | Is the ambient humidity (humidity within panel) within the acceptable range? (When used in a panel, the ambient humidity of the PCU inside the panel must be checked.) | 10% to 90% (with no condensation) | Using a hygrometer, check the ambient humidity inside the panel and make sure that it is within the acceptable range. In particular, check that there is no condensation due to sudden changes in temperature. |
| | | Is the PCU exposed to direct sunlight? | The PCU must not be exposed to direct sunlight. | Shield the PCU from direct sunlight. |
| | | Is there any accumulation of dust (including iron dust) or salts? | There must be none of these present. | Remove any accumulation of dust (including iron dust) or salts and protect the PCU against them. |
| | | Is the PCU exposed to any sprays of water, oil, or chemicals? | The PCU must not be exposed to any of these. | Protect the PCU against water, oil, and chemicals. |
| | | Is the PCU installed in a location subject to corrosive or flammable gases? | The PCU must not be exposed to any of these. | Check for odors by smelling or using a gas sensor. |
| | | Is the PCU installed in a location subject to shock or vibration? | The amount of shock or vibration must be within the acceptable ranges given in the specifications. | Install a cushion or other device to reduce shock and vibration. |
| | | Is the PCU installed in a location near any source of noise? | There must be no noise. | Remove the PCU from the noise source or take countermeasures to protect the PCU from noise. |
| 3 | Installation and wiring | Is the PCU securely mounted? | The mounting must not be loose. | Lock the sliders securely. |
| | | Are the cable connectors properly inserted and locked? | The mounting must not be loose. | Insert and lock all cable connectors properly. |
| | | Are any external cables disconnected? | There must be no external abnormalities. | Do a visual check and connect or replace cables as required. |



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**Required Inspection Tools**

The following tools, materials, and equipment are required for performing inspections.

- Voltage tester or digital voltage meter
- Industrial alcohol and a clean cotton cloth

The following measuring devices may be required when performing an inspection.

- Oscilloscope
- Memory recorder
- Thermometer
- Hygrometer

# 13-3 Handling Precautions

- Turn OFF the power before replacing the PCU.
- If a PCU is found to be faulty and is replaced, also check the new PCU to make sure that there are no errors.
- When returning a faulty PCU for repair, make a detailed record of the PCU's malfunction and take it together with the PCU to your nearest OMRON office or sales representative.
- If a contact is faulty, clean the contact by applying some industrial alcohol to a clean cotton cloth and wiping the surface, and then install the PCU.

# 13-4 Procedure for Replacing a PCU

Use the following procedure when it is necessary to replace a PCU due to malfunction or other cause. The method for backing up data saved in the PCU's internal flash memory is also provided here.

## 13-4-1 Procedure for Replacing a PCU

Use the following procedure to replace a PCU.

***1,2,3...***

1. Make a note of the unit number of the PCU to be replaced.
2. Use the READ DATA Bit to read the parameters saved in the PCU to be replaced to the PLC's DM Area first. Then save the DM Area data to a floppy disk or hard disk using, for example, CX-Programmer. Alternatively, use the CPU Unit's simple backup function or the PCU's backup function to back up (write) the PCU parameter data to the Memory Card installed in the CPU Unit.
3. Turn OFF the power to the CPU Unit.
4. Disconnect the MECHATROLINK-II communications cables that are connected to the Servo Driver.
5. Replace the PCU and reconnect the MECHATROLINK-II communications cables, making sure that they are securely locked.
6. Set the unit number for the PCU.
7. Turn ON the power supply to the CPU Unit.



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8. Transfer the saved parameters and operating data to the CPU Unit's DM Area using, for example, CX-Programmer, and then transfer them to the PCU using the WRITE DATA Bit. After transferring, save the parameters and operating data to the flash memory. When the PCU's parameter data has been saved to the Memory Card using the CPU Unit's simple backup function or the PCU's backup function, execute the command to restore (read) the data from the Memory Card. Save the backed up parameters to the PCU's flash memory by reading them from the Memory Card.
9. Turn OFF the power supply to the CPU Unit, and then turn it ON again.

For details on transferring PCU data to the Memory Card installed in the CPU Unit, refer to the next section *13-4-2 Memory Card Backup*.

**Note** The above procedure is used when replacing the PCU, and transferring only the parameters saved in the PCU. This procedure is not used to transfer Servo Parameters saved in the Servo Driver.
When replacing the Servo Driver, use the PCU's READ SERVO PARAMETER Bit to read the parameters saved in the Servo Driver to be replaced to the CPU Unit's DM Area first. Then save the DM Area data to a floppy disk or hard disk using, for example, CX-Programmer. After replacing the Servo Driver, transfer the saved Servo Parameters to the CPU Unit's DM Area using, for example, CX-Programmer, and then write them to the Servo Driver's non-volatile memory using the PCU's SAVE SERVO PARAMETER Bit.

## 13-4-2 Memory Card Backup

The following data can be saved to the PCU's internal flash memory.

- Common Parameters
- Axis Parameters

The PCU can save this data to the Memory Card installed in the CPU Unit by using the CPU Unit's simple backup function or the PCU's backup function. The data saved to the Memory Card can also be read to the PCU's flash memory.

**Note** Do not read out data backed up to a Memory Card installed in the CPU Unit from a Position Control Unit with unit version 1.0 to a Position Control Unit with unit version 1.1 or later (for both the simple backup function and the PCU's backup function). If Position Control Unit Ver. 1.0 backup data is restored for Position Control Unit Ver. 1.1 or later, the linear interpolation function will be disabled. To transfer setting data from Position Control Unit Ver. 1.0 to Position Control Unit Ver. 1.1 or later, use the parameter transfer function using the data transfer bits (WRITE DATA, READ DATA, and SAVE DATA) in the Common Operating Memory Area.

### CPU Unit's Simple Backup Function

CS/CJ-series CPU Units have a simple backup function that enables all the setup data in the CPU Unit for every Unit to be backed up (written) to the Memory Card that is installed in the CPU Unit or restored (read) from the Memory Card at the same time by simply operating a switch on the front of the CPU Unit.

When replacing the PCU, the time required to reset each Unit can be shortened by reading the backup file.

The CJ1W-NCF71/CS1W-NCF71 PCUs described in this manual support the CS/CJ-series CPU Unit simple backup function.

**Note** The simple backup function can be used to back up the PCU's Common Parameters and Axis Parameters. The Servo Parameters for each Servo Driver connected to the PCU will not be saved to the Memory Card.



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The PCU data backed up using the CPU Unit's simple backup function is stored in the Memory Card under the following filename.

File name: BACKUP□□.PRM
(**Note:** The boxes indicate the PCU's unit number + 10 hex)

For details on the CPU Unit's simple backup function, refer to *5-2-6 Simple Backup Function* in the *CS/CJ-series Programmable Controllers Programming Manual* (W394).

**Note** The CPU Unit's simple backup function is used to backup or restore data for the entire CPU Unit's system at the same time. Changing the system configuration may prevent restoration of the PCU's data. To backup or restore data for a single PCU, use the PCU's backup function as described next.

## PCU's Backup Function

The PCU has a backup function for separately transferring data that has been saved in the PCU's internal flash memory to the Memory Card installed in the CPU Unit using the READ BACKUP DATA Bit and WRITE BACKUP DATA Bit in the Common Operating Memory Area.

The PCU's backup function can be executed while MECHATROLINK communications are stopped (connection released) and the Unit Busy Flag is OFF. If this command is executed during MECHATROLINK communications, the command will be ignored and backup will not be performed.

Writing and reading of backup data starts at the rising edge (↑) when the WRITE BACKUP DATA Bit and READ BACKUP DATA Bit turn ON, respectively, in the Common Operating Memory Area.

### Common Operating Memory Area (Output)

| Name | Word | Bit | Contents |
|---|---|---|---|
| WRITE BACKUP DATA | n+1 | 06 | ↑: Starts writing backup data |
| READ BACKUP DATA | | 07 | ↑: Starts reading backup data |

n = CIO 1500 + (unit number × 25)

When executing the PCU's backup function, make sure that the WRITE BACKUP DATA Bit or READ BACKUP DATA Bit remains ON until the Unit Busy Flag turns ON.

The Unit Busy Flag is ON while data is being transferred between the PCU and Memory Card. When transferring data is completed, the Unit Busy Flag turns OFF.

### Common Operating Memory Area (Input)

| Name | Word | Bit | Contents |
|---|---|---|---|
| Memory Card Transfer Error Flag | n+16 | 12 | 0: No Memory Card transfer error<br>1: A Memory Card transfer error has occurred |
| Unit Busy Flag | | 14 | 0: PCU is not busy<br>1: PCU is busy |

n = CIO 1500 + (unit number × 25)

If an error occurs in transferring data between the PCU and Memory Card when using the PCU's backup function, the data transfer will be cancelled, and the Memory Card Transfer Error Flag in the Common Operating Memory Area will turn ON.

If a Memory Card Transfer Error occurs, execute UNIT ERROR RESET and after the error is reset, execute the backup function again.



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The PCU data backed up using the PCU's backup function is stored in the Memory Card under the following filename.

File name: UNIT□□.PRM
(**Note:** The boxes indicate the PCU's unit number + 10 hex)

**Note**

(1) Execute PCU's READ BACKUP DATA to restore (read) data from the Memory Card to the PCU's internal flash memory. The data restored in the internal flash memory is enabled by restarting the PCU or cycling the power to the CPU Unit.

(2) If a Memory Card Transfer Error occurs while using the PCU's backup function, the backup to the Memory Card or restoration of data to the PCU's internal flash memory will not be executed correctly. If such an error occurs, always execute the backup function again, and backup or restore the correct data.



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# Appendix A
## Performance Characteristics

The performance characteristics of the CJ1W-NCF71 are described here.

Refer to these characteristics when building applications.

The numerical values for each performance characteristic are obtained using the following machines and configuration.

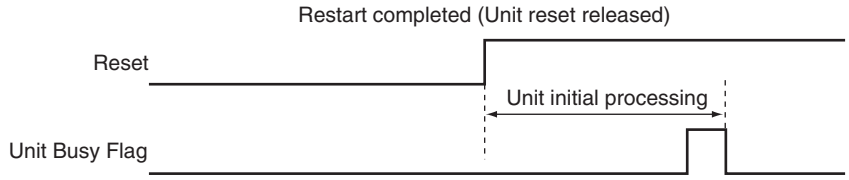
| | |
|---|---|
| CPU Unit: | CJ1H-CPU□□H (without an Expansion Rack) |
| Position Control Unit: | A single PCU installed on the CPU Rack. |
| Servo Driver: | R88D-WT01HL Servo Driver equipped with a JUSP-NS115 MECHATROLINK-II Application Module |

**Note** The performance values shown in this Appendix will depend on conditions such as the CPU Unit, user program, and other installed Units used. Therefore, these values are for reference purposes only.

## Power Up Time

When the PCU is powered up or restarted, the time required for the Unit to complete its initial processing and be ready to receive commands from the CPU Unit is 500 ms max.

The Unit Busy Flag turns ON during initial processing after turning ON the PCU power or restarting the Unit.




## Command Response Time

The PCU's command response time is the time from when the CPU Unit (user program) sends a command to the PCU until the Servo Driver actually starts operating in response to the command, and the changes in Servo Driver, such as the present position and statuses are reflected in the CPU Unit's user program.

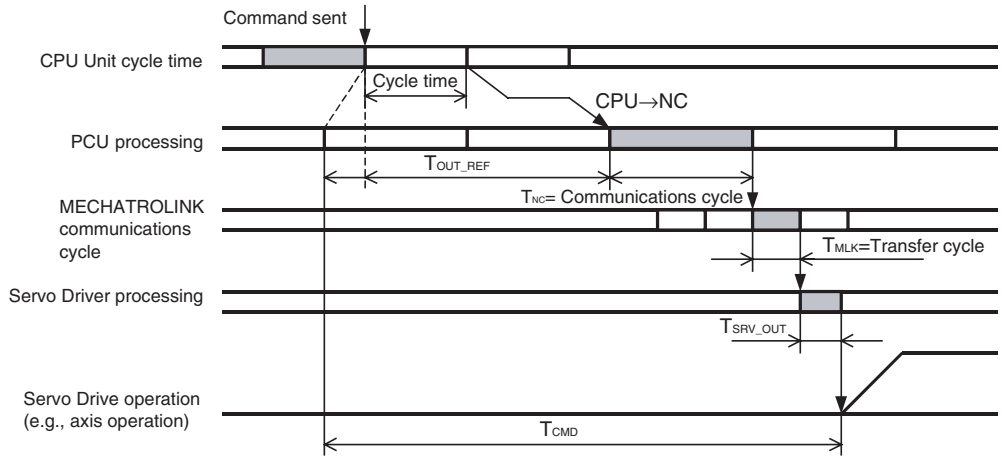
The command response time depends on the CPU Unit's cycle time, MECHATROLINK's transfer time and communications cycle, and the command processing time of MECHATROLINK slave station device.



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## Servo Driver's Response Time for Commands from the CPU Unit

The response time starts with refreshing outputs for the cycle in which the command was sent from the CPU Unit and continues until the Servo Driver starts operating in response to the command.




The maximum time from the end refresh of the user program's cycle in which the command was sent until the command is actually received by the PCU is indicated as $T_{OUT_REF}$:

(CPU cycle time or MECHATROLINK communications cycle, whichever is longer) + communications cycle × 1

The PCU processing time from when the command is received by the PCU until it is sent using MECHATROLINK communications is indicated as $T_{NC}$:

MECHATROLINK communications cycle × 1

**Note** If a warning occurs, PCU retry processing is required, so the value for $T_{NC}$ is the MECHATROLINK communications cycle × 3.

The time for a command sent from the PCU using MECHATROLINK communications to reach the Servo Driver is indicated as $T_{MLK}$:

MECHATROLINK transfer cycle × 1

The processing time until execution of the command received by the Servo Driver is indicated as $T_{SRV_OUT}$:

625 μs (using an R88D-WT□ and JUSP-NS115 MECHATROLINK-II Application Module or the SMARTSTEP Junior)

425 μs (using an R88D-WN□-ML2)

The maximum value for the time until the Servo Driver actually starts operating in response to the command sent from the CPU Unit's user program, as indicated by $T_{CMD}$, is calculated as the total of these values, as follows:

$T_{CMD(MAX)} = T_{OUT_REF} + T_{NC} + T_{MLK} + T_{SRV_OUT}$

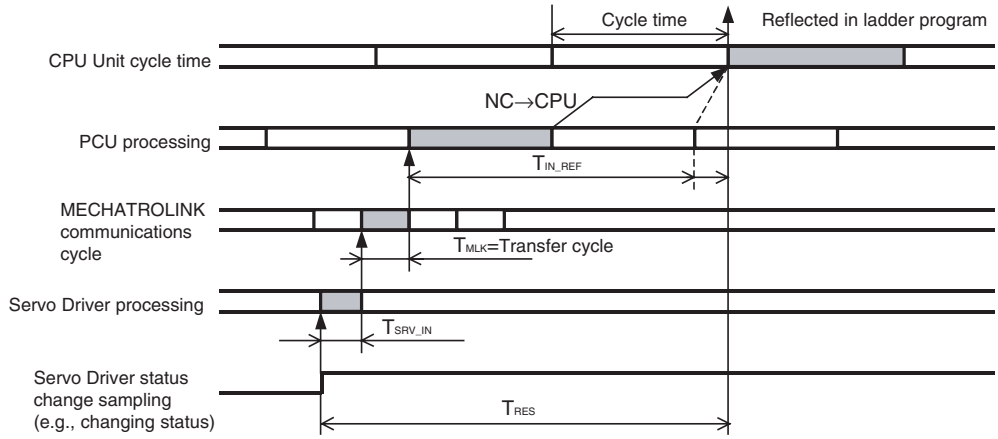
**Note** $T_{CMD}$ varies depending on the width of $T_{OUT_REF}$.



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## Response Time to Reflect Servo Driver Status Changes in CPU Unit

The response time starts when status transmitted via MECHATROLINK communications is sampled and continues until that status is refreshed in the CPU Unit's input status.




The processing time for the changes in status detected in the Servo Driver to be sent using MECHATROLINK communications is indicated as $T_{SRV_IN}$:

625 μs (using an R88D-WT□ and JUSP-NS115 MECHATROLINK-II Application Module or the SMARTSTEP Junior)

450 μs (using an R88D-WN□-ML2)

The time for the Servo Driver status to reach the PCU via MECHATROLINK communications is indicated as $T_{MLK}$:

MECHATROLINK transfer cycle × 1

The maximum time from the end refresh of the user program's cycle in which the command was sent until the command is actually received by the PCU is $T_{IN_REF}$:

(CPU cycle time or MECHATROLINK communications cycle, whichever is longer) + CPU Unit's cycle time × 1

The maximum value for the time until changes in the Servo Driver status are reflected in the CPU Unit's user program, as indicated by $T_{RES}$, is a total of these values, as follows:

$T_{RES(MAX)} = T_{SRV_IN} + T_{MLK} + T_{IN_REF}$

**Note** $T_{RES}$ varies depending on the width of $T_{IN_REF}$.

Example:
CPU Unit cycle time: 1 ms
PCU communications setting: Transfer cycle: 1 ms
Communications cycle = 1 (transfer cycle × 1 = 1 ms)
Connected Servo Driver: W-series Servo Driver + JUSP-NS115

The command response time for the above conditions is as follows:

(This example applies when no warning has occurred in the PCU.)

| Item | Maximum response time | Calculation method |
|---|---|---|
| CPU Unit to PCU | 4.625 ms | $T_{CMD(MAX)} = T_{OUT_REF} + T_{NC} + T_{MLK} + T_{SRV_OUT}$<br>= 2 ms + 1 ms + 1 ms +625 μs |
| PCU to CPU Unit | 3.625 ms | $T_{RES(MAX)} = T_{SRV_IN} + T_{MLK} + T_{IN_REF}$<br>= 625 μs + 1 ms + 2 ms |

**Note** When mounting a Position Control Unit to a CS-series Long-distance Expansion Rack, refer to the graph on I/O refresh time coefficients in the *CS-series CPU Unit Operation Manual* (Cat. No. W339).



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# Effect on CPU Unit Cycle Time

When a single PCU is mounted, the CPU Unit's cycle time increases with the amount of Servo Driver axes connected to the PCU, as follows:

| Model | Number of axes connected | Additional time for each PCU connected |
|---|---|---|
| CJ1W-NCF71 | 1 | 0.2 ms |
| | 3 | 0.3 ms |
| | 6 | 0.4 ms |
| | 16 | 1.0 ms |

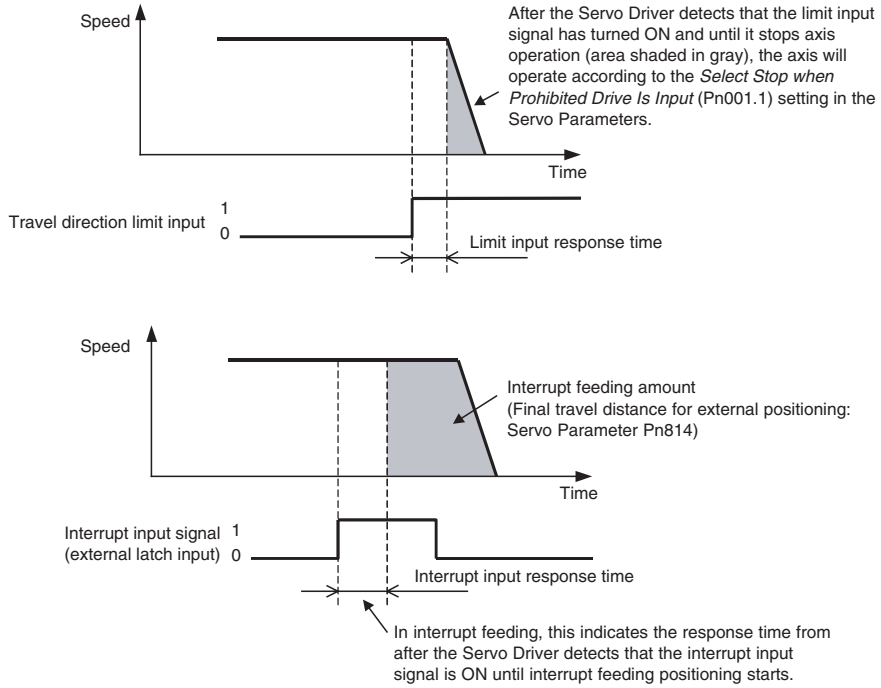
# External Input Response Time

The response time is as shown below for external input signals, such as limit inputs and interrupt inputs. The following response times indicate the time until the Servo Driver starts operating according to the function corresponding to the input signal.

The command response time is required for the status of the signal that was input to be reflected in the input area of the CPU Unit.

| External input signal | Response time | Details |
|---|---|---|
| Limit input signal | 2 ms max. | Response time until the Servo Driver starts the Servomotor's stop operation according to the setting in Servo Parameter Pn001.1 in response to input of the limit input signal. |
| Interrupt input signal | 3 ms max. | Response time until the interrupt feeding operation starts after input of the interrupt input signal for interrupt feeding. |

**Note** The numerical values are obtained when a W-series Servo Driver is used with a JUSP-NS115 MECHATROLINK-II Application Module.




# Difference in Start Times for Simultaneously Started Axes

There is no difference in start times between axes when multiple axes are started at the same time (the bit to start operation turns ON at the same I/O refresh timing).



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# Appendix B
## List of Parameters

## Common Parameter Area

| PCU's internal address | Name | Bit | | | |
|---|---|---|---|---|---|
| | | 15 to 12 | 11 to 08 | 07 to 04 | 03 to 00 |
| 1838 hex | Area allocations | Axis Operating Output Memory Area designation<br>0000 hex: No setting<br>00B0 hex: CIO Area<br>00B1 hex: WR Area<br>00B2 hex: HR Area<br>00B3 hex: AR Area<br>0082 hex: DM Area<br>0050 to 0059, 005A, 005B, 005C: EM Area (5□: □ = EM Bank No.) | | | |
| 1839 hex | | Beginning word of Axis Operating Output Memory Area: 0000 to 7FFF hex | | | |
| 183A hex | | Axis Operating Input Memory Area designation<br>0000 hex: No setting<br>00B0 hex: CIO Area<br>00B1 hex: WR Area<br>00B2 hex: HR Area<br>00B3 hex: AR Area<br>0082 hex: DM Area<br>0050 to 0059, 005A, 005B, 005C: EM Area (5□: □ = EM Bank No.) | | | |
| 183B hex | | Beginning word of Axis Operating Input Memory Area: 0000 to 7FFF hex | | | |
| 183C hex | Scan list | Axis 2 allocation<br>00 hex: Axis not used (no allocation)<br>40 hex: Allocates axis to the Servo Driver. | | Axis 1 allocation<br>00 hex: Axis not used (no allocation)<br>40 hex: Allocates axis to the Servo Driver. | |
| 183D hex | | Axis 4 allocation (same as above) | | Axis 3 allocation (same as above) | |
| 183E hex | | Axis 6 allocation (same as above) | | Axis 5 allocation (same as above) | |
| 183F hex | | Axis 8 allocation (same as above) | | Axis 7 allocation (same as above) | |
| 1840 hex | | Axis 10 allocation (same as above) | | Axis 9 allocation (same as above) | |
| 1841 hex | | Axis 12 allocation (same as above) | | Axis 11 allocation (same as above) | |
| 1842 hex | | Axis 14 allocation (same as above) | | Axis 13 allocation (same as above) | |
| 1843 hex | | Axis 16 allocation (same as above) | | Axis 15 allocation (same as above) | |
| 1844 hex to 1855 hex | Reserved by the system. | 0 | 0 | 0 | 0 |
| 1856 hex | MECHATROLINK communications setting | Transfer cycle<br>00: 1 ms (default setting)<br>01: 1 ms 02: 2 ms<br>03: 3 ms 04: 4 ms<br>05: 5 ms 06: 6 ms<br>07: 7 ms 08: 8 ms<br>A2 hex: 0.25 ms<br>A5 hex: 0.5 ms | | Communications cycle<br>Sets the factor used as the integer multiple for the transfer cycle.<br>Set value: 00 to 20 hex<br>The default setting 00 is the same as when the cycle is set to 3. | |
| 1857 hex | | 0 | 0 | C2 Master Connection<br>0: No C2 master (default setting)<br>1: C2 master connected | Number of communications retries<br>Set value: 0 to 7, F hex |
| 1858 hex to 185F hex | Reserved by the system. | 0 | 0 | 0 | 0 |



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# Axis Parameter Area

Beginning word of Axis Parameter Area for Axis N: d = 1860 hex + (N − 1) × 14 hex (N = 1 to 16)

| PCU's internal address (hexadecimal) | | | | | | | | | | | | | | | | Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Axis 1 | Axis 2 | Axis 3 | Axis 4 | Axis 5 | Axis 6 | Axis 7 | Axis 8 | Axis 9 | Axis 10 | Axis 11 | Axis 12 | Axis 13 | Axis 14 | Axis 15 | Axis 16 | |
| 1860 | 1874 | 1888 | 189C | 18B0 | 18C4 | 18D8 | 18EC | 1900 | 1914 | 1928 | 193C | 1950 | 1964 | 1978 | 198C | Input signal selection |
| 1861 | 1875 | 1889 | 189D | 18B1 | 18C5 | 18D9 | 18ED | 1901 | 1915 | 1929 | 193D | 1951 | 1965 | 1979 | 198D | Operation mode selection |

Input signal selection

| Bit | Function | Settings |
|---|---|---|
| 00 to 07 | Interrupt input signal selection | 00: Phase Z<br>01: External latch signal 1 input<br>02: External latch signal 2 input<br>03: External latch signal 3 input |
| 08 to 15 | Origin input signal selection | 00: Phase Z<br>01: External latch signal 1 input<br>02: External latch signal 2 input<br>03: External latch signal 3 input |

Operation mode selection

| Bit | Function | Settings |
|---|---|---|
| 00 to 03 | Reserved by the system. | 0 |
| 04 to 07 | Origin search operation | 0: Reversal mode 1<br>1: Reversal mode 2<br>2: Single-direction mode<br>3: Reversal mode 3 (See note.) |
| 08 to 11 | Origin detection method (See note.) | 0: Origin proximity input signal reversal<br>1: No origin proximity input signal reversal<br>2: Do not use origin proximity input signal |
| 12 | Origin search direction | 0: Forward<br>1: Reverse |
| 13 | Origin search preset (See note.) | 0: Not set.<br>1: Set. |
| 14 to 15 | Reserved by the system. | 0 |



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| PCU's internal address (hexadecimal) | | | | | | | | | | | | | | | | Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Axis 1** | **Axis 2** | **Axis 3** | **Axis 4** | **Axis 5** | **Axis 6** | **Axis 7** | **Axis 8** | **Axis 9** | **Axis 10** | **Axis 11** | **Axis 12** | **Axis 13** | **Axis 14** | **Axis 15** | **Axis 16** | |
| 1862 | 1876 | 188A | 189E | 18B2 | 18C6 | 18DA | 18EE | 1902 | 1916 | 192A | 193E | 1952 | 1966 | 197A | 198E | Operation mode selection<br>**Bit** / **Function** / **Settings**<br>00 to 03 / Encoder type / 0: Incremental encoder; 1: Absolute encoder<br>04 to 07 / Reserved by the system. / 0<br>08 to 11 / Reserved by the system. / 0<br>12 to 15 / Reserved by the system. / 0 |
| 1863 to 1873 | 1877 to 1887 | 188B to 189B | 189F to 18AF | 18B3 to 18C3 | 18C7 to 18D7 | 18DB to 18EB | 18EF to 18FF | 1903 to 1913 | 1917 to 1927 | 192B to 193B | 193F to 194F | 1953 to 1963 | 1967 to 1977 | 197B to 198B | 198F to 199F | 0000 (Reserved by the system.) |

**Note** The reversal mode 3 setting for the origin search operation, the origin detection method, and the origin search preset can be used only with Position Control Units with unit version 2.0 or later. They cannot be used with Position Control Units with unit version 1.3 or earlier.

# Servo Parameter Area

The Servo Parameters listed here can be used when the PCU is used with either an OMRON R88D-WT□ W-series Servo Driver equipped with a Yaskawa JUSP-NS115 MECHATROLINK-II Application Module, an R88D-WN□-ML2 W-series Servo Driver with built-in MECHATROLINK-II communications or a SMARTSTEP Junior Servo Driver with Built-in MECHATROLINK-II Communications (R7D-ZN□-ML2).

For further details on each of the parameters, refer to the operation manuals for OMRON W-series Servo Drivers and Yaskawa JUSP-NS115 MECHATROLINK-II Application Modules.

## R88D-WT□ W-series Servo Driver Equipped with JUSP-NS115

### Function Selection Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn000 | Function selection basic switch | 2 | 0 | Reverse rotation | 0 | CCW direction is taken for positive command. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | CW direction is taken for positive command. | | | | | |
| | | | 1 | Not used. | --- | The setting is disabled. (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 2 | Unit No. setting | 0 to F | Servo Driver communications unit number setting when using personal computer monitoring software | 0 | --- | --- | Offline | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn001 | Function selection application switch 1 | 2 | 0 | Select stop if an alarm occurs when Servomotor is OFF | 0 | Servomotor stopped by dynamic brake. | 2 | --- | --- | Offline | --- |
| | | | | | 1 | Servomotor stopped by dynamic brake. Dynamic brake released after stopping. | | | | | |
| | | | | | 2 | Servomotor stopped with free run. | | | | | |
| | | | 1 | Select stop when prohibited drive is input | 0 | Stop according to Pn001.0 settings (release Servomotor after stopping). | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Stop Servomotor using torque set in Pn406, and lock Servomotor after stopping. | | | | | |
| | | | | | 2 | Stop Servomotor using torque set in Pn406, and release Servomotor after stopping. | | | | | |
| | | | 2 | Select AC/DC power input | 0 | AC power supply: AC power supplied from L1, L2, (L3) terminals | 0 | --- | --- | Offline | --- |
| | | | | | 1 | DC power supply: DC power supplied from +1, – terminals | | | | | |
| | | | 3 | Select warning code output | 0 | Alarm code only output from ALO1, ALO2, ALO3 | 1 | --- | --- | Offline | --- |
| | | | | | 1 | Alarm code and warning code both output from ALO1, ALO2, ALO3 | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn002 | Function selection application switch 2 | 2 | 0 | Torque command input change (during speed control) | 0 | Option command value not used. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Option command value 1 used as torque limit input. | | | | | |
| | | | | | 2 | Option command value 1 used as the torque feed forward input. | | | | | |
| | | | | | 3 | Option command values 1 and 2 used as torque limit inputs according to the forward/reverse rotation current limit setting. | | | | | |
| | | | 1 | Speed command input change (during torque control) | 0 | Option command value not used. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Option command value 1 used as speed limit input. | | | | | |
| | | | 2 | Operation switch when using absolute encoder | 0 | Use as absolute encoder. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Use as incremental encoder. | | | | | |
| | | | 3 | Fully-closed encoder usage method | 0 | Fully-closed encoder is not used. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Fully-closed encoder is used without phase Z. | | | | | |
| | | | | | 2 | Fully-closed encoder is used with phase Z. | | | | | |
| | | | | | 3 | Fully-closed encoder is used in Reverse Rotation Mode without phase Z. | | | | | |
| | | | | | 4 | Fully-closed encoder is used in Reverse Rotation Mode with phase Z. | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn003 | Function selection application switch 3 | 2 | 0 | Analog monitor 1 (AM) allocation | 0 | Servomotor rotation speed: 1 V/1,000 r/min | 2 | --- | --- | Online | --- |
| | | | | | 1 | Speed command: 1 V/1,000 r/min | | | | | |
| | | | | | 2 | Torque command: 1 V/100% | | | | | |
| | | | | | 3 | Position deviation: 0.05 V/1 command unit | | | | | |
| | | | | | 4 | Position deviation: 0.05 V/100 command units | | | | | |
| | | | | | 5 | Command pulse frequency: 1 V/1,000 r/min | | | | | |
| | | | | | 6 | Servomotor rotation speed: 1 V/250 r/min | | | | | |
| | | | | | 7 | Servomotor rotation speed: 1 V/125 r/min | | | | | |
| | | | | | 8 to F | Not used. | | | | | |
| | | | 1 | Analog monitor 2 (NM) allocation | 0 to F | Same as Pn003.0 | 0 | --- | --- | Online | --- |
| | | | 2 to 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn004 | Not used. | --- | --- | --- | --- | (Do not change the setting.) | 0200 | --- | --- | --- | Fixed setting: 0200 |
| Pn005 | Not used. | --- | --- | --- | --- | (Do not change the setting.) | 0000 | --- | --- | --- | --- |

## Servo Gain Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn100 | Speed loop gain | 2 | Adjusts speed loop responsiveness. | | | | 80 | Hz | 1 to 2000 | Online | --- |
| Pn101 | Speed loop integration constant | 2 | Speed loop integral time constant | | | | 2000 | ×0.01 ms | 15 to 51200 | Online | --- |
| Pn102 | Position loop gain | 2 | Adjusts position loop responsiveness. | | | | 40 | 1/s | 1 to 2000 | Online | --- |
| Pn103 | Inertia ratio | 2 | Sets using the ratio between the machine system inertia and the Servomotor rotor inertia. | | | | 300 | % | 0 to 20000 | Online | --- |
| Pn104 | Speed loop gain 2 | 2 | Adjusts speed loop responsiveness (enabled by automatic gain switching input). | | | | 80 | Hz | 1 to 2000 | Online | --- |
| Pn105 | Speed loop integration constant 2 | 2 | Speed loop integral time constant (enabled by automatic gain switching input) | | | | 2000 | ×0.01 ms | 15 to 51200 | Online | --- |
| Pn106 | Position loop gain 2 | 2 | Adjusts position loop responsiveness (enabled by automatic gain switching input). | | | | 40 | 1/s | 1 to 2000 | Online | --- |
| Pn107 | Bias rotational speed | 2 | Sets position control bias. | | | | 0 | r/min | 0 to 450 | Online | --- |
| Pn108 | Bias addition band | 2 | Sets the position control bias operation start using deviation counter pulse width. | | | | 7 | Command unit | 0 to 250 | Online | --- |
| Pn109 | Feed-forward amount | 2 | Position control feed-forward compensation value | | | | 0 | % | 0 to 100 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn10A | Feed-forward command filter | 2 | Sets position control feed-forward command filter. | | | | 0 | ×0.01 ms | 0 to 6400 | Online | --- |
| Pn10B | Speed control setting | 2 | 0 | P control switching conditions | 0 | Sets internal torque command value conditions (Pn10C). | 4 | --- | --- | Online | --- |
| | | | | | 1 | Sets speed command value conditions (Pn10D). | | | | | |
| | | | | | 2 | Sets acceleration command value conditions (Pn10E). | | | | | |
| | | | | | 3 | Sets deviation pulse value conditions (Pn10F). | | | | | |
| | | | | | 4 | No P control switching function | | | | | |
| | | | 1 | Speed control loop switching | 0 | PI control | 0 | --- | --- | Offline | --- |
| | | | | | 1 | IP control | | | | | |
| | | | 2 | Automatic gain switching | 0 | Automatic gain switching disabled | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Gain switching using position commands | | | | | |
| | | | | | 2 | Gain switching using position deviation | | | | | |
| | | | | | 3 | Gain switching using position commands and position deviation | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn10C | P control switching (torque command) | 2 | Sets level of torque command to switch from PI control to P control. | | | | 200 | % | 0 to 800 | Online | --- |
| Pn10D | P control switching (speed command) | 2 | Sets level of speed command to switch from PI control to P control. | | | | 0 | r/min | 0 to 10000 | Online | --- |
| Pn10E | P control switching (acceleration command) | 2 | Sets level of acceleration command to switch from PI control to P control. | | | | 0 | 10 r/min/s | 0 to 3000 | Online | --- |
| Pn10F | P control switching (deviation pulse) | 2 | Sets level of deviation pulses to switch from PI control to P control. | | | | 10 | Command unit | 0 to 10000 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn110 | Online autotuning setting | 2 | 0 | Select online autotuning | 0 | Autotunes initial operations only after power is turned ON. | 2 | --- | --- | Offline | --- |
| | | | | | 1 | Always autotunes. | | | | | |
| | | | | | 2 | No autotuning | | | | | |
| | | | 1 | Select speed feedback compensation function | 0 | ON | 1 | --- | --- | Online | --- |
| | | | | | 1 | OFF | | | | | |
| | | | 2 | Select adhesive friction compensation function | 0 | Friction compensation: OFF | 0 | --- | --- | Online | --- |
| | | | | | 1 | Friction compensation: Rated torque ratio small | | | | | |
| | | | | | 2 | Friction compensation: Rated torque ratio large | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn111 | Speed feedback compensation gain | 2 | Adjusts speed loop feedback gain. | | | | 100 | % | 1 to 500 | Online | --- |
| Pn112 to Pn123 | Not used. | --- | (Do not change the setting.) | | | | --- | --- | --- | --- | --- |
| Pn124 | Automatic gain switching timer | 2 | Sets the switching delay after conditions have been met, when the automatic gain switching function is used. (Pn10B.2 = 1 to 3). | | | | 100 | ms | 1 to 10000 | Online | --- |
| Pn125 | Automatic gain switching width (amount of position deviation) | 2 | Sets the position deviation used as the switching condition when the automatic gain switching function by position deviation (Pn10B.2 = 2, 3) is used. | | | | 7 | Command unit | 1 to 250 | Online | --- |

## Position Control Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn200 | Position control setting 1 | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | Fixed setting: 1 |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn201 | Encoder divider rate | 2 | Sets the number of output pulses from the Servo Driver. | | | | 1000 | Pulses /rotation | 16 to 16384 | Offline | --- |
| Pn202 | Electronic gear ratio G1 (numerator) | 2 | Sets the pulse rate for the command pulses and Servomotor travel distance. $0.01 \leq G1/G2 \leq 100$ | | | | 4 | --- | 1 to 65535 | Offline | --- |
| Pn203 | Electronic gear ratio G2 (denominator) | 2 | | | | | 1 | --- | 1 to 65535 | Offline | --- |
| Pn204 | Not used. | --- | (Do not change the setting.) | | | | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn205 | Absolute encoder multi-turn limit setting | 2 | Sets the limit to the rotation speed when using a Servomotor with an absolute encoder. | | | | 65535 | Rotations | 0 to 65535 | Offline | --- |
| Pn206 | Number of fully-closed encoder pulses | 2 | Sets the number of fully-closed encoder pulses for each motor rotation. | | | | 16384 | Pulses /rotation | 513 to 32768 | Offline | --- |
| Pn207 | Position control setting 2 | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | Fixed setting: 1 |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn208 | Not used. | --- | (Do not change the setting.) | | | | 0 | --- | --- | --- | --- |
| Pn212 | Not used. | --- | (Do not change the setting.) | | | | 2048 | --- | --- | --- | --- |
| Pn217 | Not used. | --- | (Do not change the setting.) | | | | 1 | --- | --- | --- | --- |
| Pn218 | Position control setting 3 | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 1 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |

## Speed Control Parameters

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn300 | Not used. | --- | (Do not change the setting.) | 1000 | --- | --- | --- | --- |
| Pn301 | Not used. | --- | (Do not change the setting.) | 100 | --- | --- | --- | --- |
| Pn302 | Not used. | --- | (Do not change the setting.) | 200 | --- | --- | --- | --- |
| Pn303 | Not used. | --- | (Do not change the setting.) | 300 | --- | --- | --- | --- |
| Pn304 | Jog speed | 2 | Sets the rotation speed used during jog operation (executed from the Servo Driver's Parameter Unit). | 500 | r/min | 0 to 10000 | Online | --- |
| Pn305 | Soft start acceleration time | 2 | Sets acceleration time during speed control soft start. | 0 | ms | 0 to 10000 | Online | --- |
| Pn306 | Soft start deceleration time | 2 | Sets deceleration time during speed control soft start. | 0 | ms | 0 to 10000 | Online | --- |
| Pn307 | Not used. | --- | (Do not change the setting.) | 40 | --- | --- | --- | --- |
| Pn308 | Speed feedback filter time constant | 2 | Sets filter time constant for speed feedback. | 0 | ×0.01 ms | 0 to 65535 | Online | --- |
| Pn309 | Not used. | --- | (Do not change the setting.) | 60 | --- | --- | --- | --- |

## Torque Control (Torque Limit) Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn400 | Not used. | --- | (Do not change the setting.) | | | | 30 | --- | --- | --- | --- |
| Pn401 | Torque command filter time constant | 2 | Sets the filter time constant for the internal torque command. | | | | 40 | ×0.01 ms | 0 to 65535 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn402 | Forward torque limit | 2 | Forward rotation output torque limit (rated torque ratio). | | | | 350 | % | 0 to 800 | Online | --- |
| Pn403 | Reverse torque limit | 2 | Reverse rotation output torque limit (rated torque ratio). | | | | 350 | % | 0 to 800 | Online | --- |
| Pn404 | Forward rotation external current limit | 2 | Output torque limit during input of forward rotation current limit (rated torque ratio). | | | | 100 | % | 0 to 800 | Online | --- |
| Pn405 | Reverse rotation external current limit | 2 | Output torque limit during input of reverse rotation current limit (rated torque ratio). | | | | 100 | % | 0 to 800 | Online | --- |
| Pn406 | Emergency stop torque | 2 | Deceleration torque when an error occurs (rated torque ratio). | | | | 350 | % | 0 to 800 | Online | --- |
| Pn407 | Speed limit | 2 | Sets the speed limit in torque control mode. | | | | 3000 | r/min | 0 to 10000 | Online | --- |
| Pn408 | Torque command setting | 2 | 0 | Selects notch filter 1 function | 0 | Notch filter 1 not used. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Notch filter 1 used for torque commands. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Selects notch filter 2 function | 0 | Notch filter 2 not used. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Notch filter 2 used for torque commands. | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn409 | Notch filter 1 frequency | 2 | Sets notch filter 1 frequency for torque command. | | | | 2000 | Hz | 50 to 2000 | Online | --- |
| Pn40A | Notch filter 1 Q value | 2 | Sets Q value of notch filter 1. | | | | 70 | ×0.01 | 50 to 400 | Online | --- |
| Pn40B | Notch filter 2 frequency | 2 | Sets notch filter 2 frequency for torque command. | | | | 2000 | Hz | 50 to 2000 | Online | --- |
| Pn40C | Notch filter 2 Q value | 2 | Sets Q value of notch filter 2. | | | | 70 | ×0.01 | 50 to 400 | Online | --- |

## I/O and Status Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn500 | Positioning completion range 1 | 2 | Sets the width of the positioning completed range. | | | | 3 | Command unit | 0 to 250 | Online | --- |
| Pn501 | Not used. | --- | (Do not change the setting.) | | | | 10 | --- | --- | --- | --- |
| Pn502 | Rotation speed for motor rotation detection | 2 | Sets the number of rotations for detecting the Zero Speed Flag. | | | | 20 | r/min | 1 to 10000 | Online | --- |
| Pn503 | Speed conformity signal output width | 2 | Sets the allowable fluctuation range (rotation speed) for the Speed Conformity Flag. | | | | 10 | r/min | 0 to 100 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn504 | Positioning completion range 2 | 2 | Sets the proximity range for the Positioning Proximity Flag. | | | | 3 | Command unit | 1 to 250 | Online | --- |
| Pn505 | Deviation counter overflow level | 2 | Sets the detection level for the deviation counter over alarm. | | | | 1024 | ×256 pulses | 1 to 32767 | Online | --- |
| Pn506 | Brake timing 1 | 2 | Sets the delay from the brake command to the Servomotor turning OFF. | | | | 0 | ×10 ms | 0 to 50 | Online | --- |
| Pn507 | Brake command speed | 2 | Sets the rotation speed for outputting the brake command. | | | | 100 | r/min | 0 to 10000 | Online | --- |
| Pn508 | Brake timing 2 | 2 | Sets the delay from the Servomotor turning OFF to the brake command output. | | | | 50 | ×10 ms | 10 to 100 | Online | --- |
| Pn509 | Momentary hold time | 2 | Sets the time during which alarm detection is disabled when a power failure occurs. | | | | 20 | ms | 20 to 1000 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50A | Input signal selection 1 | 2 | 0 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | Fixed setting: 1 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 3 | POT (forward drive prohibited input) signal input terminal allocation | 0 | Allocated to CN1, pin 40: Valid for low input | 8 | --- | --- | Offline | Standard setting: 2 |
| | | | | | 1 | Allocated to CN1, pin 41: Valid for low input | | | | | |
| | | | | | 2 | Allocated to CN1, pin 42: Valid for low input | | | | | |
| | | | | | 3 | Allocated to CN1, pin 43: Valid for low input | | | | | |
| | | | | | 4 | Allocated to CN1, pin 44: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 45: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 46: Valid for low input | | | | | |
| | | | | | 7 | Always valid. | | | | | |
| | | | | | 8 | Always invalid. | | | | | |
| | | | | | 9 | Allocated to CN1, pin 40: Valid for high input | | | | | |
| | | | | | A | Allocated to CN1, pin 41: Valid for high input | | | | | |
| | | | | | B | Allocated to CN1, pin 42: Valid for high input | | | | | |
| | | | | | C | Allocated to CN1, pin 43: Valid for high input | | | | | |
| | | | | | D | Allocated to CN1, pin 44: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 45: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 46: Valid for high input | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50B | Input signal selection 2 | 2 | 0 | NOT (reverse drive prohibited input) signal input terminal allocation | 0 to F | Same as Pn50A.3 | 8 | --- | --- | Offline | Standard setting: 3 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 2 | PCL (forward rotation current limit) signal input terminal allocation | 0 to F | Same as Pn50A.3 | 5 | --- | --- | Offline | Standard setting: 8 |
| | | | 3 | NCL (reverse rotation current limit) signal input terminal allocation | 0 to F | Same as Pn50A.3 | 6 | --- | --- | Offline | Standard setting: 8 |
| Pn50C | Input signal selection 3 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| Pn50D | Input signal selection 4 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | Fixed setting: 8 |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| Pn50E | Output signal selection 1 | 2 | 0 | INP1 (positioning completed 1) signal output terminal allocation | 0 | No output | 1 | --- | --- | Offline | Standard setting: 1 |
| | | | | | 1 | Allocated to CN1, pins 25, 26 | | | | | |
| | | | | | 2 | Allocated to CN1, pins 27, 28 | | | | | |
| | | | | | 3 | Allocated to CN1, pins 29, 30 | | | | | |
| | | | 1 | VCMP (speed conformity) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 1 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | TGON (Servomotor rotation detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 2 | --- | --- | Offline | Standard setting: 0 |
| | | | 3 | READY (Servomotor warmup complete) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 3 | --- | --- | Offline | Standard setting: 3 |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50F | Output signal selection 2 | 2 | 0 | CLIMT (current limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 1 | VLIMT (speed limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | BKIR (brake interlock) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 2 |
| | | | 3 | WARN (warning) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| Pn510 | Output signal selection 3 | 2 | 0 | INP2 (positioning completed 2) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn511 | Input signal selection 5 | 2 | 0 | DEC signal input terminal allocation | 0 | Allocated to CN1, pin 40: Valid for low input | 8 | --- | --- | Offline | Standard setting: 1 |
| | | | | | 1 | Allocated to CN1, pin 41: Valid for low input | | | | | |
| | | | | | 2 | Allocated to CN1, pin 42: Valid for low input | | | | | |
| | | | | | 3 | Allocated to CN1, pin 43: Valid for low input | | | | | |
| | | | | | 4 | Allocated to CN1, pin 44: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 45: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 46: Valid for low input | | | | | |
| | | | | | 7 | Always enabled. | | | | | |
| | | | | | 8 | Always disabled. | | | | | |
| | | | | | 9 | Allocated to CN1, pin 40: Valid for high input | | | | | |
| | | | | | A | Allocated to CN1, pin 41: Valid for high input | | | | | |
| | | | | | B | Allocated to CN1, pin 42: Valid for high input | | | | | |
| | | | | | C | Allocated to CN1, pin 43: Valid for high input | | | | | |
| | | | | | D | Allocated to CN1, pin 44: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 45: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 46: Valid for high input | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn511 | Input signal selection 5 | 2 | 1 | EXT1 signal input terminal allocation | 0 to 3 | Always disabled. | 8 | --- | --- | Offline | Standard setting: 4 |
| | | | | | 4 | Allocated to CN1, pin 44: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 45: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 46: Valid for low input | | | | | |
| | | | | | 7 | Always enabled. | | | | | |
| | | | | | 8 | Always disabled. | | | | | |
| | | | | | 9 to C | Always disabled. | | | | | |
| | | | | | D | Allocated to CN1, pin 44: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 45: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 46: Valid for high input | | | | | |
| | | | 2 | EXT2 signal input terminal allocation | 0 to F | Same as Pn511.1 | 8 | --- | --- | Offline | Standard setting: 5 |
| | | | 3 | EXT3 signal input terminal allocation | 0 to F | Same as Pn511.1 | 8 | --- | --- | Offline | Standard setting: 6 |
| Pn512 | Output signal reverse | 2 | 0 | Output signal reverse for CN1 pins 25, 26 | 0 | Not reversed. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Reversed. | | | | | |
| | | | 1 | Output signal reverse for CN1 pins 27, 28 | 0, 1 | Same as above | 0 | --- | --- | Offline | --- |
| | | | 2 | Output signal reverse for CN1 pins 29, 30 | 0, 1 | Same as above | 0 | --- | --- | Offline | --- |
| | | | 3 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn513 | Input signal selection 6 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn51A | Motor-load deviation over level | 2 | Sets the allowable range for the number of pulses for fully-closed encoders and semi-closed encoders. | | | | 0 | Pulse | 0 to 32767 | Online | --- |
| Pn51B | Not used. | --- | (Do not change the setting.) | | | | 100 | --- | --- | --- | --- |
| Pn51C | Not used. | --- | (Do not change the setting.) | | | | 450 | --- | --- | --- | --- |
| Pn51E | Deviation counter overflow warning level | 2 | Sets the detection level for the deviation counter overflow warning. | | | | 0 | % | 0 to 100 | Online | --- |



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## Other Parameters

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn600 | Regeneration resistor capacity | 2 | Setting for the regeneration resistance load ratio monitoring calculations. | 0 | ×10 W | From 0 (Varies by Unit.) | Online | --- |
| Pn601 | Not used. | 0 | (Do not change the setting.) | --- | --- | --- | --- | --- |



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## Control Function Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn800 | Communications control | 2 | 0 | MECHATROLINK-II communications check mask | 0 | Detects both communications errors (A.E6) and synchronization errors (A.E5). | 0 | --- | --- | Online | Always set to 0. |
| | | | | | 1 | Ignores communications errors (A.E6). | | | | | |
| | | | | | 2 | Ignores synchronization errors (A.E5). | | | | | |
| | | | | | 3 | Ignores both communications errors (A.E6) and synchronization errors (A.E5). | | | | | |
| | | | 1 | Warning check mask | 0 | Detects parameter setting warnings (A.94), MECHATROLINK command warnings (A.95), and communications errors (A.96). | 4 | --- | --- | Online | Always set to 4 or 0. |
| | | | | | 1 | Ignores parameters setting warnings (A.94). | | | | | |
| | | | | | 2 | Ignores MECHATROLINK-II command warnings (A.95). | | | | | |
| | | | | | 3 | Ignores both parameter setting warnings (A.94) and MECHATROLINK-II command warnings (A.95). | | | | | |
| | | | | | 4 | Ignores communications errors (A.96). | | | | | |
| | | | | | 5 | Ignores both parameter setting warnings (A.94) and communications errors (A.96). | | | | | |
| | | | | | 6 | Ignores both MECHATROLINK-II command warnings (A.95) and communications errors (A.96). | | | | | |
| | | | | | 7 | Ignores parameter setting warnings (A.94), MECHATROLINK-II command warnings (A.95), and communications errors (A.96). | | | | | |
| | | | 2 | Communications error count at single transmission | 0 to F | Detects a communications error (A.E6) when the number of errors specified by the set value + 2 have occurred continuously. | 0 | --- | --- | Online | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn801 | Software limits | 2 | 0 | Software limit function | 0 | Software limit enabled. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Forward software limit disabled. | | | | | |
| | | | | | 2 | Reverse software limit disabled. | | | | | |
| | | | | | 3 | Software limit disabled in both directions. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Software limit check using references | 0 | No software limit check using references. | 0 | --- | --- | Online | Always set to 0. |
| | | | | | 1 | Software limit check using references. | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn802 | Not used. | --- | (Do not change the setting.) | 0000 | --- | --- | --- | --- |
| Pn803 | Zero point width | 2 | Sets the detection range for the Origin Stop Flag. | 10 | Command unit | 0 to 250 | Online | --- |
| Pn804 | Forward software limit | 4 | Sets the forward software limit. | 819,191,808 | Command unit | –1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn806 | Reverse software limit | 4 | Sets the reverse software limit. | –819,191,808 | Command unit | –1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn808 | Absolute encoder zero point position offset | 4 | Sets the offset for the mechanical origin from the absolute encoder's absolute value data. | 0 | Command unit | –1,073,741,823 to 1,073,741,823 | Offline | --- |
| Pn80A | First-step linear acceleration constant | 2 | Sets the first-step acceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80B | Second-step linear acceleration constant | 2 | Sets the second-step acceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80C | Acceleration constant switching speed | 2 | Sets the speed for switching between first-step and second-step acceleration for the acceleration/deceleration curve used in position control. | 0 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn80D | First-step linear deceleration constant | 2 | Sets the first-step deceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/s$^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80E | Second-step linear deceleration constant | 2 | Sets the second-step deceleration speed for the acceleration/deceleration curve used in position control. | 100 | ×10,000 command units/s$^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80F | Deceleration constant switching speed | 2 | Sets the speed for switching between first-step and second-step deceleration for the acceleration/deceleration curve used in position control. | 0 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn810 | Exponential acceleration/ deceleration bias | 2 | Sets the exponential acceleration/deceleration bias speed for the acceleration/deceleration curve used in position control. | 0 | Command units/s | 0 to 32767 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn811 | Exponential acceleration/ deceleration time constant | 2 | Sets exponential acceleration/deceleration time constant for the acceleration/deceleration curve used in position control. | 0 | ×0.1 ms | 0 to 5100 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn812 | Movement average time | 2 | Sets the S-curve acceleration/deceleration moving average time for the acceleration/deceleration curve used in position control. | 0 | ×0.1 ms | 0 to 5100 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn813 | Not used. | --- | (Do not change the setting.) | 0010 | --- | --- | --- | --- |
| Pn814 | Final travel distance for external positioning | 4 | Sets the final travel distance for external positioning when executing INTERRUPT FEEDING using direct operation. | 100 | Command unit | –1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn816 | Zero point return mode setting | 2 | 0 | Zero point return direction | 0 | Forward | 0 | --- | --- | Online | Set the same direction as the origin search direction set in the Axis Parameters. Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| | | | | | 1 | Reverse | | | | | |
| | | | 1 to 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn817 | Zero point return approach speed 1 | 2 | Sets the origin (zero point) input signal search speed used after the origin proximity signal has been detected in an origin search. | | | | 50 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn818 | Zero point return approach speed 2 | 2 | Sets the origin (zero point) return final travel distance positioning speed used after the origin input signal has been detected in an origin search. | | | | 5 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn819 | Final travel distance to return to zero point | 4 | Sets the amount of compensation positioning used after the origin input signal has been detected in an origin search. | | | | 100 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn81B | Backlash compensation amount | 2 | Sets the amount of backlash compensation. | | | | 0 | ×0.1 command unit | −32,768 to 32,767 | Online | --- |
| Pn81C | Not used. | --- | (Do not change the setting.) | | | | 0000 | --- | --- | --- | --- |
| Pn81D | Compensation function selection | 2 | 0 | Backlash compensation selection | 0 | Compensates in forward direction. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Compensates in reverse direction. | | | | | |
| | | | 1 to 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn81E to Pn823 | Not used. | --- | (Do not change the setting.) | | | | 0000 | --- | --- | --- | --- |



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# R88D-WN□-ML2 W-series Servo Driver with Built-in MECHATROLINK-II Communications

## Function Selection Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn000 | Function selection basic switches | 2 | 0 | Reverse rotation | 0 | CCW direction is taken for positive command | 0 | --- | --- | Offline | --- |
| | | | | | 1 | CW direction is taken for positive command | | | | | |
| | | | | | 2 to 3 | Not used. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Unit No. setting | 0 to F | Servo Driver communications unit number setting (necessary for multiple Servo Driver connections when using personal computer monitoring software) | 0 | --- | --- | Offline | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn001 | Function selection application switches 1 | 2 | 0 | Stop selection if an alarm occurs when Servomotor is OFF | 0 | Servomotor stopped by dynamic brake. | 2 | --- | --- | Offline | --- |
| | | | | | 1 | Dynamic brake OFF after Servomotor stopped | | | | | |
| | | | | | 2 | Servomotor stopped with free run | | | | | |
| | | | 1 | Stop selection when drive prohibited is input | 0 | Stop according to Pn001.0 setting (release Servomotor after stopping) | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Stop Servomotor using torque set in Pn406, and lock Servomotor after stopping | | | | | |
| | | | | | 2 | Stop Servomotor using torque set in Pn406, and release Servomotor after stopping | | | | | |
| | | | 2 | AC/DC power input selection | 0 | AC power supply: AC power supplied from L1, L2, (L3) terminals | 0 | --- | --- | Offline | --- |
| | | | | | 1 | DC power supply: DC power from +, – (2) terminals | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn002 | Function selection application switches 2 | 2 | 0 | Torque command input change (during speed control) | 0 | Do not use option command value. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Use option command value 1 as the torque limit value. | | | | | |
| | | | | | 2 | Use option command value 1 as the torque feed forward command value. | | | | | |
| | | | | | 3 | Use option command value 1 or 2 as the torque limit value, according to the forward and reverse torque limits that are specified. | | | | | |
| | | | 1 | Speed command input change (during torque control) | 0 | Do not use option command value. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Use option command value 1 as the speed limit value. | | | | | |
| | | | 2 | Operation switch when using absolute encoder | 0 | Use as absolute encoder | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Use as incremental encoder | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn004 | Function selection application switches 4 | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 2 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn006 | Function selection application switches 6 | 2 | 0 to 1 | Analog monitor 1 (AM) signal selection | 00 | Servomotor rotation speed: 1 V/1000 r/min | 02 | --- | --- | Online | --- |
| | | | | | 01 | Speed command: 1 V/1000 r/min | | | | | |
| | | | | | 02 | Torque command: gravity compensation torque (Pn422) (1 V per 100%) | | | | | |
| | | | | | 03 | Position deviation: 0.05 V/1 command unit | | | | | |
| | | | | | 04 | Position amplifier deviation (after electronic gear) (0.05 V per encoder pulse unit) | | | | | |
| | | | | | 05 | Position command speed (1 V/1,000 r/min) | | | | | |
| | | | | | 06 | Not used. | | | | | |
| | | | | | 07 | Not used. | | | | | |
| | | | | | 08 | Positioning completed command (Positioning completed: 5 V; positioning not completed: 0 V | | | | | |
| | | | | | 09 | Speed feed forward (1 V/1,000 r/min) | | | | | |
| | | | | | 0A | Torque feed forward (1 V per 100%) | | | | | |
| | | | | | 0B to 1F | Not used. | | | | | |
| | | | 2 | Analog monitor 1 signal multiplier selection | 0 | 1x | 0 | --- | --- | Online | --- |
| | | | | | 1 | 10x | | | | | |
| | | | | | 2 | 100x | | | | | |
| | | | | | 3 | 1/10x | | | | | |
| | | | | | 4 | 1/100x | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn007 | Function selection application switches 7 | 2 | 0 to 1 | Analog monitor 2 (NM) signal selection | 00 | Servomotor rotation speed: 1V/1000 r/min | 00 | --- | --- | Online | --- |
| | | | | | 01 | Speed command: 1 V/1000 r/min | | | | | |
| | | | | | 02 | Torque command: gravity compensation torque (Pn422) (1 V per 100%) | | | | | |
| | | | | | 03 | Position deviation: 0.05 V/1 command unit | | | | | |
| | | | | | 04 | Position amplifier deviation (after electronic gear) (0.05 V per encoder pulse unit) | | | | | |
| | | | | | 05 | Position command speed (1 V/1,000 r/min) | | | | | |
| | | | | | 06 | Not used. | | | | | |
| | | | | | 07 | Not used. | | | | | |
| | | | | | 08 | Positioning completed command (Positioning completed: 5 V; positioning not completed: 0 V | | | | | |
| | | | | | 09 | Speed feed forward (1 V/1,000 r/min) | | | | | |
| | | | | | 0A | Torque feed forward (1 V per 100%) | | | | | |
| | | | | | 0B to 1F | Not used. | | | | | |
| | | | 2 | Analog monitor 2 signal multiplier selection | 0 | 1x | 0 | --- | --- | Online | --- |
| | | | | | 1 | 10x | | | | | |
| | | | | | 2 | 100x | | | | | |
| | | | | | 3 | 1/10x | | | | | |
| | | | | | 4 | 1/100x | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn008 | Function selection application switches 8 | 2 | 0 | Lowered battery voltage alarm/warning selection | 0 | Regard battery voltage drop as alarm (A.830). | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Regard battery voltage drop as warning (A.930). | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Warning detection selection | 0 | Warnings detected. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Warnings not detected. | | | | | |
| | | | 3 | Not used. | 4 | (Do not change the setting.) | 4 | --- | --- | --- | --- |



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## Servo Gain Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn100 | Speed loop gain | 2 | Adjusts speed loop response. | | | | 800 | ×0.1 Hz | 10 to 20000 | Online | --- |
| Pn101 | Speed loop integration constant | 2 | Speed loop integral time constant | | | | 2000 | ×0.01 ms | 15 to 51200 | Online | --- |
| Pn102 | Position loop gain | 2 | Adjusts position loop response. | | | | 400 | ×0.1/s | 10 to 20000 | Online | --- |
| Pn103 | Inertia ratio | 2 | Set using the ratio between the machine system inertia and the Servomotor rotor inertia. | | | | 300 | % | 0 to 20000 | Online | --- |
| Pn104 | Speed loop gain 2 | 2 | Adjusts speed loop response (enabled by automatic gain switching input). | | | | 800 | ×0.1 Hz | 10 to 20000 | Online | --- |
| Pn105 | Speed loop integration constant 2 | 2 | Speed loop integral time constant (enabled by automatic gain switching input). | | | | 2000 | ×0.01 ms | 15 to 51200 | Online | --- |
| Pn106 | Position loop gain 2 | 2 | Adjusts position loop response (enabled by automatic gain switching input). | | | | 400 | ×0.1/s | 10 to 20000 | Online | --- |
| Pn107 | Bias rotational speed | 2 | Sets position control bias. | | | | 0 | r/min | 0 to 450 | Online | --- |
| Pn108 | Bias addition band | 2 | Sets the position control bias operation start using deviation counter pulse width. | | | | 7 | Command unit | 0 to 250 | Online | --- |
| Pn109 | Feed-forward amount | 2 | Position control feed-forward compensation value | | | | 0 | % | 0 to 100 | Online | --- |
| Pn10A | Feed-forward command filter | 2 | Sets position control feed-forward command filter. | | | | 0 | ×0.01 ms | 0 to 6400 | Online | --- |
| Pn10B | Speed control setting | 2 | 0 | P control switching conditions | 0 | Sets internal torque command value conditions (Pn10C). | 4 | --- | --- | Online | --- |
| | | | | | 1 | Sets speed command value conditions (Pn10d). | | | | | |
| | | | | | 2 | Sets acceleration command value conditions (Pn10E). | | | | | |
| | | | | | 3 | Sets deviation pulse value conditions (Pn10F). | | | | | |
| | | | | | 4 | No P control switching function | | | | | |
| | | | 1 | Speed control loop switching | 0 | PI control | 0 | --- | --- | Offline | --- |
| | | | | | 1 | IP control | | | | | |
| | | | | | 2 to 3 | Not used. | | | | | |
| | | | 2 | Position loop control method | 0 | Standard position control | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Less deviation control | | | | | |
| | | | | | 2 to 3 | Not used. | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn10C | P control switching (torque command) | 2 | Sets level of torque command to switch from PI control to P control. | | | | 200 | % | 0 to 800 | Online | --- |
| Pn10D | P control switching (speed command) | 2 | Sets level of speed command to switch from PI control to P control. | | | | 0 | r/min | 0 to 10000 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn10E | P control switching (acceleration command) | 2 | Sets level of acceleration command to switch from PI control to P control. | | | | 0 | r/min/s | 0 to 30000 | Online | --- |
| Pn10F | P control switching (deviation pulse) | 2 | Sets level of deviation pulses to switch from PI control to P control. | | | | 10 | Command unit | 0 to 10000 | Online | --- |
| Pn110 | Normal autotuning switches | 2 | 0 | Not used. | 2 | (Do not change the setting.) | 2 | --- | --- | Offline | --- |
| | | | 1 | Speed feedback compensation function selection | 0 | ON | 1 | --- | --- | Offline | --- |
| | | | | | 1 | OFF | | | | | |
| | | | | | 2 to 3 | Not used. | | | | | |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn111 | Speed feedback compensating gain | 2 | Adjusts speed loop feedback gain. | | | | 100 | % | 1 to 500 | Online | --- |
| Pn119 | Not used. | --- | (Do not change the setting.) | | | | 500 | --- | --- | --- | --- |
| Pn11A | Not used. | --- | (Do not change the setting.) | | | | 1000 | --- | --- | --- | --- |
| Pn11E | Not used. | --- | (Do not change the setting.) | | | | 1000 | --- | --- | --- | --- |
| Pn11F | Position integral time constant | 2 | Position loop integral time constant | | | | 0 | ×0.1 ms | 0 to 50000 | Online | --- |
| Pn12B | Not used. | --- | (Do not change the setting.) | | | | 400 | --- | --- | --- | --- |
| Pn12C | Not used. | --- | (Do not change the setting.) | | | | 2000 | --- | --- | --- | --- |
| Pn12D | Not used. | --- | (Do not change the setting.) | | | | 400 | --- | --- | --- | --- |
| Pn12E | Not used. | --- | (Do not change the setting.) | | | | 400 | --- | --- | --- | --- |
| Pn12F | Not used. | --- | (Do not change the setting.) | | | | 2000 | --- | --- | --- | --- |
| Pn130 | Not used. | --- | (Do not change the setting.) | | | | 400 | --- | --- | --- | --- |
| Pn131 | Gain switching time 1 | 2 | Switching time from No. 1 gain to No. 2 gain | | | | 0 | ms | 0 to 65535 | Online | --- |
| Pn132 | Gain switching time 2 | 2 | Switching time from No. 2 gain to No. 1 gain | | | | 0 | ms | 0 to 65535 | Online | --- |
| Pn135 | Gain switching waiting time 1 | 2 | The time from when gain switching condition A is satisfied until switching from the No. 1 gain to the No. 2 gain begins. | | | | 0 | ms | 0 to 65535 | Online | --- |
| Pn136 | Gain switching waiting time 2 | 2 | The time from when gain switching condition B is satisfied until switching from the No. 2 gain to the No. 1 gain begins. | | | | 0 | ms | 0 to 65535 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn139 | Automatic gain changeover related switches 1 | 2 | 0 | Gain switching selection switch | 0 | Manual gain switching (automatic gain switching not used) | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Automatic switching pattern 1 Automatic switching from No. 1 gain to No. 2 gain when gain switching condition A is satisfied. Automatic switching from No. 2 gain to No. 1 gain when gain switching condition B is satisfied. | | | | | |
| | | | | | 2 to 4 | Not used. | | | | | |
| | | | 1 | Gain switching condition A | 0 | Positioning completed output 1 (INP1) ON | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Positioning completed output 1 (INP1) OFF | | | | | |
| | | | | | 2 | Positioning completed output 2 (INP2) ON | | | | | |
| | | | | | 3 | Positioning completed output 2 (INP2) OFF | | | | | |
| | | | | | 4 | The position command filter output is 0, and also the position command input is 0. | | | | | |
| | | | | | 5 | The position command input is not 0. | | | | | |
| | | | 2 | Gain switching condition B | 0 to 5 | Same as Pn139.1 | 0 | --- | --- | Offline | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn144 | Not used. | --- | (Do not change the setting.) | | | | 1000 | --- | --- | --- | --- |
| Pn150 | Predictive control selection switches | 2 | 0 | Predictive control selection | 0 | Predictive control not used. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Predictive control used. | | | | | |
| | | | | | 2 | Not used. | | | | | |
| | | | 1 | Predictive control type | 0 | Predictive control for tracking | 1 | --- | --- | Offline | --- |
| | | | | | 1 | Predictive control for positioning | | | | | |
| | | | 2 | Not used. | 2 | (Do not change the setting.) | 2 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn151 | Predictive control acceleration/deceleration gain | 2 | Adjusts acceleration and deceleration response for predictive control. | | | | 100 | % | 0 to 300 | Online | --- |
| Pn152 | Predictive control weighting ratio | 2 | Adjusts position deviation for predictive control. | | | | 100 | % | 0 to 300 | Online | --- |
| Pn1A0 | Servo rigidity | 2 | Adjusts the Servo rigidity for the No. 1 gain. | | | | 60 | % | 1 to 500 | Online | --- |
| Pn1A1 | Servo rigidity 2 | 2 | Adjusts the Servo rigidity for the No. 2 gain. | | | | 60 | % | 1 to 500 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn1A2 | Speed feedback filter time constant | 2 | Sets the filter time constant for No. 1 gain speed feedback. | | | | 72 | ×0.01 ms | 30 to 3200 | Online | --- |
| Pn1A3 | Speed feedback filter time constant 2 | 2 | Sets the filter time constant for No. 2 gain speed feedback. | | | | 72 | ×0.01 ms | 30 to 3200 | Online | --- |
| Pn1A4 | Torque command filter time constant 2 | 2 | Sets the filter time constant for the torque command. | | | | 36 | ×0.01 ms | 0 to 2500 | Online | --- |
| Pn1A7 | Utility control switches | 2 | 0 | Integral compensation processing | 0 | Integral compensation processing not executed. | 1 | --- | --- | Online | --- |
| | | | | | 1 | Integral compensation processing executed. | | | | | |
| | | | | | 2 | Integral compensation is executed for No. 1 gain and not for No. 2 gain for less-deviation gain switching. | | | | | |
| | | | | | 3 | Integral compensation is executed for No. 2 gain and not for No. 1 gain for less-deviation gain switching. | | | | | |
| | | | 1 | Not used. | 2 | (Do not change the setting.) | 2 | --- | --- | --- | --- |
| | | | 2 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 3 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| Pn1A9 | Utility integral gain | 2 | Adjusts the auxiliary integral responsive. | | | | 37 | Hz | 0 to 500 | Online | --- |
| Pn1AA | Position proportional gain | 2 | Adjusts the position proportional responsive. | | | | 60 | Hz | 0 to 500 | Online | --- |
| Pn1AB | Speed integral gain | 2 | Adjusts the speed integral responsive. | | | | 0 | Hz | 0 to 500 | Online | --- |
| Pn1AC | Speed proportional gain | 2 | Adjusts the speed proportional responsive. | | | | 120 | Hz | 0 to 2000 | Online | --- |
| Pn1B5 | Not used. | --- | (Do not change the setting.) | | | | 150 | --- | --- | --- | --- |



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## Position Control Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn200 | Not used. | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn205 | Absolute encoder multi-turn limit setting | 2 | Sets the multi-turn limit for when a Servomotor with an absolute encoder is used. | | | | 65535 | Rotation | 0 to 65535 | Offline | --- |
| Pn207 | Position control settings 2 | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 2 | Backlash compensation selection | 0 | Disabled | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Compensates to forward rotation side. | | | | | |
| | | | | | 2 | Compensates to reverse rotation side. | | | | | |
| | | | 3 | INP 1 output timing | 0 | When the position deviation is below the INP1 range (Pn522). | 0 | --- | --- | Offline | --- |
| | | | | | 1 | When the position deviation is below the INP1 range (Pn522) and also the command after the position command filter is 0. | | | | | |
| | | | | | 2 | When the absolute value for the position deviation is below the INP1 range (Pn522) and also the position command input is 0. | | | | | |
| Pn209 | Not used. | --- | (Do not change the setting.) | | | | 0 | --- | --- | --- | --- |
| Pn20A | Not used. | --- | (Do not change the setting.) | | | | 32768 | --- | --- | --- | --- |
| Pn20E | Electronic gear ratio G1 (numerator) | 4 | Sets the pulse rate for the command pulses and Servomotor movement distance.<br>0.001 ≤ G1/G2 ≤ 1000 | | | | 4 | --- | 1 to 1073741824 | Offline | --- |
| Pn210 | Electronic gear ratio G2 (denominator) | 4 | | | | | 1 | --- | 1 to 1073741824 | Offline | --- |
| Pn212 | Encoder divider rate | 4 | Sets the number of output pulses per Servomotor rotation. | | | | 1000 | Pulses /rotation | 16 to 1073741824 | Offline | --- |
| Pn214 | Backlash compensation amount | 2 | Mechanical system backlash amount (the mechanical gap between the drive shaft and the shaft being driven) | | | | 0 | Command unit | −32767 to 32767 | Online | --- |
| Pn215 | Backlash compensation time constant | 2 | Sets the backlash compensation time constant. | | | | 0 | ×0.01 ms | 0 to 65535 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn216 | Not used. | --- | (Do not change the setting.) | | | | 0 | --- | --- | --- | --- |
| Pn217 | Not used. | --- | (Do not change the setting.) | | | | 0 | --- | --- | --- | --- |
| Pn281 | Not used. | --- | (Do not change the setting.) | | | | 20 | --- | --- | --- | --- |

## Speed Control Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn300 | Not used. | --- | (Do not change the setting.) | | | | 600 | --- | --- | --- | --- |
| Pn301 | Not used. | --- | (Do not change the setting.) | | | | 100 | --- | --- | --- | --- |
| Pn302 | Not used. | --- | (Do not change the setting.) | | | | 200 | --- | --- | --- | --- |
| Pn303 | Not used. | --- | (Do not change the setting.) | | | | 300 | --- | --- | --- | --- |
| Pn304 | Jog speed | 2 | Sets rotation speed during jog operation (using Servo Driver's personal computer monitoring software) | | | | 500 | r/min | 0 to 10000 | Online | --- |
| Pn305 | Soft start acceleration time | 2 | Sets acceleration time during speed control soft start. | | | | 0 | ms | 0 to 10000 | Online | --- |
| Pn306 | Soft start deceleration time | 2 | Sets deceleration time during speed control soft start. | | | | 0 | ms | 0 to 10000 | Online | --- |
| Pn307 | Not used. | --- | (Do not change the setting.) | | | | 40 | --- | --- | --- | --- |
| Pn308 | Speed feedback filter time constant | 2 | Sets constant during filter of speed feedback. | | | | 0 | ×0.01 ms | 0 to 65535 | Online | --- |
| Pn310 | Vibration detection switches | 2 | 0 | Vibration detection selection | 0 | Vibration detection not used. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Gives warning (A.911) when vibration is detected. | | | | | |
| | | | | | 2 | Gives alarm (A.520) when vibration is detected. | | | | | |
| | | | 1 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn311 | Vibration detection sensitivity | 2 | Sets the vibration detection sensitivity. | | | | 100 | % | 50 to 500 | Online | --- |
| Pn312 | Vibration detection level | 2 | Sets the vibration detection level | | | | 50 | r/min | 0 to 500 | Online | --- |



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## Torque Control (Torque Limit) Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn400 | Not used. | --- | (Do not change the setting.) | | | | 30 | --- | --- | --- | --- |
| Pn401 | 1st step 1st torque command filter time constant | 2 | Sets the filter time constant for internal torque commands. | | | | 40 | ×0.01 ms | 0 to 65535 | Online | --- |
| Pn402 | Forward torque limit | 2 | Forward rotation output torque limit (rated torque ratio). | | | | 350 | % | 0 to 800 | Online | --- |
| Pn403 | Reverse torque limit | 2 | Reverse rotation output torque limit (rated torque ratio). | | | | 350 | % | 0 to 800 | Online | --- |
| Pn404 | Forward rotation external current limit | 2 | Output torque limit during input of forward rotation current limit (rated torque ratio) | | | | 100 | % | 0 to 800 | Online | --- |
| Pn405 | Reverse rotation external current limit | 2 | Output torque limit during input of reverse rotation current limit (rated torque ratio) | | | | 100 | % | 0 to 800 | Online | --- |
| Pn406 | Emergency stop torque | 2 | Deceleration torque when an error occurs (rated torque ratio) | | | | 350 | % | 0 to 800 | Online | --- |
| Pn407 | Speed limit | 2 | Sets the speed limit in torque control mode. | | | | 3000 | r/min | 0 to 10000 | Online | --- |
| Pn408 | Torque command setting | 2 | 0 | Selects notch filter 1 function. | 0 | Notch filter 1 not used. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Notch filter 1 used for torque commands. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Selects notch filter 2 function. | 0 | Notch filter 2 not used. | 0 | --- | --- | Online | --- |
| | | | | | 1 | Notch filter 2 used for torque commands. | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn409 | Notch filter 1 frequency | 2 | Sets notch filter 1 frequency for torque command. | | | | 2000 | Hz | 50 to 2000 | Online | --- |
| Pn40A | Notch filter 1 Q value | 2 | Sets Q value of notch filter 1. | | | | 70 | ×0.01 | 50 to 1000 | Online | --- |
| Pn40C | Notch filter 2 frequency | 2 | Sets the notch filter 2 frequency for torque commands. | | | | 2000 | Hz | 50 to 2000 | Online | --- |
| Pn40D | Notch filter 2 Q value | 2 | Sets Q value of notch filter 2. | | | | 70 | ×0.01 | 50 to 1000 | Online | --- |
| Pn40F | 2nd step 2nd torque command filter frequency | 2 | Sets the filter frequency for internal torque commands. | | | | 2000 | Hz | 100 to 2000 | Online | --- |
| Pn410 | 2nd step 2nd torque command filter Q value | 2 | Sets the torque command filter Q value. | | | | 70 | ×0.01 | 50 to 1000 | Online | --- |
| Pn411 | 3rd step torque command filter time constant | 2 | Sets the filter time constant for internal torque commands. | | | | 0 | µs | 0 to 65535 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn412 | 1st step 2nd torque command filter time constant | 2 | Sets the filter time constant for No. 2 gain internal torque commands. | | | | 100 | ×0.01 ms | 0 to 65535 | Online | --- |
| Pn413 | Not used. | --- | (Do not change the setting.) | | | | 100 | --- | --- | --- | --- |
| Pn414 | Not used. | --- | (Do not change the setting.) | | | | 100 | --- | --- | --- | --- |
| Pn420 | Damping for vibration suppression on stopping | 2 | Sets the vibration suppression value while stopped. | | | | 100 | % | 10 to 100 | Online | --- |
| Pn421 | Vibration suppression starting time | 2 | Sets the time from when the position command becomes 0 until damping for vibration suppression on stopping begins. | | | | 1000 | ms | 0 to 65535 | Online | --- |
| Pn422 | Gravity compensation torque | 2 | Sets the gravity compensation torque. | | | | 0 | ×0.01 % | –20000 to 20000 | Online | --- |
| Pn456 | Sweep torque command amplitude | 2 | Sets the sweep torque command amplitude. | | | | 15 | % | 1 to 800 | Online | --- |

## I/O and Status Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn501 | Not used. | --- | (Do not change the setting.) | | | | 10 | --- | --- | --- | --- |
| Pn502 | Rotation speed for motor rotation detection | 2 | Sets the number of rotations for the Servomotor rotation detection output (TGON). | | | | 20 | r/min | 1 to 10000 | Online | --- |
| Pn503 | Speed conformity signal output width | 2 | Sets the allowable fluctuation (number of rotations) for the speed conformity output (VCMP). | | | | 10 | r/min | 0 to 100 | Online | --- |
| Pn506 | Brake timing 1 | 2 | Sets the delay from the brake command to the Servomotor turning OFF. | | | | 0 | ×10 ms | 0 to 50 | Online | --- |
| Pn507 | Brake command speed | 2 | Sets the number of rotations for outputting the brake command. | | | | 100 | r/min | 0 to 10000 | Online | --- |
| Pn508 | Brake timing 2 | 2 | Sets the delay time from the Servomotor turning OFF to the brake command output. | | | | 50 | ×10 ms | 10 to 100 | Online | --- |
| Pn509 | Momentary hold time | 2 | Sets the time during which alarm detection is disabled when a power failure occurs. | | | | 20 | ms | 20 to 1000 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50A | Input signal selections 1 | 2 | 0 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | POT (forward drive prohibited input) signal Input terminal allocation | 0 | Allocated to CN1, pin 13: Valid for low input | 1 | --- | --- | Offline | Standard setting: 1 |
| | | | | | 1 | Allocated to CN1, pin 7: Valid for low input | | | | | |
| | | | | | 2 | Allocated to CN1, pin 8: Valid for low input | | | | | |
| | | | | | 3 | Allocated to CN1, pin 9: Valid for low input | | | | | |
| | | | | | 4 | Allocated to CN1, pin 10: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 11: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 12: Valid for low input | | | | | |
| | | | | | 7 | Always enabled. | | | | | |
| | | | | | 8 | Always disabled. | | | | | |
| | | | | | 9 | Allocated to CN1, pin 13: Valid for high input | | | | | |
| | | | | | A | Allocated to CN1, pin 7: Valid for high input | | | | | |
| | | | | | B | Allocated to CN1, pin 8: Valid for high input | | | | | |
| | | | | | C | Allocated to CN1, pin 9: Valid for high input | | | | | |
| | | | | | D | Allocated to CN1, pin 10: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 11: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 12: Valid for high input | | | | | |
| Pn50B | Input signal selections 2 | 2 | 0 | NOT (reverse drive prohibited input) signal Input terminal allocation | 0 to F | Same as Pn50A.3 | 2 | --- | --- | Offline | Standard setting: 2 |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50C | Input signal selections 3 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| Pn50D | Input signal selections 4 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| Pn50E | Output signal selections 1 | 2 | 0 | INP1 (positioning completed 1) signal output terminal allocation | 0 | Not used. | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | | | 1 | Allocated to CN1 pins 1, 2 | | | | | |
| | | | | | 2 | Allocated to CN1 pins 23, 24 | | | | | |
| | | | | | 3 | Allocated to CN1 pins 25, 26 | | | | | |
| | | | 1 | VCMP (speed conformity) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | TGON (servomotor rotation detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 3 | READY (servo ready) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| Pn50F | Output signal selections 2 | 2 | 0 | CLIMT (current limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 1 | VLIMT (speed limit detection) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 2 | BKIR (brake interlock) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 1 |
| | | | 3 | WARN (warning) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn510 | Output signal selections 3 | 2 | 0 | INP2 (positioning completed 2) signal output terminal allocation | 0 to 3 | Same as Pn50E.0 | 0 | --- | --- | Offline | Standard setting: 0 |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn511 | Input signal selections 5 | 2 | 0 | DEC signal input terminal allocation | 0 | Allocated to CN1, pin 13: Valid for low input | 3 | --- | --- | Offline | Standard setting: 3 |
| | | | | | 1 | Allocated to CN1, pin 7: Valid for low input | | | | | |
| | | | | | 2 | Allocated to CN1, pin 8: Valid for low input | | | | | |
| | | | | | 3 | Allocated to CN1, pin 9: Valid for low input | | | | | |
| | | | | | 4 | Allocated to CN1, pin 10: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 11: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 12: Valid for low input | | | | | |
| | | | | | 7 | Always enabled. | | | | | |
| | | | | | 8 | Always disabled. | | | | | |
| | | | | | 9 | Allocated to CN1, pin 13: Valid for high input | | | | | |
| | | | | | A | Allocated to CN1, pin 7: Valid for high input | | | | | |
| | | | | | B | Allocated to CN1, pin 8: Valid for high input | | | | | |
| | | | | | C | Allocated to CN1, pin 9: Valid for high input | | | | | |
| | | | | | D | Allocated to CN1, pin 10: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 11: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 12: Valid for high input | | | | | |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn511 | Input signal selections 5 | 2 | 1 | EXT1 signal input terminal allocation | 0 to 3 | Always disabled. | 4 | --- | --- | Offline | Standard setting: 4 |
| | | | | | 4 | Allocated to CN1, pin 10: Valid for low input | | | | | |
| | | | | | 5 | Allocated to CN1, pin 11: Valid for low input | | | | | |
| | | | | | 6 | Allocated to CN1, pin 12: Valid for low input | | | | | |
| | | | | | 7 | Always enabled. | | | | | |
| | | | | | 8 | Always disabled. | | | | | |
| | | | | | 9 to C | Always disabled. | | | | | |
| | | | | | D | Allocated to CN1, pin 10: Valid for high input | | | | | |
| | | | | | E | Allocated to CN1, pin 11: Valid for high input | | | | | |
| | | | | | F | Allocated to CN1, pin 12: Valid for high input | | | | | |
| | | | 2 | EXT2 signal input terminal allocation | 0 to F | Same as Pn511.1 | 5 | --- | --- | Offline | Standard setting: 5 |
| | | | 3 | EXT3 signal input terminal allocation | 0 to F | Same as Pn511.1 | 6 | --- | --- | Offline | Standard setting: 6 |
| Pn512 | Output signal reverse | 2 | 0 | Output signal reverse for CN1 pins 1, 2 | 0 | Not reversed. | 0 | --- | --- | Offline | --- |
| | | | | | 1 | Reversed. | | | | | |
| | | | 1 | Output signal reverse for CN1 pins 23, 24 | 0, 1 | Same as above | 0 | --- | --- | Offline | --- |
| | | | 2 | Output signal reverse for CN1 pins 25, 26 | 0, 1 | Same as above | 0 | --- | --- | Offline | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn513 | Not used. | --- | (Do not change the setting.) | | | | 0321 | --- | --- | --- | --- |
| Pn515 | Not used. | --- | (Do not change the setting.) | | | | 8888 | --- | --- | --- | --- |
| Pn51B | Not used. | --- | (Do not change the setting.) | | | | 1000 | --- | --- | --- | --- |
| Pn51E | Deviation counter overflow warning level | 2 | Sets the detection level for the deviation counter overflow warning. | | | | 100 | % | 10 to 100 | Online | --- |
| Pn520 | Deviation counter overflow level | 4 | Sets the deviation counter overflow alarm detection level. | | | | 262144 | Command unit | 1 to 1073741823 | Online | --- |
| Pn522 | Positioning completed range 1 | 4 | Setting range for positioning completed range 1 (INP1) | | | | 3 | Command unit | 0 to 1073741823 | Online | --- |
| Pn524 | Positioning completed range 2 | 4 | Setting range for positioning completed range 2 (INP2) | | | | 3 | Command unit | 1 to 1073741823 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn526 | Deviation counter overflow level at Servo-ON | 4 | Sets the deviation counter overflow alarm detection level for Servo ON. | | | | 262144 | Command unit | 1 to 1073741823 | Online | --- |
| Pn528 | Deviation counter overflow warning level at Servo-ON | 2 | Sets the deviation counter overflow warning detection level for Servo ON. | | | | 100 | % | 10 to 100 | Online | --- |
| Pn529 | Speed limit level at Servo-ON | 2 | Sets the speed limit for when the Servo turns ON with position deviation accumulated. | | | | 10000 | r/min | 0 to 10000 | Online | --- |
| Pn52A | Not used. | --- | (Do not change the setting.) | | | | 20 | --- | --- | --- | --- |
| Pn52F | Not used. | --- | (Do not change the setting.) | | | | FFF | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn530 | Program JOG operation related switches | 2 | 0 | Program JOG operating pattern | 0 | (Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536 | 0 | --- | --- | Online | --- |
| | | | | | 1 | (Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536 | | | | | |
| | | | | | 2 | Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536 (Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536 | | | | | |
| | | | | | 3 | (Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536 (Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536 | | | | | |
| | | | | | 4 | (Waiting time Pn535 → Forward movement Pn531 → Waiting time Pn535 → Reverse movement Pn531) × Number of movement operations Pn536 | | | | | |
| | | | | | 5 | (Waiting time Pn535 → Reverse movement Pn531 → Waiting time Pn535 → Forward movement Pn531) × Number of movement operations Pn536 | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn531 | Program JOG movement distance | 4 | Sets the program JOG movement distance. | | | | 32768 | Command unit | 1 to 1073741824 | Online | --- |
| Pn533 | Program JOG movement speed | 2 | Sets the program JOG operation movement speed. | | | | 500 | r/min | 1 to 10000 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn534 | Program JOG acceleration/deceleration time | 2 | Sets the acceleration/deceleration time for program JOG operation. | | | | 100 | ms | 2 to 10000 | Online | --- |
| Pn535 | Program JOG waiting time | 2 | Sets the delay time from the program JOG operation start input until operation starts. | | | | 100 | ms | 0 to 10000 | Online | --- |
| Pn536 | Number of program JOG movements | 2 | Sets the number of repetitions of the program JOG operations. | | | | 1 | Times | 1 to 1000 | Online | --- |
| Pn540 | Gain limit | 2 | Sets the gain limit. | | | | 2000 | ×0.1 Hz | 10 to 2000 | Online | --- |
| Pn550 | Analog monitor 1 offset voltage | 2 | Sets the analog monitor 1 offset voltage. | | | | 0 | ×0.1 V | −10000 to 10000 | Online | --- |
| Pn551 | Analog monitor 2 offset voltage | 2 | Sets the analog monitor 2 offset voltage. | | | | 0 | ×0.1 V | −10000 to 10000 | Online | --- |

## Other Parameters

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn600 | Regeneration resistor capacity | 2 | Setting for regeneration resistance load ratio monitoring calculations | 0 | ×10 W | 0 to (varies by model) | Online | --- |



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## Control Function Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn800 | Communications control | 2 | 0 | MECHATROLINK communications check mask | 0 | Detects both communications errors (A.E6□) and synchronization errors (A.E5□). | 0 | --- | --- | Online | Always set to 0. |
| | | | | | 1 | Ignores communications errors (A.E6□). | | | | | |
| | | | | | 2 | Ignores synchronization errors (A.E5□). | | | | | |
| | | | | | 3 | Ignores communications errors (A.E6□) and synchronization errors (A.E5□). | | | | | |
| | | | 1 | Warning check mask | 0 | Detects all parameter setting warnings (A.94□), MECHATROLINK command warnings (A.95□), and communications errors (A.96□). | 4 | --- | --- | Online | Always set to 4 or 0. |
| | | | | | 1 | Ignores parameter setting warning (A. 94□). | | | | | |
| | | | | | 2 | Ignores command warning (A. 95□). | | | | | |
| | | | | | 3 | Ignores parameter setting warning (A. 94□) and command warning (A. 95□). | | | | | |
| | | | | | 4 | Ignores communications warning (A. 96□). | | | | | |
| | | | | | 5 | Ignore setting warning (A. 94□) and communications warning (A. 96□). | | | | | |
| | | | | | 6 | Ignores command warning (A. 95□) and communications warning (A. 96□). | | | | | |
| | | | | | 7 | Ignores setting warning (A. 94□), command warning (A. 95□), and communications warning (A. 96□). | | | | | |
| | | | 2 | Communications error count at single transmission | 0 to F | Detects communications errors (A.E60) if they occur consecutively for the set value plus two times. | 0 | --- | --- | Online | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn801 | Function selection application 6 (software LS) | 2 | 0 | Software limit function | 0 | Software limit enabled. | 3 | --- | --- | Online | --- |
| | | | | | 1 | Forward software limit disabled. | | | | | |
| | | | | | 2 | Reverse software limit disabled. | | | | | |
| | | | | | 3 | Forward/reverse software limits disabled. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Software limit check using reference | 0 | No software limit check using reference | 0 | --- | --- | Online | Always set to 0. |
| | | | | | 1 | Software limit check using reference | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn802 | Not used. | --- | (Do not change the setting.) | 0000 | --- | --- | --- | --- |
| Pn803 | Zero point width | 2 | Sets the origin position detection range. | 10 | Command unit | 0 to 250 | Online | --- |
| Pn804 | Forward software limit | 4 | Sets the software limit for the positive direction. | 819,191,808 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn806 | Reverse software limit | 4 | Sets the software limit for the negative direction. | −819,191,808 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn808 | Absolute encoder zero point position offset | 4 | Sets the encoder position and machine coordinate system offsets for when an absolute encoder is used. | 0 | Command unit | −1,073,741,823 to 1,073,741,823 | Offline | --- |
| Pn80A | First step linear acceleration constant | 2 | Sets the step 1 acceleration for when two-step acceleration is used. | 100 | ×10,000 command units/s$^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80B | Second step linear acceleration constant | 2 | Sets the step 2 acceleration for when two-step acceleration is executed, or the one-step acceleration constant for when one-step acceleration is executed. | 100 | ×10,000 command units/s$^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80C | Acceleration constant switching speed | 2 | Sets the switching speed for the step 1 and step 2 acceleration when two-step acceleration is executed. | 0 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn80D | First step linear deceleration constant | 2 | Sets the step 1 deceleration for when two-step deceleration is used. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80E | Second step linear deceleration constant | 2 | Sets the step 2 deceleration for when two-step deceleration is executed, or the one-step deceleration constant for when one-step deceleration is executed. | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80F | Deceleration constant switching speed | 2 | Sets the switching speed for the step 1 and step 2 deceleration when two-step deceleration is executed. | 0 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn810 | Exponential acceleration/ deceleration bias | 2 | Sets the bias for when an exponential filter is used for the position command filter. | 0 | Command units/s | 0 to 32767 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn811 | Exponential acceleration/ deceleration time constant | 2 | Sets the time constant for when an exponential filter is used for the position command filter. | 0 | ×0.1 ms | 0 to 5100 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn812 | Moving average time | 2 | Sets the average movement time for when S-curve acceleration/ deceleration is used, and an average movement filter is used for the position command filter. | 0 | ×0.1 ms | 0 to 5100 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn813 | Reserved. | --- | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn814 | Final travel distance for external positioning | 4 | Sets the distance from the external signal input position when external positioning is executed. | 100 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn816 | Zero point return mode settings | 2 | 0 | Zero point return direction | 0 | Forward direction | 0 | --- | --- | Online | Set the same direction as the origin search direction set in the Axis Parameters.<br>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| | | | | | 1 | Reverse direction | | | | | |
| | | | 1 to 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn817 | Zero point return approach speed 1 | 2 | Sets the origin search speed after the deceleration limit switch signal turns ON. | | | | 50 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn818 | Zero point return approach speed 2 | 2 | Sets the origin search speed after the deceleration limit switch signal turns ON. | | | | 5 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn819 | Final travel distance to return to zero point | 4 | Sets the distance from the latch signal input position to the origin, for when origin search is executed. | | | | 100 | Command unit | −1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn81B to Pn825 | Not used. | --- | (Do not change the setting.) | | | | 0000 | --- | --- | --- | --- |
| Pn900 to Pn910 | Not used. | --- | (Do not change the setting.) | | | | --- | --- | --- | --- | --- |
| Pn920 to Pn95F | Not used. | --- | (Do not change the setting.) | | | | ---- | --- | --- | --- | --- |



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# R7D-ZN□-ML2 SMARTSTEP Junior Servo Driver with Built-in MECHATROLINK-II Communications

## Function Selection Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn000 | Function selection basic switches | 2 | 0 | Reverse rotation | 0 | CCW direction is taken for positive command | 0 | --- | --- | Offline | --- |
| | | | | | 1 | CW direction is taken for negative command | | | | | |
| | | | | | 2 to 3 | Not used. | | | | | |
| | | | 1 | Not used. | 1 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn00A | Filter settings | 2 | Sets the filter time constants.<br>When using this parameter, turn ON bit 4 of SW2 on the SMARTSTEP Junior Servo Driver. | | | | 0000 | --- | 0000 to 000F | Online | --- |

## Position Control Parameters

| Parameter No. | Parameter name | Parameter size | Contents | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|
| Pn20E | Electronic gear ratio G1(numerator) | 4 | Sets the pulse rate for the command pulses and Servomotor travel distance.<br>0.01 ≤ G1/G2 ≤ 100 | 1 | --- | 1 to 1073741824 | Offline | --- |
| Pn210 | Electronic gear ratio G2 (denominator) | 4 | | 1 | --- | 1 to 1073741824 | Offline | --- |

## I/O and Status Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn50A | Input signal selection 1 | 2 | 0 | Not used. | 1 | (Do not change the setting.) | 1 | --- | --- | --- | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | POT (forward drive prohibited input) signal input terminal allocation | 2 | Allocated to CN1, pin 4: Valid for low input | 2 | --- | --- | Offline | Standard setting: 2 |
| | | | | | 8 | Always invalid. | | | | | |
| Pn50B | Input signal selection 2 | 2 | 0 | NOT (reverse drive prohibited input) signal input terminal allocation | 3 | Allocated to CN1, pin 3: Valid for low input | 3 | --- | --- | Offline | Standard setting: 3 |
| | | | | | 8 | Always invalid. | | | | | |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn515 | Input signal selection 7 | 2 | 0 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 1 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| | | | 2 | Emergency stop (STOP) signal input pin allocation | 4 | Allocated to CN1, pin 6: Valid for low input | 4 | --- | --- | Offline | Standard setting: 4 |
| | | | | | 8 | Always invalid. | 8 | | | | |
| | | | 3 | Not used. | 8 | (Do not change the setting.) | 8 | --- | --- | --- | --- |
| Pn522 | Positioning completion range 1 | 4 | Sets the width of the positioning completed range. | | | | 10 | Command unit | 0 to 1,073,741,824 | Online | --- |
| Pn524 | Positioning completion range 2 | 4 | Sets the allowable fluctuation range (rotation speed) for the Speed Conformity Flag. | | | | 100 | Command unit | 0 to 1,0737,41,824 | Online | --- |



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## Control Function Parameters

| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn800 | Communications control | 2 | 0 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 1 | Warning check mask | 0 | Detects all parameter setting warnings (A.94), MECHATROLINK command warnings (A.95), and communications errors (A.96). | 4 | --- | --- | Online | Always set to 4 or 0. |
| | | | | | 1 | Ignores parameter setting warning (A.94). | | | | | |
| | | | | | 2 | Ignores command warning (A.95). | | | | | |
| | | | | | 3 | Ignores setting warning (A.94) and command warning (A.95). | | | | | |
| | | | | | 4 | Ignores communications warning (A.96). | | | | | |
| | | | | | 5 | Ignore setting warning (A.94) and communications errors (A.96). | | | | | |
| | | | | | 6 | Ignores command warnings (A.95) and communications errors (A.96). | | | | | |
| | | | | | 7 | Ignores setting warning (A.94, command warning (A.95), and communications errors (A.96). | | | | | |
| | | | 2 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn801 | Function selection application 6 (software LS) | 2 | 0 | Software limit function | 0 | Software limit enabled. | 3 | --- | --- | Online | --- |
| | | | | | 1 | Forward software limit disabled. | | | | | |
| | | | | | 2 | Reverse software limit disabled. | | | | | |
| | | | | | 3 | Forward/reverse software limits disabled. | | | | | |
| | | | 1 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| | | | 2 | Software limit check using reference | 0 | No software limit check using reference | 0 | --- | --- | Online | Always set to 0. |
| | | | | | 1 | Software limit check using reference | | | | | |
| | | | 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn803 | Zero point width | 2 | Sets the origin position detection range. | | | | 10 | Command unit | 0 to 250 | Online | --- |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn804 | Forward software limit | 4 | Sets the software limit for the positive direction. | | | | 1,073,741,823 | Command unit | –1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn806 | Reverse software limit | 4 | Sets the software limit for the negative direction. | | | | –1,073,741,823 | Command unit | –1,073,741,823 to 1,073,741,823 | Online | --- |
| Pn80B | Linear acceleration constant | 2 | Sets the acceleration constant for the acceleration/deceleration curves for positioning. | | | | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn80E | Linear deceleration constant | 2 | Sets the deceleration constant for the acceleration/deceleration curves for positioning. | | | | 100 | ×10,000 command units/$s^2$ | 1 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn814 | Final travel distance for external positioning | 4 | Sets the distance from the external signal input position when external positioning is executed. | | | | 100 | Command unit | –1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |



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| Parameter No. | Parameter name | Parameter size | Contents | | | | Default setting | Unit | Setting range | Enable setting | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Digit No. | Name | Setting | Explanation | | | | | |
| Pn816 | Zero point return mode settings | 2 | 0 | Zero point return direction | 0 | Forward direction | 0 | | | | Set the same direction as the origin search direction set in the Axis Parameters.<br>Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| | | | | | 1 | Reverse direction | | | | | |
| | | | 1 to 3 | Not used. | 0 | (Do not change the setting.) | 0 | --- | --- | --- | --- |
| Pn817 | Zero point return approach speed 1 | 2 | Sets the origin search speed after the deceleration limit switch signal turns ON. | | | | 50 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn818 | Zero point return approach speed 2 | 2 | Sets the origin search speed after the deceleration limit switch signal turns ON. | | | | 5 | ×100 command units/s | 0 to 65535 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn819 | Final travel distance to return to zero point | 4 | Sets the distance from the latch signal input position to the origin, for when origin search is executed. | | | | 100 | Command unit | –1,073,741,823 to 1,073,741,823 | Online | Settings can be changed when the axes are stopped (Busy Flag for each axis = 0). |
| Pn820 to Pn823 | Not used. | --- | (Do not change the setting.) | | | | 0000 | --- | ---- | --- | --- |



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# Appendix C
## Operation Area I/O Allocations

## Common Operating Memory Area

### Common Operating Output Memory Area Allocations

n = CIO 1500 + (unit number × 25)

| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | n | 00 | --- | UNIT ERROR RESET | ↑: Clears the Unit common error that occurred. |
| | | 01 | Data transfer commands | WRITE DATA | ↑: Starts writing data. |
| | | 02 | | READ DATA | ↑: Starts reading data |
| | | 03 | | SAVE DATA | ↑: Starts saving data |
| | | 04 to 15 | --- | Not used (reserved by the system). | --- |
| | n+1 | 00 | Communications control commands | CONNECT | ↑: Establishes connection.<br>↓: Releases connection. |
| | | 01 to 05 | | Reserved by the system. | --- |
| | | 06 | | WRITE BACKUP DATA | ↑: Starts writing backup data. |
| | | 07 | | READ BACKUP DATA | ↑: Starts reading backup data. |
| | | 08 to 14 | | Not used (reserved by the system). | --- |
| | | 15 | | REJOIN (See note.) | ↑: Starts processing for axes to rejoin the connection. |
| | n+2 | --- | | Axes to connect (See note.) | Sets the following for the axes registered in the scan list (bits 0 to 15 correspond to axes 1 to 16).<br>0: Start MECHATROLINK communications.<br>1: Do no start MECHATROLINK communications. |
| | n+3 to n+5 | --- | --- | Not used (reserved by the system). | --- |



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| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | n+6 | --- | Operating data for data transfer | Number of write words | Specifies the number of words to be written to the PCU. |
| | n+7 | --- | | Write source area | Specifies the area of the data to be written to the PCU.<br>00B0 hex: CIO Area<br>00B1 hex: WR Area<br>00B2 hex: HR Area<br>00B3 hex: AR Area<br>0082 hex: DM Area<br>005□ hex: EM Area<br>□: EM bank No.= 0 to 9, A, B, C |
| | n+8 | --- | | Write source word | Specifies in hexadecimal the beginning word of the area for the data to be written to the PCU. |
| | n+9 | --- | | Write destination address | Specifies the write destination address in the PCU. |
| | n+10 | --- | | Number of read words | Specifies the number of words to be read from the PCU. |
| | n+11 | --- | | Read source address | Specifies the read source address in the PCU. |
| | n+12 | --- | | Read destination area | Specifies the area used to store the data read from the PCU.<br>00B0 hex: CIO Area<br>00B1 hex: WR Area<br>00B2 hex: HR Area<br>00B3 hex: AR Area<br>0082 hex: DM Area<br>005□ hex: EM Area<br>□: EM bank No.= 0 to 9, A, B, C |
| | n+13 | --- | | Read destination word | Specifies in hexadecimal the beginning word of the area where the data read from the PCU is stored. |
| | n+14 | --- | --- | Not used (reserved by the system). | --- |

**Note** The REJOIN Bit and the Axes to Connect parameter are supported for unit version 2.0 or later. The allocated bit and word are not used for earlier unit versions.



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## Common Operating Input Memory Area Allocations

n = CIO 1500 + (unit number × 25)

| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | n+15 | 00 to 11 | PCU common status words | Not used (reserved by the system). | --- |
| | | 12 | | Unit Error Flag | 0: Unit common error has not occurred.<br>1: Unit common error has occurred. |
| | | 13 | | Not used (reserved by the system). | --- |
| | | 14 | | Data Transferring Flag | 0: Powerup, transfer completed, or transfer failed.<br>1: Transferring data. |
| | | 15 | | Not used (reserved by the system). | --- |
| | n+16 | 00 to 11 | | Reserved by the system. | --- |
| | | 12 | | Memory Card Transfer Error | 0: No Memory Card transfer error has occurred.<br>1: A Memory Card transfer error has occurred. |
| | | 13 | | Reserved by the system. | --- |
| | | 14 | | Unit Busy Flag | 0: PCU is not busy.<br>1: PCU is busy. |
| | | 15 | | Connection Status Flag | 0: MECHATROLINK communications stopped.<br>1: MECHATROLINK communications executing. |
| | n+17 to n+20 | --- | --- | Reserved by the system. | --- |
| | n+21 | --- | | Unit error code | Shows the error code for the Unit common error that occurred. |



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| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | n+22 | 00 | Axis communications status bits | Axis 1 communications status | Bits 00 to 15 correspond to the communications status for axes 1 to 16.<br>The bits will turn ON if the corresponding axes registered in the scan list are communicating normally.<br>0: Communications for the corresponding axis have stopped, or the axis not registered in scan list.<br>1: The corresponding axis is communicating. |
| | | 01 | | Axis 2 communications status | |
| | | 02 | | Axis 3 communications status | |
| | | 03 | | Axis 4 communications status | |
| | | 04 | | Axis 5 communications status | |
| | | 05 | | Axis 6 communications status | |
| | | 06 | | Axis 7 communications status | |
| | | 07 | | Axis 8 communications status | |
| | | 08 | | Axis 9 communications status | |
| | | 09 | | Axis 10 communications status | |
| | | 10 | | Axis 11 communications status | |
| | | 11 | | Axis 12 communications status | |
| | | 12 | | Axis 13 communications status | |
| | | 13 | | Axis 14 communications status | |
| | | 14 | | Axis 15 communications status | |
| | | 15 | | Axis 16 communications status | |
| | n+23 to n+24 | --- | --- | Not used (reserved by the system). | --- |



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# Axis Operating Output Memory Area Allocations

a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | a | 00 | Direct operation commands | LINEAR INTERPOLATION SETTING (See note 1.) | ↑: Starts setting linear interpolation. |
| | | 01 | | LINEAR INTERPOLATION START (See note 1.) | ↑: Starts linear interpolation. (Valid only when LINEAR INTERPOLATION SETTING = 1.) |
| | | 02 | | Not used (reserved by the system). | --- |
| | | 03 | | ABSOLUTE MOVEMENT | ↑: Starts absolute movement. |
| | | 04 | | RELATIVE MOVEMENT | ↑: Starts relative movement. |
| | | 05 | | INTERRUPT FEEDING | 1: Enables interrupt feeding. |
| | | 06 | Origin positioning commands | ORIGIN SEARCH | ↑: Starts origin search. |
| | | 07 | | ORIGIN RETURN | ↑: Starts origin return. |
| | | 08 | | PRESENT POSITION PRESET | ↑: Starts present position preset. |
| | | 09 | Commands for special functions | JOG | ↑: Starts jogging.<br>↓: Stops jogging. |
| | | 10 | | Direction designation | 0: Forward rotation direction<br>1: Reverse rotation direction |
| | | 11 | | Not used (reserved by the system). | --- |
| | | 12 | | ERROR RESET | ↑: Clears the axis error that occurred. |
| | | 13 | | DEVIATION COUNTER RESET (See note 4.) | ↑: Starts DEVIATION COUNTER RESET. |
| | | 14 | | Override Enable Bit | 0: Override disabled.<br>1: Override enabled. |
| | | 15 | | DECELERATION STOP | ↑: Starts deceleration stop. |
| | a+1 | 00 | Commands for special functions | SERVO LOCK | ↑:Starts SERVO LOCK. |
| | | 01 | | SERVO UNLOCK | ↑: Starts SERVO UNLOCK. |
| | | 02 | | SPEED CONTROL | ↑: Starts speed control. |
| | | 03 | | TORQUE CONTROL | ↑: Starts torque control. |
| | | 04 to 10 | | Not used (reserved by the system). | --- |
| | | 11 | Servo Parameter transfer commands | DEVICE SETUP | ↑: Starts device setup for the Servo Driver. |
| | | 12 | | WRITE SERVO PARAMETER | ↑: Starts writing Servo Parameter. |
| | | 13 | | READ SERVO PARAMETER | ↑: Starts reading Servo Parameter. |
| | | 14 | | SAVE SERVO PARAMETER | ↑: Starts writing Servo Parameter to non-volatile memory. |
| | | 15 | Special command | EMERGENCY STOP | ↑: Starts emergency stop. |



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| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | a+2 | --- | Operating data for position control | Position command value (rightmost word) | Position command value (rightmost word)<br>Position command value (leftmost word)<br>Unit: command unit |
| | a+3 | --- | | Position command value (leftmost word) | |
| | a+4 | --- | | Speed command value (rightmost word) | Speed command value (rightmost word)<br>Speed command value (leftmost word)<br>Unit: Command units/s |
| | a+5 | --- | | Speed command value (leftmost word) | |
| | a+6 | --- | Speed control data | Speed command value for speed control (rightmost word) | Speed command value (rightmost word)<br>Speed command value (leftmost word)<br>Unit: 0.001% |
| | a+7 | --- | | Speed command value for speed control (leftmost word) | |
| | a+8 | --- | Torque control data | Torque command value (rightmost word) | Torque command value (rightmost word)<br>Torque command value (leftmost word)<br>Unit: 0.001% |
| | a+9 | --- | | Torque command value (leftmost word) | |
| | a+10 | --- | Position/ speed/ torque control data | Option command value 1 (rightmost word) | Linear interpolation:<br>Interpolation acceleration time, Unit: ms<br>Speed control:<br>Torque limit/torque feed forward, Unit: %<br>Torque control:<br>Speed limit, Unit: 0.001% |
| | a+11 | --- | | Option command value 1 (leftmost word) | |
| | a+12 | --- | | Option command value 2 (rightmost word) | Linear interpolation:<br>Interpolation deceleration time, Unit: ms<br>Speed control:<br>Torque limit, Unit: % |
| | a+13 | --- | | Option command value 2 (leftmost word) | |
| | a+14 | --- | Operating data for special function | Override | Override ratio (unit: 0.01%) |
| | a+15 | 00 to 03 | Operating data for expanded monitoring | Monitor 1 type | Specifies monitor type for monitor 1. |
| | | 04 to 07 | | Monitor 2 type | Specifies monitor type for monitor 2. |
| | | 08 to 15 | | Not used (reserved by the system). | --- |



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| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | a+16 | 00 to 02 | --- | Reserved by the system. | --- |
| | | 03 | Acceleration/deceleration curves | Exponential curve designation | 1: Use exponential acceleration/deceleration curve. |
| | | 04 | | S-curve designation | 1: Use S-curve acceleration/deceleration curve. |
| | | 05 to 13 | --- | Reserved by the system. | --- |
| | | 14 | Torque limit | Forward rotation current limit designation | 1: Use forward torque limit. |
| | | 15 | | Reverse rotation current limit designation | 1: Use reverse torque limit. |
| | a+17 | --- | Operating data for transferring Servo Parameters | Servo Parameter No. | Specifies the parameter number of the Servo Driver that will transfer the data. |
| | a+18 | --- | | Parameter size | Specifies the data length of the parameter to be transferred in byte units. |
| | a+19 | --- | | Write data (rightmost word) | Specifies the data to be written to the Servo Driver. |
| | a+20 | --- | | Write data (leftmost word) | |
| | a+21 | 00 | Linear interpolation data | Interpolation axis designation for axis 1 (See note 2.) | Specify the axes for linear interpolation for combinations of axes 1 to 4. Bits 00 to 03 correspond to axes 1 to 4.<br>0: Not an interpolation axis.<br>1: Interpolation axis. |
| | | 01 | | Interpolation axis designation for axis 2 (See note 2.) | |
| | | 02 | | Interpolation axis designation for axis 3 (See note 2.) | |
| | | 03 | | Interpolation axis designation for axis 4 (See note 2.) | |
| | | 04 | | Interpolation axis designation for axis 5 (See note 3.) | Specify the axes for linear interpolation for combinations of axes 5 to 8. Bits 04 to 07 correspond to axes 5 to 8.<br>0: Not an interpolation axis.<br>1: Interpolation axis. |
| | | 05 | | Interpolation axis designation for axis 6 (See note 3.) | |
| | | 06 | | Interpolation axis designation for axis 7 (See note 3.) | |
| | | 07 | | Interpolation axis designation for axis 8 (See note 3.) | |
| | | 08 to 15 | | Not used (reserved by the system). | --- |



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| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Output (CPU Unit to PCU) | a+22 | 00 | Linear interpolation data | Interpolation position designation for axis 1 (See note 2.) | Specify absolute or relative positioning for the axes for linear interpolation. Bits 00 to 03 correspond to axes 1 to 4.<br>0: Absolute positioning<br>1: Relative positioning |
| | | 01 | | Interpolation position designation for axis 2 (See note 2.) | |
| | | 02 | | Interpolation position designation for axis 3 (See note 2.) | |
| | | 03 | | Interpolation position designation for axis 4 (See note 2.) | |
| | | 04 | | Interpolation position designation for axis 5 (See note 3.) | Specify absolute or relative positioning for the axes for linear interpolation. Bits 04 to 07 correspond to axes 5 to 8.<br>0: Absolute positioning<br>1: Relative positioning |
| | | 05 | | Interpolation position designation for axis 6 (See note 3.) | |
| | | 06 | | Interpolation position designation for axis 7 (See note 3.) | |
| | | 07 | | Interpolation position designation for axis 8 (See note 3.) | |
| | | 08 to 15 | | Not used (reserved by the system). | --- |
| | a+23 | --- | | Interpolation speed command value (rightmost word) (See note 1.) | Interpolation speed command value (rightmost word) |
| | a+24 | --- | | Interpolation speed command value (leftmost word) (See note 1.) | Interpolation speed command value (leftmost word)<br>Unit: Command units/s |

**Note** (1) Allocated in Axis Operating Output Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(2) Allocated in Axis Operating Output Memory Area for axis 1 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(3) Allocated in Axis Operating Output Memory Area for axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(4) The DEVIATION COUNTER RESET can be used with unit version 1.3 or later. This bit is not used for earlier unit versions.



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# Axis Operating Input Memory Area Allocations

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | b | 00 | Axis Control Status Flags | Receiving Command Flag | 0: Command reception enabled.<br>↑: Command reception started.<br>1: Receiving command (command reception disabled) |
| | | 01 to 04 | | Not used (reserved by the system). | Always 0. |
| | | 05 | | PCU Positioning Completed Flag | ↑: Positioning is completed. |
| | | 06 | | No Origin Flag | 0: Origin established.<br>1: No origin established. |
| | | 07 | | Origin Stop Flag | 0: Outside origin range.<br>1: Within origin range. |
| | | 08 to 10 | | Not used (reserved by the system). | Always 0. |
| | | 11 | | Warning Flag | 0: No warning has occurred.<br>1: Warning has occurred. |
| | | 12 | | Error Flag | 0: No axis error has occurred.<br>1: Axis error has occurred. |
| | | 13 | | Busy Flag | 0: Axis is not busy.<br>1: Axis is busy. |
| | | 14 | | Servo Parameter Transferring Flag | 0: Powerup, transfer completed, or transfer failed.<br>1: Servo Parameter transferring. |
| | | 15 | | Stop Execution Flag | ↑: Stop operation completed. |



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| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | b+1 | 00 to 02 | Servo Status Flags | Reserved by the system. | Used by the PCU system. |
| | | 03 | | Servo ON Flag (SVON) | 0: Servo unlocked.<br>1: Servo locked. |
| | | 04 | | Main Power ON Flag (PON) | 0: Main circuit power supply OFF<br>1: Main circuit power supply ON |
| | | 05 and 06 | | Reserved by the system. | Used by the PCU system. |
| | | 07 | | Position Completed (PSET) Flag/Speed Conformity (V-CMP) Flag | During position control: Position Completed Flag<br>0: Servo Driver executing position control command or the position is outside *Positioning Completion Range 1*.<br>1: Servo Driver finished executing position control command and the position is within *Positioning Completion Range 1*.<br>During speed control: Speed Conformity Flag<br>0: Speed does not match the speed designation for speed control.<br>1: Speed matches the speed designation for speed control. |
| | | 08 | | Distribution Completed (DEN) Flag/ Zero Speed (ZSPD) Flag | During position control: Distribution Completed Flag<br>0: Servo Driver is executing a position control command.<br>1: Servo Driver has completed executing a position control command.<br>During speed control: Zero Speed Flag<br>0: Not at zero speed.<br>1: Detecting zero speed. |
| | | 09 | | Torque Limit (T_LIM) Status Flag | 0: Torque limit function disabled.<br>1: Torque limit function enabled. |
| | | 10 | | Reserved by the system. | Used by the PCU system. |
| | | 11 | | Positioning Proximity (NEAR) Flag/ Speed Limit (V_LIM) Status Flag | During position control: Positioning Proximity Flag<br>0: Outside *Positioning Completion Range 2*.<br>1: Within *Positioning Completion Range 2*.<br>During torque control: Speed Limit Status Flag<br>0: Speed limit function disabled.<br>1: Speed limit function enabled. |
| | | 12 | | Forward Software Limit Flag (P_SOT) | 0: Within forward software limit range.<br>1: Forward software limit range exceeded. |
| | | 13 | | Reverse Software Limit Flag (N_SOT) | 0: Within reverse software limit range.<br>1: Reverse software limit range exceeded. |
| | | 14 to 15 | | Reserved by the system. | Used by the PCU system. |
| | b+2 | --- | --- | Reserved by the system. | Used by the PCU system. |



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| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | b+3 | 00 | External I/O status | Forward rotation limit input | Returns the status of I/O signals for each axis.<br>1: Signal valid<br>0: Signal invalid<br>The external I/O status shows the enabled/disabled status of signals used for PCU control.<br>This status is different from the electrical ON/OFF status of the I/O signals. |
| | | 01 | | Reverse rotation limit input | |
| | | 02 | | Origin proximity input | |
| | | 03 | | Encoder Phase A input | |
| | | 04 | | Encoder Phase B input | |
| | | 05 | | Encoder Phase Z input | |
| | | 06 | | External latch signal 1 input | |
| | | 07 | | External latch signal 2 input | |
| | | 08 | | External latch signal 3 input | |
| | | 09 | | Brake output | |
| | | 10 | | Emergency stop input (See note 2.) | |
| | | 11 to 15 | | Reserved by the system. | |
| | b+4 | --- | Errors | Axis error code | Displays axis error code/warning code for each axis. |
| | b+5 | 00 to 03 | Expanded monitoring | Monitor 1 type | Shows monitor type for monitor 1. |
| | | 04 to 07 | | Monitor 2 type | Shows monitor type for monitor 2. |
| | | 08 to 15 | | Not used (reserved by the system). | Always 0. |
| | b+6 | --- | Present position | Feedback present position (rightmost word) | Present position:<br>Feedback present position (rightmost word)<br>Feedback present position (leftmost word) |
| | b+7 | --- | | Feedback present position (leftmost word) | |
| | b+8 | --- | | Command present position (rightmost word) | Present position:<br>Command position (rightmost word)<br>Command position (leftmost word) |
| | b+9 | --- | | Command present position (leftmost word) | |
| | b+10 | --- | Expanded monitoring | Monitor 1 (rightmost word) | Monitor value specified for monitor 1 type. |
| | b+11 | --- | | Monitor 1 (leftmost word) | |
| | b+12 | --- | | Monitor 2 (rightmost word) | Monitor value specified for monitor 2 type. |
| | b+13 | --- | | Monitor 2 (leftmost word) | |
| | b+14 | --- | Servo Parameter data | Read data (rightmost word) | Contains the Servo Parameter that was read. |
| | b+15 | --- | | Read data (leftmost word) | |
| | b+16 to b+23 | --- | --- | Not used (reserved by the system). | Always 0. |



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| I/O | Word | Bits | Category | Name | Function |
|---|---|---|---|---|---|
| Input (PCU to CPU Unit) | b+24 | 00 | Linear interpolation status | Linear interpolation setting completed (See note 1.) | 0: Linear interpolation setting will be accepted.<br>↑: Linear interpolation setting accepted.<br>1: Linear interpolation setting completed. (New setting not accepted.) |
| | | 01 to 12 | | Not used (reserved by the system). | Always 0. |
| | | 13 | | Linear interpolation executing (See note 1.) | 1: Linear interpolation operation in progress or linear interpolation command in progress. |
| | | 14 and 15 | | Not used (reserved by the system). | Always 0. |

**Note** (1) Allocated in Axis Operating Input Memory Areas for axis 1 and axis 5 for Position Control Unit Ver. 1.1 or later. These bits are not used in the Axis Operating Output Memory Areas for other axes.

(2) The emergency stop input status is input only for SMARTSTEP Junior Servo Drivers. This status is not used (reserved by the system) for W-series Servo Drivers.



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# Appendix D
## List of Error Codes

## PCU Common Errors

| | Indicator status | | | | | Category | Error name | Error code |
|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | |
| Errors at powerup | Not lit | Not lit | Not lit | Not lit | Not lit | CPU Unit power interruption | Power Interruption | --- |
| | | | | | | Unit system error | Watchdog Timer Operation | --- |
| | Not lit | Not lit | Lit | Not lit | Not lit | Setting error | Unit Number Error | --- |
| | | | | | | | Unit Recognition Incomplete | --- |
| | | | | | | | Data Transfer Error | --- |
| | Not lit | Lit | Not lit | Not lit | Not lit | Unit malfunction | Common Memory Error | --- |
| | Not lit | Lit | Lit | Not lit | Not lit | Unit recognition error | Unit Recognition Error | --- |
| CPU Unit errors | Lit | Flashing | Lit | Not lit | Not lit | CPU Unit error | CPU Fatal Error | 000A |
| | | | | | | | CPU Unit Watchdog Timer Error | 000B |
| | | | | | | | CPU Unit Monitor Error | 000C |
| | | | | | | | Bus Error | 000D |
| PCU internal errors | Lit | Lit | Not lit | Not lit | Not lit | Unit error | MLK Device Error | 0026 |
| | | | | | | | MLK Device Initialization Error | 0030 |
| | | | | | | Data corrupted | Memory Error | 00F1 |
| MECHATROLINK communications errors | Lit | Flashing | Not lit | Lit | Undetermined | Scan list mismatch | MLK Initialization Error | 0020 |
| | | | | | | Communications error | MLK Communications Error | 0025 |
| PCU settings and operations errors | Lit | Flashing | Not lit | Not lit | Undetermined | Illegal operation | Multistart Error | 0021 |
| | | | | | | | FINS Command Monitoring Error | 0024 |
| | | | | | | Illegal data | Write Transfer Error | 0022 |
| | | | | | | | Read Transfer Error | 0023 |
| | | | | | | | Transfer Cycle Setting Error | 0027 |
| | | | | | | | Initialization Common Parameter Check Error | 0028 |
| | | | | | | | Data Transfer Common Parameter Check Error | 0029 |

## Individual Axis Errors

| | Indicator status | | | | | Category | Error name | Error code |
|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | |
| MECHATROLINK communications errors | Lit | Flashing | Not lit | Lit | Undetermined | Communications error | Synchronous Communications Alarm | 3010 |
| | | | | | | | Communications Alarm | 3011 |
| | | | | | | | Command Timeout | 3012 |



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| | Indicator status | | | | | Category | Error name | Error code |
|---|---|---|---|---|---|---|---|---|
| | RUN | ERC | ERH | ERM | MLK | | | |
| PCU settings and operations errors | Lit | Flashing | Not lit | Not lit | Lit | Illegal operation | Present Position Unknown Error | 3030 |
| | | | | | | | Servo Unlock Error | 3040 |
| | | | | | | | Multistart Error | 3050 |
| PCU settings and operations errors | Lit | Flashing | Not lit | Not lit | Lit | Illegal data | Position Designation Error | 3060 |
| | | | | | | | Speed Designation Error | 3061 |
| | | | | | | | Speed Control Speed Designation Error | 3062 |
| | | | | | | | Torque Command Value Error | 3063 |
| | | | | | | | Option Command Value 1 Error | 3064 |
| | | | | | | | Option Command Value 2 Error | 3065 |
| | | | | | | | Override | 3070 |
| | | | | | | | Initialization Axis Parameter Check Error | 3090 |
| | | | | | | | Data Transfer Axis Parameter Check Error | 3091 |
| | | | | | | | Data Setting Error | 3099 |
| MECHATROLINK slave station device errors | Lit | Flashing | Not lit | Flashing | Lit | External sensor input | Forward Rotation Limit Input | 3000 |
| | | | | | | | Reverse Rotation Limit Input | 3001 |
| | | | | | | | Forward Software Limit | 3002 |
| | | | | | | | Reverse Software Limit | 3003 |
| | | | | | | | Emergency Stop Signal Input | 3004 |
| | | | | | | Origin search error | No Origin Proximity or Origin Input Signal | 3020 |
| | | | | | | | Limit Input Already ON | 3021 |
| | | | | | | | Limit Input Signal ON in Both Directions | 3022 |
| | | | | | | Servo Driver error | Drive Main Circuit OFF Error | 3080 |
| | | | | | | MECHATROLINK device alarm | | 4000 + Alarm code for each device |

# Alarm Displays for Servo Drivers

The following table lists the alarm displays for Servo Drivers.

When an alarm or warning occurs for one of the connected MECHATROLINK slave station devices, the PCU turns ON the Error Flag or Warning Flag and returns the following error code.

Error code: 40□□ hex

The boxes (□□) indicate the alarm/warning display number for the Servo Driver.

When using an R88D-WN□-ML2 W-series Servo Driver with built-in MECHATROLINK-II communications, however, only the upper two digits of the display number's three digits will be displayed.

The alarms that occur in the Servo Driver correspond to error codes that are detected by the PCU when a MECHATROLINK communications connection has been established, as shown in the following table.



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When using an R88D-WT□ Servo Driver, the two digits following "A." in the Servo Driver's display number in the table are displayed. When using an R88D-WN□-ML2 W-series Servo Driver, three digits are displayed (the value indicated by the display number box is used to further classify the alarm).

For details on each alarm and countermeasures, refer to the operation manual for the Servo Driver being used.

## Alarm Display

| Servo Driver display | PCU error code | Error detection function | Detected error or cause of error |
|---|---|---|---|
| A.02□ | 4002 | Parameter corrupted | Parameter checksum read from EEPROM does not match. |
| A.03□ | 4003 | Main circuit detection error | Error in detection data for power supply circuit |
| A.04□ | 4004 | Parameter setting error | The parameter setting is incorrect. |
| A.05□ | 4005 | Servomotor mismatch | The Servomotor and Servo Driver combination is incorrect. |
| A0b□ (See note 3.) | 400B | Servo ON command disabled | The PCU sent a SERVO LOCK command when the Servo ON function was being used from personal computer monitoring software |
| A.10□ | 4010 | Overcurrent | An overcurrent has occurred or the radiation shield has overheated (1.5- to 3-kW models only). |
| A.28 (See note 4.) | (See note 4.) | Emergency stop | The emergency stop signal was input while the motor was operating. |
| A.30□ (See note 5.) | 4030 | Regeneration error | The regenerative circuit is damaged due to large regenerative energy. |
| A.32□ (See note 5.) | 4032 | Regeneration overload | The regenerative energy has exceeded the regeneration resistor capacity. |
| A.33□ (See note 5.) | 4033 | Main-circuit power supply setting error | The setting of Pn001.2 (AC/DC input selection) and the AC/DC wiring method used for the main circuit power supply are not the same. |
| A.40□ | 4040 | Overvoltage | The main circuit DC voltage has exceeded the specified values. |
| A.41□ | 4041 | Undervoltage | The main circuit DC voltage is under the specified values. |
| A.51□ | 4051 | Overspeed | The Servomotor rotation speed has exceeded the maximum rotation speed. |
| A52□ (See note 3.) | 4052 | Fluctuation or autotuning alarm | An abnormal fluctuation was detected in the Servomotor rotation speed, or the inertia ratio calculation during autotuning was abnormal. |
| A.71□ | 4071 | Overload | Operating with output torque exceeding 245% of the rated torque for a W-series Servo Driver or exceeding 200% of the rated torque for a SMARTSTEP Junior Servo Driver. |
| A.72□ | 4072 | Overload | Operation continuing with output torque at 120% to 245% of the rated torque for a W-series Servo Driver or at 115% to 200% of the rated torque for a SMARTSTEP Junior Servo Driver. |
| A.73□ | 4073 | Dynamic brake overload | The rotary energy has exceeded the dynamic brake resistor capacity during dynamic brake operation. |
| A.74□ (See note 5.) | 4074 | Inrush resistance overload | The inrush current when power was turned ON exceeded the inrush resistor capacity. |
| A.7A□ | 407A | Overheat | Overheating in the radiation shield was detected or the cooling fan in the Servo Driver has stopped. |
| A.81□ (See note 5.) | 4081 | Backup error (Absolute encoders only) | The encoder's backup power supply has fallen. |
| A.82□ (See note 5.) | 4082 | Checksum error (Absolute encoders only) | An encoder memory checksum error has occurred. |
| A.83□ (See note 5.) | 4083 | Battery error (Absolute encoders only) | The encoder's battery voltage has fallen (to 2.7 V or lower). |
| A.84□ (See note 5.) | 4084 | Absolute error (Absolute encoders only) | An internal encoder data error has occurred. |
| A.85□ (See note 5.) | 4085 | Overspeed error (Absolute encoders only) | The Servomotor is rotating at 200 r/min. or more when the encoder power supply is turned ON. |



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| Servo Driver display | PCU error code | Error detection function | Detected error or cause of error |
|---|---|---|---|
| A.86□ (See note 5.) | 4086 | Encoder overheating (Absolute encoders only) | Overheating in the encoder was detected. |
| A.b1 (See note 2.) | 40B1 | Speed command input reading error | The A/D completion signal from the A/D converter is not being output within the fixed interval. |
| A.b2 (See note 2.) | 40B2 | Torque command input reading error | The A/D completion signal from the A/D converter is not being output within the fixed interval. |
| A.b3□ (See note 3.) | 40B3 | Current detection error | The Servo Driver's current detector is faulty. |
| A.b6□ | 40B6 | LSI for communications corrupted | The LSI used for MECHATROLINK communications is corrupted. |
| A.bF□ | 40BF | System error | A system error in the control circuit was detected. |
| A.C1□ | 40C1 | Runaway detected | The Servomotor rotated in the opposite direction to the command. |
| A.C2 (See note 4.) | 40C2 | Phase detection error | A Servomotor magnetic pole signal was incorrectly detected. |
| A.C5 (See note 4.) | 40C5 | Magnetic pole detection error | A Servomotor magnetic pole signal was incorrectly detected. |
| A.C8□ (See note 5.) | 40C8 | Multi-turn data error (Absolute encoders only) | The absolute encoder setup is incorrect. |
| A.C9□ | 40C9 | Encoder communications error | Communications between the encoder and Servo Driver are not possible. |
| A.CA□ (See note 5.) | 40CA | Encoder parameter error | The parameter settings in the encoder are corrupted. |
| A.Cb□ (See note 5.) | 40CB | Encoder data error | Data from the encoder is corrupted. |
| A.CC□ (See note 5.) | 40CC | Multi-turn limit discrepancy (Absolute encoders only) | The absolute encoder multi-turn limit for the encoder and Servo Driver do not match. |
| A.d0□ (See note 5.) | 40D0 | Deviation counter overflow | The number of pulses in the deviation counter has exceeded the deviation counter overflow level set in Pn505 (R88D-WT□) or Pn520 (R88D-WN□-ML2). |
| A.d1□ (See note 5.) | 40D1 | Motor-load deviation over | The deviation between the fully-closed encoder and semi-closed encoder has reached or exceeded the command unit set in Pn51A. |
| A.E0□ | See note 1. | No option or Servo Driver error | The MECHATROLINK-II Application Module is not installed, or the Servo Driver has malfunctioned. |
| A.E1 (See note 2.) | See note 1. | Option timeout | There is no response from the MECHATROLINK-II Application Module. |
| A.E2 (See note 2.) | See note 1. | Option WDC error | An error has occurred in the MECHATROLINK-II Application Module.<br>(MECHATROLINK-II Application Module's watchdog timer count) |
| A.E4□ (See notes 3 and 4.) | 40E4 | Transfer cycle setting error | MECHATROLINK-II transfer cycle setting is incorrect. |
| A.E5□ | 40E5 | Synchronization error | MECHATROLINK-II synchronization error |
| A.E6□ | 40E6 | Communications error | MECHATROLINK-II communications error<br>(Continuous communications errors have occurred.) |
| A.EA□ | 40EA | Servo Driver malfunction | The Servo Driver has malfunctioned. |
| A.EB (See note 2.) | 40EB | Servo Driver initial access error | The Servo Driver initial processing cannot be executed from the MECHATROLINK-II Application Module. |
| A.EC (See note 2.) | 40EC | Servo Driver error | An error has occurred in the Servo Driver.<br>(Servo Driver's watchdog timer count) |
| A.Ed□ | 40ED | Command execution incomplete | MECHATROLINK communications command aborted during execution. |



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| Servo Driver display | PCU error code | Error detection function | Detected error or cause of error |
|---|---|---|---|
| A.F1□ (See note 5.) | 40F1 | Missing phase detected | Main circuit power supply phase is missing, or the wire is burnt out. |
| A.F5 (See note 2.) | 40F5 | Motor current error | The current to the Servomotor is too small for the torque command from the Servo Driver. |
| A.F6 (See note 2.) | 40F6 | Motor conduction error | The Servo is ON, but the Servomotor is not conducting current regardless of the Servo Driver settings and external input. |

**Note** (1) Errors that occur in the MECHATROLINK-II Application Module cannot be detected by the PCU because the communications connection is not established. The PCU is not able to detect the corresponding axis during execution of CONNECT, so an MLK Initialization Error (Unit error code: 0020 hex) will occur.

(2) This alarm occurs when using an R88D-WT□ W-series Servo Driver together with the JUSP-NS115 MECHATROLINK-II Application Module.

(3) This alarm occurs when using an R88D-WN□-ML2 W-series Servo Driver.

(4) This alarm may occur when a SMARTSTEP Junior Servo Driver (R7D-ZN□-ML2) is being used. The A.28 (emergency stop) alarm is treated as an emergency stop signal input error (axis error code: 3004 (hex) in the Position Control Unit and the Servo will be unlocked for the axis.

(5) This alarm is not detected for SMARTSTEP Junior Servo Drivers (R7D-ZN□-ML2).

## Warning Display

| Servo Driver display | PCU error code | Warning detection function | Warning details |
|---|---|---|---|
| A.90□ (See note 1.) | 4090 | Deviation counter overflow | The number of pulses in the deviation counter has exceeded the deviation counter overflow level set in Pn505 (when using R88D-WT□) or Pn520 (when using R88D-WN□-ML2) multiplied by the rate (%) set in Pn51E. |
| A.91□ | 4091 | Overload or fluctuation | This warning occurs before the Overload Alarm (A.71□, A.72□) occurs. If operation is continued in this state, an alarm may occur.This warning also occurs when an abnormal fluctuation is detected in the Servomotor rotation speed. |
| A.92□ (See note 1.) | 4092 | Regeneration overload | This warning occurs before the Regeneration Overload Alarm (A.32) occurs. If operation is continued in this state, an alarm may occur. |
| A.93□ (See note 1.) | 4093 | Battery warning (Absolute encoders only) | This warning occurs before the Battery Error (A.83) occurs. If the power is turned OFF, an alarm may occur the next time the power is turned ON. (Replace the battery while the control circuit power supply is ON.) |
| A.94□ | See note 2. | Parameter setting warning | A value outside the setting range has been set for the MECHATROLINK slave station device. |
| A.95□ | See note 2. | MECHATROLINK-II command warning | An illegal communications command or unsupported communications command has been sent to the MECHATROLINK slave station device. |
| A.96□ | 4096 | Communications warning | A single MECHATROLINK-II communications error has occurred. (See note 3.) |

**Note** (1) This warning is not detected for SMARTSTEP Junior Servo Drivers (R7D-ZN□-ML2).

(2) If a Parameter Setting Warning or MECHATROLINK-II Command Warning occurs in the Servo Driver, a data setting error (axis error code: 3099 hex) will occur at the PCU, and the active axis in which the error occurred will decelerate to a stop.

(3) If a MECHATROLINK-II communications error occurs once independently, a communications warning occurs, and the PCU will perform a communications retry. If the communications warning occurs continually, a communications error will occur.



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# Appendix E
## Changing to CS1W/CJ1W-NCF71 from CS1W/CJ1W-NC113/133/213/233/413/433

The settings and methods for using CS1W/CJ1W-NCF71 Position Control Units include those that are different from the pulse-output models (CS1W/CJ1W-NC113/133/213/233/413/433).

The following information is important when replacing equipment that uses pulse-output PCUs and pulse-input Servo Drivers or Stepping Motor Drives with the CS1W/CJ1W-NCF71 PCU and MECHATROLINK-II-compatible Servo Driver.

## Installation

- The Yaskawa JUSP-NS115 MECHATROLINK-II Application Module must be installed when using an R88D-WT□ OMRON W-series Servo Driver (without built-in MECHATROLINK-II communications). The JUSP-NS115 is installed on the right side of the Servo Driver, so make sure that sufficient space is provided around the Servo Driver.
- R88D-WT□ W-series Servo Drivers must be Ver.39 or later. The Servo Driver must be changed if an earlier version is being used. The Servomotor, power cables, and encoder cables, however, can be used as is without changing.

## Wiring

- MECHATROLINK-II Cables are used for the connection between the PCU and Servo Driver (MECHATROLINK-II Application Module). The cables for pulse-output PCUs and Servo Relay Units cannot be used.
- The external sensor signals, such as limit inputs and origin proximity inputs, are connected to the Servo Driver's control I/O connector (CN1). The Servo Driver's CN1 connector must be wired.
- Emergency stop input signals are not provided as external input signals for the PCU or Servo Driver. To ensure safety in the system, provide safety measures in external circuits (i.e., not in the Programmable Controller or Position Control Unit), such as using a breaker for the Servo Driver's main circuit power supply.
- To perform an origin search, the origin proximity input signal must be used. Make sure that the dog width of the limit input signal and origin proximity input signal remains at the length of the MECHATROLINK-II communications cycle or longer.

## System Configuration

Pulse-output PCUs are classified as CS/CJ-series Special I/O Units, whereas CS1W/CJ1W-NCF71 PCUs are classified as CS/CJ-series CPU Bus Units. Make sure that the PCU's unit number is not already used by another CPU Bus Unit and that the area allocated to the PCU in the PLC is not occupied by another Unit.



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# PCU Parameters and Operating Data

The functions and classification of the PCU's parameters and operating data are shown in the following table.

| CS1W/CJ1W-NC113/133/213/233/413/433 | | CS1W/CJ1W-NCF71 | |
|---|---|---|---|
| **Item** | **Setting** | **Item** | **Setting** |
| Common Parameter Area | Used to allocate the Operating Data Area and designates the Axis Parameters.<br>The area is set in the PLC's DM Area words allocated to Special I/O Units. | Common Parameter Area | Used to allocate the Axis Operating Memory Areas and MECHATROLINK communications settings.<br>The settings are written to the PCU's internal memory using the data transfer functions. |
| Axis Parameter Area | Used to allocate each Axis's operating mode, maximum speed, and software limits.<br>The area is set in the PLC's DM Area words allocated to Special I/O Units or in the PCU's internal memory. | Axis Parameter Areas<br>Axis Operating Memory Area<br>Servo Parameter Area | The Axis Parameter Areas are used to select operating modes (origin search) and input signals.<br>The settings are written to the PCU's internal memory using the data transfer functions.<br>Some Axis Parameters are set as command values in the Axis Operating Memory Areas and are used as operating data.<br>Other existing PCU Axis Parameters are set to the corresponding Servo Parameters. |
| Operating Memory Area | Used to input and output bit data, such as operating command outputs and status (flags) inputs.<br>The area is allocated in the Special I/O Unit Area and is determined according to the unit number set for the PCU. | Axis Operating Memory Area<br>Servo Parameter Area | The I/O information (bit and word data) is handled in the Axis Operating Output Memory Areas and Axis Operating Input Memory Areas as output data and input data, respectively.<br>The Axis Operating Output Memory Areas and Axis Operating Input Memory Areas are allocated in the PLC's memory according to the settings in the Common Parameters.<br>Acceleration/deceleration data is set in the Servo Parameters. |
| Operating Memory Data | Used to input and output parameter data, such as position command value outputs and present position inputs.<br>The area is allocated in the PLC's DM Area according to the setting in the Common Parameter Area. | | |
| Memory operation data | Used to set the position/speed data for memory operations.<br>The settings are written to the PCU's internal memory using the data transfer functions. | --- | Memory operation functions are not provided. |
| Zone data | Used to set the zones.<br>The settings are written to the PCU's internal memory using the data transfer functions. | --- | A zone function is not provided. |
| --- | --- | Common Operating Memory Area | Performs operations common to the PCU such as MECHATROLINK communications control.<br>The allocated area is contained in the PLC's CPU Bus Unit Memory Area according to the PCU's unit number. |

A comparison of individual parameters and operating data, and operating precautions are provided in the following pages.



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## Common Parameter Area

| CS1W/CJ1W-NC113/133/213/233/413/433 | | CS1W/CJ1W-NCF71 | |
|---|---|---|---|
| | **Setting** | | **Setting** |
| m | Operating Data Area designation | Common Parameter Area | Used to allocate Axis Operating Memory Areas and to perform MECHATROLINK communications settings.<br>The settings are written to the PCU's internal memory using the data transfer functions. |
| m+1 | Beginning word of the Operating Data Area | | |
| m+2 | Axis Parameters designation | | |

## Axis Parameter Area

To use data in the CS1W/CJ1W-NCF71 that was set as Axis Parameters in the earlier PCUs, the data must be converted either to corresponding settings in the Axis Parameter Area and Servo Parameter Area, or assigned in the Axis Operating Output Memory Area as command values used as operating data.

The setting location in the CS1W/CJ1W-NCF71 corresponding to the Axis Parameters in earlier PCUs and the differences between the different parameters is shown in the following table.

The Axis Parameter addresses shown for CS1W/CJ1W-NC113/133/213/233/413/433 are those for the X axis. The setting locations in the CS1W/CJ1W-NCF71 indicated as word d in the Axis Parameters and word a in the Axis Operating Output Memory Area can be calculated using the following equations.

d = 1860 hex + (Axis No. −1) × 14 hex

a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

| CS1W/CJ1W-NC113/133/213/233/413/433 | | | | CS1W/CJ1W-NCF71 | | |
|---|---|---|---|---|---|---|
| **Word** | **Name** | **Bit** | **Setting** | **Setting location** | | **Difference** |
| 0004 | I/O settings | 00 | Output pulse selection | --- | --- | Output pulse selection is not provided, so this parameter setting is not available. |
| | | 01 to 03 | Not used. | --- | --- | --- |
| | | 04 | Limit input signal type | Servo Parameter Area | Pn50A.3<br>Pn50B.0 | Sets the input signal logic using the input allocations for the forward/reverse drive prohibited signals. |
| | | 05 | Origin proximity input signal type | Servo Parameter Area | Pn511.0 | Sets the input signal logic using the input allocations for the origin return deceleration LS signals. |
| | | 06 | Origin input signal type | Servo Parameter Area | Pn511.1<br>Pn511.2<br>Pn511.3 | Sets the input signal logic according to the input allocations for the external latch signal when external latch signal is selected as the origin input signal. This setting is not available when the Servomotor phase Z signal is selected as the origin input signal. |
| | | 07 | Emergency stop input signal | --- | --- | An emergency stop input signal is not provided, so this parameter is not available.<br>The stop methods used for limit inputs and software limits, however, can be specified in Servo Parameter Pn001.1. (For details, refer to *7-5 Limit Input Operations*.) |
| | | 08 | Origin undefined designation | --- | --- | This parameter setting is not available.<br>The Servo Driver's feedback position is obtained. Therefore, the origin is not lost even when operation stops due to an external sensor. |
| | | 09 to 15 | Not used. | --- | --- | --- |



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| CS1W/CJ1W-NC113/133/213/233/413/433 | | | | CS1W/CJ1W-NCF71 | | |
|---|---|---|---|---|---|---|
| **Word** | **Name** | **Bit** | **Setting** | **Setting location** | | **Difference** |
| 0005 | Operation mode selection | 00 to 03 | Operation mode | Axis Parameter Area word d+1 | Bits 00 to 03 | Not used. Operation mode selection is not provided, so this parameter setting is not available. |
| | | 04 to 07 | Origin search operation | | Bits 04 to 07 | This parameter setting is the same. |
| | | 08 to 11 | Origin detection method | | Bits 08 to 11 | Not used. Origin searches always use the origin proximity input signal. The origin detection method is fixed as the method that receives the origin input signal after the origin proximity input signal turns from ON to OFF. (This method corresponds with the setting when the origin detection method in the earlier PCUs is set to 0.) |
| | | 12 to 15 | Origin search direction | | Bits 12 to 15 | This parameter setting is the same. Servo Parameter Pn816 (zero point return direction), however, must be set at the same time to the same setting as for this parameter. (For details, refer to *8-2-3 Data Settings Required for Origin Search*.) |
| 0006 | Maximum speed (rightmost word) | | | --- | --- | A maximum speed setting is not provided. The maximum speed is clamped at approximately 110% when a speed command is sent for a value that is equal or higher than the Servo Driver's (Servomotor's) maximum speed. |
| 0007 | Maximum speed (leftmost word) | | | | | |
| 0008 | Initial speed (rightmost word) | | | --- | --- | An initial speed setting is not provided. The acceleration/deceleration settings, however, enable two-step acceleration/deceleration curves and exponential acceleration/deceleration curves with bias. (For details, refer to *7-4 Acceleration and Deceleration Operations*.) |
| 0009 | Initial speed (leftmost word) | | | | | |
| 000A | Origin search high speed (rightmost word) | | | Axis Operating Output Memory Areas | Word a+4 Word a+5 | The origin search high speed is the speed command value for origin searches and is designated with the operating command in the Axis Operating Output Memory Areas. |
| 000B | Origin search high speed (leftmost word) | | | | | |
| 000C | Origin search proximity speed (rightmost word) | | | Servo Parameter Area | Pn817 Pn818 | Sets the Servo Parameters Pn817 (zero point return approach speed 1) and Pn818 (zero point return approach speed 2). The setting unit is ×100 command units/s. (For details, refer to *8-2-3 Data Settings Required for Origin Search*.) |
| 000D | Origin search proximity speed (leftmost word) | | | | | |
| 000E | Origin compensation value (rightmost word) | | | Servo Parameter Area | Pn819 Pn81A | The amount of compensation positioning after detection of the origin input signal is set in Servo Parameter Pn819 (final travel distance to return to zero point). (For details, refer to *8-2-3 Data Settings Required for Origin Search*.) |
| 000F | Origin compensation value (leftmost word) | | | | | |



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| CS1W/CJ1W-NC113/133/213/233/413/433 | | | | CS1W/CJ1W-NCF71 | | |
|---|---|---|---|---|---|---|
| **Word** | **Name** | **Bit** | **Setting** | **Setting location** | | **Difference** |
| 0010 | Backlash compensation | | | Servo Parameter Area | Pn81B<br>Pn81D.0<br>Pn207.2<br>Pn214 | The backlash compensation is set in Servo Parameters Pn81B (backlash compensation amount) and Pn81D.0 (backlash compensation direction) when using R88D-WT□ Servo Drivers and in Pn207.2 (backlash compensation selection) and Pn214 (backlash compensation amount) when using R88D-WN□-ML2 Servo Drivers. (For details, refer to *10-7 Backlash Compensation*.) |
| 0011 | Backlash compensation speed (rightmost word) | | | --- | --- | Backlash compensation is executed by adding it to the amount of movement for positioning, so these parameter settings are not supported. |
| 0012 | Backlash compensation speed (leftmost word) | | | | | |
| 0013 | Acceleration/deceleration curves | | | Axis Operating Output Memory Areas | Word a+16, bits 03 to 04 | The acceleration/deceleration curves are designated with the operating command in the Axis Operating Output Memory Areas as command values for executing positioning operations. |
| 0014 | Origin search acceleration time (rightmost word) | | | Servo Parameter Area | Pn80A<br>Pn80B<br>Pn80C | The acceleration used for origin searches is the same as that used in other positioning operations and is set according to the combination of settings in Servo Parameters Pn80A, Pn80B, and Pn80C. (For details, refer to *7-4 Acceleration and Deceleration Operations*.) |
| 0015 | Origin search acceleration time (leftmost word) | | | | | |
| 0016 | Origin search deceleration time (rightmost word) | | | Servo Parameter Area | Pn80D<br>Pn80E<br>Pn80F | The deceleration used for origin searches is the same as that used in other positioning operations and is set according to the combination of settings in Servo Parameters Pn80D, Pn80E, and Pn80F. (For details, refer to *7-4 Acceleration and Deceleration Operations*.) |
| 0017 | Origin search deceleration time (leftmost word) | | | | | |
| 0018 | Positioning monitor time | | | --- | --- | A positioning monitor is not provided, so this parameter setting is not available.<br>Refer to the programming examples and set a timing monitor in the user program. (Refer to *11-2-6 Positioning (Absolute Movement or Relative Movement)*.) |
| 0019 | CCW software limit (rightmost word) | | | Servo Parameter Area | Pn804<br>Pn805 | The forward software limit is set in Servo Parameters Pn804 and Pn805 in command units. (For details, refer to *10-8 Software Limits*.) |
| 001A | CCW software limit (leftmost word) | | | | | |
| 001B | CW software limit (rightmost word) | | | Servo Parameter Area | Pn806<br>Pn807 | The reverse software limit is set in Servo Parameters Pn806 and Pn807 in command units. (For details, refer to *10-8 Software Limits*.) |
| 001C | CW software limit (leftmost word) | | | | | |
| 001D | Reserved by the system. | | | --- | --- | --- |
| 001E | Reserved by the system. | | | --- | --- | --- |
| 001F | Initial pulse designation | | | --- | --- | Initial pulse designation is not provided, so this parameter setting is not available. |



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## Operating Memory Area

In the CS1W/CJ1W-NCF71 PCU, the Operating Memory Area allocations and functions have changed, as shown in the following table.

A comparison of the functions of these words is provided in the following table. The differences between the functions, such as in axis operations executed by the Operating Memory Area words, are explained later in this appendix.

Operating Memory Area words for CS1W/CJ1W-NC113/133/213/233/413/433 PCUs are shown in the following table as those for the X axis of the CS1W/CJ1W-NC113 PCU, and the beginning word n is calculated using the following equation.

n = 2000 + (unit number × 10)

The Operating Memory Area words for CS1W/CJ1W-NCF71 PCUs are calculated for each axis using the following equation.

a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

| I/O | CS1W/CJ1W-NC113/133/213/233/413/433 | | | | CS1W/CJ1W-NCF71 | | |
|---|---|---|---|---|---|---|---|
| | Word | Bits | Category | Name | Word | Bits | Differences |
| Output (CPU Unit to PCU) | n | 00 | Memory operation commands | Sequence Number Enable | a | 00 | Used as linear interpolation command bits. Memory operation functions are not provided, so memory operation command bits are not allocated. |
| | | 01 | | START | | 01 | |
| | | 02 | | INDEPENDENT START | | 02 | |
| | | 03 | Direct operation commands | ABSOLUTE MOVEMENT | | 03 | The function of this bit is the same. |
| | | 04 | | RELATIVE MOVEMENT | | 04 | The function of this bit is the same. |
| | | 05 | | INTERRUPT FEEDING | | 05 | The method for starting interrupt feeding has been changed. This bit is an Interrupt Feeding Designation Bit for ABSOLUTE/RELATIVE MOVEMENT, and is used together with ABSOLUTE/RELATIVE MOVEMENT bits. |
| | | 06 | Origin positioning commands | ORIGIN SEARCH | | 06 | The function of this bit is the same. |
| | | 07 | | ORIGIN RETURN | | 07 | The function of this bit is the same. |
| | | 08 | | PRESENT POSITION PRESET | | 08 | The function of this bit is the same. When the DECELERATION STOP Bit is ON, however, PRESENT POSITION PRESET cannot be received. |



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| I/O | CS1W/CJ1W-NC113/133/213/233/413/433 | | | | CS1W/CJ1W-NCF71 | | |
|---|---|---|---|---|---|---|---|
| | Word | Bits | Category | Name | Word | Bits | Differences |
| Output (CPU Unit to PCU) | n | 09 | Commands for special functions | JOG | a | 09 | The function of this bit is the same. |
| | | 10 | | Direction designation | | 10 | The function of this bit is the same for JOG direction. The rotation direction cannot be designated for interrupt feeding. |
| | | 11 | | TEACH | | 11 | Not used.<br>A teaching function is not provided, so this bit is not allocated. |
| | | 12 | | ERROR RESET/RELEASE PROHIBIT | | 12 | The function of this bit is the same for resetting errors that occur in individual axes.<br>The function to release prohibit on pulse outputs is not provided.<br>The function to reset Unit common errors is allocated in the Common Operating Memory Area. |
| | | 13 | | Deviation counter reset output/origin-adjustment command output | | 13 | Same bit function as the deviation counter reset for PCUs with unit versions 1.3 or later. This function, however, does not turn on the deviation counter reset output but rather starts the DEVIATION COUNTER RESET command.<br>(For PCUs with unit versions 1.2 or earlier, counter reset output and origin-adjustment command output functions are not provided, so this bit is not allocated.) |
| | | 14 | | Override Enable | | 14 | The function of this bit is the same. |
| | | 15 | | (DECELERATION) STOP | | 15 | The function of this bit is the same. |
| | n+1 | 00 | | Not used. | a+1 | 00 | Used as the SERVO LOCK Bit. |
| | | 01 | | Not used. | | 01 | Used as the SERVO UNLOCK Bit. |
| | | 02 | | Not used. | | 02 | Used as the SPEED CONTROL Bit. |
| | | 03 | | Not used. | | 03 | Used as the TORQUE CONTROL Bit. |
| | | 04 to 07 | | Not used. | | 04 to 07 | Not used. |
| | | 08 | | FORCED INTERRUPT | | 08 | Not used.<br>A forced interrupt start function is not provided, so this bit is not allocated. |
| | | 09 to 10 | | Not used. | | 09 to 10 | Not used. |
| | | 11 | | Not used. | | 11 | Used as the DEVICE SETUP Bit. |
| | | 12 | Data transfer commands | WRITE DATA | | 12 | Used as the WRITE SERVO PARAMETER Bit.<br>The PCU's WRITE DATA Bit is allocated in the Common Operating Memory Area. |
| | | 13 | | READ DATA | | 13 | Used as the READ SERVO PARAMETER Bit.<br>The PCU's READ DATA Bit is allocated in the Common Operating Memory Area. |
| | | 14 | | SAVE DATA | | 14 | Used as the SAVE SERVO PARAMETER Bit.<br>The PCU's SAVE DATA Bit is allocated in the Common Operating Memory Area. |



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| I/O | CS1W/CJ1W-NC113/133/213/233/413/433 | | | | CS1W/CJ1W-NCF71 | | |
|---|---|---|---|---|---|---|---|
| | Word | Bits | Category | Name | Word | Bits | Differences |
| Output (CPU Unit to PCU) | n+1 | 15 | Data transfer commands | Not used. | a+1 | 15 | Used as the EMERGENCY STOP Bit. The Servomotor stops after moving for the amount of pulses remaining the Servo Driver's deviation counter when this bit turns ON. |
| Input (PCU to CPU Unit) | n+2 | 00 | PCU status | Not used. | b | 00 | Used as the Receiving Command Flag. |
| | | 01 to 03 | | Not used. | | 01 to 03 | Not used. |
| | | 04 | | Waiting for Memory Operation Flag | | 04 | Not used.<br>Memory operation functions are not provided, so this bit is not allocated. |
| | | 05 | | Positioning Completed Flag | | 05 | The function of this bit is the same.<br>Name: PCU Positioning Completed Flag |
| | | 06 | | No Origin Flag | | 06 | The function of this bit is the same.<br>The conditions whereby the origin is lost after being established are different from earlier PCUs. |
| | | 07 | | Origin Stop Flag | | 07 | This flag functions in the same way, showing whether the present position is within the origin positioning range (zero point width). This flag turns ON when the origin is passed, which is different from earlier PCUs. |
| | | 08 | | Zone 0 Monitor Flag | | 08 | Not used.<br>A zone function is not provided, so these bits are not allocated. |
| | | 09 | | Zone 1 Monitor Flag | | 09 | |
| | | 10 | | Zone 2 Monitor Flag | | 10 | |
| | | 11 | | Teaching Completed Flag | | 11 | A teaching function is not provided.<br>This bit is used as a Warning Flag. |
| | | 12 | | Error Flag | | 12 | The function of this bit is the same for errors that occur in individual axes.<br>The error flags for Unit common errors are allocated as Unit Error Flags in the Common Operating Memory Area. |
| | | 13 | | Busy Flag | | 13 | The function of this bit is the same for indicating busy status of functions for individual axes.<br>The busy status for Unit common functions (including Unit initial processing) is allocated as Unit Busy Flags in the Common Operating Memory Area. |
| | | 14 | | Data Transferring Flag | | 14 | Used as the Servo Parameter Transferring Flag.<br>The PCU's Data Transferring Flag is allocated as the Data Transferring Flag in the Common Operating Memory Area. |
| | | 15 | | Deceleration Stop Execution Flag | | 15 | The function of this bit is the same.<br>The EMERGENCY STOP Bit is turned ON by executing EMERGENCY STOP, however, and not by an external input (the CS1W/CJ1W-NCF71 does not have emergency stop inputs). |



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| I/O | CS1W/CJ1W-NC113/133/213/233/413/433 | | | | CS1W/CJ1W-NCF71 | | |
|---|---|---|---|---|---|---|---|
| | Word | Bits | Category | Name | Word | Bits | Differences |
| Input (PCU to CPU Unit) | n+3 | 00 | External I/O status | Not used. | b+3 | 00 | Used as the forward rotation limit input signal status. |
| | | 01 | | Not used. | | 01 | Used as the reverse rotation limit input signal status. |
| | | 02 | | Not used. | | 02 | Used as the origin proximity input signal status. |
| | | 03 | | Not used. | | 03 | Used as the encoder phase A input signal status. |
| | | 04 | | Not used. | | 04 | Used as the encoder phase B input signal status. |
| | | 05 | | Not used. | | 05 | Used as the encoder phase Z input signal status. |
| | | 06 | | Not used. | | 06 | Used as the external latch signal 1 input signal status. |
| | | 07 | | Not used. | | 07 | Used as the external latch signal 2 input signal status. |
| | | 08 | | CW limit input signal | | 08 | Used as the external latch signal 3 input signal status.<br>The forward rotation limit input signal status is allocated to bit 00 of this word (b+3). |
| | | 09 | | CCW limit input signal | | 09 | Used as the brake output signal status.<br>The reverse rotation limit input signal status is allocated to bit 01 of this word (b+3). |
| | | 10 | | Origin proximity input signal | | 10 | This bit is reserved by the system.<br>The origin proximity input signal status is allocated to bit 02 of this word (b+3). |
| | | 11 | | Origin input signal | | 11 | This bit is reserved by the system.<br>The origin input status is provided either in bit 05 of this word (b+3) when phase Z input signal is set or in bits 06 to 08 of this word when the external latch signal is set, according to the selected signal. |
| | | 12 | | Interrupt input signal | | 12 | This bit is reserved by the system.<br>The interrupt input signal status is provided in bits 06 to 08 of this word (b+3) according to the external latch signal. |
| | | 13 | | Emergency stop input signal | | 13 | An emergency stop input signal is not provided.<br>This bit is reserved by the system. |
| | | 14 | | Positioning completed input signal | | 14 | This bit is reserved by the system.<br>The Servo Driver's positioning completed signal status (indicating that the deviation counter is within the *Positioning Completion Range 1*) is allocated as the Position Completed (PSET) Flag in bit 07 of word b+2 (Servo Status Flags) in the Axis Operating Input Memory Area. |
| | | 15 | | Deviation counter reset output/origin-adjustment command output | | 15 | An deviation counter reset output/origin-adjustment command output is not provided as an external output.<br>This bit is reserved by the system. |



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| I/O | CS1W/CJ1W-NC113/133/213/233/413/433 | | | | CS1W/CJ1W-NCF71 | | |
|---|---|---|---|---|---|---|---|
| | Word | Bits | Category | Name | Word | Bits | Differences |
| Input (PCU to CPU Unit) | n+4 | --- | Error code | Error code | b+4 | --- | The function of this word is the same for errors that occur in individual axes. The error codes for Unit common errors are allocated as Unit error codes in the Common Operating Memory Area. |

## Operating Data Area

The operating data designated in the data memory of earlier PCUs is allocated in the CS1W/CJ1W-NCF71 in either the Common Operating Memory Area or Axis Operating Memory Area, as shown in the following table.

A comparison of the functions for these words is provided in the following table. The differences between these functions, such as in axis operations executed by the Operating Memory Area bits, are explained later in this appendix.

Operating Data Area words for CS1W/CJ1W-NC113/133/213/233/413/433 PCUs are shown in the following table for the X axis of the CS1W/CJ1W-NC113 PCU. The beginning word "l" is allocated in either the Special I/O Unit Area or a user-specified DM/EM Area using settings in the Common Parameters.

The Operating Memory Area words for CS1W/CJ1W-NCF71 PCUs are allocated either to the Common Operating Memory Area or Axis Operating Memory Area, which are calculated using the following equations.

n = CIO 1500 + (unit number × 25)

a = Beginning word of Axis Operating Output Memory Areas specified in Common Parameters + (Axis No. −1) × 25

b = Beginning word of Axis Operating Input Areas specified in Common Parameters + (Axis No. −1) × 25

| I/O | CS1W/CJ1W-NC113/133/213/233/413/433 | | | CS1W/CJ1W-NCF71 | |
|---|---|---|---|---|---|
| | Word | Category | Name | Word | Differences |
| Output (CPU Unit to PCU) | l | Operating data for data transfer | Number of write words | n+6 | The function is the same as data for WRITE DATA used to transfer PCU parameters. The data transferring method for the WRITE SERVO PARAMETER function is different. |
| | l+1 | | Write source area | n+7 | |
| | l+2 | | Write source word | n+8 | |
| | l+3 | | Write destination address | n+9 | |
| | l+4 | | Number of read words | n+10 | The function is the same as data for READ DATA used to transfer PCU parameters. The data transferring method for the READ SERVO PARAMETER function is different. |
| | l+5 | | Read source address | n+11 | |
| | l+6 | | Read destination area | n+12 | |
| | l+7 | | Read destination word | n+13 | |
| | l+8 | Operating data for direct operation | Position (rightmost word) | a+2 | The function of these words is the same. The data unit, however, is the command unit determined according to the setting for the electronic gear. |
| | l+9 | | Position (leftmost word) | a+3 | |
| | l+10 | | Speed (rightmost word) | a+4 | The function of these words is the same. The data unit, however, is the command unit/s determined according to the setting for the electronic gear. |
| | l+11 | | Speed (leftmost word) | a+5 | |
| | l+12 | | Acceleration time (rightmost word) | --- | The acceleration and deceleration times cannot be set in the PLC's memory area as operating data. The acceleration/deceleration constants are set by transferring them as Servo Parameters using the Servo Parameter transferring functions. |
| | l+13 | | Acceleration time (leftmost word) | | |
| | l+14 | | Deceleration time (rightmost word) | | |
| | l+15 | | Deceleration time (leftmost word) | | |
| | l+16 | Operating data for memory operation | Sequence number | --- | Memory operation functions are not provided, so this data is not allocated. |



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| I/O | CS1W/CJ1W-NC113/133/213/233/413/433 | | | CS1W/CJ1W-NCF71 | |
|---|---|---|---|---|---|
| | Word | Category | Name | Word | Differences |
| Output (CPU Unit to PCU) | l+17 | Operating data for special functions | Override | a+14 | Override ratio (unit: 0.01%) |
| | l+18 | | Teaching address | --- | Memory operation functions are not provided, so this data is not allocated. |
| | l+19 | | Not used. | --- | --- |
| Input (PCU to CPU Unit) | l+20 | PCU status | Present position (rightmost word) | b+6 | This word functions as a feedback present position (rightmost word).<br>The command present position (rightmost word) is allocated in word b+8. |
| | l+21 | | Present position (leftmost word) | b+7 | This word functions as a feedback present position (leftmost word).<br>The command present position (leftmost word) is allocated in word b+9. |
| | l+22 | | Sequence number | --- | Memory operation functions are not provided, so this data is not allocated. |
| | l+23 | | Output code | --- | Output code functions are not provided, so this data is not allocated. |

# Functions

The main functions that are different between earlier PCUs and the CS1W/CJ1W-NCF71 are explained here.

## ORIGIN SEARCH

### Acceleration/Deceleration Settings

The acceleration/deceleration settings for origin searches are set in the parameters for each axis in earlier PCUs, but they are set in the Servo Parameters (using Servo Parameter transfer functions) of the CS1W/CJ1W-NCF71.

#### CS1W/CJ1W-NC113/133/213/233/413/433

The time from the initial speed until the maximum speed is reached is set in the following axis parameters.

Origin search acceleration time (ms)
Origin search deceleration time (ms)

Each parameter setting is transferred to the PCU using data transfer functions (data transfer bit or IOWR instruction), or transferred automatically from the DM Area allocated to Special I/O Units when the PCU power is turned ON or the Unit is restarted.

#### CS1W/CJ1W-NCF71

The rate of increase or decrease in speed within a specified time unit is set in the following Servo Parameters.

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| Acceleration/deceleration constants | Pn80A | First-step linear acceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 |
| | Pn80B | Second-step linear acceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 |
| | Pn80C | Acceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 |
| | Pn80D | First-step linear deceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 |
| | Pn80E | Second-step linear deceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 |
| | Pn80F | Deceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 |



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Each parameter is set in the Servo Driver via the PCU using the PCU's Servo Parameter transfer functions (WRITE/SAVE SERVO PARAMETER Bits).

When using a trapezoidal curve (linear acceleration/deceleration) with the initial speed set to 0 (pulses/s), the set values for the origin search acceleration time and origin search deceleration time used in the earlier PCUs are converted to the following settings.

Pn80A (first-step linear acceleration constant):

The origin search uses a first-step acceleration/deceleration curve, so this parameter setting is not used.

Pn80B (second-step linear acceleration constant):

The maximum speed, initial speed, and origin search acceleration time in the axis parameters of earlier PCUs are converted to the value determined from the following equation.

$$\text{Pn80B} = \frac{\text{Maximum speed} - \text{Initial speed (0)}}{\text{Origin search acceleration time} \times 10} (\times 10{,}000 \text{ pulses/s}^2)$$

Pn80C (acceleration constant switching speed):

The origin search uses a first-step acceleration/deceleration curve, so this parameter is set to 0 (default setting).

Pn80D (first-step linear deceleration constant):

The origin search uses a first-step acceleration/deceleration curve, so this parameter setting is not used.

Pn80E (second-step linear deceleration constant):

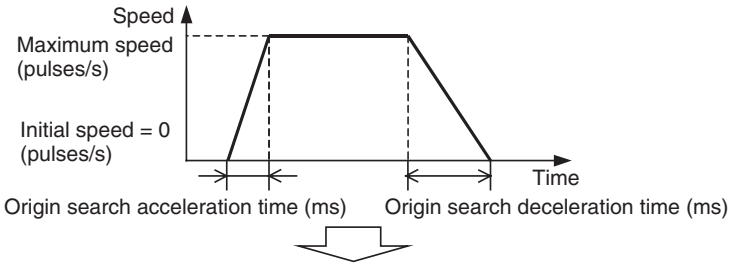
The maximum speed, initial speed, and origin search deceleration time in the axis parameters of earlier PCUs are converted to the value determined from the following equation.

$$\text{Pn80E} = \frac{\text{Maximum speed} - \text{Initial speed (0)}}{\text{Origin search deceleration time} \times 10} (\times 10{,}000 \text{ pulses/s}^2)$$

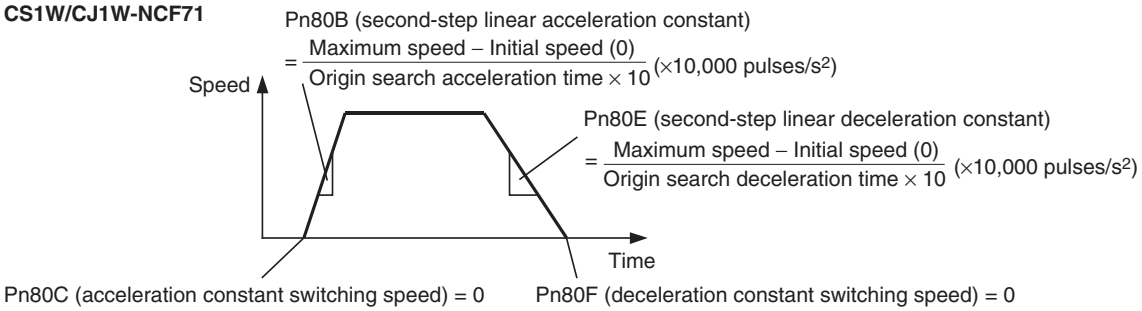
Pn80F (deceleration constant switching speed):

The origin search uses a first-step acceleration/deceleration curve, so this parameter is set to 0 (default setting).

**CS1W/CJ1W-NC113/133/213/233/413/433**




**CS1W/CJ1W-NCF71**






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## Origin Search High Speed

The origin search high speed (speed until detection of the origin proximity input signal) is set in the axis parameters in earlier PCUs. In the CS1W/CJ1W-NCF71, however, this parameter value is set as the *Speed Command Value* for origin searches in the Axis Operating Output Memory Area when the origin search is started.

## Origin Search Proximity Speed

The origin search proximity speed (speed after detection of the origin proximity input signal until detection of the origin input signal) is set in the axis parameters in earlier PCUs. In the CS1W/CJ1W-NCF71, however, this parameter value is set as the *Zero Point Return Approach Speed 1* (Pn817) in the Servo Parameter Area.

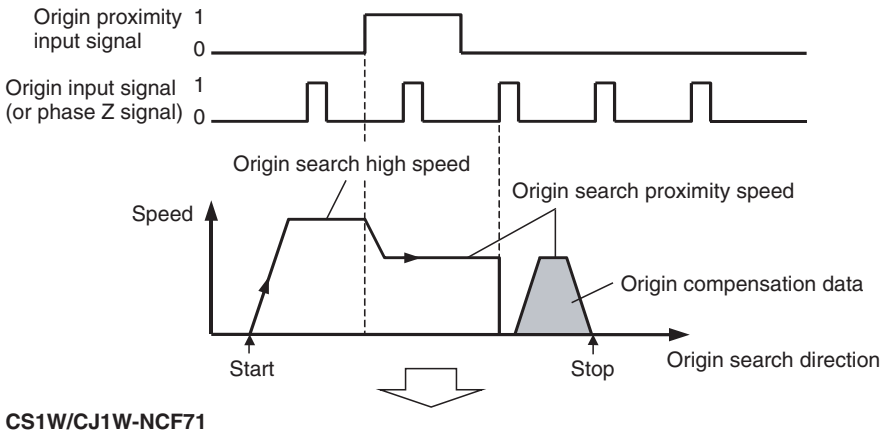
The setting unit for the *Zero Point Return Approach Speed 1* parameter is 100 command units/s. Therefore, to set the command unit to pulses, the set value for earlier PCUs must be multiplied by 1/100 to obtain the set value required for CS1W/CJ1W-NCF71 PCUs.

## Origin Compensation

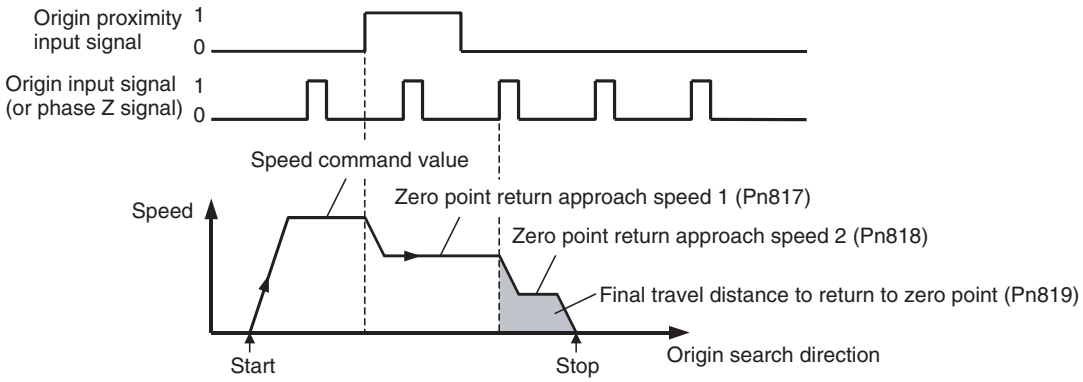
When using origin compensation in earlier PCUs, positioning was executed for the amount of origin compensation data at the origin search proximity speed. This operation is performed after first stopping the search operation using origin input signal detection.

For CS1W/CJ1W-NCF71 PCUs, origin compensation is performed following origin input signal detection by executing positioning using the Servo Parameters *Zero Point Return Approach Speed 2* (Pn818) and *Final Travel Distance to Return to Zero Point* (Pn819).

**CS1W/CJ1W-NC113/133/213/233/413/433**




**CS1W/CJ1W-NCF71**






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### Origin Established and No Origin Status

The No Origin Flag in both earlier PCUs and the CS1W/CJ1W-NCF71 indicates whether the origin has been established or not. The differences in the conditions whereby the No Origin Flag turns ON or OFF are as follows:

| | CS1W/CJ1W-NC113/133/213/233/413/433 | CS1W/CJ1W-NCF71 |
|---|---|---|
| Initial status<br>(when power is turned ON) | (After PCU's initial processing is completed)<br>ON status (origin not established) | Same as left |
| ON condition<br>(Origin is lost) | • At power up, or restart<br>• When executing ORIGIN SEARCH (See note.)<br>• When the emergency stop input signal or limit input signal is input (if origin undefined designation of I/O settings (for x axis, word 0004 bit 08) in the axis parameters is set so) | • At power up, or restart<br>• When connection is released (if CONNECT Bit is turned OFF or the connection is released due to an error)<br>• When DEVICE SETUP is executed |
| OFF condition<br>(Origin is established) | • When ORIGIN SEARCH execution is completed<br>• When PRESENT POSITION PRESET is executed | • When ORIGIN SEARCH execution is completed<br>• When PRESENT POSITION PRESET is executed<br>When using absolute encoders:<br>• When connection is established<br>• When SERVO LOCK is executed |

**Note** In earlier PCUs, if ORIGIN SEARCH is executed again after establishing the origin, the origin will be lost (until ORIGIN SEARCH execution is completed). In the CS1W/CJ1W-NCF71, however, once the origin has been established, the origin will not be lost, even if ORIGIN SEARCH is executed again. If ORIGIN SEARCH is executed again, the search operation will be executed using the coordinates based on the previous origin until the new origin is established. When the software limits are enabled at this point, the software limits will apply to the origin search operation, causing operation to stop due to an error. (Positioning will not be reversed at the software limits when origin searches are performed in reversal mode.)

## Position Control (Direct Operation)

### Acceleration/Deceleration Settings

The acceleration/deceleration settings for position control (direct operation) are specified in the Operating Data Area at start up in earlier PCUs. In CS1W/CJ1W-NCF71 PCUs, however, these settings are set in the Servo Parameters (using Servo Parameter transfer functions).

**CS1W/CJ1W-NC113/133/213/233/413/433:**

The following operation data is designated for the time from the initial speed until the maximum speed is reached.

Acceleration time (ms)
Deceleration time (ms)

For each parameter, the data that has been set in the Operating Data Area is enabled when the direct operation (ABSOLUTE MOVEMENT or RELATIVE MOVEMENT) is started.



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**CS1W/CJ1W-NCF71**

The rate of increase or decrease in speed within a specified time unit is set in the following Servo Parameters.

| Type | Parameter No. | Parameter name | Unit | Setting range | Parameter size | Default setting |
|---|---|---|---|---|---|---|
| Acceleration/deceleration constants | Pn80A | First-step linear acceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 |
| | Pn80B | Second-step linear acceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 |
| | Pn80C | Acceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 |
| | Pn80D | First-step linear deceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 |
| | Pn80E | Second-step linear deceleration constant | 10,000 command units/$s^2$ | 1 to 65535 | 2 | 100 |
| | Pn80F | Deceleration constant switching speed | 100 command units/s | 0 to 65535 | 2 | 0 |

Each parameter is set in the Servo Driver via the PCU using the PCU's Servo Parameter transfer functions (WRITE/SAVE SERVO PARAMETER Bits).

When a trapezoidal curve (linear acceleration/deceleration) is used with the initial speed set to 0 (pulses/s), the set values for the acceleration time and deceleration time in the Operating Data Area of the earlier PCUs are converted to the following settings.

Pn80A (first-step linear acceleration constant):
The operation uses a first-step acceleration/deceleration curve, so this parameter setting is not used.

Pn80B (second-step linear acceleration constant):
The maximum speed and initial speed in the axis parameters and the acceleration time in the Operating Data Area of earlier PCUs are converted to the value determined from the following equation.

$$\text{Pn80B} = \frac{\text{Maximum speed} - \text{Initial speed (0)}}{\text{Acceleration time} \times 10} \ (\times 10{,}000 \text{ pulses/s}^2)$$

Pn80C (acceleration constant switching speed):
The operation uses a first-step acceleration/deceleration curve, so this parameter is set to 0 (default setting).

Pn80D (first-step linear deceleration constant):
The operation uses a first-step acceleration/deceleration curve, so this parameter setting is not used.

Pn80E (second-step linear deceleration constant):
The maximum speed and initial speed in the axis parameters and the deceleration time in the Operating Data Area of earlier PCUs are converted to the value determined from the following equation.

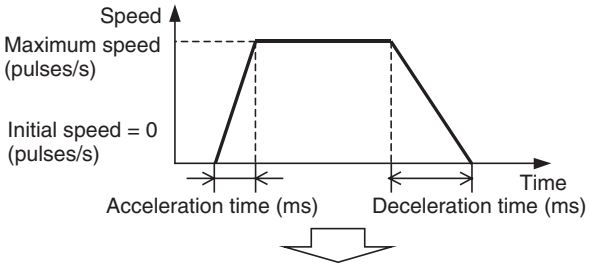
$$\text{Pn80E} = \frac{\text{Maximum speed} - \text{Initial speed (0)}}{\text{Deceleration time} \times 10} \ (\times 10{,}000 \text{ pulses/s}^2)$$

Pn80F (deceleration constant switching speed):
The operation uses a first-step acceleration/deceleration curve, so this parameter is set to 0 (default setting).



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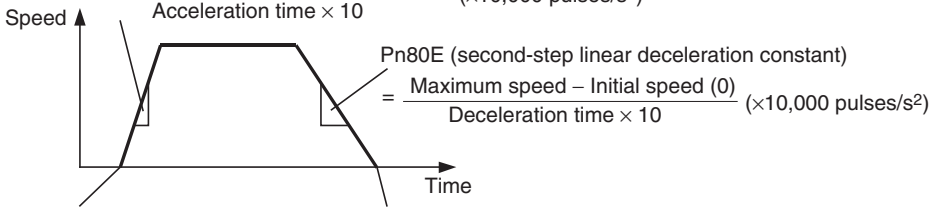
**CS1W/CJ1W-NC113/133/213/233/413/433**




**CS1W/CJ1W-NCF71**

Pn80B (second-step linear acceleration constant)

$$= \frac{\text{Maximum speed} - \text{Initial speed (0)}}{\text{Acceleration time} \times 10} \ (\times 10{,}000 \text{ pulses/s}^2)$$




Pn80E (second-step linear deceleration constant)

$$= \frac{\text{Maximum speed} - \text{Initial speed (0)}}{\text{Deceleration time} \times 10} \ (\times 10{,}000 \text{ pulses/s}^2)$$

Pn80C (acceleration constant switching speed) = 0

Pn80F (deceleration constant switching speed) = 0

## Changing Target Position and Changing Target Speed

The target position and target speed can be changed during axis operation in the same way for both earlier PCUs and the CS1W/CJ1W-NCF71 PCU by using the following operation.

Changing target position: Set the new target position in *Position Command Value* and send an operation command again. (Strictly speaking, the new target position is to be set in Position of the Operating Data Area for earlier PCUs while it is set in Position Command Value in the Axis Operating Output Memory Area for CS1W/CJ1W-NCF71 PCUs.)

Changing target speed: Change *Speed Command Value* during axis operation to immediately change the target speed. (Strictly speaking, the new target speed is to be set in Speed of the Operating Data Area for earlier PCUs while it is set in Speed Command Value in the Axis Operating Output Memory Area for CS1W/CJ1W-NCF71 PCUs.)

When changing the target position with a CS1W/CJ1W-NCF71 PCU, however, the Receiving Command Flag must be used to control the ON/OFF timing for the operation command bits.

## Interrupt Feeding

Interrupt feeding in earlier PCUs is executed by independently operating individual start bits. With CS1W/CJ1W-NCF71 PCUs, however, interrupt feeding is an additional function for the direct operation (ABSOLUTE MOVEMENT or RELATIVE MOVEMENT).

To execute interrupt feeding, turn ON the Interrupt Feeding Designation Bit in the Axis Operating Output Memory Area and execute ABSOLUTE MOVEMENT or RELATIVE MOVEMENT.

When using earlier PCUs, interrupt feeding functions by switching from speed control to position control (positioning is performed for the amount of interrupt feeding after detection of the interrupt input signal). With CS1W/CJ1W-NCF71 PCUs, however, interrupt feeding functions by switching from one position control operation (ABSOLUTE MOVEMENT or RELATIVE MOVEMENT) to another position control operation (positioning is performed for the amount of interrupt feeding after detection of the interrupt input signal), and if an interrupt input signal is not input, the original positioning operation is completed.

# Memory Operation

Memory operation functions are not provided in CS1W/CJ1W-NCF71 PCUs.

The teaching function, forced interrupt operation, and output codes, which are related to memory operations, are also not provided.



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Operations that use automatic patterns and continuous patterns must be created in the user program.

## Jogging

### Acceleration/Deceleration Settings

In earlier PCUs, the acceleration/deceleration settings for jogging are specified as operation data in the Operating Data Area when jogging is started. In CS1W/CJ1W-NCF71 PCUs, however, these settings are set in the Servo Parameters (using Servo Parameter transfer functions).

Details on acceleration/deceleration settings are the same as those provided for position control (direct operation), so refer to the section on position control (direct operation).

### Changing Target Speed

The target speed can be changed during jogging operations in the same way for both earlier PCUs and the CS1W/CJ1W-NCF71 PCU by using the following operation.

Changing target speed: Change the *Speed Command Value* parameter during jogging operations to immediately change the target speed. (Strictly speaking, the new target speed is to be set in Speed of the Operating Data Area for earlier PCUs while it is set in Speed Command Value in the Axis Operating Output Memory Area for CS1W/CJ1W-NCF71 PCUs.)

## Present Position

Earlier PCUs use open-loop control, and monitor the command position (PCU's output pulses) as the present position. CS1W/CJ1W-NCF71 PCUs exchange data with Servo Drivers that have a semi-closed loop configuration. Therefore, both the feedback present position (total of feedback pulses from the Servomotor's encoder) and command present position (total of PCU's position command values) are monitored as the present position.

## Data Transfer

In earlier PCUs, all the parameters set by the PCU are in the Unit, and data is transferred using the PCU's data transfer functions (data transfer bit or IOWR instruction).

In CS1W/CJ1W-NCF71 PCUs, however, data is classified into three types: Common Parameters, Axis Parameters, and Servo Parameters. Common Parameters and Axis Parameters are configured in the PCU, and Servo Parameters are configured in the Servo Driver. Therefore, the transfer functions used to transfer the parameters in the PCU are different than those used to transfer the parameters in the Servo Driver.

- Common Parameters and Axis Parameters
  These parameters are transferred to the PCU using the data transfer bits (WRITE DATA, READ DATA, and SAVE DATA) in the Common Operating Memory Area.
- Servo Parameters
  These parameters are transferred to each axis using the Servo Parameter transfer bits (WRITE SERVO PARAMETER, READ SERVO PARAMETER, and SAVE SERVO PARAMETER) in the Axis Operating Output Memory Area. Parameters are transferred between the PLC and Servo Driver by executing these Servo Parameter transfer functions.

The IOWR and IORD instructions are not supported by the CS1W/CJ1W-NCF71 PCUs.



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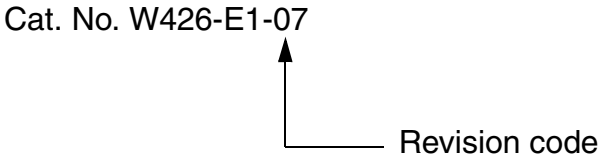


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# Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.




The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

| Revision code | Date | Revised content |
|---|---|---|
| 01 | July 2004 | Original production |
| 02 | September 2004 | Information was expanded and revised to include new functionality, and corrections were made, as follows:<br>**Page xii:** Information on unit versions added.<br>**Page 5:** Information on linear interpolation added.<br>**Pages 6, 9, 122, 164, 240, 243, 245, and 300:** Information on torque corrected.<br>**Pages 64, 65, 66, 97, 98, 99, 100, 107, 371, 372, 375, and 388:** Tables expanded and notes added.<br>**Page 149:** Notes added.<br>**Pages 165, 233, and 241:** Table revised.<br>**Page 206:** Information on ABSOLUTE MOVEMENT added.<br>**Page 218:** Subsection on linear interpolation added.<br>**Pages 336 and 337:** Information added.<br>**Page 342:** Note added. |
| 03 | April 2005 | Revisions were made throughout the manual to include new functionality for the upgrade to unit version 1.2 and information on R88D-WN□-ML2 W-series Servo Drivers with built-in MECHATROLINK-II communications that differs from information for R88D-WT□ W-series Servo Drivers equipped with Yaskawa JUSP-NS115 MECHATROLINK-II Application Modules. |
| 04 | February 2006 | Revisions were made throughout the manual to include new functionality for the upgrade to unit version 1.3 and to include the new CS-series PCU. |
| 05 | December 2006 | Revisions were made throughout the manual to include new functionality for the upgrade to unit version 2.0 and to support SMARTSTEP Junior Servo Drivers (R7D-ZN□-ML2). |
| 06 | August 2007 | **Pages 202 and 274:** Information added on setting the transfer cycle and communications cycle when setting an absolute encoder zero point position offset for an origin search. |
| 07 | February 2008 | New functionality for the upgrade to unit version 2.1 were added, additional descriptions were added, and errors were corrected. |



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