Cat. No. W419-E1-04

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Programmable Controller
SYSMAC CS-series
CS1W-MCH71
Motion Control Unit

OPERATION MANUAL

OMRON

CS1W-MCH71 Motion Control Unit

Operation Manual

Revised September 2004

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.

⚠ WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ 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.

Introduction

We are flattered that you have purchased OMRON SYSMAC CS-series advanced Motion Control Unit.

Motion control Unit CS1W-MCH71 (the abbreviation “MC Unit” is in this mean) is a high performance CPU unit of the programmable controller SYSMAC CS-series that has been produced by OMRON's advanced technology for control and abundant experience.

This instruction manual describes MC Unit's specifications and procedures for operation.

Please read each section in its entirety and be sure you understand the information provided in the section and relate sections before attempting any of the procedures or operation given.

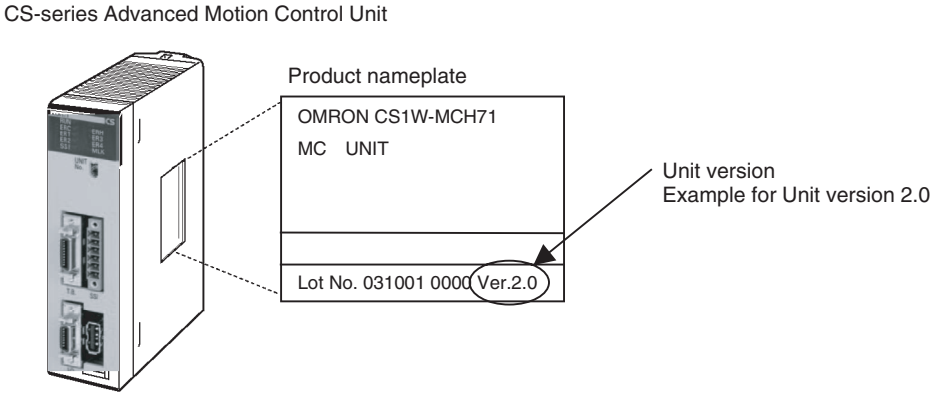
Unit Versions of CS-series Advanced Motion Control Units

Unit Versions

A “Unit version” has been introduced to manage Advanced Motion Control Units (MC Units) in the CS Series according to differences in functionality accompanying Unit upgrades.

Notation of Unit Versions on Products

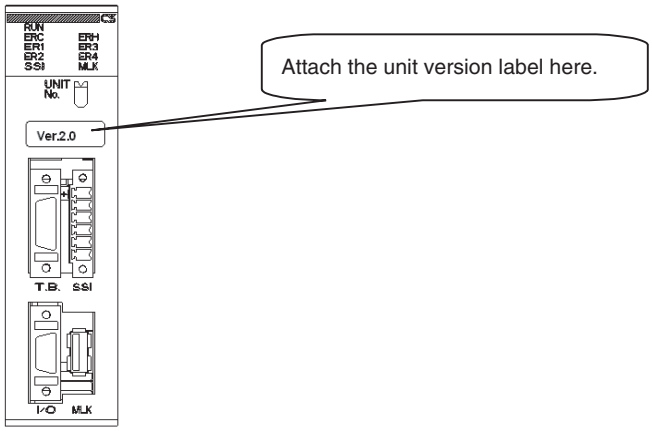
The unit version is given to the right of the lot number on the nameplate of the applicable CS-series Advanced Motion Control Units, as shown below.



The unit version of the Advanced Motion Control Units begins at version 2.0.

Identifying Unit Versions

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



Confirming Unit Versions with Support Software

The unit version cannot be confirmed in *Unit Manufacturing Information* of CX-Programmer version 4.0 or higher.

Use the MC-Miel for MCH Support Tool for Motion Control Units to confirm the unit version, as shown in the following table.

Method for confirming the internal system software version	Confirm in the device information under the Tools Menu in the MC-Miel for MCH.
Corresponds to the unit version	Internal system software version Pre-Ver. 2.0: 1.00xxxx to 1.04xxxx Unit Ver. 2.0: 1.05xxxx

Unit Version Notation

In this manual, the unit version of a Motion Control Unit is given as shown in the following table.

Product nameplate	Notation used in this manual	Special remarks
Ver. 2.0 or later number shown to the right of the lot number	CS-series Advanced Motion Control Unit Ver. 2.0 or later.	Information without reference to specific Unit versions applies to all versions of the Unit.
Blank to the right of lot number	Pre-Ver. 2.0 CS-series Advanced Motion Control Unit	

Functions Supported by Advanced Motion Control Unit Ver. 2.0

Unit Version		Pre-Ver. 2.0 Motion Control Unit	Motion Control Unit Ver. 2.0
Internal system software version		1.00 to 1.04	1.05
CS-series Advanced Motion Control Unit model numbers		CS1W-MCH71	CS1W-MCH71
	Jogging	Not supported	Supported
	Communications levels	Not supported	Supported
	Communications cycle/Unit cycle	Not supported	Supported
	LATCH command processing time	Not supported	Supported
	Latch status refresh time	Not supported	Supported
	Using interpolation commands during pass operation	Not supported	Supported
	Acceleration/deceleration time during pass operation	Not supported	Supported
	Deceleration time during pass operation	Not supported	Supported
	Torque to position switching	Not supported	Supported
	Speed to position switching	Not supported	Supported
Support Software		MC-Miel for MCH Ver. 1.5.7 or lower	MC-Miel for MCH Ver. 1.5.8 or higher

Unit Versions and Lot Numbers

Type	Model		Date of manufacture	
			June 2004 or earlier	July 2004 or later
CPU Bus Unit	Advanced Motion Control Unit	CS1W-MCH71	No version code (pre-Ver. 2.0)	Unit Ver. 2.0. (Lot No.: 040715 or later)

Version Upgrade Information

The following tables outline changes made for the most recent version upgrade for SYSMAC CS-Series Advanced Motion Control Units.

Jogging

Previous versions	Present version (unit Ver. 2.0 or later)
The following procedure was required to set or reverse the jogging direction. • Specify the feed direction using the JOG/STEP Direction Bit. • Turn ON The JOG Operation Bit. • Turn OFF the JOG Operation Bit to reverse the feed direction. • Reverse the JOG/STEP Direction Bit after the axis has stopped. • Turn ON the JOG Operation Bit. • The jogging direction will then be reversed.	• The following setting/reversal method has been added. • Specify the feed direction using the JOG/STEP Direction Bit. • Turn ON the JOG Operation Bit. • Leave the JOG Operation Bit turned ON and simply reverse the JOG/STEP Direction Bit setting to reverse the feed direction. • Use the following parameter to switch between the previous function and the new function. Parameter No.: P00004 Bit: 05 0: Default setting. Same functionality as previous versions. This bit was previously reserved (default setting 0). 1: Selects new function supported with this version.

Network Levels

Previous versions	Present version (unit Ver. 2.0 or later)
Motion Control Units could be used to control communications across three network levels.	Motion Control Units now support communications across eight network levels, the same as CPU Units. CPU Units with unit Ver. 2.0 or later support eight network levels.

Communications Cycle/Unit Cycle

Previous versions	Present version (unit Ver. 2.0 or later)
The communications cycle and Unit cycle were as follows: Communications cycle: 1 ms, 2 ms, or 4 ms Unit cycle: 1 ms, 2 ms, 4 ms, or 8 ms	• A 3-ms communications cycle is now supported, enabling higher-precision performance. Communications cycle: 1 ms, 2 ms, 3 ms, or 4 ms Unit cycle: 1 ms, 2 ms, 3 ms, 4 ms, 6 ms, or 8 ms • Use the following parameter to switch between the previous function and the new function. Parameter No.: P00004 Bit: 03 0: Default setting. Same functionality as previous versions. This bit was previously reserved (default setting 0). 1: Enables 3-ms cycle provided with this version.

LATCH Command Processing Time

Previous versions	Present version (unit Ver. 2.0 or later)
The time required to detect the external latch signal after the LATCH command is executed was as follows: Receiving latch signals at any position: 105 ms to 232 ms Receiving only those latch signals within a specific positioning range: 105 ms to 232 ms	The required time has been shortened for receiving latch signals at any position, as follows: Receiving latch signals at any position: 3 ms to 24 ms (improved) Receiving only those latch signals within a specific positioning range: 105 ms to 232 ms (same)

Latch Status Refresh Time

Previous versions	Present version (unit Ver. 2.0 or later)
After LATCH command execution, the time required from input of the latch signal until the input is reflected in the system variable (variable showing latch completion) was as follows: 14.5 ms to 85.5 ms	The required time has been shortened as follows: 7.5 ms to 37.5 ms

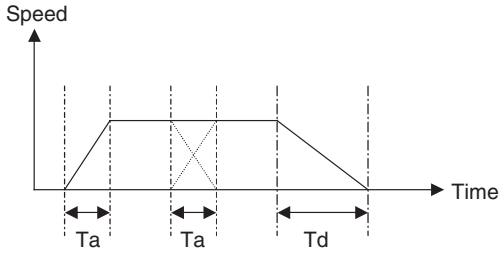
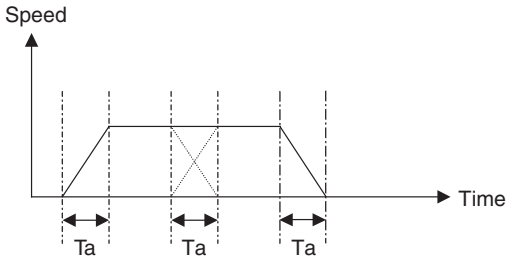
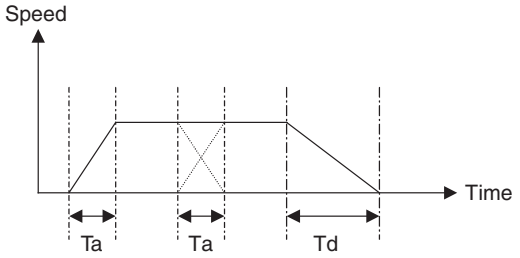
Using Interpolation Commands in Pass Operations

Previous versions	Present version (unit Ver. 2.0 or later)
To execute a pass operation when the axis was stopped required two interpolation commands just for the first movement. Example: PASSMODE; MOVEL [J01]100 F10000; MOVEL [J02]400 F10000; WHILE #MW0000==0; INC MOVEL [J02]100 F1000; WEND; etc.	A pass operation can be executed when the axis is stopped using a single interpolation command. Example: PASSMODE; WHILE #MW0000==0; INC MOVEL [J02]100 F1000; WEND; etc.

Acceleration/Deceleration Time During Pass Operation

Previous versions	Present version (unit Ver. 2.0 or later)
Parallel processing had to be executed using the PARALLEL command to change the acceleration/deceleration time during a pass operation, making changes at user-specified timing difficult.	• The acceleration/deceleration time can be changed during pass operation. • The acceleration/deceleration time can be easily switched using the newly added parameter, as follows: MOVEL [J01]1000 F1000 #IW0A00 = 2; [The pass operation will be performed to the next position using the time set in bank 2.] MOVEL [J01]5000 F1000 • The following ten new parameters have been added and use the area previously allocated for task parameters. The setting range is 0 to 60,000 ms. No. P00M11 Interpolation feed acceleration/deceleration time (Bank 1) to P00M20 Interpolation feed acceleration/deceleration time (Bank 10)

Deceleration Time During Pass Operation

Previous versions	Present version (unit Ver. 2.0 or later)
The interpolation feed deceleration time was used to decelerate to a stop during pass operation. Example: Pass Mode Select P00M06 = 0 Interpolation feed acceleration time Ta=P0MM02 Interpolation feed deceleration time Td=P00M03 Program: PASSMODE; INC MOVEL [J01]1000 F100000; INC MOVEL [J01]1000 F100000; END;  	• The interpolation time used for the pass operation (interpolation feed acceleration time or deceleration time) is used to decelerate to a stop during pass operation. Example: Pass Mode Select P00M06 = 0 Interpolation feed acceleration time Ta=P0MM02 Interpolation feed deceleration time Td=P00M03 Program: PASSMODE; INC MOVEL [J01]1000 F100000; INC MOVEL [J01]1000 F100000; END;  • To decelerate to a stop using the interpolation feed deceleration time in the same way as previous versions, add STOPMODE before the final interpolation command before stopping. PASSMODE; INC MOVEL [J01]1000 F100000; STOPMODE INC MOVEL [J01]1000 F100000; END; 

Switching from Torque to Position Control

Previous versions	Present version (unit Ver. 2.0 or later)
Torque control switched could be switched to position control using the TORQUR command only after the axis feedback speed reached 0.	• Torque control can be switched to position control using the TORQUR command when the axis feedback speed reaches the speed specified in the specified parameter (specified as a percentage of the rated speed). • The following new parameter uses an area previously reserved in the axis parameter area. Parameter No.: P3AA09 Parameter name: Position Control Switching Speed Setting range: 0 to 32767 (unit: 0.01%)

Switching from Speed to Position Control

Previous versions	Present version (unit Ver. 2.0 or later)
Speed control switched could be switched to position control using the SPEEDR command only after the axis feedback speed reached 0.	• Speed control can be switched to position control using the SPEEDR command when the axis feedback speed reaches the speed specified in the specified parameter (specified as a percentage of the rated speed). • The following new parameter uses an area previously reserved in the axis parameter area Parameter No.: P3AA09 Parameter name: Position Control Switching Speed Setting range: 0 to 32767 (unit: 0.01%)

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About this Manual:

This manual describes the installation and operation of the CS1W-MCH71 Motion Control Unit (MC Unit) 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 MC Unit. Be sure to read the precautions provided in the following section.

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

Section 1 introduces the features and system configuration of the CS1W-MCH71 CS-series Motion Control Unit. It also describes product operating principles and provides product specifications

Section 2 provides an overview of the basic procedures required to use the CS1W-MCH71 Motion Control Unit.

Section 3 describes the names of Unit parts and how to install and wire the CS1W-MCH71 Motion Control Unit.

Section 4 describes the data configuration uses to set up, operate, and monitor the CS1W-MCH71 Motion Control Unit and related devices.

Section 5 describes how to transfer data between the CPU Unit and the CS1W-MCH71 Motion Control Unit and how data is stored.

Section 6 describes how to program CS1W-MCH71 Motion Control Unit operation, including the program configuration and the specific commands used in programming.

Section 7 describes the interface area in the CPU Unit used to control and monitor the CS1W-MCH71 Motion Control Unit.

Section 8 describes how to establish the origin in the positioning system.

Section 9 describes special operations for the CS1W-MCH71 Motion Control Unit, including teaching, program debugging, coordinate systems, and backup functions.

Section 10 provides a programming example to demonstrate how the CS1W-MCH71 Motion Control Unit can be used.

Section 11 describes how to troubleshoot problems that may occur when using the CS1W-MCH71 Motion Control Unit.

Section 12 describes the maintenance and inspection procedures required to keep the CS1W-MCH71 Motion Control Unit in optimum condition.

⚠ 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.

PRECAUTIONS

This section provides general precautions for using the CS1W-MCH71 Motion Control Unit and related devices.

The information contained in this section is important for the safe and reliable application of the CS1W-MCH71 Motion Control Unit. You must read this section and understand the information contained before attempting to set up or operate a CS1W-MCH71 Motion Control Unit.

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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 PLC and all PLC Units 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 a PLC System to the above-mentioned applications.

3 Safety Precautions

⚠ DANGER
Never attempt to disassemble any Units while power is being supplied. Doing so may result in serious electronic shock. 
Never touch any of the terminals while power is being supplied. Doing so may result in serious electronic shock. 
Provide safety measures in external circuits (i.e., not in the Programmable Controller or MC Unit) to ensure safety in the system if an abnormality occurs due to malfunction of the PLC or MC unit. Not providing sufficient safety measures may result in serious accidents.  • Emergency- stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits. • The PLC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. As a countermeasure for such errors, external safety measures must be provided to ensure safety in the system. • The PLC or MC Unit 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-VDC (service power supply to the PLC) is overloaded or short-circuited, the voltage may drop 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. • Provide safety measures in external circuits to ensure safety in system if an abnormality occurs due to malfunction of MC Unit connectors.

⚠ WARNING
Execute online edit only after confirming that the cycle time extension will not cause any adverse effects. Some input signals may not be read if the cycle time is extended. 
Confirm the safety of the destination node before transferring program to the node or changing the contents of I/O memory. Doing either of these without confirming safety may result in injury. 
Do not save data into the flash memory during memory operation or while the motor is running. Otherwise, unexpected operation may be caused. 
Do not reverse the polarity of the 24-V power supply. The polarity Must be correct. Otherwise, the motor may start running unexpectedly and may not stop. 
When positioning is performed using Teaching function, positioning specification in the motion program must be [Absolute specification]. If [Incremental specification] is specified, positioning will be executed at the different point from where Teaching conducted. 

4 Application Precautions

Observe the following precautions when using the MC Unit or the PLC.

- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
- Always turn off after power supply to the Unit before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
  - Mounting or dismounting the MC Unit or any other unit.
  - Assembling the Units.
  - Setting Rotary switches.
  - Connecting Cables or wiring the system.
  - Connecting or disconnecting the connectors.
- Confirming 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 operation mode of the PLC (including the setting of the startup operating mode).
  - Changing the present value of any word or any set value in memory.
  - Force-setting /force-resetting any bit in memory.
- Always connect to a ground of 100Ω or less when installing the Units. Not connecting to a ground of100Ω or less may result in electric shock.
- Before touching the Unit, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.
- Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in this manual. Incorrect tightening torque may result in malfunction.
- Tighten the mounting screws at the bottom of the Unit to a torque of 0.4 N·m.
  Incorrect tightening torque may result in malfunction.
- Perform wiring according to specified procedures.
- Leave the label attached to the Unit when wiring. Removing the label may result in malfunction if foreign matter enters the Unit.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Check the pin numbers before wiring the connectors.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.
- Be sure that the connectors, terminal blocks, I/O cables, cables between drivers, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Always use the power supply voltage specified in this manual. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An in correct power supply may result in malfunction.
- Do not apply voltages to the Input Units in excess of the rated input voltage. Excess voltage may result in burning.
- Do not apply voltages or connect loads to the Output Units in excess of the maximum switching capacity. Excess voltages or loads may result in burning.
- Check carefully all wiring and switch setting before turning ON the power supply. Incorrect wiring may result in burning.
- Separate the line ground terminal (LG) from the functional ground terminal (GR) on the Power Supply Unit before performing withstand voltage tests or insulation resistance tests. Not doing so may result in burning.
- Do not place objects on the top of the cables or other wiring lines.
  Doing either of these may break the cables.

- Do not pull on the cables or bend the cables beyond their natural limit. Doing so may break the cables.
- Do not turn off the power supply to the Unit while data is being written to flash memory. Doing so may cause problems with flash memory.
- Confirm that user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Resume operation only after transferring to the new MC Unit the contents of the parameters, position data, and other data required for resuming operation. Not doing so may result in an unexpected operation.
- Resume operation only after transferring to the new CPU Unit the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in an unexpected operation.
- After transferring the system parameters, servo parameters, programs, position data, and CAM data to the MC Unit, be sure to save the data in flash memory within the MC Unit (using the data save command from support tool or CPU Unit) before turning OFF the power supply to the Unit. Transferring the data to the MC Unit will simply save the data in the internal memory (S-RAM) of the MC Unit and this data will be deleted when the power supply to the Unit is turned OFF.
- After transferring the system parameter data to the MC Unit and saving the data to flash memory, be sure to reset the power supply to the unit or restart the Unit. Otherwise, some of the unit parameters and machine parameters will not be changed.
- The Machine lock function is enabled in each axis, for the effects on the operations with multiple axes such as interpolation operation be sure to machine lock all of relative axes in order to prevent the interference with other axes or devices.
- If axes are stopped during a synchronized operation, however, the synchronization of the master axis and slave axes positions will be cancelled. For that reason, be aware of the interference with other axes or devices when restarting up.
- When the load OFF status is occurred in the CPU Unit during manual operation such as JOG, which is performed by operating input variables from the MC Unit's program, the operation will be continued for one-cycle of the Unit. Using the WHILE command to repeat until given condition is satisfied, however, it continues to operate even load-OFF has occurred, be aware of the interference with other axes or devices.
- Parameters and programs for MC Units with unit version 2.0 or later can be transferred to pre-Ver. 2.0 MC Units, but the new and upgraded functions for unit Ver. 2.0 will be disabled.
- Do not attempt to take any Units apart, to repair any Units, or to modify any Units in anyway.

5 Operating Environment Precautions

- The installation must be conducted correctly.
- Do not operate the control system in the following places.
  - 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.
- Take appropriate and sufficient countermeasures when installing systems in the following locations. Inappropriate and insufficient measures may result in malfunction.
  - Locations subject to static electricity or other sources of noise.
  - Locations subject to strong electromagnetic fields.
  - Locations subject to possible exposure to radioactivity.
  - Locations close to power supplies.

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 to that they can be more easily built into other devices or machines. The actual products have been checked for conformity to EMC standards (see the following note). The customer, however, must check whether the products conform to the standard in the system used by the customer.

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

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

Note Applicable EMC (Electro-Magnetic Compatibility) standards are as follows:
EMS (Electro-Magnetic Susceptibility): EN61000-6-2,
EMI (Electro-Magnetic Interference): EN55011
EN55011 Radiated emission 10-m regulations

6-3 Conformance to EC Directives

The CS1W-MCH71 “MC Unit” comply with EC Directives. To ensure that the machine or device in which an MC Unit is used complies with EC Directives, the MC Unit must be installed as directed below:

1. The MC Unit must be installed within a control panel.
   Use a control panel like SA20-712 (Nitto Electronics) or similar to this.
2. Reinforced insulation or double insulation must be used for the DC power supplies used for the communications and I/O power supplies.
3. MC Units complying with EC Directives also conform to the Common Emission Standard (EN50081-2). With regard to the radiated emission (10-m regulations), countermeasures will vary depending on the devices connected to the control panel, wiring, the configuration of the system, and other conditions. The customer must, therefore, perform final checks to confirm that devices and the overall machine conform to EC Directions.

6-4 Installation within Control Panel

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

SECTION 1
Features and System Configuration

The section introduces the features and system configuration of the CS1W-MCH71 CS-series Motion Control Unit. It also describes product operating principles and provides product specifications.

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1-1 Features

1-1-1 Overview

The CS1W-MCH71 model is a CS-series Motion Control Unit that can control thirty axes. An internal motion language programming is mounted, so that it can perform the advanced motion control operations.

1. Position Control

- Point-to-Point Control: With point-to-point (PTP) control, positioning is controlled independently for each axis. The pathway varies according to the travel distances, the feed rates, and so on.
- Continuous Path Control: With continuous path (CP) control, not only the start position and target position are controlled but also the path between those points. Functions such as linear interpolation, circular interpolation, helical circular interpolation, and traverse can be performed.

2. Speed Control

It makes the motor run at the specified speed, it also specifies the rate of speed change.

3. Torque Control

It generates specified Torque and specifies the rate of Torque change.

4. Synchronous Control

- Electronic Shaft: Functions the same as for the rolls connected to the gearbox with a gearshift.
- Electronic Cam: Functions the same as for the Machine CAM.

The MC Unit has been developed for use in simple positioning applications using servomotors. Applicable machines are as follows:

- Conveyor Systems: X/Y tables, palletizers/depalletizers, loaders/unloaders, etc. (Palletizers and depalletizers are devices used for loading goods onto pallets or for unloading them from pallets. Loaders and unloaders are devices that have shelves corresponding with the steps of a multi-step press and used for inserting or removing all the materials at one time.)
- Assembling Systems: Simple robots (including orthogonal robots), simple automated assembling machines (such as coil winding, polishing, hole punching), etc.

Note The MC Unit is not designed to perform the interpolation movement like a linear interpolation, a circular interpolation, or a helical circular interpolation with horizontal articulated robots or cylindrical robots, because it does not support coordinate conversions (cylindrical coordinate rotation function). The MC Unit can, however, perform PTP control with these robots.

1-1-2 Features

Simple System Architecture

- Independent control of multiple axes (Up to 30 physical axes; including virtual axes total is 32)
- Each axis can be set as either a physical or virtual axis.
- Additional unit is not required.

Easiest Information Management

- High-speed channel with servo driver enables parameters' setting of servo driver, status monitoring.
  These functions are possible from computer support tool or PT.
- Backup using Memory Card in CPU Unit.

Various motion controls ~Distributed control system~

- Besides CPU Unit of PLC, executes motion program for motion control.
- Regarding to motion task, up to 8 motion programs can be simultaneously executed. In each of these 8 programs, programs can be executed in parallel.

High-speed and flexibility

- It is possible to realize variety of applications because of its availability for Synchronous Controls (Electric Shaft, Electronic cam, Trailing Synchronization), Speed Control, Torque Control, and Position Control.
- The minimum length of servo communication cycle is 1 ms.
- It is possible to switch position, speed, and Torque command during axis movement (there are few restrictions).
- The accurate controls of MC Unit and Servo driver or dispersion module are possible conducting a completely synchronized processing at fixed intervals.

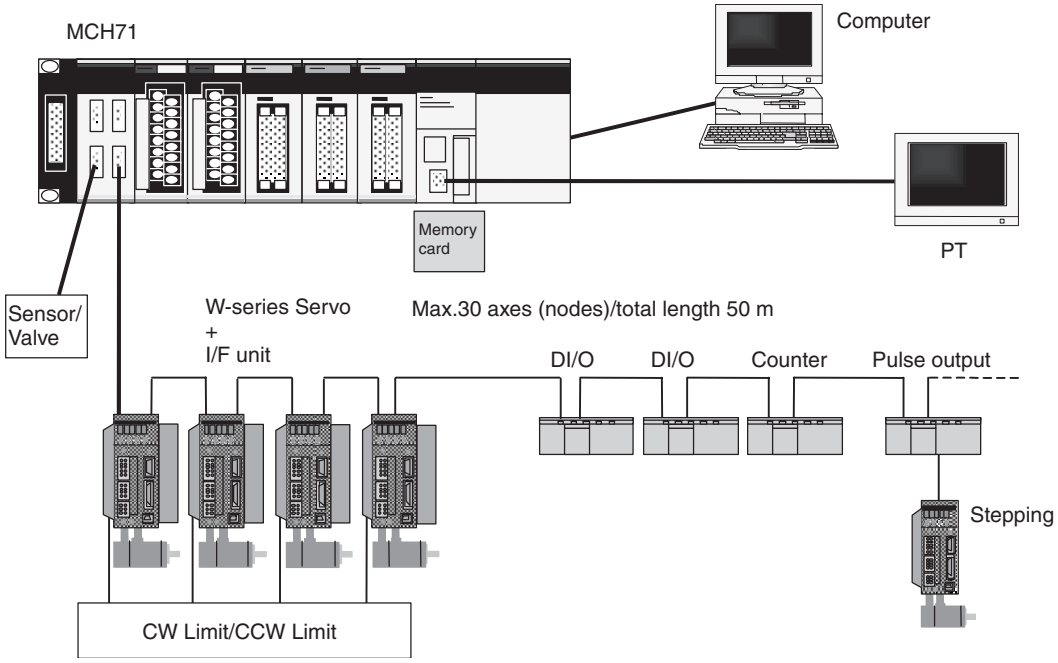
Combination of basic functions makes variety of synchronizations possible

- Electronic Shaft function
- Electronic cam function (Time, position)
- Virtual axis function
- Axis movement function for superimposed axis, ADDAX
- Resist function (with present position hardware latch and window function).
- Electronic link operation
- Trailing synchronization
- Target position change function
- Speed command
- Torque command
- Time-fixed positioning

1-2 System Configuration

1-2-1 System Configuration Example

The MC Unit is adopted a high-speed communication pathway to simplify its wiring. It makes it possible to have up to 30 axes for controls.



Note

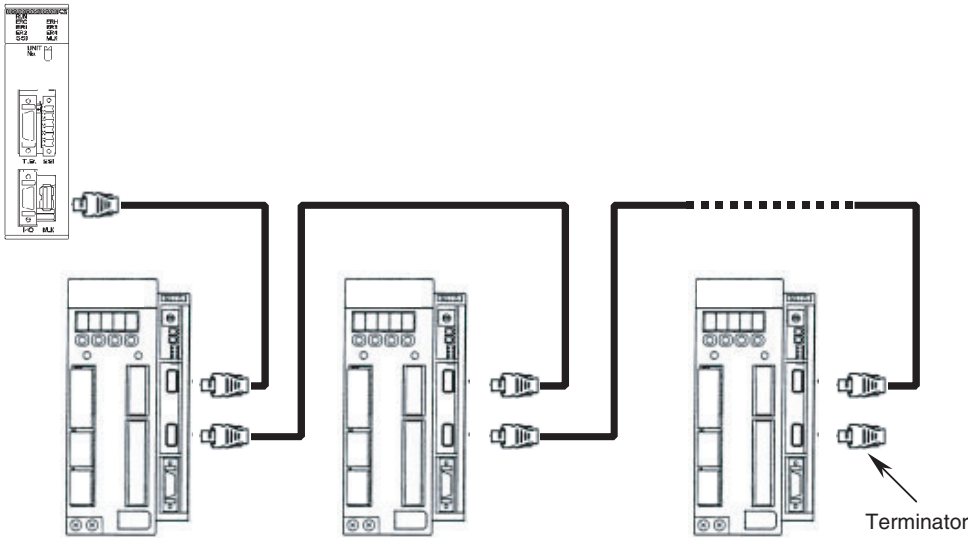
(1) The MECHATROLINK is registered trademark of YASKAWA ELECTRIC CORPORATION.

(2) W-series servo driver requires YASKAWA MECHATROLINK-II I/F unit model JUSP-NS115.

(3) Each of the products of the following version can be used. The version name is identified on the nameplates of each product.
W-series servo driver: VER.39 or Later
I/F unit: VER ***03 Later, or Equal

(4) When MECHATROLINK-II devices are connected up to 16 nodes (within 30 m) or 15 nodes (within 50 m), a repeater unit is not required. A repeater unit is required to connect MECHATROLINK-II devices more than the cases above.

(5) Attach a terminator to the termination slave of MECHATROLINK devices.



1-2-2 Peripheral Devices (Models and Specifications)

Support Tool

Name	Cat. No.	Specification Overview
Support Tool for Motion Control Unit MC-Miel for MCH	SBCE-023B	Support Tool for computers Japanese version
Support Tool for Motion Control Unit MC-Miel for MCH	I809-E1-02	Support tool for computers English version

Note When ordering support tools, please contact our sales representatives indicating the Cat. No.

MECHATROLINK-II Devices and Cables

Name	YASKAWA Model	OMRON Model	Specification Overview
MECHATROLINK-II I/F Unit	JUSP-NS115	FNY-NS115	For W-series servo driver
DC24V I/O Module	JEPMC-IO2310	FNY-IO2310	Input: 64 Output: 64
Counter Module	JEPMC-PL2900	FNY-PL2900	Reversing Counter 2CH
Pulse Output module	JEPMC-PL2910	FNY-PL2910	Pulse Positioning
MECHATROLINK-II Cables for W-Series (With USB connectors and Ring Core)	JEPMC-W6003-A5	FNY-W6003-A5	0.5 m
	JEPMC-W6003-01	FNY-W6003-01	1.0 m
	JEPMC-W6003-03	FNY-W6003-03	3.0 m
	JEPMC-W6003-05	FNY-W6003-05	5.0 m
	JEPMC-W6003-10	FNY-W6003-10	10.0 m
	JEPMC-W6003-20	FNY-W6003-20	20.0 m
	JEPMC-W6003-30	FNY-W6003-30	30.0 m
Terminating resistance for MECHATROLINK-II	JEPMC-W6022	FNY-W6022	Terminating resistance
Repeater for MECHATROLINK-II	JEPMC-REP2000	FNY-REP2000	Repeater

Note MECHATROLINK-related products are manufactured by YASKAWA ELECTRIC CORPORATION.
We, OMRON, can take orders for them. When ordering them through OMRON, follow OMRON's ordering format. (The delivered products will be of YASKAWA BRAND.)
Ask our sales representatives about the price at when ordering them through OMRON.

1-3 Basic Operations

1-3-1 Applicable Machines

The MC Unit was developed for the purpose of motion control using servomotors.

Even though it depends on the machine accuracy, use an encoder, which is capable to detect 5-10 times more accurate than the machine accuracy.

Applicable machines

1,2,3...

1. Assembling Systems
   Simple robots, package machinery (horizontal type forming and vertical type forming), filling machine, grinder, drilling machinery, simple automated assembling machines, etc.
2. Conveyor Systems
   XY tables, palletizers/depalletizers, loaders/unloaders, etc.

Note The MC Unit is not designed to perform linear interpolation, circular interpolation, or helical circular interpolation with horizontal articulated robots or cylindrical robots, because it does not support coordinate conversions. The MC Unit can, however, perform PTP control with these robots.

1-3-2 Position Control

The MC Unit offers the following three types of motion control:

- PTP Control
- CP Control (linear interpolation and circular interpolation)
- Interrupt Feeding

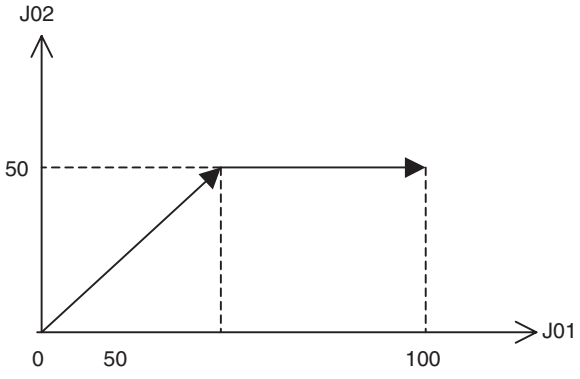
Control programs are created in the Motion language.

PTP Control

PTP control is used to control each axis (J01 and J02 axis) independently. Positioning time depends on the travel distance and speed of each axis.

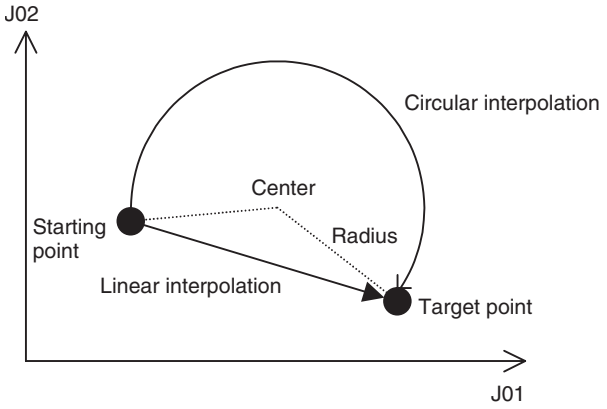
Example: Moving from the origin to the J01-axis coordinate of 100 and J02-axis coordinate of 50 at the same speed.

Positioning is executed separately for each axis, so travel between the two points is carried out as shown in the diagram below:

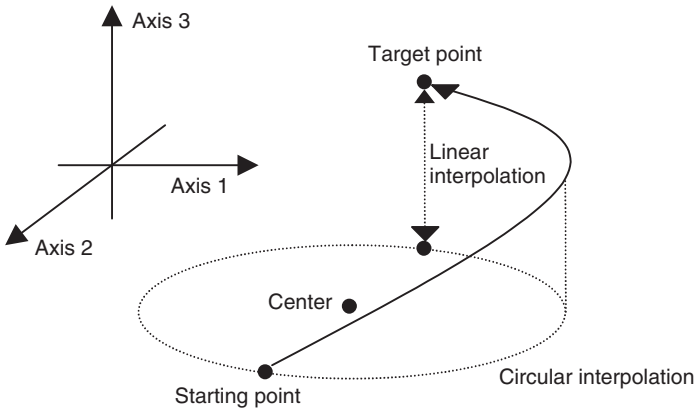


CP Control

CP Control is used to position by designing not only the starting point and the target point, but also the path between these two points. Both linear interpolation and circular interpolation are possible.



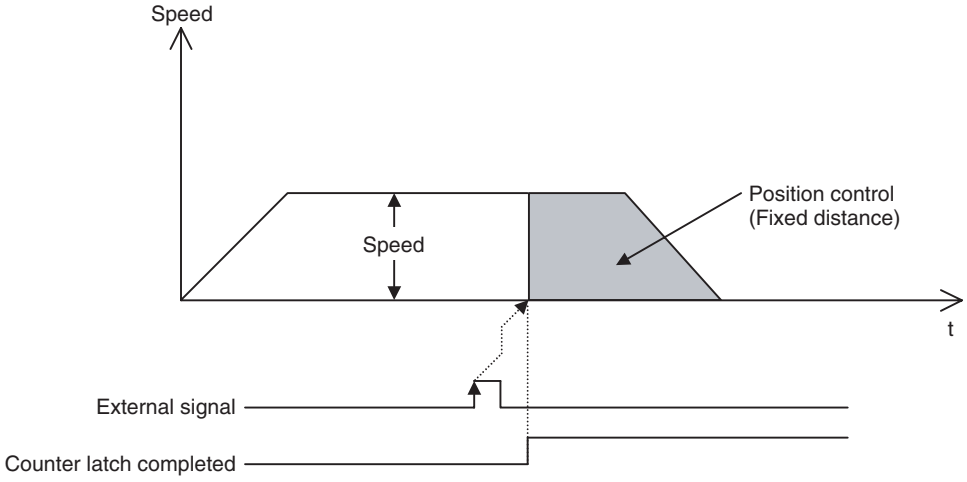
If [axis name 3] is added, helical interpolation is added to the linear interpolation. (The linear interpolation portion for multiple revolutions specifies the total travel distance.)



Interrupt Feeding

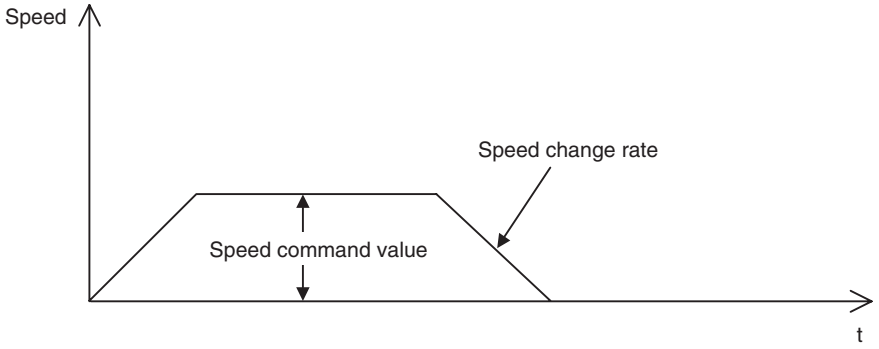
Interrupt feeding is used to perform position control for a fixed distance when the external signal is input.

Positioning with no interrupt signal is also possible.



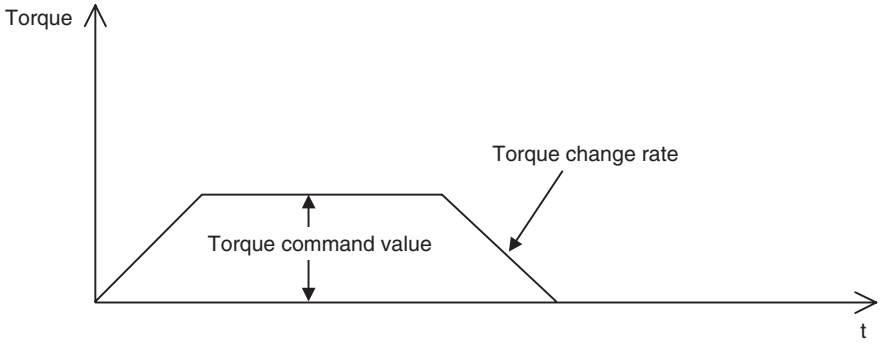
1-3-3 Speed Control

Make the motor run at a specified speed. It is also possible to specify the speed change rate.



1-3-4 Torque Control

The designated torque can be generated. It is also possible to specify the torque change rate.



1-3-5 Synchronous Control

Listed below are the synchronous controls of this unit.

- Electronic Shaft
- Electronic cam
- Linking motions
- Trailing synchronization
- Super position control

Each of above controls is programmed by motion language.

Electronic Shaft

This function can be used like rolls connected to gearbox with gearshift.
The slave axis synchronizes with the master axis at a specified ratio.

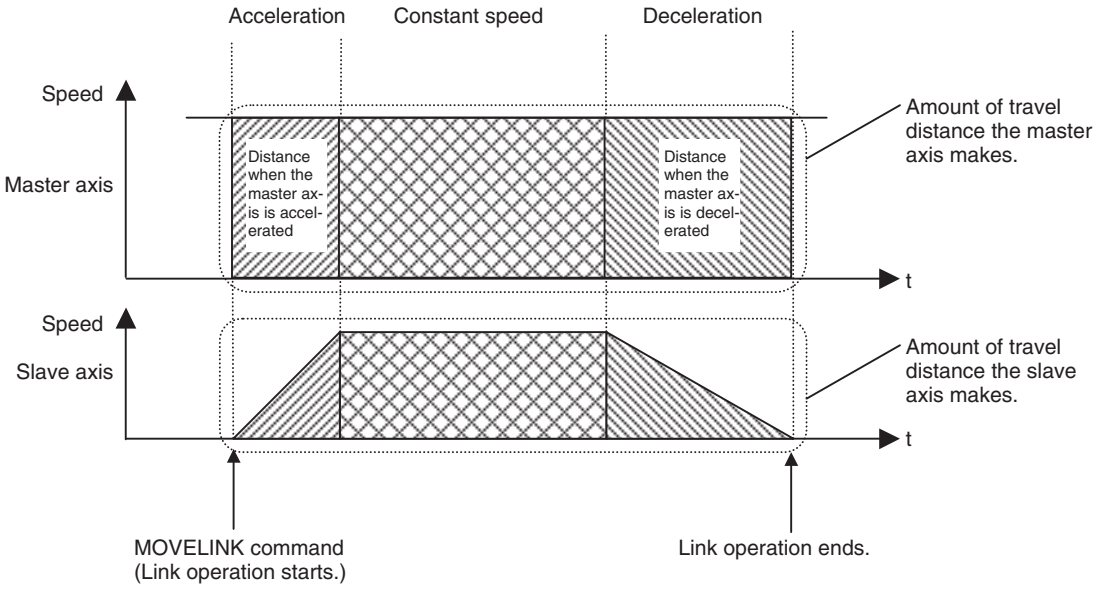
Electronic cam

This function can be used like the cam mechanism of a machine.
The slave axis synchronizes with the master axis according to the cam table.

Link operation

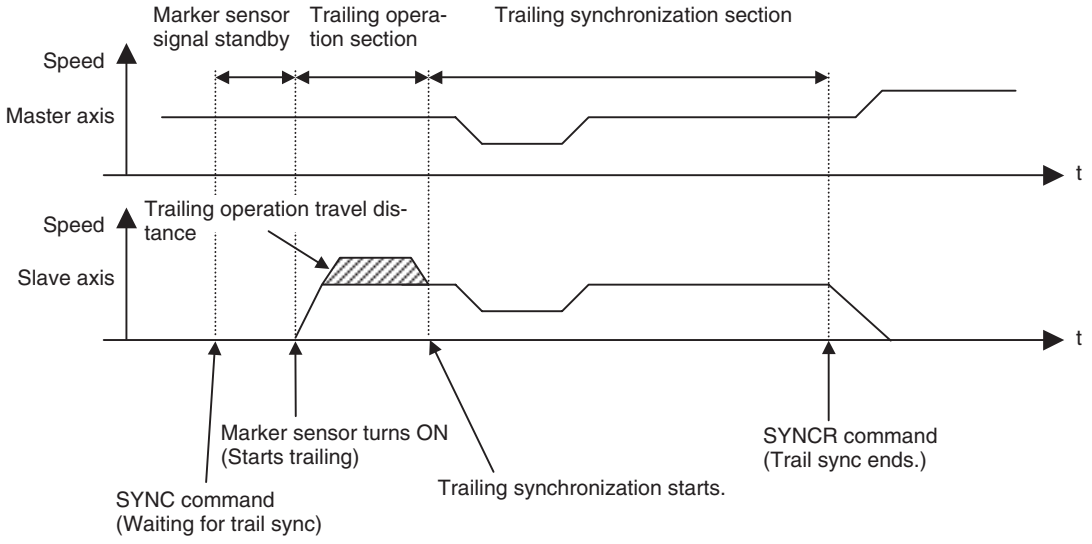
This function can be used like the link mechanism of a machine.

The slave axis synchronizes with the master axis following the specified acceleration, constant speed, and deceleration areas.
(In the diagram below, vertical and horizontal axes indicate speed and time respectively.)



Trailing Synchronization

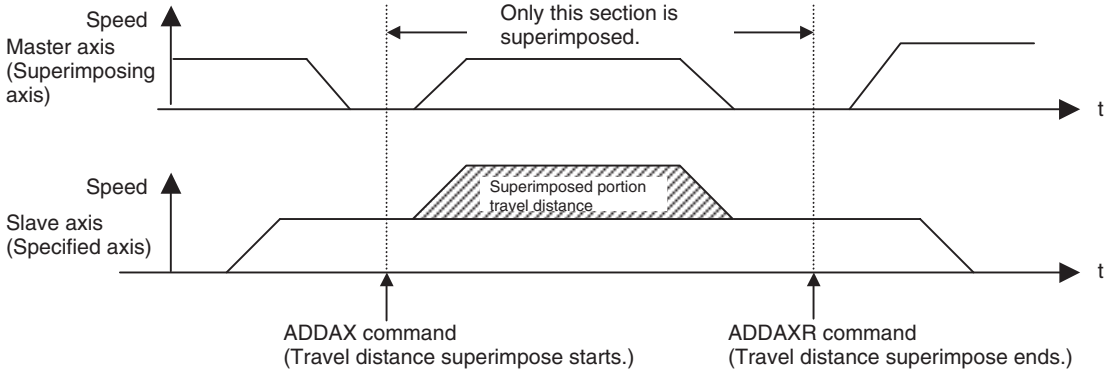
Trailing is started when the slave axis is standing by and the marker sensor is turned ON. Once it catches up with the master axis, synchronous operation is initiated.



Travel Distance Superimpose

The travel distance of the master axis is superimposed on the slave axis.

This function can be used like the differential gear of a machine.



1-3-6 Other Functions

Origin Search Establishes the origin for a specified axis.

Jogging Starts and stops a specified axis at a specified speed.

Error Counter Reset Forcibly resets the error counter to zero and stops axis operation after completing a deceleration command.

Present Position Preset Changes the present position to specified position data.

Teaching Obtains the present position to create position data.

Override (Real-time Speed Change) Changes the speed during PTP, linear interpolation, or circular interpolation operations.

Backlash Correction Compensates errors caused by faulty meshing in the mechanical system.

Unlimited Feeding Controls axes such as turntables and conveyors that are fed only in one direction unlimitedly.

Debugging It is possible to execute just one line of a program through single block operation. It is also possible to run programs without operating the machine system through Machine Lock.

Data Storage Backups and restores data using PLC memory cards.

Arithmetical Operation Command Performs Simple arithmetic operation, Functions, and Logic Operations.

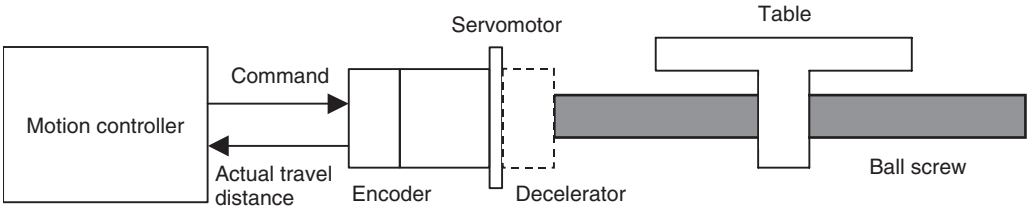
1-4 Control System Configuration and Principles

The servo system used by and the internal operations of the MC Unit are briefly described below.

1-4-1 Control System Configuration

Semi-closed Loop System The MC unit uses the servo system called the semi-closed loop system.

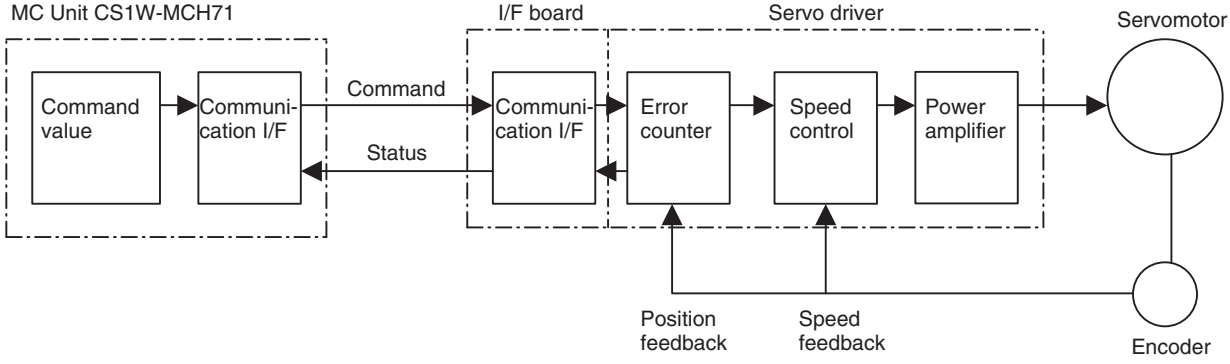
This system is designed to detect actual machine travel distance for a command value using rotations of the motor and the detected value is fed back to the MC unit. The unit computes and compensates the error between the command value and actual travel distance to make it zero.



The semi-closed loop system is the mainstream in modern servo systems applied to positioning devices for industrial applications.

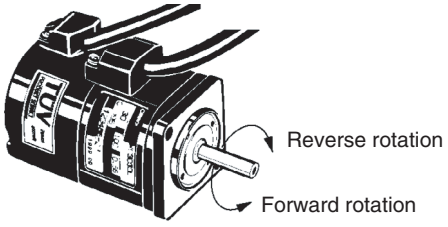
1-4-2 Control System Principles

Internal Operations of the MC Unit



1-4-3 Feedback Pulse

Normal rotation/Counter rotation of a motor



(CCW) is the forward rotation and (CW) is the reverse rotation when viewed from the output shaft side of the motor.

1-5 Performance Specifications

1-5-1 General Specifications

Item	Specifications
Model	CS1W-MCH71
Power supply voltage	DC 5V (from Backplane)
	DC24V (from external power supply)
Voltage fluctuation tolerance	DC4.75-5.25V (from Backplane)
	DC21.6-26.4V (from external power supply)
Internal current consumption	DC5V 0.8A or less
	DC24V 0.3A or less
Weight (Connectors excluded)	300g or less
Dimensions	130 (H) × 35 (H) × 100.5 (D) (single)
Altitude	At 2,000m elevation or lower.

Specifications other than those shown above conform to the general specifications for the SYSMAC CS series.

1-5-2 Functions and Performance Specifications

Item		Specifications
Model		CS1W-MCH71
Applicable PLC		CS series New Version (CS1□-CPU□□H)
Type of Unit		CS series CPU Bus Unit
Mounting		CPU unit or CS series expansion rack
Method for data transfer with CPU Unit	CIO Area for CPU Bus Unit	Occupies the area for 1 unit (25 words)
		For units and tasks: 11 to 25 words (Depending on the number of motion tasks)
	DM Area for CPU Bus Unit	Occupies the area for 1 unit (100 words)
		For units and tasks: 32 to 74 words (Depending on the number of motion tasks)
	Custom Bit Area	For axes: 0-64 words (Depending on the greatest number of the axis used)
	Custom Data Area	For axes: 0-128 words (Depending on the greatest number of the axis used)
	Custom Data Area	For General I/O: 0-1280 words (Depending on setting)
Controlled Devices		MECHATROLINK-II below supported • W-series Servo Driver (OMRON) + I/F Unit (YASKAWA) • Various I/O units (YASKAWA) Up to 30 nodes * When MECHATROLINK-II devices are connected up to 16 nodes (within 30m) or 15 nodes (within 50m), a repeater unit is not required. A repeater unit is required to connect MECHATROLINK-II devices more than the cases described above.
Built-in program language		Dedicated motion control language
Control	Control method	MECHATROLINK-II • Position commands, Speed commands, Torque commands
	Number of controlled axes	32 axes max. Physical axes/Virtual axes: 30 axes max. (Either can be selected for each axis) Dedicated for virtual axes: 2 axes
Operating modes		RUN mode, CPU mode, Tool mode/System (Depending on the tool)
Automatic/Manual Mode		Automatic mode: Executing built-in programs of MC Unit controls motion. Manual mode: Executing commands from CPU Unit (PC interface area) controls motion. **Note** The Automatic or Manual Mode is set according to the PC Interface area of the CPU Unit.
Control unit	Minimum setting unit	1, 0.1, 0.01, 0.001, 0.0001
	Units	mm, inch, deg, pulse
Maximum position command value		–2147483648 to 2147483647 pulses (signed 32-bit) Mode for unlimited axes feeding is possible. Example: With 16-bit encoder (65536 pulse/rev), Minimum setting unit: 0.001mm, 10mm/rev, the position command value range will be from –327679999 to 327679999 command units.

Item		Specifications
Control operations based on commands from the CPU Unit	Servo lock/unlock	Executes Servo driver lock or unlock
	Jogging	Executes continuous feeding independently for each axis, by means of speed set in system parameter x override.
	STEP operation	Feeds a specified distance for a specified axis.
	Origin search	Defines the machines origin according to the search method set in the system parameters.
	Forced origin	Forcibly sets the present position to 0 to establish it as the origin.
	Absolute origin setting	Sets the origin when an absolute encoder is used. Offset value: Signed 32-bit (pulses)
	Error counter reset	Forcibly resets the error counter to 0.
	Machine lock	Prohibits the output of motion commands to the axes.
	Single block	Executes the motion program one block at a time.
	Auto/manual change	Switches between auto mode and manual mode.
Control Operations according to motion program	Positioning (PTP)	Executes positioning independently for each axis at the speed set in the system parameters. Simultaneous specification: 8 axes max. /block Simultaneous execution: 32 blocks max. /unit
	Linear interpolation	Executes linear interpolation for up to 8 axes simultaneously at the specified interpolation speed. Simultaneous specification: 8 axes max. /block Simultaneous execution: 32 blocks max. /system
	Circular interpolation	Executes clockwise or counterclockwise circular interpolation for two axes at their specified interpolation speed. Simultaneous specification: 2 or 3 axes/block Simultaneous execution: 16 blocks max. /system
	Origin search	Defines the machine origin according to the search method set in the system parameters. An offset can be specified for the position after the origin search. The absolute encoder can also execute origin search.
	Interrupt feeding	By means of inputs to the servo driver, moves a specified axis for a specified travel distance to perform positioning.
	Time-specified Positioning	Executes positioning with time specified.
	Traverse function	Performs winding operation (traverse control) with two specified axes.
	Electronic Cam, Single Axis	Execute cam operation according to the specified cam table data with reference to elapse of time.
	Synchronous Electronic cam	Executes cam operation according to the specified cam table data with reference to the position of the specified axis.
	Link operation	Executes link operation according to set conditions with reference to the position of the specified axis.
	Electronic Shaft	Executes synchronous operation at a speed calculated with the speed of the specified axis and gear ratio.
	Trailing synchronous operation	Executes trailing + synchronous operations with reference to the position of the specified axis.
	Speed command	Outputs speed commands to the specified axis.
	Torque command	Outputs torque commands to the specified axis.
Acceleration /deceleration curve		Trapezoidal or S-shape
Acceleration/ deceleration time	Acceleration/ deceleration time	60000ms max.
	S-shape time constant	30000ms max.

Item		Specifications
External I/O	For high-speed servo communication bus	One port for MECHATROLINK-II
	Servo encoder	Incremental rotary encoder Absolute rotary encoder (Unlimited length ABS supported with some conditions)
	I/O	Deceleration stop input: 1pt General input: 2pts General output: 2pts
	External power supply for I/O	24V
Feed rate	Rapid feed rate	1 to 2147483647 [Command unit/min]
	Interpolation feed rate	1 to 2147483647 [Command unit/min]
	Override	Changes the operation speed by applying a given factor to the speed specified by the system parameters or the motion program. 0.00 to 327.67% (Setting unit: 0.01%, can be specified for each axis or task)
Axis control	Backlash compensation	Compensates mechanical backlash (the mechanical play between driving and driven axes) with a value registered in advance. This function uses a parameter in the servo driver.
	In-position	This function is used whether a positioning is completed or not. This function uses a parameter in the servo driver.
	Position loop gain	This is the position loop gain of the servo driver. This function uses a parameter in the servo driver.
	Feed forward gain	The command values created in the MC Unit are multiplied by this feed forward gain. This function uses a parameter in the MC Unit.
Program	Number of tasks	Motion task: 8 tasks max.
	Parallel branching in task	Motion task: 8 branches max.
	Number of programs	256 programs max. /unit The program Nos. used for programs are from 0000 to 0999.
	Program numbers	0000 to 0499: Main programs for motion tasks 0500 to 0999: Sub-programs for motion tasks
	Program capacity	2 Mbytes 8000 blocks max. /unit by motion program conversion.
	Number of blocks	800 blocks/program
	Position data capacity	10240 points/unit
	Sub-program nesting	5 levels max.
	Start	Starts program operation from program (of another task)
	Start mode	Motion task: Initial, continue, next
	Deceleration stop	Motion task: Executes deceleration stop regardless of block
	Block stop	Motion task: Executes deceleration stop at the end of the block currently being executed.
	Single-block mode	Motion task: the program is executed one block at a time.
Saving program data	MC Unit	Flash memory backup
Self-diagnostic function		Watchdog, FLASH-ROM check, RAM check, etc.
Error detection function		Deceleration stop input, unit number error, CPU Unit error, software limit over errors, etc.
Error log function		The error log is to be read from the CPU Unit by means of the IORD instructions as needed.
Alarm reset		Alarm reset

Note (1) To determine the number of MC Units that can be mounted under one CPU Unit, examine the followings:

- Maximum number of CPU Bus Units that can be allocated words in the CPU Unit being used
- The capacity of the power supply unit used for each rack (CPU Unit and Expansion Rack) and the current consumption of the units mounted on the racks. (Refer to the CPU Unit's operation manual for details on calculation methods.)

(2) The user must prepare the required power supply.

(3) The service life for the flash memory is 100,000 writing operations.

(4) The model CS1□-CPU□□H is the CPU Unit in which the IOWR/IORD instructions can be used. However, the version of the Unit decides whether the Unit has the function or not. See below:

(a) CPU Units before Jan. 7, 2002 (Lot. 020107)
They do not have the function.

(b) CPU Units after April 18, 2003 (Lot. 030418)
They have the function.

The maximum command values and software limit values will be as shown in the following table corresponding to the position command decimal point position.

Position command decimal point (Setting value for P5AA02)		Setting ranges
1	(0)	–2147483648 to 2147483647
0.1	(1)	–214748364.8 to 214748364.7
0.01	(2)	–21474836.48 to 21474836.47
0.001	(.3)	–2147483.648 to 2147483.647
0.0001	(4)	–214748.3648 to 214748.3647

The actual ranges that can be set may be smaller than those shown above depending on the pulse rate. The setting values must satisfy the following conditions:

With INC Specification:

Minimum value: –2147483648
Maximum value: 2147483647

With Limited Length Axis ABS Specification:

Minimum value: –(P5AA04 × P5AA06 × 2147483647)/(Encoder resolution × P5AA05)
Maximum value: (P5AA04 × P5AA06 × 2147483647)/(Encoder resolution × P5AA05)

With Unlimited Length Axis ABS Specification:

Minimum value: –(P5AA04 – 1)
Maximum value: P5AA04 – 1

P5AA04: Command unit/1 machine rotation
P5AA05: Gear ratio 1 (Motor rotation speed)
P5AA06: Gear ratio 2 (Machine rotation speed)

Example: With Limited length axis ABS specification, 1mm/rev, 16384 pulses/rev with multiplication factor, and Minimum setting unit: 0.0001mm; The value will be from –131072000 to 131071999.
Additionally, the present positions that can be displayed on support tools are to be within the range described in the above table.

The basic concept for immediate value:
There are integer and decimal immediate values; the applicable numeric value range for the MC Unit is shown below:

Integer: Numeric value without decimal point
Minimum value: –2147483648
Maximum value: 2147483647

Decimal: Numeric value with decimal point
Minimum value: –2147483648.
Maximum value: 2147483647.
Maximum number of decimals: 30 digits
Maximum number of digits excluding zero: 10 digits
(Negative definite: 2147483648, Positive definite: 2147483647)

<Example> Maximum number of decimals

Number of decimals				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Negative definite	-	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4	7	4	8	3	6	4	8
Positive definite	+	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4	7	4	8	3	6	4	7
Maximum number of digits excluding 0																								<----------10 dights ---------->									
Maximum number of decimals				<---------- 30 digihts ---------->																													

1-6 Command List

Item		Contents	Page
Operating modes		The following 2 modes are provided: Manual Modes: Operation according to commands from CPU Unit PC interface area. Automatic Mode: Operation according to commands in program.	346 469
Manual mode JOG STEP Origin Search	Jogging	Moves axes continuously by manual operation.	436
	Deceleration stop (Axis)	Decelerates manual mode operations (Jogging, STEP, Origin search) and stop.	432
	STEP operation	Feeds a specified axis for a specified distance.	440
	Manual origin search	Searches for the machine origin (Possible with either Incremental or Absolute encoder)	444
	Manual origin return	Moves the axis to the origin in the reference coordinate system.	448
	Forced origin	Forcibly sets the present position to 0 to establish it as the origin. (In the absolute encoder system, only the present position of the MC Unit will be set to 0.) **Note** To preset the preset position to any given value, IOWR instruction is used.	457
	Absolute origin setting	Sets the origin for an absolute encoder.	459

Item		Contents	Page
Automatic	Positioning (PTP)	Execute positioning independently for each axis at the specified speed or the speed set in the system parameters.	271
	Positioning with linear interpolation	Executes linear interpolation at the specified interpolation feed rate for up to 8 axes simultaneously	273
	Positioning with circular interpolation	Executes clockwise or counterclockwise 2-axis circular interpolation at the specified interpolation feed rate.	274
	Positioning with helical circular interpolation	Executes clockwise or counterclockwise 2-axis circular interpolation and 1-axis linear interpolation (i.e., helical interpolation) at the specified interpolation feed rate.	274
	Origin search	Defines the machine origin according to the search method set in the system parameters.	278
	Interrupt feeding	Moves a specified axis for a specified distance when a general input is turned ON.	281
	Time-specified positioning	Executes positioning to a specified position with time specified.	282
	Target position change	Changes target position of an operating axis to a specified position.	305
	Traverse	Execute winding (traverse) function.	284
	Electronic Shaft function	Executes synchronous operation at a speed calculated with the speed of the specified master axis and a specified gear ratio.	296
	Electronic cam (Single axis)	Executes cam operation in a specified time period using a specified cam table.	286
	Electronic cam (Synchronous)	Synchronizes the slave axis to the master axis using cam table.	292
	Link operation	Synchronizes the slave axis to the master axis with specified acceleration, constant speed, and deceleration areas.	289
	Trailing synchronization	Slave axis starts trailing master axis at the rise of marker sensor when standing by. Once it catches up with master, synchronization starts.	297
	Travel distance superimpose	Superimposes travel distance of the master axis on the slave axis. It functions like the differential gear.	298
	Speed control	Rotates the motor at the specified speed. Speed change rate can also be specified.	300
	Torque control	Generates the specified torque. Torque change rate can also be specified.	303
	Virtual axis	This is an axis without an actual axis. It is used as a master axis to perform an ideal operation.	256
	Counter latch	The present position of an axis can be stored in hardware.	311
	Switching to Pass Mode	Changes to Pass Mode, in which operations are executed continuously with no deceleration stop.	308
	Dwell timer	Pauses positioning for a specified time.	316
	Arithmetic command	Performs arithmetic, function, and logic operations.	327 329 331
	Program start	Executes a program from the beginning block, resumes a program execution from the block where it was stopped, or resumes a program from the next block to the one where it was stopped.	404
	Single block	Executes programs one block at a time.	419
	Block stop	Stops program execution at the end of the block being executed.	414

Item		Contents	Page
Automatic/ Manual mode	Backlash compensation	Compensates mechanical backlash (mechanical play between driving and driven axes) with the value registered in advance. (This is a function of the servo driver.)	183
	Error counter reset	Forcibly resets the error counter to 0, and stops axis operation. (Enabled when no speed reference is given to the servo driver)	452
	Unlimited feed mode/ Unlimited present position display	Moves the axis with no limit. In this mode, data range for updating the present position can be specified.	515
	Present position preset	Changes the present position to the specified position data.	50
	Trapezoid/S-curve acceleration and deceleration	Either trapezoid or S-curve acceleration / deceleration can be specified for starting and stopping each axis.	228
	Axis alarm reset	Resets alarms occurring on axes.	474
	Unit alarm reset	Resets alarms occurring on units.	381
	Task alarm reset	Resets alarms occurring on tasks.	426
	Teaching	Creates position data for the specified axis.	504
	Deceleration stop (Task)	Decelerates each task to a stop.	409
	Override	Changes the operating speed by applying a specified percentage to the speed specified in the system parameters or programs.	423 462
	Servo-lock	Establishes the position loop and turns ON the RUN command output to the servo driver.	434
	Servo-unlock	Releases the position loop and turns OFF the RUN command output to the servo driver.	434
	Machine lock	Updates the position display without moving control axes. This is used for debugging program.	465
Data transfer and storage	Data transfer	Transfer data from the CPU to the MC Unit and vice versa in a short period of time using IOWR/IORD instruction in the ladder program.	50 203
	Data link	Custom data can be exchanged during I/O refresh by setting custom I/O area in the words allocated in the DM area of CPU Unit.	343 364
	Saving data	Stores programs, CAM data, parameters, position data, etc. in the MC Unit's flash memory.	195
	Backup and restore	Backs up or restores all the data in the MC Unit using the easy backup function of the CPU Unit.	522

1-7 Performance

Item	Performance data	Description
Power ON startup time	Approximately (13+0.1×No. of axes) seconds	Time from turning ON the power until the MC Unit becomes ready to accept manual operation commands.
PLC scan time	Tc	Scan time of the PLC
Unit cycle	Tm	This is the time required to execute a motion task when there is only one motion task. Refer to *Calculation Method for Unit Cycle* on page 19.
Communications cycle	Ts	Communications cycle of MECHATROLINK-II. Refer to *Calculation Method for Communications Cycle* on page 20.
Operation startup time	When Tc < Tm: 2Ts+Tm+0.625ms+Tc~2Ts+Tm+Ts+0.625ms+Tm+Tm When Tc > Tm: 2Ts+Tm+0.625ms+Tc~2Ts+Tm+Ts+0.625ms+Tm+Tc	This is the time from enabling the start signal allocated to the input unit of PLC until the operation command is output to the control loop of the servo driver when there is only one motion task and all the axes are operated simultaneously.

Item		Performance data	Description
Time lag per axis (Interpolation)		0	Time delay caused when interpolation is performed with one motion task. No delay between axes.
Time lag per axis (Independent operation)		0	Time delay caused when every motion task with one axis is started simultaneously. No delay between axes.
Minimum operation time		Tm	Minimum operation time required to stay in Pass Mode. The same as the Unit Cycle.
Minimum traverse reversal time		Tm	Minimum time required for reversal operation of traverse command. The same as the Unit cycle.
External input response time	Unit Built-in general input	Tm or less	Time from accepting the Unit built-in general input until it is reflected to input variables. It is the same or less than Unit cycle.
	Unit Built-in deceleration stop input	2Ts+Tm+0.625ms~2Ts+Tm+Ts+0.625ms+Tm	Time from receiving deceleration stop input until the operation command is output to the control loop of the servo driver
	CW/CCW limit origin proximity input	4Ts+Tm+0.625ms~4Ts+Tm+Ts+0.625ms+Tm	Time from when the servo driver recognizes the input until the operation command is output to the control loop of the servo driver.
Synchronization delay	MECHATROLINK slaves	4Ts+Tm+0.625ms~4Ts+Tm+Ts+0.625ms+Tm	Time from when the slave recognizes the input until the operation command is output to the control loop of the servo driver.
Counter latch startup time	W + NS115	[(20ms/Tm) ×5+5] ×Tm+Ts×3+4ms~[(20ms/Tm) ×8+5] ×Tm+Ts×3+4ms	Time taken by the MC unit to become able to execute the counter latch after issuing a LATCH command. Refer to*Calculation Method for the Counter Latch Startup Time* on page 20.
		Unit Ver. 2.0 or Later When the starting and target positions are not specified: Tm × 3 + Ts × 3 + 4 ms	

Processing Cycle of MC Unit

The MC Unit holds Control Cycle for the entire Unit and Communication Control Cycle.

The system software calculates each control cycle, and it operates when "Unit cycle: Communications cycle" is "1:1" or "2:1".

Calculation methods for each control cycle are as follows:

- Calculates the Unit Cycle
- Calculates the Communication Cycle
- Adjusts and matches the Unit Cycle and Communications Cycle.

Calculation Method for Unit Cycle

Basic formula for calculating Unit Cycle is shown below:

Unit Cycle [μs] = (115.0 × No. of axes)+(165.0 × No. of motion tasks × No. of parallel branches) + (0.3 × No. of general allocated words) + 350.0 --- (1)

- No. of axes: No. of axes allocated in [P1AA01:Physical axis setting] (Sum of virtual and actual axes)
- No. of Motion tasks: P00001 [No. of Motion tasks]
- No. of parallel branches: P00002 [No. of parallel branches]
- No. of general allocated words:
  No. of Allocated words to be used as general purpose I/O (Sum of inputs and outputs)

Note for P00003 [Unit Scan time]

When P00003 [Unit Scan time] is greater than the result of the formula (1), the formula (2) below is to be used.

Unit Cycle [μs] = P00003 × 1000 ---(2)

Determining Unit Cycle

The Unit Cycle can be determined by rounding up the Unit Cycle [us] that was found by the formula (1) or (2) to 1ms/2ms/3ms/4ms/6ms/8ms.

Calculation Method for Communications Cycle

Basic formula for calculating Communications Cycle is shown below:

Communications Cycle [μs]= ((No. of allocated nodes + No. of Retries) × 133.3 + 26.2) × 1.1 ---(3)

- No. of Allocated Node: No. of MECHATROLINK-II slaves (only physical axes) allocated in [P1AA01: Physical Axis Setting]
- No. of Retries: No. of retries specified in [P00009: MECHATROLINK No. of retrial nodes setting] (= 0-7).

Note for W-series Servo Driver

When a W-series Servo Driver and NS115 communications module are allocated as slaves, Minimum communications cycle of MECHATROLINK-II will be 1ms. If the Communications cycle that was found by the formula (3) was less than 1ms, the formula (4) below is to be used.

Communications cycle [μs] = 1000 ---(4)

Determining Communications Cycle

The Communications Cycle can be determined by rounding up the Communications Cycle [μs] that was found by the formula (3) or (4) to 1ms/2ms/3ms/4ms.

Adjusting and Matching Unit Cycle and Communications Cycle

Determine the combination of the Unit Cycle and Communications Cycle using the following table:

Control cycle relations	Adjusting/matching method
Unit Cycle < Communications Cycle	Communications Cycle remains the same, and Unit Cycle is adjusted so that it is the same as Communications Cycle.
Unit Cycle = Communications Cycle	Used as they are.
Unit Cycle > Communications Cycle	When Unit Cycle is 8ms: The Communications Cycle is 4ms. Other cases: When Unit Cycle/Communications Cycle = 2 or less: The Unit Cycle remains the same, and the Communications Cycle will be the half of the Unit Cycle. Besides the above case: The Unit Cycle remains the same, but the Communications Cycle will be the same as the Unit Cycle.

Calculation Method for the Counter Latch Startup Time

Basic formula for calculating the counter latch startup time is shown below:

1. Pre-Ver. 2.0 MC Units or When Latch Starting and Target Positions Are Specified

When Unit Cycle = 1ms or 2ms:
[(20ms/Tm) × 5 + 5] × Tm + Ts × 3 + 4ms ~ [(20ms/Tm) × 6 + 5] × Tm + Ts × 3 + 4ms

When Unit Cycle = 3ms, 4ms, 6ms, or 8ms:
[(20ms/Tm) × 7 + 5] × Tm + Ts × 3 + 4ms ~ [(20ms/Tm) × 8 + 5] × Tm + Ts × 3 + 4ms

Note Round up the figures below the decimal place of the value found by calculations.

According to the calculation methods above, the counter latch startup time will be as follows:

- Unit Cycle = 1ms: Communication Cycle = 1ms 112 ms ~ 132 ms
- Unit Cycle = 2ms: Communication Cycle = 1ms 117 ms ~ 137 ms
- Unit Cycle = 2ms: Communication Cycle = 2ms 120 ms ~ 140 ms
- Unit Cycle = 3ms: Communication Cycle = 3ms 175 ms ~ 196 ms
- Unit Cycle = 4ms: Communication Cycle = 2ms 170 ms ~ 190 ms
- Unit Cycle = 4ms: Communication Cycle = 4ms 176 ms ~ 196 ms
- Unit Cycle = 6ms: Communication Cycle = 3ms 211 ms ~ 235 ms
- Unit Cycle = 8ms: Communication Cycle = 4ms 224 ms ~ 248 ms
- Unit Cycle = 8ms: Communication Cycle = 8ms 236 ms ~ 260 ms

2. Ver. 2.0 MC Units or When Latch Starting and Target Positions Are Not Specified

$Tm \times 3 + Ts \times 3 + 4ms$

Note Round up the figures below the decimal place of the value found by calculations.

According to the calculation methods above, the counter latch startup time will be as follows:

- Unit Cycle = 1ms: Communication Cycle = 1ms 10 ms
- Unit Cycle = 2ms: Communication Cycle = 1ms 13 ms
- Unit Cycle = 2ms: Communication Cycle = 2ms 16 ms
- Unit Cycle = 3ms: Communication Cycle = 3ms 22 ms
- Unit Cycle = 4ms: Communication Cycle = 2ms 22 ms
- Unit Cycle = 4ms: Communication Cycle = 4ms 28 ms
- Unit Cycle = 6ms: Communication Cycle = 3ms 31 ms
- Unit Cycle = 8ms: Communication Cycle = 4ms 40 ms

SECTION 2
Basic Procedures

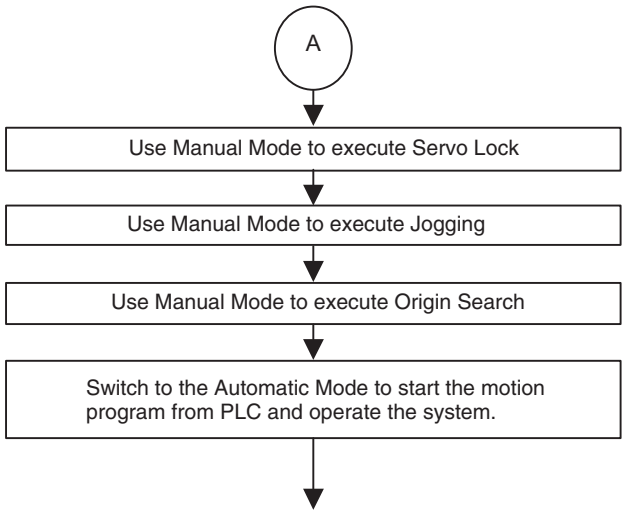
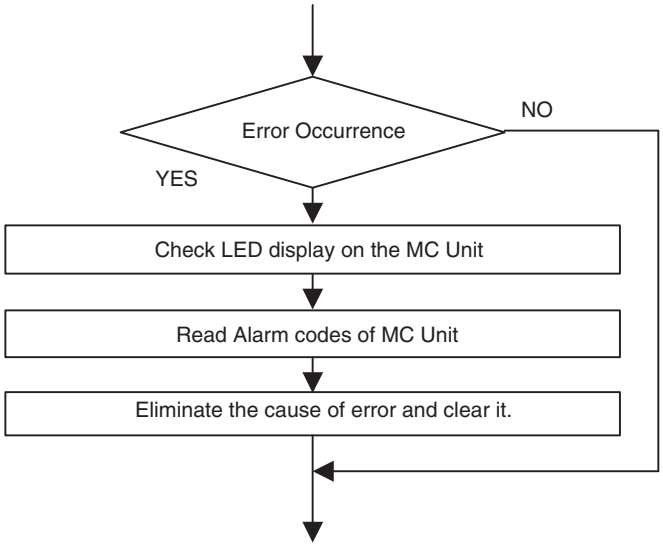
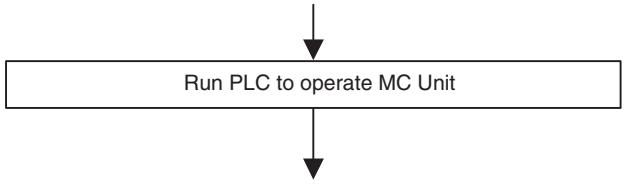
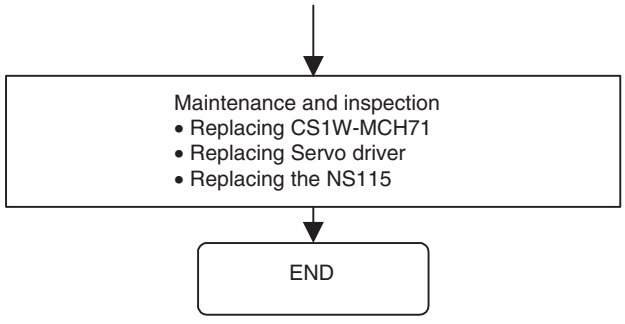
This section provides an overview of the basic procedures required to use the CS1W-MCH71 Motion Control Unit.

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2-2-2 MC-Miel Function List 26
2-2-3 Installing and Uninstalling MC-Miel 27
2-2-4 MC-Miel Operation Flow 27

2-1 Basic Operation Flow

This Section gives an overview of the procedures required to use CS1W-MCH71.

OPR.	Operation Flow	Reference
Setup	START ↓ Install MC Unit ↓ Set Unit No. for MC Unit ↓ Connect Support Tool/CX-Programmer ↓ Connect MC Unit with External Input Devices ↓ Connect Servo Driver and Servomotor ↓ Connect Servo Driver and MC Unit ↓	*SECTION 3 Installation and Wiring* *3-2 Installation* *3-1 Nomenclature and Functions* *3-4 Wiring*
MC Unit Setting	↓ Turn ON the Power to the PLC ↓ Create the I/O table of PLC ↓ Set MC Unit Allocation Area in PLC DM Area ↓ Power OFF and ON the PLC ↓ Use MC-Miel to set the system parameters, transfer them to MC Unit, and save them to flash memory. ↓ Use MC-Miel to create motion programs and position data. Transfer them to MC Unit and save them to flash memory. ↓ Turn ON the power to the PLC or restart MC Unit to enable settings. ↓ A	Users Manual for CS Series CPU Unit *SECTION 7 PC Interface Area* *7-3 Allocations for the CPU Unit* *SECTION 4 MC Unit Internal Data Configuration and Setting* *4-2 System Parameters* *4-4 Position Data* *SECTION 6 Programming*

OPR.	Operation Flow	Reference
Trial OPR		*SECTION 7 PC Interface Area* *7-3 Allocations for the CPU Unit* *7-4 Interface Specifics* *SECTION 8 Establishing the Origin*
Debug		*SECTION 11 Troubleshooting*
Run		*SECTION 10 Program Example*
Maintenance		*SECTION 12 Maintenance and Inspection*

Note For details of the procedure, refer to HELP of the Support Tool.

2-2 Overview and Operating Procedure of MC-Miel

This section explains the overview, features, and operating procedure of the support tool, MC-Miel for MCH (MC-Miel hereinafter). MC-Miel helps to set various parameters and data for CS1W-MCH71.

For detailed information on the performance and operating procedure, refer to MC-Miel Online Help.

2-2-1 Overview and features

MC-Miel is the software that can help to create various data used on the MC Unit model CS1W-MCH71, (MC Unit hereinafter) and to monitor the status of the MC Unit. Its features are as follows:

Supports eight layers of network

Using MC-Miel with OMRON's Communication Unit will enable communications with the MC Unit over eight layers of network.

Easy communication settings

When communicating with MC Unit, it is required only to set the network address and communication speed. Setting data length, stop bit, etc. is not necessary.

Unitary management of data

MC Unit handles various data such as parameters, position data, programs, etc. MC-Miel manages these data unitarily, i.e. on the basis of one file for one MC Unit.

Possible to edit parameters of servo drivers and motors

With MC-Miel, it is possible to edit not only the parameters of MC Unit, but also the ones related to the servo drivers and motors on the same network.

Backing up and restoring the data all at once

Easy operation will make the data of MC Unit backed up and restored all at once.

Tying up with application software on the market

Using "Copy and Paste" of the application on the market (Excel) will make it easy to create the position data and parameters.

2-2-2 MC-Miel Function List

Overview of the MC-Miel functions is listed below:

Function classification	Function	Description
Basic function	Create	Creates new MCH data. **Note** Contents of MCH data are as follows: Parameters, Position data, Programs, and Cam data
	Read	Reads the MCH data stored in external memory device.
	Save	Saves the MCH data that was read or is being edited to external memory device.
	Transfer all at once	Transfers various data in MC Unit to personal computer all at once. Transfers various data in personal computer to MC Unit all at once.
	Print	Prints out parameters, position data, and programs.
	Network setting	Helps various settings to establish communication with MC Unit.
	Help	Explains the operation method of MC-Miel.
	Version display	Displays the version of MC-Miel.

Function classification	Function	Description
Edit function	Parameter edit	Creates, edits, and transfers parameters.
	Program edit	Creates, edits, and transfers programs.
	Position data edit	Creates, edits, and transfers position data.
	Cam data edit	Creates, edits, and transfers cam data.
	Factory default setting	Brings the dragged portion of MCH data back to its factory default setting.
	Copy and paste	Copies the dragged portion of MCH data to clipboard. Pastes the data in clipboard to the dragged area of MCH data.
MC unit supporting function	Flash memory save	Saves various data in MC unit to F-ROM of MC Unit. Saves parameters of servo driver in MC Unit to EEP-ROM of servo driver.
	Memory initialization	Initializes various data in MC Unit.
	Error log	Displays or initializes error log in MC Unit.
	Device information	Reads information (model, software version) of MC Unit.
Tool function	Present position/alarm monitor	Monitors present position and alarm information of each axis. Monitors program No. being executed by each task.
	Variables monitor/setting	Monitors and sets different types of variables in MC Unit.

2-2-3 Installing and Uninstalling MC-Miel

Installing Procedure

1,2,3...

1. Start Windows.
2. Insert MC-Miel (CD-ROM) into CD-ROM drive.
3. Installer will start automatically. Follow the instruction on the screen to install.

   Installing MC-Miel completed

Note To see the operating manual
To see the operating manual of MC Unit provided in the CD-ROM, Acrobat Reader is required.

1,2,3...

1. Double-click “AcroReader51_ENU.exe” in Acrobat\Reader to install Adobe Acrobat Reader 5.1.
2. After installation, open the operating manual.

Uninstalling Procedure

1,2,3...

1. Start “add/delete application” following the operation below:
   Select **Start** button → **Setting** → **Control Panel**.
   Then, start “Add/delete application”.
2. Delete “MC-Miel for MCH” after having found it with search.

   Uninstalling MC-Miel completed

2-2-4 MC-Miel Operation Flow

When using motion control system (MC System hereinafter), settings for PLC, MC Unit, and Peripherals are required.

The explanation below is provided on the assumption that all the devices required for MC System are prepared. (For details, refer to the MC-Miel Online Help.)

Operating Procedure

1,2,3...

1. Connect a personal computer to PLC with MC Unit not mounted yet.
2. Turn ON the personal computer.

3. Turn ON PLC.
4. Set allocation area in DM area corresponding to the unit No. (UNIT No.) of the MC Unit using CX-programmer or the Programming Console of PLC.
5. Turn OFF PLC.
6. Mount MC Unit on PLC.
7. Set unit No. (UNIT No.) of MC Unit.
8. Connect various peripherals (servo driver, motor, etc.) including the Communication I/F Board to MC Unit.
9. Set Communication I/F Board.
10. Turn ON peripherals.
11. Turn ON PLC.
12. Create I/O table using CX-Programmer or the Programming Console of PLC. When finished creating I/O table, end CX-Programmer or set it Off-line.
13. Start MC-Miel.
14. Set and save parameters that have to be set with MC-Miel.
    - Allocate an axis to MC Unit.
    - After the allocation, save parameters to F-ROM of MC Unit.
    - After saving, turn OFF PLC once, then ON again.
15. Set the initial values of the following parameters and transfer them to MC Unit and servo driver.
    - Set parameters of the servo driver.
    - Set parameters of the motor.
16. After transferring the parameters, save them into F-ROM of MC Unit and EEP-ROM of servo driver.
17. Turn OFF the peripherals including the servo driver once, and then turn OFF PLC.
18. Turn ON PLC, and then turn ON peripherals including the servo driver.
19. Create and edit other parameters and data.
    - Parameters
    - Programs
    - Position data
    - Cam data
20. Transfer and save the parameters and data above to MC Unit and the servo driver.
21. At last, save all the data into the personal computer.
22. End MC-Miel.

Note CX-Programmer and MC-Miel cannot use the same communication port at the same time.
To use the same communication port, set one Off-line and the other On-line.

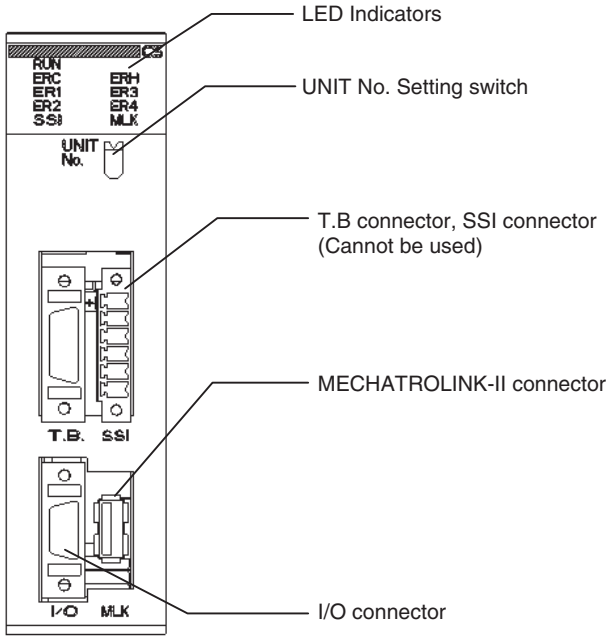
SECTION 3
Installation and Wiring

This section describes the names of Unit parts and how to install and wire the CS1W-MCH71 Motion Control Unit.

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3-1 Nomenclature and Functions

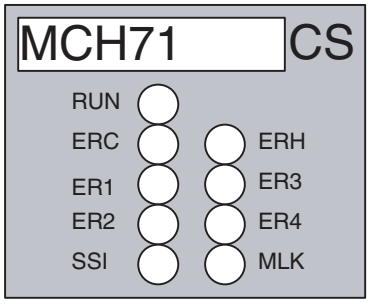
3-1-1 Nomenclature



LED Indicators

Name	Color	Status	Content
RUN (RUN)	Green	Lit	Motion Control Unit is operating normally.
		Not lit	Not recognized by PLC, or MC Unit is broken.
ERC (MC Unit Error)	Red	Lit	An error has occurred in the MC Unit.
		Not lit	MC Unit is operating normally.
ERH (CPU Unit Error)	Red	Lit	An error has occurred in the CPU Unit.
		Not lit	CPU Unit is operating normally.
ER1 (See note.) (Internal error status)	Yellow	Lit	An internal error has occurred.
		Not lit	MC Unit is operating normally.
ER2 (See note.) (Internal error status)	Yellow	Lit	An internal error has occurred.
		Not lit	MC Unit is operating normally.
ER3 (See note.) (Internal error status)	Yellow	Lit	An internal error has occurred.
		Not lit	MC Unit is operating normally.
ER4 (See note.) (Internal error status)	Yellow	Lit	An internal error has occurred.
		Not lit	MC Unit is operating normally.
SSI	Yellow	Lit	Not used.
		Not lit	Not used.
MLK (MECHATROLINK-II)	Yellow	Lit	MLK is operating normally.
		Not lit	An error has occurred in the MLK.

Note When the ERC or ERH indicator is lit, these four indicators show the internal error status.



Unit Number Setting Switch

Several MC Units can be mounted on one CS series PLC.

It is necessary to set the unit numbers to identify these units when several MC or CPU Bus Units are mounted.

The rotary switch located on the forehead of MC Unit can set the unit numbers.

(Examples)



Unit Number: 6



Unit Number: 12 (Hexadecimal)

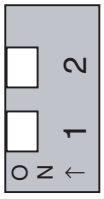
A maximum of 16 MC Units or other CPU Bus Units can be mounted on one PLC. Therefore, the setting range for the unit number is between 0 to F in hexadecimal.

The same unit number cannot be used in one PLC.

⚠ **Caution** Please check if the power is OFF when you start the settings.

Piano Switch On the Back Panel of the Unit

These switches are used for special purposes like shipping inspection mode, etc. Therefore, do not operate them.



1	2	Status
OFF	OFF	Normal operation
ON	OFF	Reserved for shipping inspection by OMRON (Do not set.)
OFF	ON	Reserved for shipping inspection by OMRON (Do not set.)
ON	ON	Reserved for shipping inspection by OMRON (Do not set.) (See note.)

Note If the power is turned ON under this setting, the MC Unit will be started after various user settings are set beck to their factory default values.

3-1-2 Area Allocations

Word Allocations Using Unit Numbers

The bit and DM areas used by the MC Unit are allocated based on the unit number.

CPU Bus Unit Allocated Bit Area

The bit area is allocated 25 words for each unit number starting from the word 1500.

The following table describes the allocations.

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

CPU Bus Unit Allocated DM Area (DM Parameter Area)

The DM area is allocated 100 words for each unit number starting from the words D30000.

The following table describes the allocations.

Unit number	DM area	Unit number	DM area
0	Words 30000-30099	8	Words 30800-30899
1	Words 30100-30199	9	Words 30900-30999
2	Words 30200-30299	10	Words 31000-31099
3	Words 30300-30399	11	Words 31100-31199
4	Words 30400-30499	12	Words 31200-31299
5	Words 30500-30599	13	Words 31300-31399
6	Words 30600-30699	14	Words 31400-31499
7	Words 30700-30799	15	Words 31500-31599

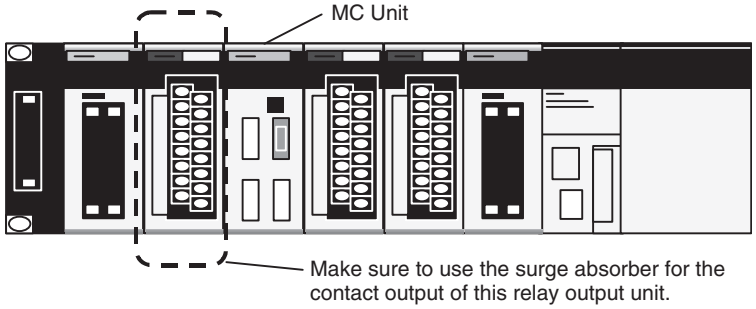
3-2 Installation

3-2-1 System Configuration Precautions

I/O bit numbers of the CPU Bus Unit are allocated based on the setting of the Unit Number Setting Switch on the front panel of the Unit, not on the slot number to which the Unit has been mounted.

MC Units can be mounted on the CPU Backplanes model CS1W-BC□□3 or CS1W-BC□□2 and the Expansion Backplanes model CS1W-BI□□3 or CS1W-BI□□2.

When mounting a relay output unit on the very left of the MC Unit, make sure to use the surge absorber for the relay output line.

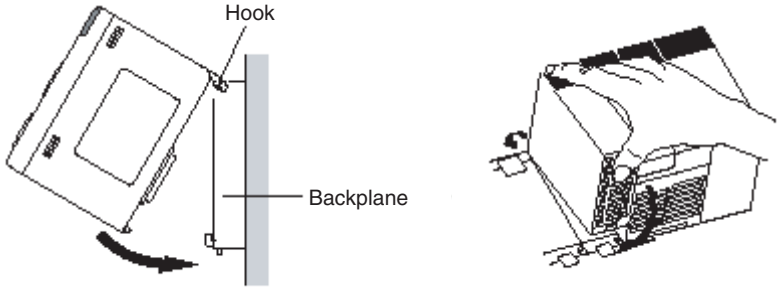


When MECHATROLINK-II devices are connected up to 16 nodes (within 30m) or 15 nodes (within 50m), no repeater unit is required. A repeater unit is required to connect MECHATROLINK-II devices more than the cases above.

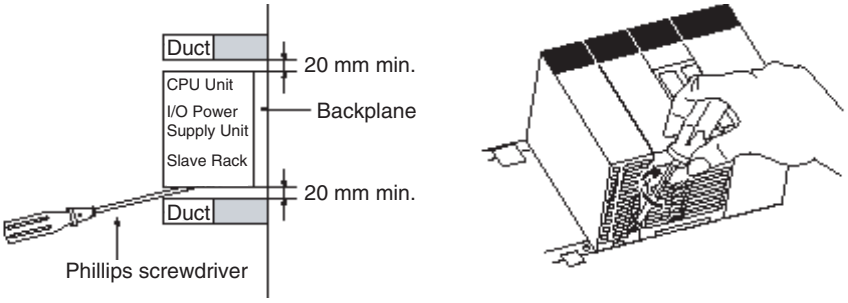
3-2-2 Mounting to the Backplane

Use the following steps to mount or remove MC Units.

1,2,3... 1. Mount the Unit on the Backplane by hooking the top of the unit into the slot on the Backplane and rotating the Unit downwards.

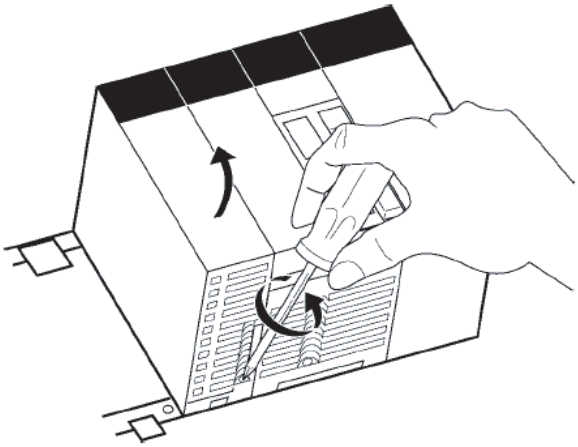


2. Make sure that the connector on the back of the Unit is property inserted into the connector on the Backplane.
3. Use a Phillips screwdriver to tighten the screw on the bottom of the Unit. The screwdriver must be held at a slight angle, so be sure to leave enough space below the rack.



Note Tighten the screw to a torque of 0.4N-m.

To remove the Unit, loosen the screw with a Phillips screwdriver, rotate the Unit upwards, and then remove it.

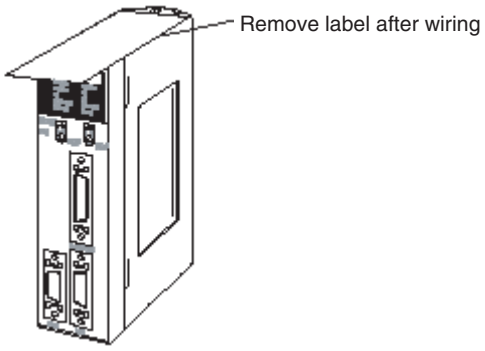


3-2-3 Unit Handling Precautions

Always turn OFF the CPU Unit before mounting or removing a MC Unit or connecting or disconnecting cables to or from the MC Unit.

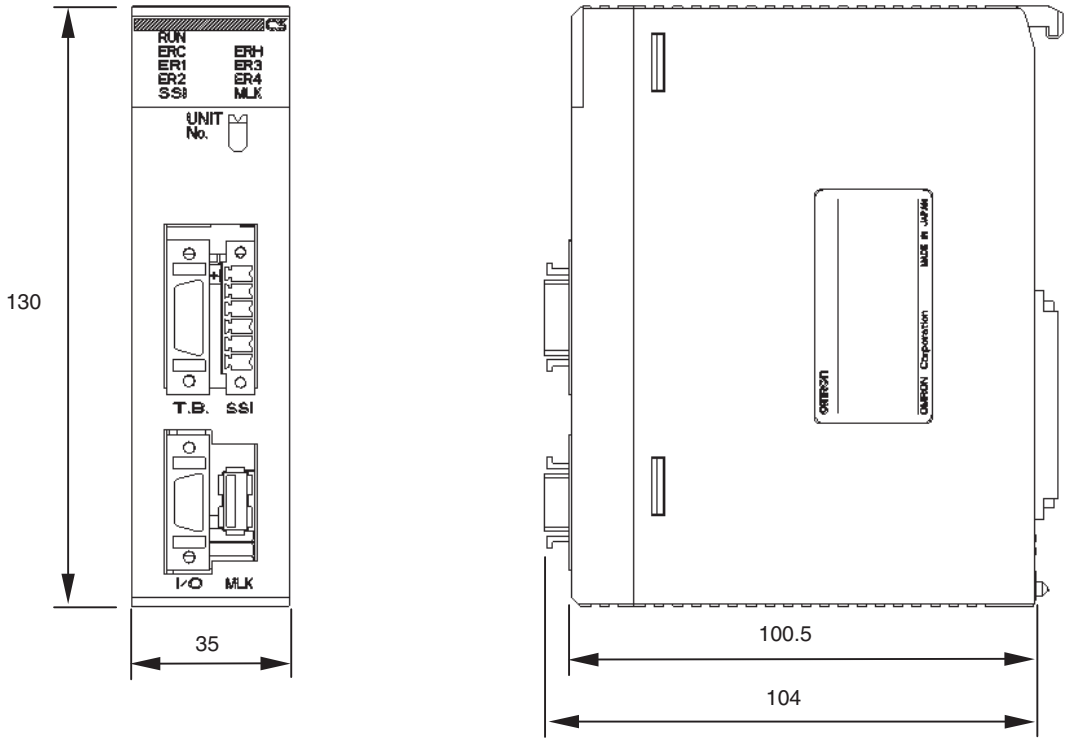
Place the port connecting cables in a different duct from those for high-voltage lines or power lines to prevent the effects of electrical noise from these lines.

Do not remove the protective label from the top of the unit until wiring has been completed. This label prevents wire strands and other foreign matter from entering the Unit during wiring. Remove the label after wiring has been completed to allow air circulation needed for cooling.



3-2-4 Dimensions

CS1W-MCH71



3-3 External I/O Circuitry

3-3-1 MECHATROLINK-II Connector

Item	Description	
Connector name	CN1	MECHATROLINK-II connector
Applicable connector	USB connector	DUSB-ARA41-T11 (DDK)
Mating connector	USB connector	DUSB-APA41-B1-C50 (DDK) *Including shell.
Pin arrangement		

No.	Signal	I/O	Description
1	(NC)	---	---
2	SRD–	I/O	Send/Receive Data (–)
3	SRD+	I/O	Send/Receive Data (+)
4	SLD	---	Shield Ground

MECHATROLINK-II Standard Cable

USB connectors on both ends: JEPMC-W6003-**

3-3-2 I/O Connectors

Item	Classification	Component and Maker
Connector name	CN2	I/O connector
Applicable connector	MDR connector	10214-52A2JL (3M)
Mating connector	Connector Housing	10114-3000VE (3M) 10314-52F0-008 (3M)
Pin arrangement		

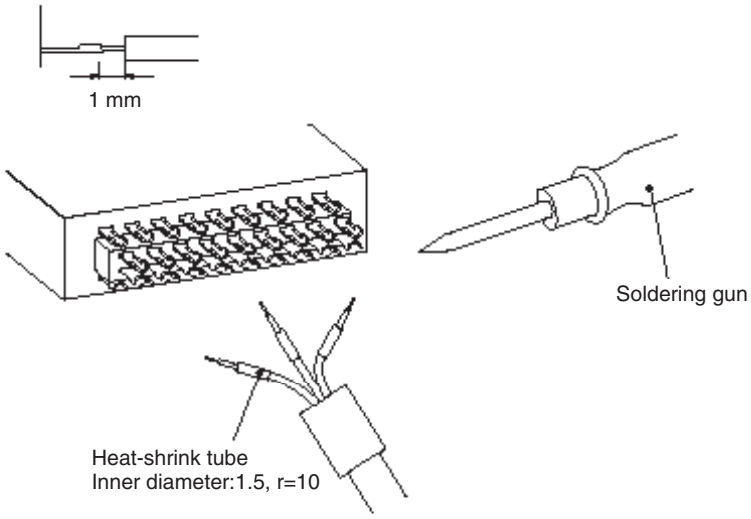
No.	Signal	I/O	Description	No.	Signal	I/O	Description
1	DI_24V	P	DI common	8	DI_24V	P	DI common
2	DI_00	I	DI input (Deceleration stop)	9	DI_01	I	DI input (Reserved)
3	DI_02	I	DI input 1	10	DI_03	I	DI input 2
4	---	---	---	11	---	---	---
5	DO_24V	P	---	12	DO_24V	P	---
6	DO_COM	P	DO common	13	DO_COM	P	DO common
7	DO_00	O.C.	DO00 output	14	DO_01	O.C.	DO01 output

P: Power supply input
I: Input signal
O.C.: Open collector output

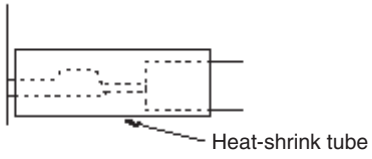
3-3-3 Wiring Connectors

Instruction:

1,2,3... 1. Pass each wire through heat-shrink tubing.
2. Spot-solder the wires and connector terminals
3. Solder the wires



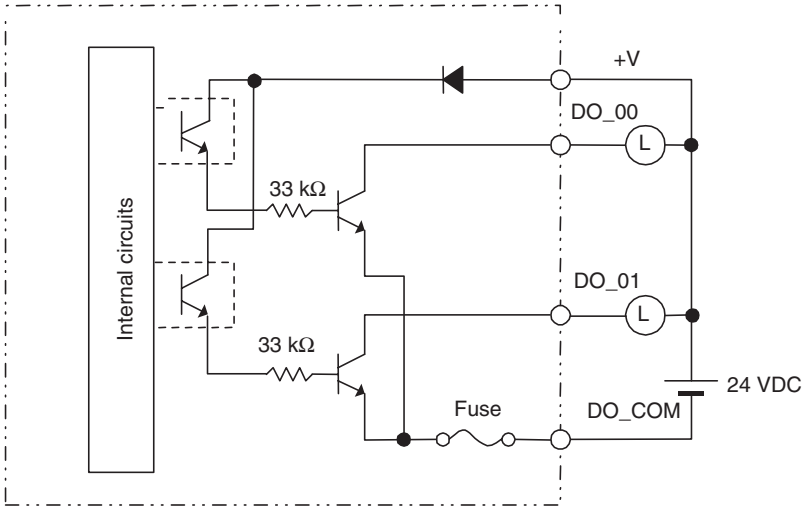
4. Pull the heat-shrink tubing back over the soldered area and heat the tubing to shrink it.



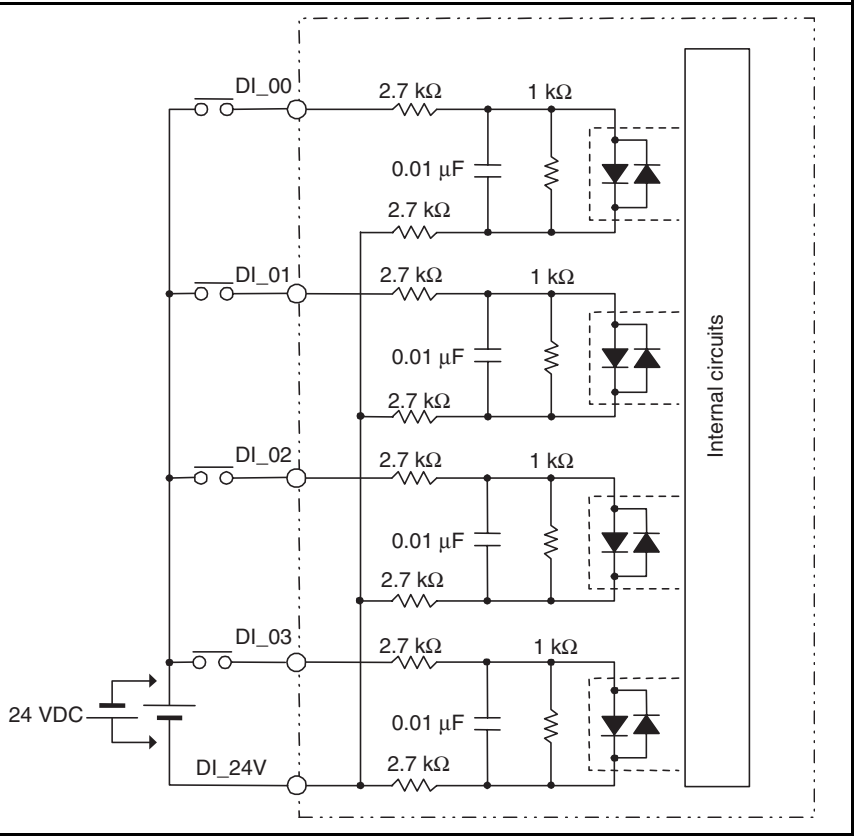
3-3-4 I/O Circuitry

Connector Interface Circuits

- 24VDC Digital Output (2 outputs)

Item	Specifications	Circuitry
Max. Output Current	100mA/24VDC	
Leakage current	1mA or lower	
Residual Voltage	1.5V or lower	
External Supply Voltage	24VDC ±10%	
Number of Common	2	

• 24VDC Digital Input

Item	Specifications	Circuitry
Rated Input Voltage	24VDC ±10%	
Rated Input Current	4.06~4.48mA ι24VDC φ	
ON Voltage	Min. ≅9.5V	
OFF Current	Max. ≅4.5V	
ON Response Time	1ms or less	
OFF Response Time	1ms or less	
Number of commons	4	

3-4 Wiring

3-4-1 Wiring Precautions

Heed the following precautions when wiring the MC Unit to the servo drivers and motors.

Electronically controlled equipment may malfunction because of noise generated by power supply lines or external loads. Such malfunctions are difficult to reproduce; hence, determining the cause often requires a great deal of time.

The following tips should aid in avoiding noise malfunction and improving system reliability.

Use electrical wires or cables of designated sizes as specified in the instruction manual for the servo driver.

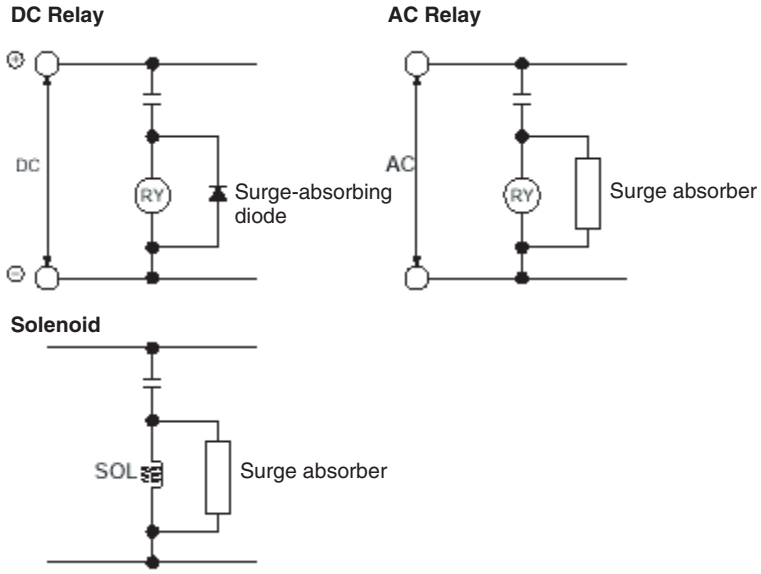
Separate power cables (AC power supply lines and motor power supply lines) from control cables (pulse output lines and external input signal lines). Do not group the two types of cable together or place them in the same conduit.

Using the laminated ceramic capacitor of 1μF for the output of 24VDC power supply will improve noise-resistance.

Use shielded cables for control lines.

For inductive loads such as relays or solenoid valves, connect surge absorbers.

The connecting cable for the servo driver must be the specified cable with ring core.



Note

(1) Connect a surge-absorbing diode or surge absorber close to the relay. Use a surge absorbing diode with a voltage tolerance at least five times greater than the circuit voltage.

(2) Noise may interfere from the power supply line if the same power supply as the electric welder or spark erosion machine is used for the MC Unit, or if there is a source of high-frequency noise around. If it occurs, insert the noise filter at the input section of the power supply.

(3) Use the twisted pair-cable for the power line.

(4) Provide grounding of 100Ω or less and use the thickest possible wire, greater than 1.25 square mm.

3-5 Connecting MECHATROLINK Devices

This section explains the method of connecting the MC Unit to devices with MECHATROLINK-II.

(As for the method of setting parameters, refer to *10-2 Slave Modules* (page 560).)

Note For details, refer to YASKAWA ELECTRIC CORPORATION's Σ-II SERIES SGDH MECHATROLINK-II APPLICATION MODULE USER'S MANUAL MODEL: JUSP-NS115 (MANUAL NO. SIEPC71080001*)".

3-5-1 Method of Connecting MECHATROLINK Devices

Connection cable

To connect MECHATROLINK devices to MC units, use the connecting cables (sold separately) in the table below.

Name	Model (OMRON)	Model (YASKAWA)	Length
MECHATROLINK-II cable (For W-series) (With ring core and USB connector on both ends)	FNY-W6003-A5	JEPMC-W6003-A5	0.5m
	FNY-W6003-01	JEPMC-W6003-01	1.0m
	FNY-W6003-03	JEPMC-W6003-03	3.0m
	FNY-W6003-05	JEPMC-W6003-05	5.0m
	FNY-W6003-10	JEPMC-W6003-10	10.0m
	FNY-W6003-20	JEPMC-W6003-20	20.0m
	FNY-W6003-30	JEPMC-W6003-30	30.0m

The terminating resistance (sold separately) in the table below should be connected to the MECHATROLINK-II termination.

Name	Model (OMRON)	Model (YASKAWA)
Terminating resistance for MECHATROLINK-II	FNY-W6022	JEPMC-W6022

Repeater unit

When MECHATROLINK-II devices are connected up to 16 nodes (within 30m) or 15 nodes (within 50m), no repeater unit is required. A repeater unit is required to connect MECHATROLINK-II devices more than the cases above.

Name	Model (OMRON)	Model (YASKAWA)
Repeater for MECHATROLINK-II	FNY-REP2000	JEPMC-REP2000

3-5-2 W-series Servo Driver

W-series Servo Driver requires YASKAWA MECHATROLINK-II I/F Unit model JUSP-NS115.

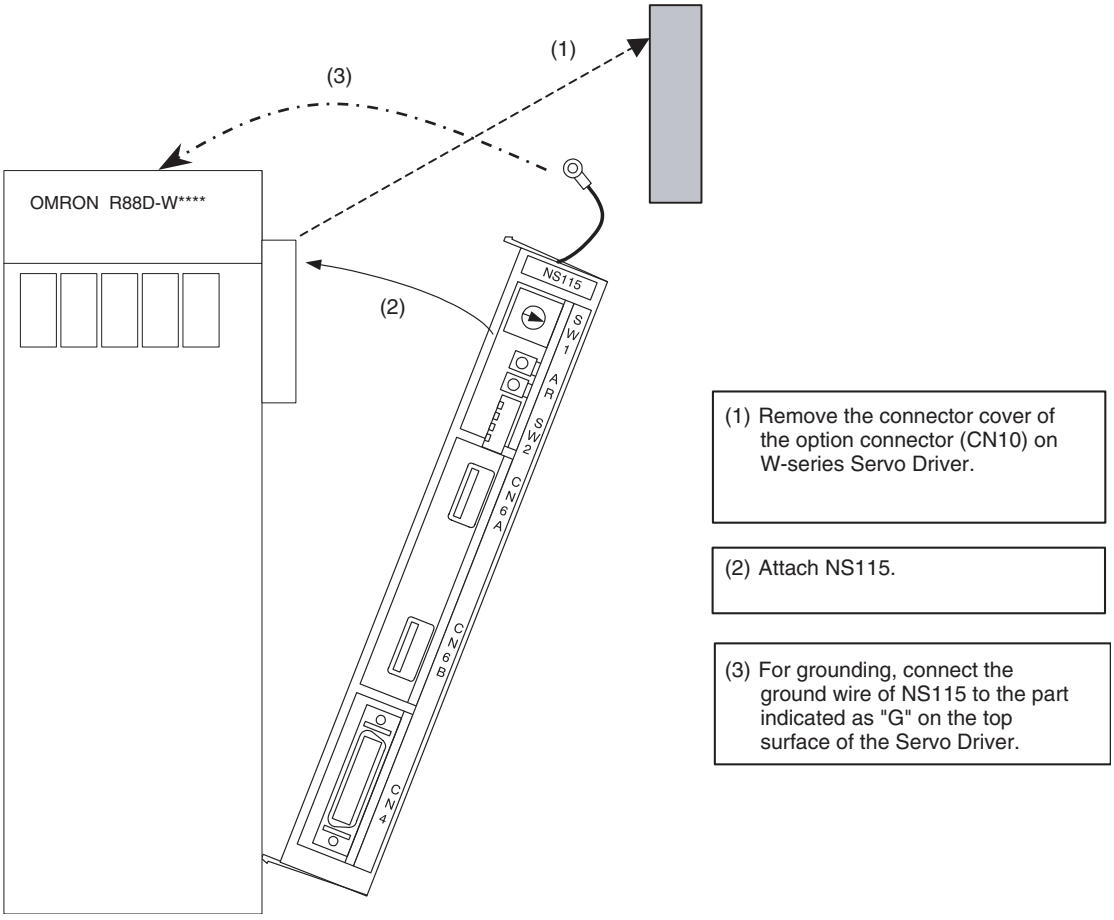
Each version of the following products can be used. The version name is indicated on the nameplates of each product.

W-series Servo Driver: Ver.39 or later

I/F Unit: VER.***03 or later

Note Using either a W-series Servo Driver or an I/F Unit of older versions can be the cause of abnormal operations. Make sure to use the versions mentioned above.

Attaching I/F Unit NS115



(1) Remove the connector cover of the option connector (CN10) on W-series Servo Driver.

(2) Attach NS115.

(3) For grounding, connect the ground wire of NS115 to the part indicated as "G" on the top surface of the Servo Driver.

Communications setting

Set MECAHTROLINK communications using SW1and SW2.

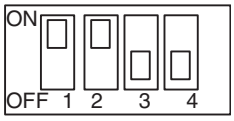
Transmission setting

MECHATROLINK communications can be specified using the

DIP switches (SW2). See the table below.

Any change of the settings becomes valid after turning OFF the power once, then ON again.

SW2	Name	Setting	Content	Default setting
Bit 1	Baud rate	OFF	4 Mbps	ON (Do not change.)
		ON	10 Mbps	
Bit 2	No. of Transmitted bytes	OFF	17 bytes	ON (Do not change.)
		ON	30 bytes	
Bit 3	Station address	OFF	Refer to Station address setting	OFF
		ON		
Bit 4	Reserved	OFF	---	OFF



SW2 (Default setting)

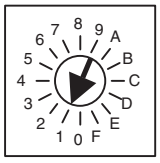
Station address setting

The station address can be set as shown in the table below using the rotary switch (SW1) and piano switch (SW2 bit 3).

The piano switch 3 of SW2 specifies the number of 10s and SW1 specifies the number of units.

Do not change the setting while the power is being supplied.

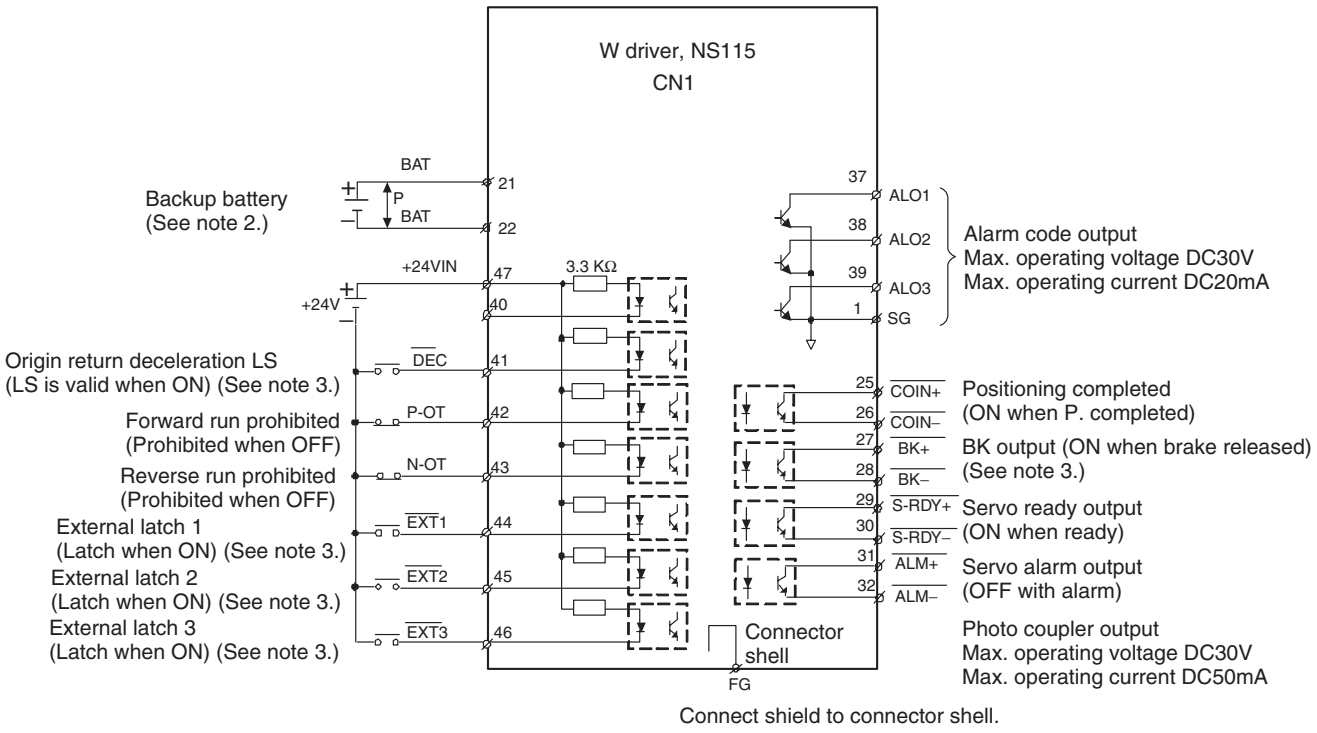
Bit 3 of SW2	SW1	Station No.	SW1 default setting
OFF	0	Do not set.	1
	1 to F	1 to 15 (1 to FH)	
ON	0 to F	16 to 30 (10H to 1EH)	



SW1

Example of connecting I/O signals

A typical connecting example with standard settings (default settings) is shown here.



Connect shield to connector shell.

Note

(1) ↕ P indicates twisted-pair wires.

(2) When using an ABS encoder, connect a backup battery only when there is no battery connected to CN8.

(3) Allocate signals using user constants.

CN1 terminal layout

CN1 terminal layout

2	SG	GND	1	SG	GND	27	/BK+ (See note 3.)	Brake interlock output	26	/COIN-	Positioning complete output
4			3			29	/S-RDY+	Servo ready output	28	/BK- (See note 3.)	Brake interlock output
6	SG	GND	5			31	ALM+	Servo alarm output	30	/S-RDY-	Servo ready output
8			7			33			32	ALM-	Servo alarm output
10	SG	GND	9			35			34		
12			11			37	ALO1	Alarm code output (Open-collector output)	36		
14			13			39	ALO3		38	ALMO2	Alarm code output
16			15			41	/DEC (See note 3.)	Origin return deceleration LS input	40		
18			17			43	N-OT	Reverse run prohibited input	42	P-OT	Forward run prohibited input
20			19			45	/EXT2 (See note 3.)	External latch signal 2 input	44	/EXT1 (See note 3.)	External latch signal 1 input
22	BAT(–)	Battery (–)	21	BAT(+)	Battery (+)	47	+24VIN	External power supply input	46	/EXT3 (See note 3.)	External latch signal 3 input
24			23			49			48		
			25	/COIN	Positioning completed output				50		

Note

(1) Connector shell: Connected to FG (Frame ground)

(2) Do not use unused terminals for relays.

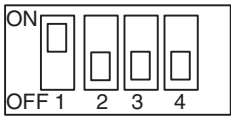
(3) Allocate the signal using user constants.

(4) For details, refer to YASKAWA ELECTRIC CORPORATION's Σ-II SERIES SGDH MECHATROLINK-II APPLICATION MODULE USER'S MANUAL MODEL: JUSP-NS115 (MANUAL NO. SIEPC71080001*)".

3-5-3 24VDC I/O Module

Communications setting

Set MECAHTROLINK communications using SW1 and SW2.

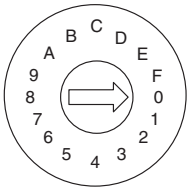


SW1 (Default setting)

Transmission settings

MECHATROLINK communications can be specified using the DIP switch (SW1). See the table below.

Note Any change of the settings becomes valid after turning OFF the power once, and then ON again.



SW2 (Default setting)

SW1	Name	Setting	Content	Default setting
1	Baud rate	OFF	4 Mbps	ON (Do not set to OFF.)
		ON	10 Mbps	
2	No. of Transmitted bytes	OFF	17 bytes	OFF
		ON	30 bytes	
3	Station address	OFF	Refer to Station address setting	OFF
		ON		
---	Reserved	OFF	---	OFF

Station address setting

Station address can be set as shown in the table below using the rotary switch (SW2) and piano switch (SW1 bit 3).

The bit 3 of SW1 specifies the number of 10s while the SW2 specifies the number of units.

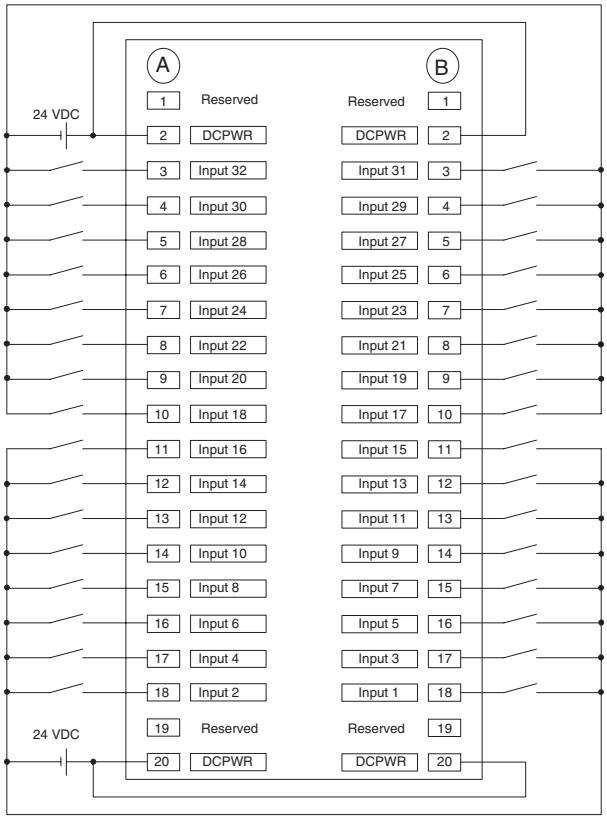
Do not change the setting while the power is being supplied.

Bit 3 of SW1	SW2	Station address	SW2 default setting
OFF	0	Do not set.	0
	1 to F	1 to 15 (1 to FH)	
ON	0 to F	16 to 30 (10H to 1EH)	

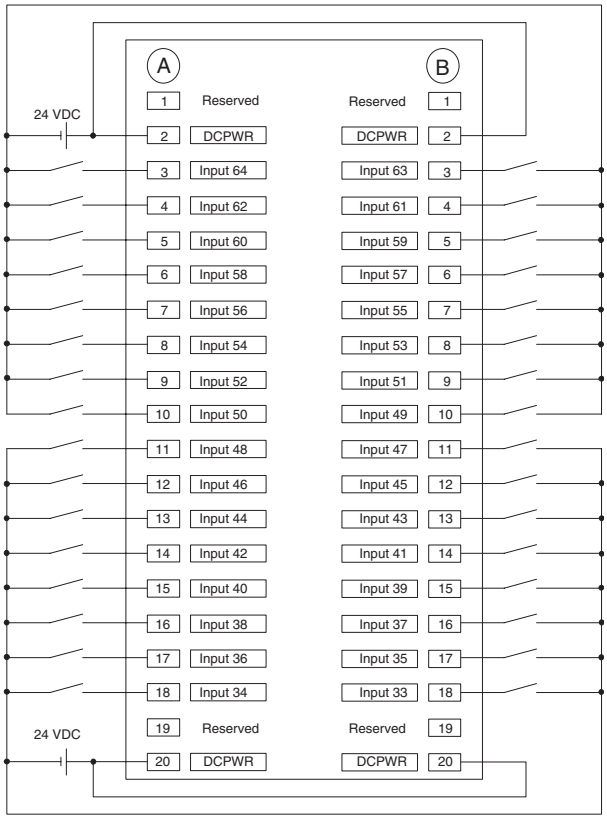
64-point I/O module (IO2310) connector pin layout, signal names, and wiring example

For details, refer to YASKAWA ELECTRIC CORPORATION's "Machine Controller MP900 Series MECHATROLINK System USER'S MANUAL (MANUAL NO. SIEZ-C887-5.1*)".

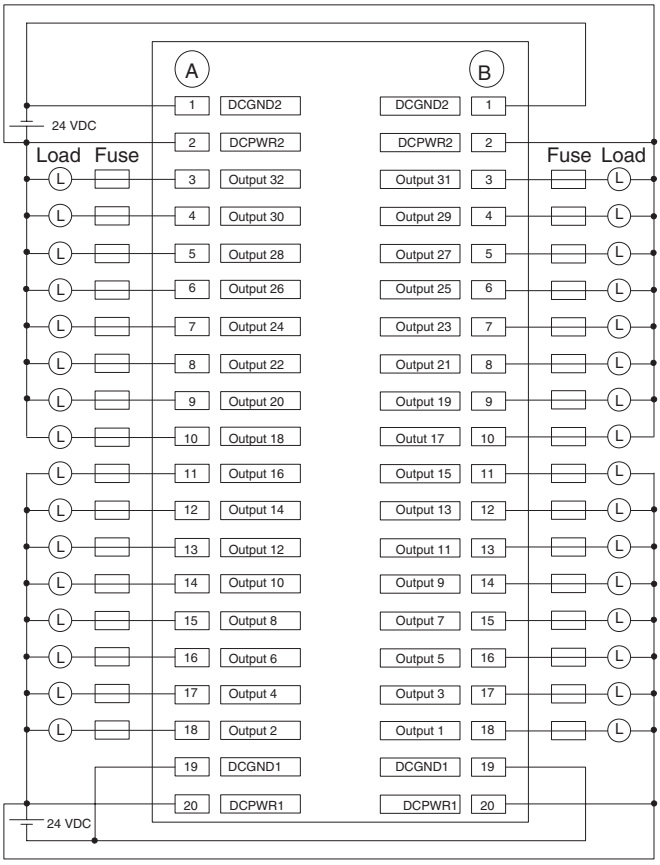
(IN1 connector)



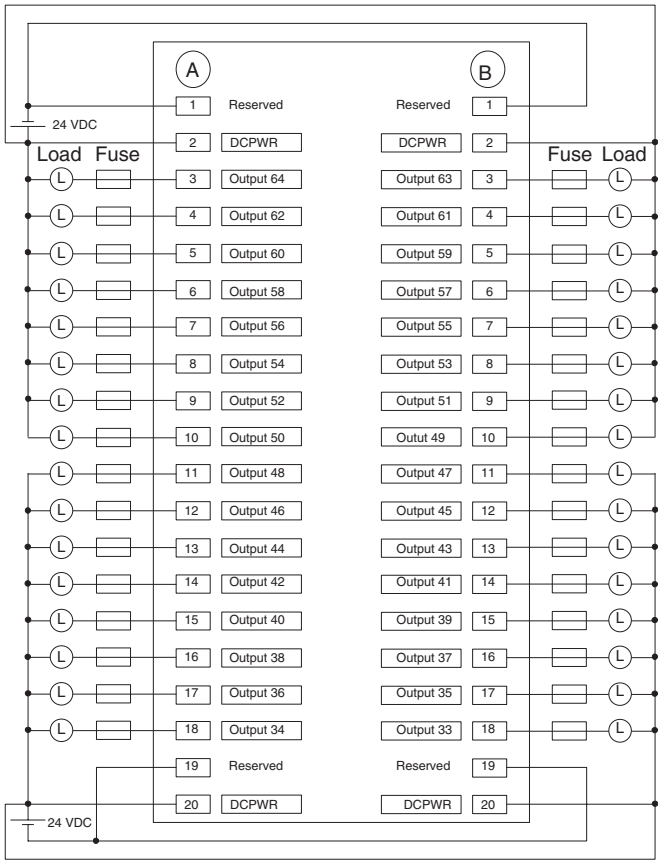
(IN2 connector)



(OUT1 connector)



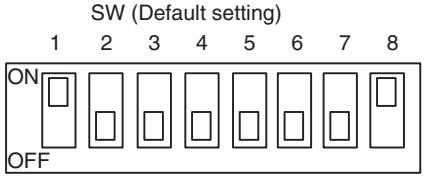
(OUT2 connector)



3-5-4 Counter Module, Pulse Output Module

Communications setting

For counter modules and pulse output modules, MECHATROLINK communications can be set using the DIP switches.



Transmission setting

MECHATROLINK communications can be specified using the DIP switches (SW) 6 to 8.

See the table below.

Any change of the settings becomes valid after turning OFF the power once, then ON again.

Pin	Name	Setting	Content	Default setting
6	Baud rate	OFF	4Mbps	OFF
		ON	10Mbps	
7	Transmission bytes	OFF	17byte	OFF
		ON	30byte	
8	Station address	OFF	Refer to Station address setting	ON (Do not set to OFF.)
		ON		

Station address setting

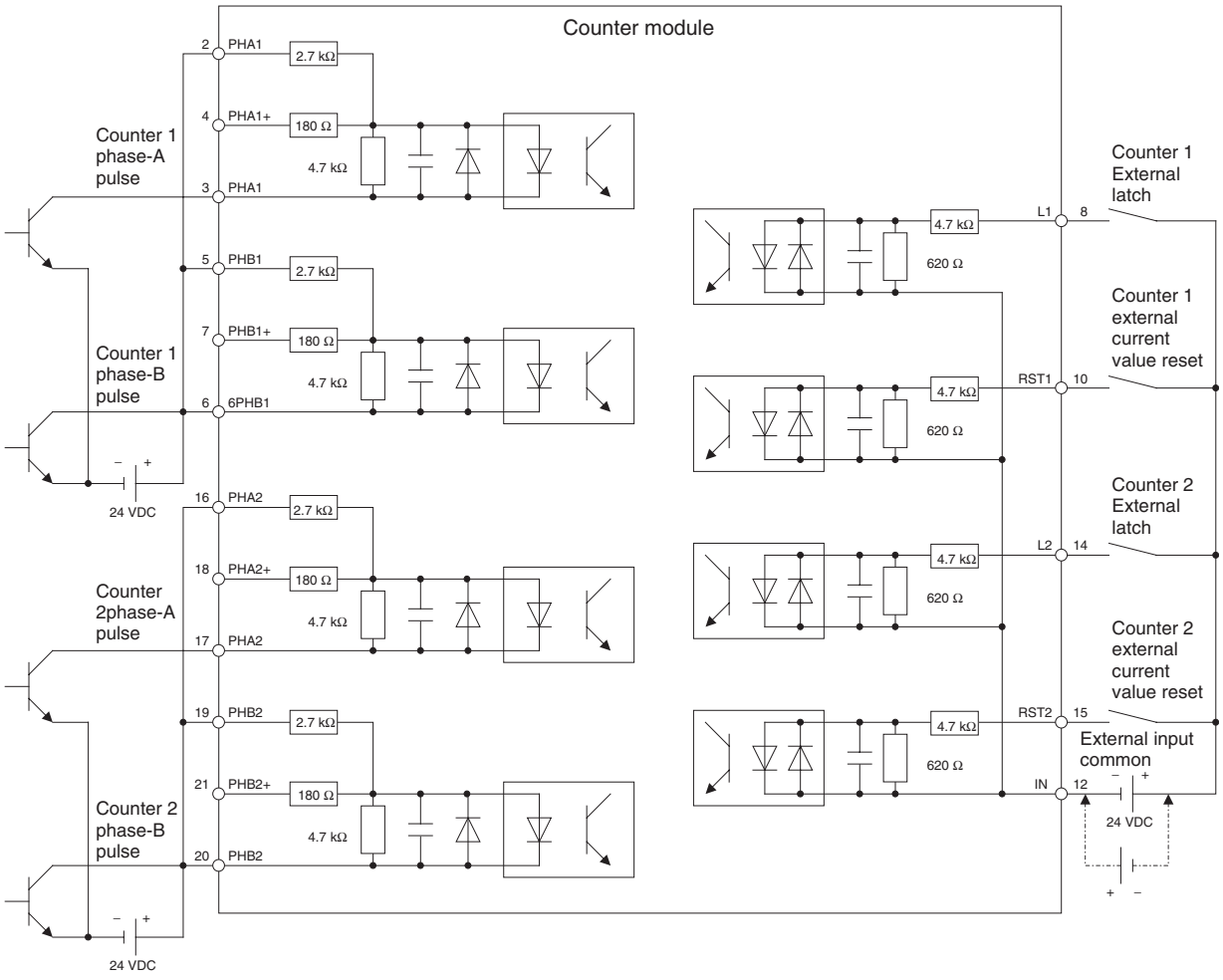
Station address can be set as shown in the table below using the DIP switch 1 to 5 (SW).

The bit 5 of SW specifies the number of 10s while the bit 1 to 4 of SW specifies the number of units.

Do not change the setting while the power is being supplied.

SW					Station address
5	4	3	2	1	
OFF	OFF	OFF	OFF	OFF	Do not set.
OFF	OFF	OFF	OFF	ON	1 (01H): Default setting
OFF	OFF	OFF	ON	OFF	2 (02H)
OFF	OFF	OFF	ON	ON	3 (03H)
~					~
OFF	ON	ON	ON	ON	15 (0FH)
ON	OFF	OFF	OFF	OFF	16 (10H)
ON	OFF	OFF	OFF	ON	17 (11H)
ON	OFF	OFF	ON	OFF	18 (12H)
ON	OFF	OFF	ON	ON	19 (13H)
~					~
ON	ON	ON	ON	ON	Do not set.

Counter module (PL2900) **Circuit Configuration and signal connection**



Signal arrangement of the terminal block

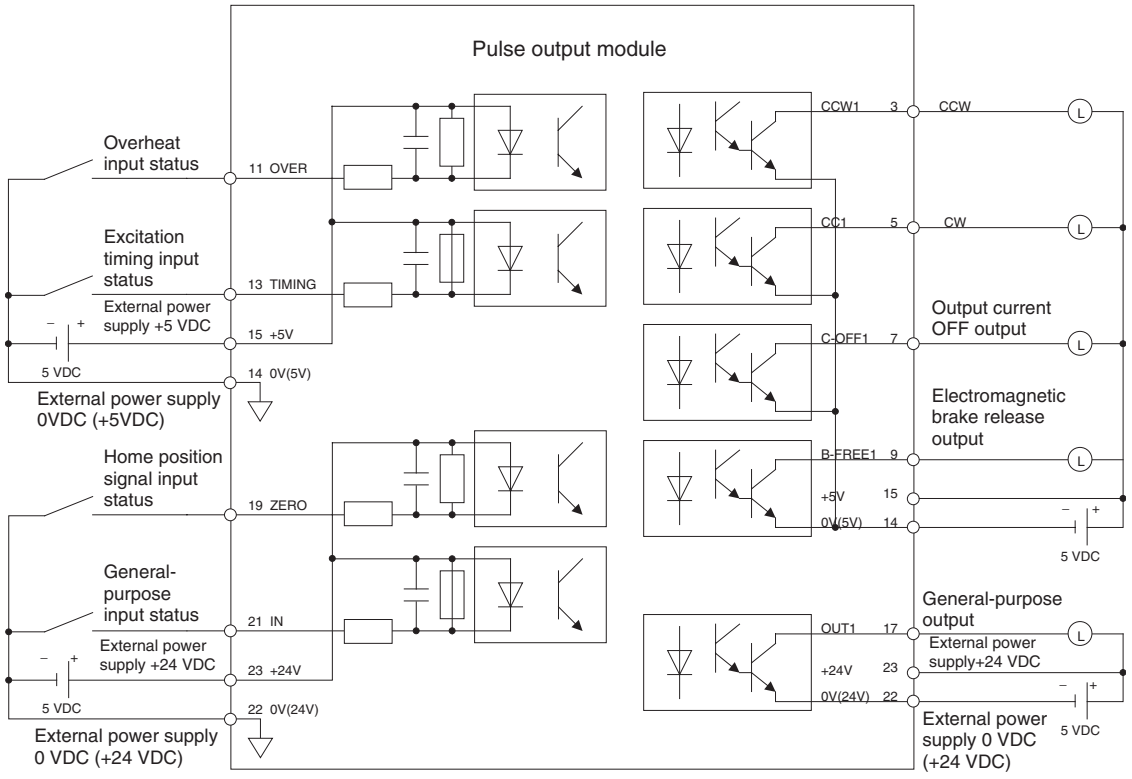
1	3 PHA1–	5 PHB1	7 PHB1+	9 N1	11 OUT–	13 N2	15 RST2	17 PHA2–	19 PHB2	21 PHB2+	23 +24V

2 PHA1	4 PHA1+	6 PHB1–	8 L1	10 RST1	12 IN–	14 L2	16 PHA2	18 PHA2+	20 PHB2–	22 0(24V)

For details, refer to YASKAWA ELECTRIC CORPORATION's "Machine Controller MP900 Series MECHATROLINK System USER'S MANUAL (MANUAL NO. SIEZ-C887-5.1*)".

Pulse output module (PL2910)

Circuit configuration and signal arrangement



Signal arrangement of the terminal block

1 FG	3 CCW1	5 CW1	7 COFF1	9 BFRE1	11 OVER1	13 TIMG1	15 +5V	17 OUT1	19 ZERO1	21 IN1	23 +24V
2 CCW2	4 CW2	6 COFF2	8 BFRE2	10 OVER2	12 TIMG2	14 0(5V)	16 OUT2	18 ZERO2	20 IN2	22 0(24V)	

For details, refer to YASKAWA ELECTRIC CORPORATION's "Machine Controller MP900 Series MECHATROLINK System USER'S MANUAL (MANUAL NO. SIEZ-C887-5.1*)".

SECTION 4
MC Unit Internal Data Configuration and Setting

This section describes the data configuration uses to set up, operate, and monitor the CS1W-MCH71 Motion Control Unit and related devices.

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4-1 Data Configuration

Data Type

There are five different types of date for MC Unit.

1,2,3...

1. System parameter
   - Unit parameter
   - Motion task parameter
   - Axis parameter (Allocation, Speed, Position, Origin, Machine & Reserved)
2. Variables
   - System variables
   - Global general variables
   - Input variables
   - Output variables
   - Position data
   - Task variables
3. Present position preset
4. Servo parameter axis specification
5. Servo parameter

Note Neither CAM data nor programs are treated as data. For more details, see *4-9 CAM Data* (page 190) and *SECTION 6 Programming*.

4-1-1 DATA

Classification	IORD/IOWR Control Address	Variables	WORD	Contents
Variables				
Position data	0000h-27FFh	PLhhhh	10240	Data indicating positions, Total number is 10240.
System variables	3000h-33FFh	S*hhhh	1024	Statuses such as the operating mode, error log, etc. of MC Unit
Global general Variables	Nil	M*hhhh	8192	Variables that can be accessed from all tasks.Use for data communications between tasks and operations.
Input variables	Nil	I*hhhh	2048	Input status from CPU Unit or MECHATROLINK-II devices
Output variables	Nil	O*hhhh	2048	Executes outputs from programs to CPU Unit or MECHATROLINK-II devices
Task variables	Nil	D*hhhh	128 × 9 tasks	Variables that can be used only in each task. Use as works in operation.
Present position preset	4000h-401Fh	Nil	32	Sets each axis's preset value for present position.

Classification		IORD/IOWR Control Address	Variables	WORD	Contents
System parameter					
	Unit	5000h-501Fh	Nil	4096	• System parameters are consisted of unit parameters, task parameters and axis parameters. • The system information used by the MC Unit, such as number of axes and tasks, feed rate, operating range etc.
	Motion task	5020h-511Fh			
	Reserved	5120h-513Fh			
	Reserved	5140h-533Fh			
	Axis: Allocations	5340h-55BFh			
	Axis: Speed	55C0h-583Fh			
	Axis: Position	5840h-5ABFh			
	Axis: Origin	5AC0h-5D3Fh			
	Axis: Machine	5D40h-5FBFh			
	Reserved	5FC0h-5FFFh			
Servo parameter axis Specification		6000h	6000h	1	Specifies the axis to access.
Servo parameter		7000h-78FFh	Nil	4096	Parameters of servo driver.

* The letters to identify data access type, hhhh: 4 digits hexadecimal address

Data Access Method

The following methods are used to access to each data. For further details, refer to *SECTION 5 Data Transfer and Storage* (page 194).

1,2,3...

1. Use the support tool (MC-Miel).
2. Execute IOWR/IORD instructions (Intelligent I/O Write/Read) from the ladder program.
3. Variables can be used in the MC Unit's programs.

"IORD/IOWR Control Address" is the internal address to identify data when IORD/IOWR instructions are executed from the ladder program. Global variables, input variables, output variables, or task variables cannot be accessed. See *4-3 Variables* (page 91) for details.

Basic Data Usage

System parameters: Created with the support tool (MC-Miel), and transferred to the MC Unit. Using the IOWR instruction during CPU Unit's operation can change the system parameters as needed.

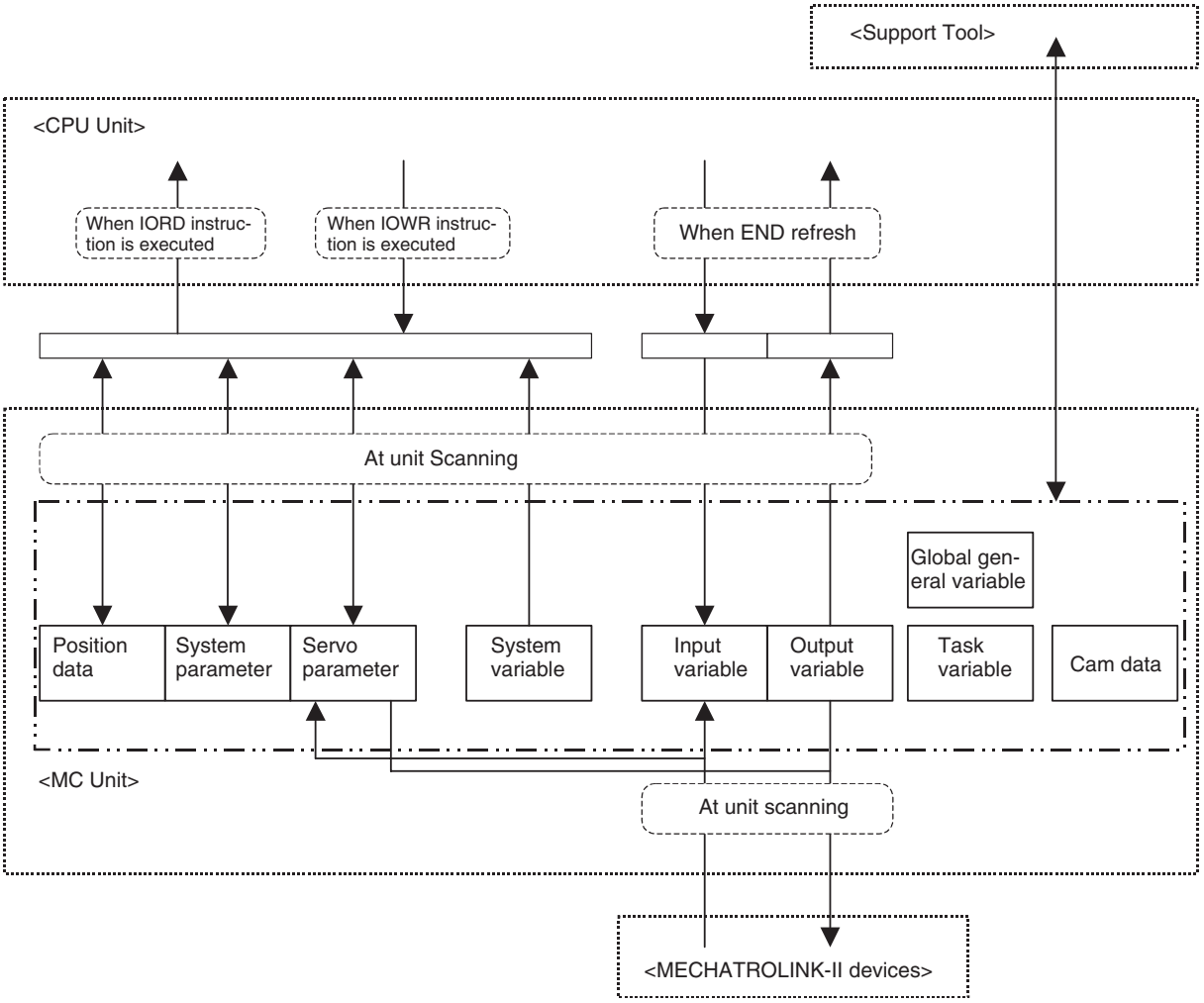
Position data: Created with the support tool (MC-Miel), and transferred to the MC Unit. Using the IOWR instruction during CPU Unit's operation can change the position data as needed. It is possible to change the position data also by using MC Unit's program.

System variables: Read with the IORD instruction from the ladder program while the CPU Unit is running.
It is also possible to read it from MC Unit's programs.

Servo parameters: Created with the support tool (MC-Miel), and transferred to the MC Unit. Using the IOWR instruction during the CPU Unit's operation can change the system parameters as needed. To use the IOWR instruction, the axis whose parameters are to be changed has to be specified in advance.

Other variables: Global general variables, input variables, output variables, and task variables can be used in MC Unit's programs.

4-1-2 Data Configuration



4-2 System Parameters

The system parameters are consisted of the following three different parameters.

- Unit parameters
- Motion task parameters
- Axis parameters (Allocations, Speed, Position, origin, Machine)

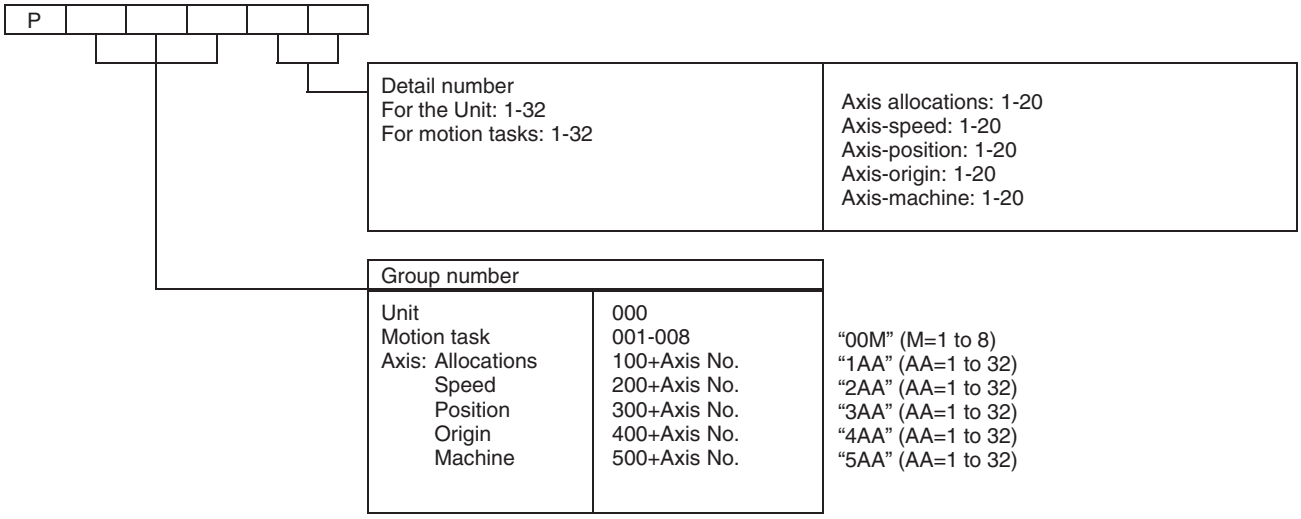
4-2-1 Description of System Parameters

The following table describes the functions of each parameter group.

Parameters	Number	IORD/IOWR Addresses (See note 3.)	Functions
Unit	P00001-P00010	5000h-5009h	Specifies information inherent to the Unit, such as the number of axes used and the number of tasks.
Motion task	P00M01-P00M20 (See note 1.)	5020h-5113h	Specifies usage of each motion task such as max. interpolation feed rate.

Parameters		Number	IORD/IOWR Addresses (See note 3.)	Functions
Axes	Allocations	P1AA01-P1AA09 (See note 2.)	5340h-55B4h	Specifies axis type and device to be used for each axis.
	Speed	P2AA01-P2AA12 (See note 2.)	55C0h-5837h	Specifies max. rapid feed rate and type of acceleration and deceleration etc. for each axis.
	Position	P3AA01-P3AA09 (See note 2.)	5840h-5AB4h	Specifies the methods regarding to position such as software limit, error counter warning etc. for each axis.
	Origin	P4AA01-P4AA12 (See note 2.)	5AC0h-5D37h	Specifies the method of origin search for each axis.
	Machine	P5AA01-P1AA09 (See note 2.)	5D40h-5FB4h	Specifies the machine information such as unit systems, gear ratio, etc. to be used for each axis.

Note
(1) The task number 1 to 8 is to be inserted in M.
(2) The axis number 1 to 32 is to be inserted in AA.
(3) The IORD/IOWR addresses in this table are the actual address range (excluding reserved ones).
(4) The parameter number is notated in 5-digit decimal in this manual.



4-2-2 System Parameters

Unit Parameters

Number	Address	Name	Function	Page
P00001	5000h	No. of motion tasks	Sets how many motion tasks are to be used.	58
P00002	5001h	No. of parallel branches	Specifies the numbers of both parallel branching and simultaneous execution commands in each motion task.	59
P00003	5002h	Unit scan time	Specifies the unit scan time.	59

Number	Address	Name	Function	Page
P00004	5003h	Unit function select	• Specifies method of specifying the speed in helical circular interpolation under MOVEC command. • Specifies center-positioning method for MOVEC command • Specifies the speed command unit for SPEED command/feedback speed. • Specifies the operation when maximum speed parameter is clamped due to servo driver's specification, whether to activate alarm or to keep operating in clamp status. • Select output method for positioning completed / positioning completed 2 signals. • Specifies the method for changing the direction for JOG operation. • Specifies support for 3-ms communications cycle. • Specifies the type of continuous operation for multi-turn operation for an infinite axis • Specifies behavior when an overtravel alarm occurs	59
P00005	5004h	Reserved		
P00006	5005h	General I/O Disabled/Enabled	Specifies general I/O signals disable/enable for MC unit.	60
P00007	5006h	Input control 1 from PLC	Specifies whether input signals from CPU to the Unit or motion tasks are enabled or disabled.	61
P00008	5007h	Input control 2 from PLC	Specifies whether input signals from CPU to axes are enabled or disabled.	62
P00009	5008h	Setting for the No. of MECHATROLINK-II Retrial Nodes, With/ without C2 master	• No. of retrial nodes: Specifies the number of nodes to be retried within MECHATROLINK-II communication cycle. • With/without C2 master: Set this parameter when there is a master unit other than MC unit. (reserved)	64
P00010	5009h	MECHATROLINK-II Delay in Communication Start	Specifies the time to make the communication start delayed in order to wait for slave startup.	65
P00011 - P00032	500Ah - 501Fh	Reserved		---

Motion Task Parameters

Note Abbreviation in the No. column: M=1-8 (motion task number)
Abbreviation in the address column: M=0-7 (motion task number−1)

No. M=1-8	Address M=0-7	Name	Function	Page
P00M01	5020h + (M * 20h)	Max. interpolation feed rate	Sets the maximum feed rate (F command) in interpolation operation	65
P00M02	5021h + (M * 20h)	Interpolation feed acceleration time	Sets the time required to accelerate from zero to max. interpolation feed rate.	66
P00M03	5022h + (M * 20h)	Interpolation feed deceleration time	Sets the time required to decelerate from max. interpolation feed rate to zero in interpolation.	66
P00M04	5023h + (M * 20h)	Interpolation S-curve filter enabled	Select enable /disable of S-curve filter at the interpolation feed rate.	67
P00M05	5024h + (M * 20h)	Interpolation S-curve time constant	Sets the S-curve filter time constant at the interpolation feed rate.	67
P00M06	5025h + (M * 20h)	Pass mode select	Sets the combination of the interpolation Accel/decel time and Pass mode with fixed acceleration disabled/enabled.	67
P00M07	5026h + (M * 20h)	Initial modal data 1 MOVE command value select	Specifies the initial value if ABL/INC specification has been omitted in a motion program.	68

No. M=1-8	Address M=0-7	Name	Function	Page
P00M08	5027h + (M * 20h)	Initial modal data 2 operating mode select	Specifies the initial value if PASSMODE/STOPMODE specification has been omitted in a motion program.	68
P00M09	5028h + (M * 20h)	Initial model data 3 interpolation feed rate	Specifies the initial value if interpolation feed rate (F command) has been omitted in a motion program.	68
P00M10	5029h + (M * 20h)	Interpolation feed decimal point position	Sets the method of interpreting the speed command value specified by an immediate value with a decimal point.	69
P00M11 - P00M20	502Ah + (M * 20h) - 5033h + (M * 20h)	Interpolation feed acceleration/deceleration bank 1 - Interpolation feed acceleration/deceleration bank 10	Specify the acceleration/deceleration times to use during interpolation. Banks are used to enable quickly switching acceleration/deceleration times with the PARAM command.	69
P00M21 - P00M32	5034h + (M * 20h) - 503Fh + (M * 20h)	Reserved		---

Axis-Allocation Parameters

Note Abbreviation in the No. column: AA=1-32 (axis number)
Abbreviation in the address column: AA=0-31 (axis number−1)

No. AA=1-32	Address AA=0-31	Name	Function	Page
P1AA01	5340h + (AA * 14h)	Physical axis setting	Specifies the usage of physical axis.	70
P1AA02	5341h + (AA * 14h)	MECHATROLINK-II device classification	Sets classification of devices connected as MECHATROLINK-II slave nodes.	71
P1AA03	5342h + (AA * 14h)	Input allocation points	Specifies the No. of points for input signals of MECHATROLINK-II slave nodes allocated to input variables of MC Unit.	71
P1AA04	5343h + (AA * 14h)	Output allocation points	Specifies the No. of points for output signals of MECHATROLINK-II slave nodes allocated to output variables of MC Unit.	71
P1AA05	5344h + (AA * 14h)	Axis allocation first address	This is the setting for the counter input/pulse output count values of MECHATROLINK-II output to the present position of MC Unit.	72
P1AA06	5345h + (AA * 14h)	MECHATROLINK-II communications error detection	Sets the No. of allowable times of communications errors on MECHATROLINK-II device.	72
P1AA07	5346h + (AA * 14h)	Reserved		---
P1AA08	5347h + (AA * 14h)	Reserved		---
P1AA09	5348h + (AA * 14h)	Reserved		---
P1AA10 - P1AA20	5349h + (AA * 14h) - 5353h + (AA * 14h)	Reserved		---

Axis-Speed Parameters

Note Abbreviation in the No. column: AA=1-32 (axis number)
Abbreviation in the address column: AA=0-31 (axis number−1)

No. AA=1-32	Address AA=0-31	Name	Function	Page
P2AA01	55C0h + (AA * 14h)	Max. rapid feed rate	Sets the maximum speed on machine's side for MOVE Command, etc.	73
P2AA02	55C1h + (AA * 14h)	Max. manual feed rate	Sets maximum speed on machine's side in JOG, STEP, DATUM operations.	73
P2AA03	55C2h + (AA * 14h)	Rapid feed rate	Sets the speed on machine's side for MOVE command, etc.	74
P2AA04	55C3h + (AA * 14h)	Manual feed rate	Sets the speed on machine's side in JOG, STEP operations.	74
P2AA05	55C4h + (AA * 14h)	Rapid feed acceleration time	Sets the time required to accelerate from zero to max. rapid feed rate.	74
P2AA06	55C5h + (AA * 14h)	Rapid feed deceleration time	Sets the time required to decelerate from the max. rapid feed rate to zero.	74
P2AA07	55C6h + (AA * 14h)	Manual feed acceleration time	Sets the time required to accelerate from zero to maximum manual feed rate	75
P2AA08	55C7h + (AA * 14h)	Manual feed deceleration time	Sets the time required to decelerate from max. manual feed rate to zero.	75
P2AA09	55C8h + (AA * 14h)	Rapid feed S-curve filter enabled	Select the S-curve filter enable/ disable at rapid feed rate.	75
P2AA10	55C9h + (AA * 14h)	Manual feed S-curve filter enabled	Select the S-curve filter enable/ disable at manual feed rate.	76
P2AA11	55CAh + (AA * 14h)	Rapid feed S-curve time constant	Sets the S-curve filter time constant at raid feed rate.	76
P2AA12	55CBh + (AA * 14h)	Manual feed S-curve time constant	Sets the S-curve filter time constant at manual feed rate.	76
P2AA13 - P2AA20	55CCh + (AA * 14h) - 55D3h + (AA * 14h)	Reserved		---

Axis-Position Parameters

Note Abbreviation in the No. column: AA=1-32 (axis number)
Abbreviation in the address column: AA=0-31 (axis number−1)

No. AA=1-32	Address AA=0-31	Name	Function	Page
P3AA01	5840h + (AA * 14h)	STEP operation travel distance	Sets travel distance for STEP operation.	76
P3AA02	5841h + (AA * 14h)	Positive direction software limit	Sets positive direction software limit value.	77
P3AA03	5842h + (AA * 14h)	Negative direction software limit	Sets negative direction software limit value.	77
P3AA04	5843h + (AA * 14h)	Software limit enabled/disabled	Sets whether software Limit is enabled/disabled.	78
P3AA05	5844h + (AA * 14h)	Error warning value	Sets enabled/disabled of warning and the No. of error pulses that causes warning.	78
P3AA06	5845h + (AA * 14h)	Position error alarm detection value	Sets enabled/disabled of alarm and the No. of error pulses that causes alarm.	78
P3AA07	5846h + (AA * 14h)	No. 2 in-position range	Sets the range for turning ON the positioning completed signal of interpolation feed in Stop mode.	78

No. AA=1-32	Address AA=0-31	Name	Function	Page
P3AA08	5847h + (AA * 14h)	Feed forward gain enabled/disabled	Sets enabled/disabled of feed forward gain specified with input variable.	79
P3AA09	5848h + (AA * 14h)	Position control switching speed	Specifies the speed to switch from torque control to position control or from speed control to position control as a percentage of the rated speed.	79
P3AA10 - P3AA20	5849h + (AA * 14h) - 5853h + (AA * 14h)	Reserved		---

Axis-Origin Parameters

Note Abbreviation in the No. column: AA=1-32 (axis number)
Abbreviation in the address column: AA=0-31 (axis number−1)

No. AA=1-32	Address AA=0-31	Name	Function	Page
P4AA01	5AC0h + (AA * 14h)	Origin search method	Sets the origin search method.	80
P4AA02	5AC1h + (AA * 14h)	Origin search start direction	Sets origin search start direction for origin search method "1".	80
P4AA03	5AC2h + (AA * 14h)	Phase-Z (Phase-C) detection direction	Sets phase-Z (phase-C) detection direction for origin search methods "1, 2, and 3".	81
P4AA04	5AC3h + (AA * 14h)	Origin deceleration method	Sets whether to use origin proximity or limit input signal as origin deceleration input signal for origin search method "1" and "3".	81
P4AA05	5AC4h + (AA * 14h)	Reserved		---
P4AA06	5AC5h + (AA * 14h)	Origin determine signal	Specifies signal to determine (latch) an origin.	81
P4AA07	5AC6h + (AA * 14h)	Origin search feed rate	Sets the speed of the 1st level for 3-level speed origin search.	82
P4AA08	5AC7h + (AA * 14h)	Origin search approach speed	Sets the speed of the 2nd level for 3-level speed origin search, or sets the speed of the 1st level for 2-level speed origin search.	82
P4AA09	5AC8h + (AA * 14h)	Origin search creep speed	Sets the speed of the 3rd level for 3-level speed origin search, or sets the speed of the 2nd level for 2-level speed origin search.	82
P4AA10	5AC9h + (AA * 14h)	Reference (Machine) origin offset	Sets the offset amount (except for DATUM command) in origin search.	82
P4AA11	5ACAh + (AA * 14h)	Origin search final travel distance	Sets the additional travel distance starting from the origin signal input position towards the detection direction.	83
P4AA12	5ACBh + (AA * 14h)	ABS origin offset	Sets offset amount for ABS origin setting.	83
P4AA13 - P4AA20	5ACCh + (AA * 14h) - 5AD3h + (AA * 14h)	Reserved		---

Axis-Machine Parameters

Note Abbreviation in the No. column: AA=1-32 (axis number)
Abbreviation in the address column: AA=0-31 (axis number−1)

No. AA=1-32	Address AA=0-31	Name	Function	Page
P5AA01	5D40h + (AA * 14h)	Units	Sets the units for present positions.	83
P5AA02	5D41h + (AA * 14h)	Position command decimal point position	Sets the method of interpreting the position command specified by an immediate value with decimal point.	84
P5AA03	5D42h + (AA * 14h)	Speed command decimal point position	Sets the method of interpreting the speed command specified by an immediate value with a decimal point.	85
P5AA04	5D43h + (AA * 14h)	Command unit/one machine rotation	Sets the command unit (travel distance) per one machine rotation.	85
P5AA05	5D44h + (AA * 14h)	Gear ratio 1 (Motor rotation speed)	Sets the No. of motor rotations related to the gear ratio between motor and machine.	86
P5AA06	5D45h + (AA * 14h)	Gear ratio 2 (Machine rotation speed)	Sets the No. of machine rotations related to the gear ratio between motor and machine.	86
P5AA07	5D46h + (AA * 14h)	Axis feed mode	Sets whether a concerned axis is operated as limited length or unlimited length.	87
P5AA08	5D47h + (AA * 14h)	External input signal select 1	• Sets the latch input signal for MOVEI command (interrupt feeding). • Sets the latch input signal for MOVELINK command (link operation start). • Sets the latch input signal for CAMBOX command (electronic cam synchronous start). • Sets the latch input signal for SYNC command (trail synchronization start).	87
P5AA09	5D48h + (AA * 14h)	External input signal select 2	Sets the latch input signal for LATCH command (present position latch).	88
P5AA10	5D49h + (AA * 14h)	Reserved		---
P5AA11	5D4Ah + (AA * 14h)	Reserved		---
P5AA12 - P5AA20	5D4Bh + (AA * 14h) - 5D53h + (AA * 14h)	Reserved		---

4-2-3 Data Configuration and Content of System Parameters

Parameters with "Yes" in "Immediate updating" column are updated without switching OFF the Unit once, and then ON again.

In the setting range and initial value columns, the upper value is in hexadecimal while the lower value in parenthesis is in decimal.

Unit Parameters

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00001	5000h	No. of motion tasks	Data	Task	No

Data configuration	Setting range	Initial value
31 00 No. of motion tasks	00000001 to 00000008 Hex (1 to 8)	00000001 (1)

Explanation
Specifies the upper limit for No. of tasks to be used. Task No. up to the value set here can be used.

Note This setting closely relates to the Unit's processing time. For details, see *1-7 Performance Calculation Method for Unit Cycle* on page 19.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00002	5001h	No. of parallel branches	Data	---	No
Data configuration 31 00 No. of parallel branches		Setting range 00000001 to 00000008 Hex (1 to 8)			Initial value 00000001 (4)

Explanation
Specifies the numbers of both parallel branching and simultaneous execution commands in each motion task.

This setting affects the maximum number of branches for PARALLEL (parallel execution) command. (It is limited by the value set here.) When the number of parallel branches in a motion program is smaller than the value set in this parameter, the value obtained from dividing the value in the parameter by the actual number of branches becomes the number of commands that can be executed simultaneously for each row of each branched program.

The number of multiple execution commands in each unit cycle is applied to the simultaneous execution.

(For details, see *6-1-3 Advancement of the Motion Program* (page 222))

Note This setting closely relates to the Unit's processing time. For details, see *1-7 Performance Calculation Method for Unit Cycle* on page 19.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00003	5002h	Unit scan time	Data	ms	No
Data configuration 31 00 Unit scan time		Setting range 00000001 to 00000010 Hex (0 to 16)			Initial value 00000000 (0)

Explanation

- Sets the unit scan time.
- Only setting the longer time than the time set automatically is valid.
- The time set automatically will be reflected in the system variable SW0000. (See *4-5 System Variables* for details.)

For details of the enabling condition, see *1-7 Performance Calculation Method for Unit Cycle* on page 19.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00004	5003h	Unit function select	Bit	---	No
Data configuration 31 28 24 20 16 12 08 04 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					Initial value 00000000 (0)

Explanation

This parameter is used for setting the following functions. Set the bits corresponding to each function.

Bit	Function and explanation
00	Helical circular interpolation speed (Sets the method for specifying the speed in helical circular interpolation executed with MOVEC command.) 0: Speed on the circumference 1: Tangential speed
01	Circular interpolation center position (Sets the method for specifying the center position for MOVEC command.) Refer to the description of the MOVEC command for details. 0: Always specify relative positions. 1: Specify relative or absolute positions.
02	Speed command value (Specifies the speed command unit for SPEED command and the unit for feedback speed 2 in present value monitoring.) 0: Rated % specified 1: r/min specified
03	Communications cycle support (Unit Ver. 2.0 or later only) Specifies the communications cycle. Normally set this parameter to 1. A setting of 0 is provided for compatibility with Pre-Ver. 2.0 Units. 0: Support 1 ms, 2 ms, and 4 ms communications cycles. 1: Support 1 ms, 2 ms, 3 ms, and 4 ms communications cycles.
04	Positioning completed signal select (Specifies the condition for turning OFF the positioning completed signal.) 0: Turns OFF when starting the position command output 1: Turns OFF when moving out of the in-position range
05	Direction switching method for JOG operation (Unit Ver. 2.0 or later only) Specifies the direction for switching the direction for the JOG operation. Refer to *JOG Operation* on page 436 for details. 0: Switch direction when stopped using the JOG/STEP direction bit. 1: Switch direction when stopped or when moving using the JOG/STEP direction bit.
06	Continuing operation for multi-turn operation with infinite axis (Supported by MC Units manufactured 2 February 2004 or later (Lot No. 040202xxxx or later). Specifies the behavior when continuing operation after is has been stopped for an infinite length axis with a command position greater than 1 turn. Refer to *When a program is stopped in the middle of a block for an infinite length axis* on page 350 for details. This function is effective for three commands: MOVE, MOVEL, and MOVET. 0: Cancel part of operation greater than one turn and continue operation to a position within one turn. 1: Continue operation toward command position.
07	Behavior for overtravel (Supported by MC Units manufactured 2 February 2004 or later (Lot No. 040202xxxx or later). Specifies the behavior for when overtravel is detected during axis operation. 0: Stop according to Pn001.1 in the Servo Driver. 1: Stop according to Pn001.0 in the Servo Driver and then turn OFF the servo. If this parameter is set to 1 and Pn001.0 is set to 2, the motor will be placed in free-run status and then the servo will be turned OFF. Caution is required when using these settings because the braking distance may increase.
08 to 31	Reserved

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00006	5005h	General I/O disabled/enabled	Bit	---	No
Data configuration					Initial value
31 28 24 20 16 12 08 04 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					00000000 (0)

Explanation

Sets whether the general I/O of MC Unit is enabled or disabled. Set the bits corresponding to each input or output.

Bit	Function and explanation
00	Deceleration stop input Sets whether deceleration stop input signal is enabled or disabled. 0: Disabled 1: Enabled
01	Reserved
02	General input 1 Sets whether general input 1 signal is enabled or disabled. 0: Disabled 1: Enabled
03	General input 2 Sets whether general input 2 signal is enabled or disabled. 0: Disabled 1: Enabled
04 to 15	Not used
16	General output 1 Sets whether general output 1 signal is enabled or disabled. 0: Disabled 1: Enabled
17	General output 2 Sets whether general output 2 signal is enabled or disabled. 0: Disabled 1: Enabled
18 to 31	Not used

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00007	5006h	Input control 1 from PLC	Bit	---	No
Data configuration					Initial value
31 28 24 20 16 12 08 04 00 0 0 0 0 0 0 0 0 Motion task setting 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					00000000 (0)

Explanation

Sets whether the input from CPU to MC Unit is enabled or disabled.
By setting 1 (ignored), no input from CPU can be accepted by the area.
Set the bits corresponding to the Unit or each motion task.

Bit	Function and explanation
00	Unit Sets whether the input to the Unit control bit area (n+0 to n+2) and the Unit control data area (m+20) are enabled or disabled. 0: Normal 1: Ignored
01	Reserved
02 to 15	Not used
16	Motion task 1 Sets whether the input to the Motion task 1 control area (n+4) and the Motion task 1 control data area (m+22 to 23) are enabled or disabled. 0: Normal 1: Ignored

Bit	Function and explanation
17	Motion task 2 Sets whether the input to the Motion task 2 control area (n+5) and the Motion task 2 control data area (m+24 to 25) are enabled or disabled. 0: Normal 1: Ignored
18	Motion task 3 Sets whether the input to the Motion task 3 control area (n+6) and the Motion task 3 control data area (m+26 to 27) are enabled or disabled. 0: Normal 1: Ignored
19	Motion task 4 Sets whether the input to the Motion task 4 control area (n+7) and the Motion task 4 control data area (m+28 to 29) are enabled or disabled. 0: Normal 1: Ignored
20	Motion task 5 Sets whether the input to the Motion task 5 control area (n+8) and the Motion task 5 control data area (m+30 to 31) are enabled or disabled. 0: Normal 1: Ignored
21	Motion task 6 Sets whether the input to the Motion task 6 control area (n+9) and the Motion task 6 control data area (m+32 to 33) are enabled or disabled. 0: Normal 1: Ignored
22	Motion task 7 Sets whether the input to the Motion task 7 control area (n+10) and the Motion task 7 control data area (m+34 to 35) are enabled or disabled. 0: Normal 1: Ignored
23	Motion task 8 Sets whether the input to the Motion task 8 control area (n+11) and the Motion task 8 control data area (m+36 to 37) are enabled or disabled. 0: Normal 1: Ignored
24 to 31	Not used

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00008	5007h	Input control 2 from PLC	Bit	---	No
Data configuration					Initial value
31 28 24 20 16 12 08 04 00					00000000 (0)

Explanation

Sets whether the input from CPU to MC Unit is enabled or disabled.

By setting 1 (Ignored), no input from CPU can be accepted by the area.

Set the bits corresponding to each axis.

Bit	Function and explanation	Bit	Function and explanation
00	Axis 1 Sets whether input to Axis 1 control bit area (x+0) and Axis 1 control data area (d+0) are enabled or disabled. 0: Normal 1: Ignored	16	Axis 17 Sets whether input to Axis 17 control bit area (x+16) and Axis 17 control data area (d+16) are enabled or disabled. 0: Normal 1: Ignored
01	Axis 2 Sets whether input to Axis 2 control bit area (x+1) and Axis 2 control data area (d+1) are enabled or disabled. 0: Normal 1: Ignored	17	Axis 18 Sets whether input to Axis 18 control bit area (x+17) and Axis 18 control data area (d+17) are enabled or disabled. 0: Normal 1: Ignored
02	Axis 3 Sets whether input to Axis 3 control bit area (x+2) and Axis 3 control data area (d+2) are enabled or disabled. 0: Normal 1: Ignored	18	Axis 19 Sets whether input to Axis 19 control bit area (x+18) and Axis 19 control data area (d+18) are enabled or disabled. 0: Normal 1: Ignored
03	Axis 4 Sets whether input to Axis 4 control bit area (x+3) and Axis 4 control data area (d+3) are enabled or disabled. 0: Normal 1: Ignored	19	Axis 20 Sets whether input to Axis 20 control bit area (x+19) and Axis 20 control data area (d+19) are enabled or disabled. 0: Normal 1: Ignored
04	Axis 5 Sets whether input to Axis 5 control bit area (x+4) and Axis 5 control data area (d+4) are enabled or disabled. 0: Normal 1: Ignored	20	Axis 21 Sets whether input to Axis 21 control bit area (x+20) and Axis 21 control data area (d+20) are enabled or disabled. 0: Normal 1: Ignored
05	Axis 6 Sets whether input to Axis 6 control bit area (x+5) and Axis 6 control data area (d+5) are enabled or disabled. 0: Normal 1: Ignored	21	Axis 22 Sets whether input to Axis 22 control bit area (x+21) and Axis 22 control data area (d+21) are enabled or disabled. 0: Normal 1: Ignored
06	Axis 7 Sets whether input to Axis 7 control bit area (x+6) and Axis 7 control data area (d+6) are enabled or disabled. 0: Normal 1: Ignored	22	Axis 23 Sets whether input to Axis 23 control bit area (x+22) and Axis 23 control data area (d+22) are enabled or disabled. 0: Normal 1: Ignored
07	Axis 8 Sets whether input to Axis 8 control bit area (x+7) and Axis 8 control data area (d+7) are enabled or disabled. 0: Normal 1: Ignored	23	Axis 24 Sets whether input to Axis 24 control bit area (x+23) and Axis 24 control data area (d+23) are enabled or disabled. 0: Normal 1: Ignored
08	Axis 9 Sets whether input to Axis 9 control bit area (x+8) and Axis 9 control data area (d+8) are enabled or disabled. 0: Normal 1: Ignored	24	Axis 25 Sets whether input to Axis 25 control bit area (x+24) and Axis 25 control data area (d+24) are enabled or disabled. 0: Normal 1: Ignored
09	Axis 10 Sets whether input to Axis 10 control bit area (x+9) and Axis 10 control data area (d+9) are enabled or disabled. 0: Normal 1: Ignored	25	Axis 26 Sets whether input to Axis 26 control bit area (x+25) and Axis 26 control data area (d+25) are enabled or disabled. 0: Normal 1: Ignored

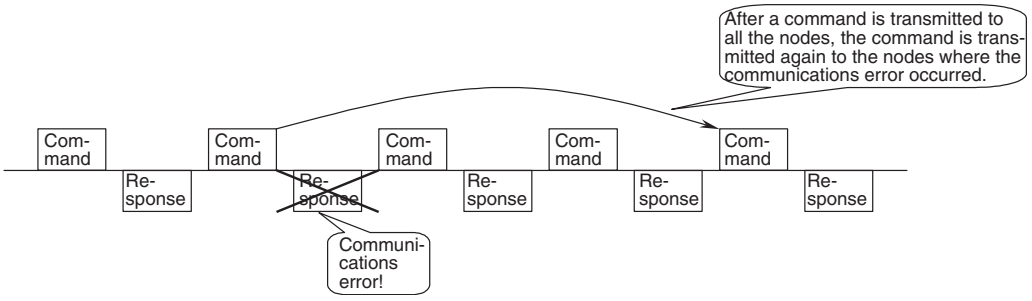
Bit	Function and explanation	Bit	Function and explanation
10	Axis 11 Sets whether input to Axis 11 control bit area (x+10) and Axis 11 control data area (d+10) are enabled or disabled. 0: Normal 1: Ignored	26	Axis 27 Sets whether input to Axis 27 control bit area (x+26) and Axis 27 control data area (d+26) are enabled or disabled. 0: Normal 1: Ignored
11	Axis 12 Sets whether input to Axis 12 control bit area (x+11) and Axis 12 control data area (d+11) are enabled or disabled. 0: Normal 1: Ignored	27	Axis 28 Sets whether input to Axis 28 control bit area (x+27) and Axis 28 control data area (d+27) are enabled or disabled. 0: Normal 1: Ignored
12	Axis 13 Sets whether input to Axis 13 control bit area (x+12) and Axis 13 control data area (d+12) are enabled or disabled. 0: Normal 1: Ignored	28	Axis 29 Sets whether input to Axis 29 control bit area (x+28) and Axis 29 control data area (d+28) are enabled or disabled. 0: Normal 1: Ignored
13	Axis 14 Sets whether input to Axis 14 control bit area (x+13) and Axis 14 control data area (d+13) are enabled or disabled. 0: Normal 1: Ignored	29	Axis 30 Sets whether input to Axis 30 control bit area (x+29) and Axis 30 control data area (d+29) are enabled or disabled. 0: Normal 1: Ignored
14	Axis 15 Sets whether input to Axis 15 control bit area (x+14) and Axis 15 control data area (d+14) are enabled or disabled. 0: Normal 1: Ignored	30	Axis 31 Sets whether input to Axis 31 control bit area (x+30) and Axis 31 control data area (d+30) are enabled or disabled. 0: Normal 1: Ignored
15	Axis 16 Sets whether input to Axis 16 control bit area (x+15) and Axis 16 control data area (d+15) are enabled or disabled. 0: Normal 1: Ignored	31	Axis 32 Sets whether input to Axis 32 control bit area (x+31) and Axis 32 control data area (d+31) are enabled or disabled. 0: Normal 1: Ignored

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00009	5008h	Setting for the No. of MECHATROLINK-II retrial nodes	Data	---	No
Data configuration 31 16 00 0 0 0 0 0 0 0 0					Initial value 00000000 (0)

Explanation

Bit	Function and explanation
00 to 15	Not used
16 to 19	No. of retrial nodes This setting decides how many retries are performed within a communication cycle in the case of a MECHATROLINK-II communications error. (Not for each and every node, but for a maximum of 7 nodes in a system) 0 to 7 Hex (0 to 7)
20 to 31	Not used

• Operation with the number of retrial nodes set



Note (1) Setting the number of retrial nodes makes MC Unit reserve the time in the cycle time for the specified number of retries.
(Even without any communications error or retries, the processing time for them is added to the cycle time.)

(2) This setting closely relates to the communications cycle. For details, see *1-7 Performance Calculation Method for Communications Cycle* on page 20.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00010	5009h	MECHATROLINK-II delay in communication start	Data	---	No
Data configuration 31 00 Delay in communications start		Setting range 00000000 to 0000EA60 Hex (0 to 60000)			Initial value 00000000 (0)

Explanation

• Specifies the time to make the communication start delayed in order to wait for slave startup.

• A period of time set here is waited for after the MC Unit has started up, and then starts communications with the slaves.

Motion Task Parameters

Note Abbreviation in the No. column: M=1-8 (motion task number)
Abbreviation in the address column: M=0-7 (motion task number−1)

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00M01	5020h + (M * 20h)	Max. interpolation feed rate	Data	Command unit/min	Yes
Data configuration 31 00 Max. interpolation feed rate		Setting range 00000001 to 7FFFFFFF Hex (1 to 2147483647)			Initial value 00002710 (10000)

Explanation

• This parameter sets the max. interpolation feed rate. (Operand F)
The max speed is limited by (32767 command unit/unit scan).

P00M01 [command unit/min] ≤ 1966020000/Ts [ms]

Ts [s]: Unit scan time
This indicates the unit cycle time of MC Unit determined by the numbers of tasks, axes, parallel branches, and refreshed words.

1966020000:
The upper limit of speed resolution is 32767 [command unit/unit scan]. The value 1966020000 is obtained by converting 32767 [command unit/unit scan] to the unit of minutes ($32767 \times 60 \times 1000$).

Note The setting of this parameter limits the speed changed with override and the speed specified with Operand F.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00M02	5021h + (M * 20h)	Interpolation feed acceleration time	Data	ms	Yes
Data configuration 31 00 Acceleration time		Setting range 00000000 to 0000EA60 Hex (0 to 60000)			Initial value 00000064 (100)

Explanation

- Pass Mode (P00M06) = 0 or 1
  Sets the time required to accelerate from zero to the feed rate specified in the interpolation command.
- Pass Mode (P00M06) = 2 or 3
  Sets the time required to accelerate from zero to the maximum interpolation feed rate (P00M06).

Note
(1) Enabling S-curve filter causes the delay for the S-curve time constant.
(2) This parameter cannot be changed during operation.
(3) For details of Accel/decel patterns, see *6-1-5 Axis Movement Operation* (page 228).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00M03	5022h + (M * 20h)	Interpolation feed deceleration time	Data	ms	Yes
Data configuration 31 00 Deceleration time		Setting range 00000000 to 0000EA60 Hex (0 to 60000)			Initial value 00000064 (100)

Explanation

- Pass Mode (P00M06) = 0 or 1
  Sets the time required to decelerate from the feed rate specified in the interpolation command to zero.
- Pass Mode (P00M06) = 2 or 3
  Sets the time required to decelerate from the maximum interpolation feed rate (P00M06) to zero.

Note
(1) Enabling S-curve filter causes the delay for the S-curve time constant.
(2) This parameter cannot be changed during operation.
(3) For details of Accel/decel patterns, see *6-1-5 Axis Movement Operation* (page 228).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00M04	5023h + (M * 20h)	Interpolation S-curve filter enabled	Data	---	Yes
Data configuration 31 00 S-curve filter enabled		Setting range 00000000 to 00000001 Hex (0 to 1)			Initial value 00000000 (0)

Explanation

Select enabled/disabled of S-curve filter at the interpolation feed rate.

0: Disabled (Symmetrical)

1: Enabled (S-curve)

Note For details of Accel/decel patterns, see *6-1-5 Axis Movement Operation* (page 228).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00M05	5024h + (M * 20h)	Interpolation S-curve time constant	Data	ms	Yes
Data configuration 31 00 S-curve time constant		Setting range 00000000 to 00007530 Hex (0 to 30000)			Initial value 00000064 (100)

Explanation

Sets the S-curve filter time constant at the interpolation feed rate.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00M06	5025h + (M * 20h)	Pass mode select	Data	---	No
Data configuration 31 00 Pass mode select		Setting range 00000000 to 00000003 Hex (0 to 3)			Initial value 00000000 (0)

Explanation

Sets the combination of the interpolation Accel/decel time and Pass mode with fixed acceleration enabled/disabled.

0: Interpolation acceleration time + Pass mode with fixed acceleration disabled

1: Interpolation deceleration time + Pass mode with fixed acceleration disabled

2: Interpolation acceleration time + Pass mode with fixed acceleration enabled

3: Interpolation deceleration time + Pass mode with fixed acceleration enabled

Note

(1) 2 and 3 are enabled when specifying only 1 axis with MOVEL command.

(2) Interpolation override in Pass mode with fixed acceleration is disabled during deceleration caused by insufficient remaining travel distance.

(3) Pass mode with fixed acceleration cannot complete the passing operation under the following condition. After a deceleration stop, the next operation is executed.

Distance required for deceleration stop from current speed > Travel distance of the next block

(4) There are several acceleration/deceleration times that can be used in the pass operation. For details, see *6-1-5 Axis Movement Operation* (page 228).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00M07	5026h + (M * 20h)	Initial modal data 1 MOVE command value select	Data	---	No
Data configuration 31 00 MOVE command value select		Setting range 00000000 to 00000001 Hex (0 to 1)			Initial value 00000000 (0)

Explanation

Specifies the initial value if ABS/INC specification has been omitted in a motion program.

0: ABL (Operation is executed defining the target position as the absolute position.)

1: INC (Operation is executed defining the target position as the relative position.)

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00M08	5027h + (M * 20h)	Initial modal data 2 Operating mode select	Data	---	No
Data configuration 31 00 Operating mode select		Setting range 00000000 to 00000001 Hex (0 to 1)			Initial value 00000000 (0)

Explanation

Specifies the initial value if PASSMODE/STOPMODE specification has been omitted in a motion program.

0: Operation is executed in Pass mode.

1: Operation is executed in Stop mode.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00M09	5028h + (M * 20h)	Initial modal data 3 Interpolation feed rate	Data	Command unit/min	No
Data configuration 31 00 Interpolation feed rate		Setting range 00000001 to 7FFFFFFF Hex (1 to 2147483647)			Initial value 00002710 (10000)

Explanation

- Specifies the initial value if interpolation feed rate (F command) has been omitted in a motion program.
  The max speed is limited by (32767 command unit/unit scan).

  P00M09 [command unit/min] ≤ 1966020000/Ts [ms]

  Ts[s]: Unit scan time
  This indicates the unit cycle time of MC Unit determined by the numbers of tasks, axes, parallel branches, and refreshed words.

1966020000:
The upper limit of speed resolution is 32767 [command unit/unit scan]. The value 1966020000 is obtained by converting 32767 [command unit/unit scan] to the unit of minutes (32767 × 60 × 1000).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00M10	5029h + (M * 20h)	Interpolation feed decimal point position	Data	---	No

Data configuration	Setting range	Initial value
31 00 Interpolation feed decimal point position	00000000 to 00000004 Hex (0 to 4)	00000000 (0)

Explanation
Sets the method of interpreting the speed command value specified by an immediate value with a decimal point.

0: ×1
1: ×10
2: ×100
3: ×1000
4: ×10000

Ex) When controlling X-axis with task 1 and selecting ×10 of interpolation feed decimal point position (P00M10) for task 1,
MOVEL [J01]100.00 F100.;
is processed as,
MOVEL [J01]100.00 F1000;

Note The following notations have the same meaning when Interpolation feed decimal point position (P00M10) is ×10.
Please note that they are treated differently from position command values.
MOVEL [J01]100.00 F1000;
MOVEL [J01]100.00 F100.;
MOVEL [J01]100.00 F100.0;

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P00M11 to P00M20	502Ah + (M * 20h) to 5033h + (M * 20h)	Interpolation feed acceleration/deceleration bank 1 to Interpolation feed acceleration/deceleration bank 10	Data	ms	Yes

Data configuration	Setting range	Initial value
31 00 Interpolation feed acceleration/deceleration bank 1 to 10	00000000 to 0000EA60 Hex (0 to 60000)	00000064 (100)

Explanation
These parameters are supported by unit version 2.0 or later.
They set the acceleration/deceleration times for interpolation feeding (MOVEL, MOVEC, and MOVETRAV).
The following variables are provided and the bank number for each task can be specified by substituting it for the variable to switch the acceleration/deceleration time to be used.

Variable	Bits	Name
IW0A00	00 to 15	Acceleration/deceleration bank selection for motion task 1 (initial value: 0)
IW0A01	00 to 15	Acceleration/deceleration bank selection for motion task 2 (initial value: 0)
IW0A02	00 to 15	Acceleration/deceleration bank selection for motion task 3 (initial value: 0)

Variable	Bits	Name
IW0A03	00 to 15	Acceleration/deceleration bank selection for motion task 4 (initial value: 0)
IW0A04	00 to 15	Acceleration/deceleration bank selection for motion task 5 (initial value: 0)
IW0A05	00 to 15	Acceleration/deceleration bank selection for motion task 6 (initial value: 0)
IW0A06	00 to 15	Acceleration/deceleration bank selection for motion task 7 (initial value: 0)
IW0A07	00 to 15	Acceleration/deceleration bank selection for motion task 8 (initial value: 0)

Setting range for acceleration/deceleration bank selections:
1 to 10: Select the acceleration/deceleration time in banks 1 to 10.
Other: Selects P00M02 (interpolation feed acceleration time) and P00M03 (interpolation feed deceleration time).

The setting of system parameter P00M06 (pass mode select) determines whether the value is used as the acceleration time or as the deceleration time.
P00M06 = 0 or 2: Used as acceleration time.
P00M06 = 1 or 3: Used as deceleration time.

Refer to *Operating Mode* under *6-1 Program and Task Configuration* (page 232) for details.

Axis-Allocation Parameters

Note Abbreviation in the No. column: AA=1-32 (axis number)
Abbreviation in the address column: AA=0-31 (axis number−1)

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P1AA01	5340h + (AA * 14h)	Physical axis setting	Data	---	No
Data configuration 31 00 Physical axis setting		Setting range 00000000 to 00000020 Hex (0 to 32)			Initial value 00000000 (0)

Explanation
Sets the usage of the physical axes (J01 to J32) to be used with MCH.

Setting	Description
00000000 Hex (0)	Not used as physical axes.
00000001 to0000001E Hex (1 to 30)	These axes are used as real axes. MECHATROLINK-II devices are used for real axes. Sets the node addresses of MECHATROLINK-II devices. Node addresses of MECHATROLINK-II devices 1 to 30 correspond to the setting values 1 to 30.
00000020 Hex (32)	This axis is used as a virtual axis.
Other than the above	Reserved Do not set.

Note
(1) For details of the differences between the virtual axis and the actual axis, see *6-1-13 Virtual Axis* (page 256).
(2) This setting relates to the unit cycle and communications cycle.
For details, see *1-7 Performance Calculation Method for Unit Cycle*, *Calculation Method for Communications Cycle* on page 20.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P1AA02	5341h + (AA * 14h)	MECHATROLINK-II device classification	Data	---	No
Data configuration 31 00 Classification		Setting range 00000000, 00000064 Hex (0, 100)			Initial value 00000000 (0)

Explanation

Sets the types of devices connected as MECHATROLINK-II slaves.

Setting	Explanation
00000000 Hex (0)	W-series Driver is used with NS115 as the option.
00000064 Hex (100)	I/O, counter, and pulse output modules are used as an I/O axis.
Other than the above	Reserved Do not set.

Note For details of differences between axes allocated as I/O and servo axes, see *6-1-14 I/O Axis* (page 257).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P1AA03	5342h + (AA * 14h)	Input allocation points (No. of words)	Data	16 points (word)	No
Data configuration 31 00 Input allocation points		Setting range 00000000 to 0000000F Hex (0 to 15)			Initial value 00000000 (0)

Explanation

00 to 03 bit: Specifies the No. of points (words) for input signals of MECHATROLINK-II slave nodes allocated to input variables of MC Unit.

Note With only 1 axis, words for the No. of words specified in the input variable IW0010 are allocated and they link with the inputs of MECHATROLINK-II slave nodes.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P1AA04	5343h + (AA * 14h)	Output allocation points (No. of words)	Data	16 points (word)	No
Data configuration 31 00 Output allocation points		Setting range 00000000 to 0000000F Hex (0 to 15)			Initial value 00000000 (0)

Explanation

00 to 03 bit: Specifies the No. of points (words) for output signals of MECHATROLINK-II slave nodes allocated to output variables of MC Unit.

Note With only 1 axis, words for the No. of words specified in the output variable OW0010 are allocated and they link with the outputs of MECHATROLINK-II slave nodes.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P1AA05	5344h + (AA * 14h)	Axis allocation first address	Data	---	No
Data configuration 31 16 15 00 Variable type | Address					Initial value 00000000 (0)

Explanation

- When using MECHATROLINK-II counter module or pulse output module as a physical axis, the present position of these counters can be output to the present position of the applicable physical axis.Some modules have 2 counters, however, only 1 counter can be specified.
- Sets the address of the "Counter present position" to be output to the present position.
- The "Counter present position" is stored in the input variable area allocated in "Input allocation points".

Bit	Explanation
00 to 15	Specifies the first address. 0000 to 0FFF Hex (0 to 4095)
16 to 31	Specifies whether the present position is imported or not. 0000 Hex (0): Counter's present positions are not imported into the physical axes. 0001 Hex (1): Counter's present positions are imported.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P1AA06	5345h + (AA * 14h)	MECHATROLINK-II communications error detection	Data	---	No
Data configuration 31 00 Communications error detection		Setting range 00000000 to 00000005 Hex (0 to 5)			Initial value 00000000 (0)

Explanation

Sets the No. of allowable times of communications errors on MECHATROLINK-II device.

The setting of this parameter is valid only for "I/O" (specified in "P1AA02: MECHATROLINK-II device classification").

When the allowable times set here are exceeded, [300Bh: Communications alarm] will occur.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P1AA07	5346h + (AA * 14h)	Reserved	Data	---	No
Data configuration 31 00 Reserved					Initial value 00000000 (0)

Explanation

Reserved

Axis-Speed Parameters

Note Abbreviation in the No. column: AA=1-32 (axis number)
Abbreviation in the address column: AA=0-31 (axis number−1)

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA01	55C0h + (AA * 14h)	Max. rapid feed rate	Data	Command unit/ min	Yes
Data configuration 31 00 Max. rapid feed rate		Setting range 00000001 to 7FFFFFFF Hex (1 to 2147483647)			Initial value 00002710 (10000)

Explanation

- Sets the maximum speed on machine's side for when operating with commands, such as MOVE, MOVEL commands, etc., that include interpolation.
  The maximum rapid feed rate can be set using the following calculation formula:

  P2AA01 [command unit/min]= P5AA04 [command unit/1 machine rotation] × Max. No. of motor rotations [rotation/min] × P5AA06 [machine rotation speed]/P5AA05 [motor rotation speed]

  The maximum speed is limited by (32767 command unit/unit scan).
  P2AA01 [command unit/min] ≤ 1966020000/Ts [ms]

  Ts[s]: Unit scan time
  This indicates the unit cycle time of MC Unit determined by the numbers of tasks, axes, parallel branches, and refreshed words.

  1966020000:
  The upper limit of speed resolution is 32767 [command unit/unit scan]. The value 1966020000 is obtained by converting 32767 [command unit/unit scan] to the unit of minutes (32767 × 60 × 1000).

Note The setting of this parameter limits the speed changed by override, the speed specified by Operand V of MOVEI command, the speed changed by override in MOVET command.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA02	55C1h + (AA * 14h)	Max. manual feed rate	Data	Command unit/ min	Yes
Data configuration 31 00 Max. manual feed rate		Setting range 00000001 to 7FFFFFFF Hex (1 to 2147483647)			Initial value 00002710 (10000)

Explanation
Sets the maximum speed on machine's side when operating with JOG, STEP operations, and DATUM command.
The max speed is limited by (32767 command unit/unit scan).

Note The setting of this parameter limits the speed changed by override.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA03	55C2h + (AA * 14h)	Rapid feed rate	Data	Command unit/ min	Yes
Data configuration 31 00 Rapid feed rate		Setting range 00000001 to 7FFFFFFF Hex (1 to 2147483647)			Initial value 00002710 (10000)

Explanation
Sets the speed (a value with override 100%) on machine's side for when operating with MOVE, MOVEI commands.
The max speed is limited by (32767 command unit/unit scan).

Note Speed can be changed during operation using override.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA04	55C3h + (AA * 14h)	Manual feed rate	Data	Command unit/ min	Yes
Data configuration 31 00 Manual feed rate		Setting range 00000001 to 7FFFFFFF Hex (1 to 2147483647)			Initial value 00002710 (10000)

Explanation
Sets the speed (a value with override 100%) on machine's side for when performing JOG and STEP operations.
The max speed is limited by (32767 command unit/unit scan).

Note Speed can be changed during operation using override.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA05	55C4h + (AA * 14h)	Rapid feed acceleration time	Data	ms	Yes
Data configuration 31 00 Acceleration time		Setting range 00000000 to 0000EA60 Hex (0 to 60000)			Initial value 00000064 (100)

Explanation
Sets the time required to accelerate from zero to max. rapid feed rate.

Note (1) Enabling S-curve filter causes the delay for the S-curve time constant.
(2) This parameter cannot be changed during operation.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA06	55C5h + (AA * 14h)	Rapid feed deceleration time	Data	ms	Yes
Data configuration 31 00 Deceleration time		Setting range 00000000 to 0000EA60 Hex (0 to 60000)			Initial value 00000064 (100)

Explanation
Sets the time required to decelerate from max. rapid feed rate to zero.

Note (1) Enabling S-curve filter causes the delay for the S-curve time constant.

(2) This parameter cannot be changed during operation.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA07	55C6h + (AA * 14h)	Manual feed acceleration time	Data	ms	Yes
Data configuration 31 00 Acceleration time		Setting range 00000000 to 0000EA60 Hex (0 to 60000)			Initial value 00000064 (100)

Explanation
Sets the time required to accelerate from zero to max. manual feed rate.

Note
(1) Enabling S-curve filter causes the delay for the S-curve time constant.
(2) This parameter cannot be changed during operation.
(3) For details of Accel/decel patterns, see *6-1-5 Axis Movement Operation* (page 228).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA08	55C7h + (AA * 14h)	Manual feed deceleration time	Data	ms	Yes
Data configuration 31 00 Deceleration time		Setting range 00000000 to 0000EA60 Hex (0 to 60000)			Initial value 00000064 (100)

Explanation
Sets the time required to decelerate from max. manual feed rate to zero.

Note
(1) Enabling S-curve filter causes the delay for the S-curve time constant.
(2) This parameter cannot be changed during operation.
(3) For details of Accel/decel patterns, see *6-1-5 Axis Movement Operation* (page 228).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA09	55C8h + (AA * 14h)	Rapid feed S-curve filter enabled	Data	---	No
Data configuration 31 00 S-curve filter enabled		Setting range 00000000 to 00000001 Hex (0 to 1)			Initial value 00000000 (0)

Explanation
Selects the S-curve filter enable/disable at rapid feed rate.
0: Disabled
1: Enabled

Note For details of Accel/decel patterns, see *6-1-5 Axis Movement Operation* (page 228).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA10	55C9h + (AA * 14h)	Manual feed S-curve filter enabled	Data	---	Yes
Data configuration 31 00 S-curve filter enabled		Setting range 00000000 to 00000001 Hex (0 to 1)			Initial value 00000000 (0)

Explanation
Selects the S-curve filter enable/disable at manual feed rate.
0: Disabled
1: Enabled

Note For details of Accel/decel patterns, see *6-1-5 Axis Movement Operation* (page 228).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA11	55CAh + (AA * 14h)	Rapid feed S-curve time constant	Data	ms	Yes
Data configuration 31 00 S-curve time constant		Setting range 00000000 to 00007530 Hex (0 to 30000)			Initial value 00000064 (100)

Explanation
Sets the S-curve filter time constant at rapid feed rate.

Note For details of Accel/decel patterns, see *6-1-5 Axis Movement Operation* (page 228).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P2AA12	55CBh + (AA * 14h)	Manual feed S-curve time constant	Data	ms	Yes
Data configuration 31 00 S-curve time constant		Setting range 00000000 to 00007530 Hex (0 to 30000)			Initial value 00000064 (100)

Explanation
Sets the S-curve filter time constant at manual feed rate.

Note For details of Accel/decel patterns, see *6-1-5 Axis Movement Operation* (page 228).

Axis-Position Parameters

Note Abbreviation in the No. column: AA=1-32 (axis number)
Abbreviation in the address column: AA=0-31 (axis number−1)

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P3AA01	5840h + (AA * 14h)	STEP operation travel distance	Data	Command unit	Yes
Data configuration 31 00 Travel distance		Setting range 00000000 to 7FFFFFFF Hex (0 to 2147483647)			Initial value 000003E8 (1000)

Explanation
Sets the travel distance for STEP operation.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P3AA02	5841h + (AA * 14h)	Positive direction software limit	Data	Command unit	No

Data configuration	Setting range	Initial value
31 00 + direction software limit	80000000 to 7FFFFFFF Hex (–2147483648 to 2147483647)	7FFFFFFF (2147483647)

Explanation
Sets the software limit value in the positive direction.
An error will occur when the command value created in every unit scan exceeds this software limit.
The value has to satisfy the following conditions:
P3AA02 [command unit] = + direction upper limit/minimum setting unit
P3AA03 [command unit] = – direction upper limit/minimum setting unit
P3AA03 < P3AA02

Ex) When positioning X-axis (ball screw) in 0.01mm unit (P5AA01, P5AA2) within –100 to 100mm, the following values are to be set:
P3AA02 = 100mm/0.01mm = 10000 [command unit]
P3AA03 = –100mm/0.01mm = –10000 [command unit]

Note The setting of this parameter is ignored in the following cases:

- When Software limit enabled/disabled (P3AA04) is set to either "0" or "2".
- When an origin has not been defined.
- When Axis feed mode (P5AA07) is set to 0010h (unlimited length).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P3AA03	5842h + (AA * 14h)	Negative direction software limit	Data	Command unit	No

Data configuration	Setting range	Initial value
31 00 – direction software limit	80000000 to 7FFFFFFF Hex (–2147483648 to 2147483647)	80000000 (–2147483648)

Explanation
Sets the software limit value in the negative direction.
An error will occur when the command value created in every unit scan is smaller than this software limit.
(See the setting example of *P3AA02: + direction software limit* on page 77.)

Note The setting of this parameter is ignored in the following cases:

- When Software limit enabled/disabled (P3AA04) is set to either "0" or "2".
- When an origin has not been defined.
- When Axis feed mode (P5AA07) is set to 0010h (unlimited length).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P3AA04	5843h + (AA * 14h)	Software limit enabled/disabled	Data	---	No
Data configuration 31 00 Software limit enabled/disabled		Setting range 00000000 to 00000003 Hex (0 to 3)			Initial value 00000000 (0)

Explanation

Sets whether software limit is enabled or disabled.

0: Disabled in both directions, + and –
1: Enabled only in + direction
2: Enabled only in – direction
3: Enabled in both directions, + and –

Note For details of software limit, see *9-3 Coordinate System* (page 514).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P3AA05	5844h + (AA * 14h)	Error warning value	Data	Pulse	Yes
Data configuration 31 00 Warning value		Setting range 00000000 to 7FFFFFFF Hex (0 to 2147483647)			Initial value 7FFFFFFF (2147483647)

Explanation

Sets the No. of error pulses that causes warning.

The error counter warning bit will turn ON if the position error exceeds the value set in this parameter.

Note Setting this parameter to 0 disables warning detection.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P3AA06	5845h + (AA * 14h)	Position error alarm detection value	Data	Pulse	Yes
Data configuration 31 00 Alarm detection value		Setting range 00000000 to 7FFFFFFF Hex (0 to 2147483647)			Initial value 7FFFFFFF (2147483647)

Explanation

Sets the No. of error pulses that causes alarm.

Note Setting this parameter to 0 disables alarm detection.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P3AA07	5846h + (AA * 14h)	No. 2 in-position range	Data	Pulse	Yes
Data configuration 31 00 No. 2 in-position range		Setting range 00000000 to 0000FFFF Hex (0 to 65535)			Initial value 0000FFFF (65535)

Explanation
Sets the range for turning ON the positioning completed signal of interpolation feed in Stop mode.

Note For details, see *6-1-5 Axis Movement Operation* (page 228).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P3AA08	5847h + (AA * 14h)	Feed forward gain enabled/disabled	Data	---	No
Data configuration 31 00 Gain enabled/disabled		Setting range 00000000 to 00000001 Hex (0 to 1)			Initial value 00000000 (0)

Explanation
Sets enabled/disabled of feed forward gain specified with input variable.
0: Enabled
1: Disabled

Note When disabled, the input variable is ignored to set feed forward gain to 0.00%.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P3AA09	5848h + (AA * 14h)	Position control switching speed	Data	0.01%	Yes
Data configuration 31 00 Position control switching speed		Setting range 00000000 to 00007FFF Hex (0 to 32767)			Initial value 00000000 (0)

Explanation
This parameter is supported by unit version 2.0 or later.
For torque control, specifies the feedback speed at which to return from torque control to position control (when using the TORQUR command) as a percentage of the motor's rated speed.
For speed control, specifies the feedback speed at which to return from speed control to position control (when using the SPEEDR command) as a percentage of the motor's rated speed.
If 0 is set, operation will be the same as for Pre-Ver. 2.0, i.e., position control will be returned to at a feedback speed of 0.

Ex) Torque Control
The following example is for a motor rated speed of 3,000 r/min and a position control switching speed of 1000 (in increments of 0.01%, i.e., 10%).

```
TORQUE [J01] 100 T100;
      :
TORQUER [J01] T100;  ←
MOVE [J01] 10000;
      :
```

Outputs from a torque of 100% to a torque of 0%.
Switches to position control mode when the motor speed reaches 300 r/min or lower (i.e., 3,000 r/min × 10%). After returning to position mode, the system waits for the positioning complete flag to turn ON. When the positioning completed flag turns ON, the next command (MOVE) is executed.

Axis-Origin Parameters

Note Abbreviation in the No. column: AA=1-32 (axis number)
Abbreviation in the address column: AA=0-31 (axis number-1)

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P4AA01	5AC0h + (AA * 14h)	Origin search method	Data	---	No

Data configuration	Setting range	Initial value
31 00 Origin search method	00000000 to 00000003 Hex (0 to 3)	00000001 (1)

Explanation
Sets the origin search method.

Setting	Explanation
0	Origin at power ON The motor position at powering ON is automatically defined as the origin. If an origin search is performed in this mode, the starting position of the origin search is defined as an origin.
1	Limit reversal Input of the limit input signal during an origin search reverses the operation. After starting an origin search in the origin search start direction at the origin search feed rate, the speed is changed to the origin search approach speed at the rise of the origin proximity input signal (Normally Open contact). At the rise of the origin determine signal after the fall of the origin proximity input signal, the speed changes to the origin search creep speed to travel for the final interval and finally an origin is determined.
2	2-level speed in 1 direction Origin search is executed only in 1 direction. After starting an origin search in the phase-Z detection direction at the origin search approach speed, the speed changes to the origin search creep speed at the rise of the origin determine signal input to travel for the final interval and an origin is determined. Inputting the limit input signal before inputting the origin determine input signal activates the alarm.
3	3-level speed in 1 direction Origin search is executed only in 1 direction.After starting an origin search in the phase-Z detection direction at the origin search feed rate, the speed is changed to the origin search approach speed at the rise of the origin proximity input signal (Normally Open contact). At the rise of the origin determine signal input after the fall of the origin proximity signal input, the speed changes to the origin search creep speed to travel for the final interval and finally an origin is determined. Inputting the limit input signal before inputting the origin proximity input signal activates the alarm.

Note For details of origin search operations, see *SECTION 8 Establishing the Origin* (page 490).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P4AA02	5AC1h + (AA * 14h)	Origin search start direction	Data	---	No

Data configuration	Setting range	Initial value
31 00 Origin search start direction	00000000 to 00000001 Hex (0 to 1)	00000000 (0)

Explanation
Sets the origin search start direction for the origin search method "1" (Limit reversal).

0: Same as the phase-Z detection direction
1: Opposite to the phase-Z detection direction

Note The setting of this parameter is ignored in other origin search methods.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P4AA03	5AC2h + (AA * 14h)	Phase-Z (Phase-C) detection direction	Data	---	No

Data configuration

31 00

Phase-Z (Phase-C) detection direction

Setting range
00000000 to 00000001 Hex
(0 to 1)

Initial value
00000000 (0)

Explanation
Sets the phase-Z (phase-C) detection direction for origin search methods "1", "2", and "3" (other than "0:Origin at power ON)".

0: + direction
1: – direction

Note The setting of this parameter is ignored in the origin search method "0: Origin at power ON".

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P4AA04	5AC3h + (AA * 14h)	Origin deceleration method	Data	---	No

Data configuration

31 00

Origin deceleration method

Setting range
00000000 to 00000001 Hex
(0 to 1)

Initial value
00000000 (0)

Explanation
Sets whether to use the origin proximity input signal or the limit input signal as the origin deceleration signal for origin search methods "1: Limit reversal" and "3: 3-level speed in 1 direction".

0: Uses the origin proximity input signal as the origin deceleration signal.
1: Uses CW and CCW as the origin deceleration signal.

Note The setting of this parameter is ignored in origin search methods "0: Origin at power ON" and "2: 2-level speed in 1 direction".

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P4AA06	5AC5h + (AA * 14h)	Origin determine signal	Data	---	No

Data configuration

31 00

Origin determine signal

Setting range
00000000 to 00000003 Hex
(0 to 3)

Initial value
00000000 (0)

Explanation
Specifies the signal to determine (latch) an origin.
0: Defines the phase-Z (phase-C) as an origin
1: Defines the external input signal 1 as an origin
2: Defines the external input signal 2 as an origin
3: Defines the external input signal 3 as an origin

Note The setting of this parameter is ignored in the origin search method "0: Origin at power ON".

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P4AA07	5AC6h + (AA * 14h)	Origin search feed rate	Data	Command unit/ min	Yes
Data configuration 31 00 Feed rate		Setting range 00000001 to 7FFFFFFF Hex (1 to 2147483647)			Initial value 00002710 (10000)

Explanation-
Sets the speed of the 1st level for 3-level speed origin search.
The maximum speed is limited by (32767 command unit/unit scan).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P4AA08	5AC7h + (AA * 14h)	Origin search approach speed	Data	Command unit/ min	Yes
Data configuration 31 00 Approach speed		Setting range 00000001 to 7FFFFFFF Hex (1 to 2147483647)			Initial value 000003E8 (1000)

Explanation
Sets the speed of the 2nd level for 3-level speed origin search, or sets the speed of the 1st level for 2-level speed origin search.
The maximum speed is limited by (32767 command unit/unit scan).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P4AA09	5AC8h + (AA * 14h)	Origin search creep speed	Data	Command unit/ min	Yes
Data configuration 31 00 Creep speed		Setting range 00000001 to 7FFFFFFF Hex (1 to 2147483647)			Initial value 00000064 (100)

Explanation
Sets the speed of the 3rd level for 3-level speed origin search, or sets the speed of the 2nd level for 2-level speed origin search.
The maximum speed is limited by (32767 command unit/unit scan).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P4AA10	5AC9h + (AA * 14h)	Reference (Machine) origin offset	Data	Command unit/ min	Yes
Data configuration 31 00 Offset amount		Setting range 80000000 to 7FFFFFFF Hex (–2147483648 to 2147483647)			Initial value 00000000 (0)

Explanation
Sets the offset amount (except for DATUM command) in an origin search.
(The present position after an origin search is recognized as the position (the value) preset in this parameter.)

Note In the origin search with DATUM command, the setting of this parameter is ignored. Instead, the operand (offset value) in the command is used.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P4AA11	5ACAh + (AA * 14h)	Origin search final travel distance	Data	Command unit/ min	Yes
Data configuration 31 00 Travel distance		Setting range 00000000 to 7FFFFFFF Hex (0 to 2147483647)			Initial value 00000000 (0)

Explanation
Sets the final travel distance in origin searches.
After the rise of the origin determine signal, the axis travels in the direction specified in P4AA03: Phase-Z (Phase-C) detection direction for the distance specified in this parameter.

Note This is the travel distance after the rise of the origin determine signal. Therefore, make sure that the final travel distance does not exceed the positions of limit input signals. (Otherwise, the alarm [3010h: Over travel reverse alarm] will occur.)

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P4AA12	5ACBh + (AA * 14h)	ABS origin offset	Data	Command unit	Yes
Data configuration 31 00 Offset amount		Setting range 80000000 to 7FFFFFFF Hex (–2147483648 to 2147483647)			Initial value 00000000 (0)

Explanation
Sets the offset amount for ABS origin setting.
When the "ABS origin setting" bit is turned ON, the compensation value of the absolute encoder is saved to the F-ROM in MC Unit. Simultaneously, the present position on the machine coordinate system is preset to the setting value in this parameter.

Axis-Machine Parameters

Note Abbreviation in the No. column: AA=1-32 (axis number)
Abbreviation in the address column: AA=0-31 (axis number−1)

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P5AA01	5D40h + (AA * 14h)	Units	Data	---	No
Data configuration 31 00 Units		Setting range 00000000 to 00000003 Hex (0 to 3)			Initial value 00000000 (0)

Explanation

Sets the unit for displaying present positions.

0: mm
1: inch
2: deg
3: pulse

Units for positioning are specified in the parameters P5AA01 and P5AA02.

Ex) Positioning X-axis (ball screw) in 0.01mm unit.
Positioning Y-axis (turn table) in 0.01deg unit.

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P5AA02	5D41h + (AA * 14h)	Position command decimal point position	Data	---	No
Data configuration 31 00 Position command decimal point position		Setting range 00000000 to 00000004 Hex (0 to 4)			Initial value 00000003 (3)

Explanation

Sets the method of interpreting the position command specified by an immediate value with a decimal point.

0: 1
1: 0.1
2: 0.01
3: 0.001
4: 0.0001

Note When "pulse" is selected for the unit, this parameter is treated as "0".

- When a position command value has a decimal point, processing is as follows:

  Ex 1) When the decimal point position of the position command value for X-axis is 1:
  MOVE [J01]100.0;
  is processed as,
  MOVE [J01]100;

  Ex 2) When the decimal point position of the X-axis position command value for X-axis is 0.01:
  MOVE [J01]100.0;
  is processed as,
  MOVE [J01]10000;

  Note The following notations have the same meaning.
  MOVE [J01]100.00;
  MOVE [J01]100.000;
  MOVE [J01]100.;

  If there is no decimal point in the position command value, it is used unaltered.

- When specifying a position command value with a variable using real data of the data access size, the decimal point position set in this parameter is used for processing.

Ex) When the decimal point position of the position command value for X-axis is 0.01:
MF1000 = 123.4567;
MOVE [J01]MF1000;
is processed as,
MOVE [J01]12345;

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P5AA03	5D42h + (AA * 14h)	Speed command decimal point position	Data	---	No

Data configuration

31 00

Speed command decimal point position

Setting range
00000000 to 00000004 Hex
(0 to 4)

Initial value
00000000 (0)

Explanation
Sets the method of interpreting the speed command specified by an immediate value with a decimal point.

0: ×1
1: ×10
2: ×100
3: ×1000
4: ×10000

Ex) When controlling X-axis with task 1 and the speed command decimal point position (P5AA03) for task 1 is ×10:
MOVEI [J01]100.00 D2000.0 V100.;
is processed as,
MOVEI [J01]100.00 D2000.0 V1000;

Note The following notations have the same meaning when Speed command decimal point position (P5AA03) is ×10.
Please note that they are treated differently from position command values.
MOVEI [J01]100.00 D2000.0 V1000;
MOVEI [J01]100.00 D2000.0 V100.;
MOVEI [J01]100.00 D2000.0 V100.0;

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P5AA04	5D43h + (AA * 14h)	Command unit/1 machine rotation	Data	Command unit	No

Data configuration

31 00

Command unit/1 machine rotation

Setting range
00000001 to 7FFFFFFF Hex
(1 to 2147483647)

Initial value
00002710 (10000)

Explanation
Sets the resolution of a command for 1 machine rotation.
(The value set here is treated as "command unit".)

Ex) When positioning X-axis (ball screw with the lead of 10mm) in 0.01mm unit (P5AA01, P5AA02), the resolution is,
10mm/0.01mm = 1000 [command unit/1 machine rotation]

Ex) When positioning Y-axis (turn table of 360deg per rotation) in 0.01deg unit (P5AA01, P5AA02), the resolution is,
360deg/0.01deg = 36000 [command unit/1 machine rotation]

Note

(1) When "pulse" is selected for the unit, the setting of this parameter is ignored.

(2) When "deg" is selected for the unit, set the value that can be obtained by ($360 \times 10^{\text{position command decimal point position}}$).

(3) When the following formula is not satisfied, the alarm [3040h: Gear ratio range error] will occur.
1/2147483647 ≤ (P5AA04 × P5AA06)/(value in the parameter 9001h × P5AA05) ≤ 2147483647

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P5AA05	5D44h + (AA * 14h)	Gear ratio 1 (Motor rotation speed)	Data	Rotation	No

Data configuration	Setting range	Initial value
31 00 Gear ratio 1	00000001 to 00989680 Hex (1 to 10000000)	00000001 (1)

Explanation
Sets the No. of motor rotations related to the gear ratio between motor and machine.

Note

(1) When "pulse" is selected for the unit, the setting of this parameter is ignored.

(2) When the following formula is not satisfied, the alarm "3040h: Gear ratio range error" will occur.
1/2147483647 ≤ (P5AA04 × P5AA06)/(value in the parameter 9001h × P5AA05) ≤ 2147483647

(3) For details of the concept of setting gear ratio, see *4-2-4 Concept of Parameters* (page 88).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P5AA06	5D45h + (AA * 14h)	Gear ratio 2 (Machine rotation speed)	Data	Rotation	No

Data configuration	Setting range	Initial value
31 00 Gear ratio 2	00000001 to 00989680 Hex (1 to 10000000)	00000001 (1)

Explanation
Sets the No. of machine rotations related to the gear ratio between motor and machine.

Note

(1) When "pulse" is selected for the unit, the setting of this parameter is ignored.

(2) When the following formula is not satisfied, the alarm "3040h: Gear ratio range error" will occur.
1/2147483647 ≤ (P5AA04 × P5AA06)/(value in the parameter 9001h × P5AA05) ≤ 2147483647

(3) For details of the concept of setting gear ratio, see *4-2-4 Concept of Parameters* (page 88).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P5AA07	5D46h + (AA * 14h)	Axis feed mode	Data	---	No
Data configuration 31 07 04 00 0 0 0 0 0 0 0 0					Initial value 00000000 (0)

Explanation

Bit	Function and explanation
00 to 03	Reserved
04 to 07	Sets the method of managing the coordinate system for position commands. 0: Limited length (On the mechanical configuration, the axis has traveling limits.) 1: Unlimited length (On the mechanical configuration, the axis does not have traveling limits.)
08 to 31	Reserved

Note For details of coordinate systems corresponding to modes, see *9-3 Coordinate System* (page 514).

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P5AA08	5D47h + (AA * 14h)	External input signal select 1	Data	---	Yes
Data configuration 31 24 16 08 00 W X Y Z					Initial value 00000000 (0)

Explanation

- Specifies the external input signal for each function at a latch request.

Bit	Function and explanation
00 to 07	Z: Specifies the latch input signal for MOVEI command (Interrupt feeding).
08 to 15	Y: Specifies the latch input signal for MOVELINK command (Link operation start).
16 to 23	X: Specifies the latch input signal for CAMBOX command (Cam synchronous start).
24 to 31	W: Specifies the latch input signal for SYNC command (Trail synchronization start).

- Setting range: 00 to 03 Hex (0 to 3)
  00 Hex (0): Phase-Z (Phase-C) signal is used as the latch request signal.
  01 Hex (1): External input signal 1 is used as the latch request signal.
  02 Hex (2): External input signal 2 is used as the latch request signal.
  03 Hex (3): External input signal 3 is used as the latch request signal.

Note To set this parameter, the input terminal has to be enabled in the servo parameter Pn511.
(It is allocated according to the initial setting; however, it will require special attention when the user has customized the setting of the parameter.)

No.	Address in MC Unit	Name	Type	Unit	Immediate updating
P5AA09	5D48h + (AA * 14h)	External input signal select 2	Data	---	Yes
Data configuration 31 07 00 0 0 0 0 0 0 X					Initial value 00000000 (0)

Explanation

- Specifies the external input signal for each function at a latch request.

Bit	Function and explanation
00 to 07	X: Specifies the latch input signal for LATCH command (Present position latch).
08 to 31	Reserved

- Setting range: 00 to 03 Hex (0 to 3)
  00 Hex (0): Phase-Z (Phase-C) signal is used as the latch request signal.
  01 Hex (1): External input signal 1 is used as the latch request signal.
  02 Hex (2): External input signal 2 is used as the latch request signal.
  03 Hex (3): External input signal 3 is used as the latch request signal.

Note To set this parameter, the input terminal has to be enabled in the servo parameter Pn511.
(It is allocated according to the initial setting; however, it will require special attention when the user has customized the setting of the parameter.)

4-2-4 Concept of Parameters

Gear Ratio

This section explains the concept of the gear ratio.

In case of position command:

In a machine configuration where the motor axis rotation (m) results in the machine axis rotation (n), set the gear ratio as shown below:
[P5AA05: Gear ratio 1 (Motor rotation speed)] = m
[P5AA06: Gear ratio 2 (Machine rotation speed) = n

Example)
If P5AA05 = 2 and P5AA06 = 1, giving a command to rotate the machine axis at 1000r/min will make the motor axis rotate at 2000r/min.

In cases of Speed Command and Torque Command:

Only the SPEED and TORQUE commands can control speed and torque respectively. These commands are for the motor axes, so there is no need to set the gear ratio.

Example)
Even when P5AA05 = 2 and P5AA06 = 1 are set, giving a command to rotate at 1000r/min with the SPEED command will make the motor axis rotate at 1000r/min.

Relations between Command Unit and Pulses

The relations between the command unit on the machine side and pulses on the motor side can be described by the following formulas:

$$\text{Pulses [on Motor]} = \text{Command unit [on Machine]} \times \frac{\text{9001h [No. of encoder pulses/ One motor rotation]} \times \text{P5AA05 [on Motor]}}{\text{P5AA04 [Command unit/One machine rotation]} \times \text{P5AA06 [on Machine]}}$$

$$\text{Command unit [on Machine]} = \text{Pulses [on Motor]} \times \frac{\text{P5AA04 [Command unit/One machine rotation]} \times \text{P5AA06 [on Machine]}}{\text{9001h [No. of encoder pulses/ One motor rotation]} \times \text{P5AA05[on Motor]}}$$

If the following formula cannot be satisfied, the alarm [3040h: Gear ratio range error] will occur.

$1/2147483647 \leq (\text{P5AA04} \times \text{P5AA06})/(\text{9001h} \times \text{P5AA05})$ (fraction to be reduced) ≤ 2147483647

Command unit limit:

The maximum value of the command unit system has to satisfy the following formula because pulse command system is described with the range in 32-bit:

– Command unit limit ≤ Command unit position ≤ Command unit limit

$$\text{Command unit limit[on machine]} = 2147483647\text{[on Motor]} \times \frac{\text{P5AA04 [Command unit/One machine rotation]} \times \text{P5AA06 [on Machine]}}{\text{9001h [No. of encoder pulses/ One motor rotation]} \times \text{P5AA05[on Motor]}}$$

When specifying a position exceeding the value obtained by the above formula in a program, the alarm [2009h: Position specification error] will occur.

Additionally, the upper limit of the [Command unit limit], 2147483647, will limit the exceeding value.

Speed

The speed unit for the position command is the Command unit/min at machine axes.

The overview of the relations between the machine axis speed [command unit/min] and motor axis rotations [r/min] can be described by the following formula.

$$\text{Motor axis speed [Motor rev/min]} = \frac{\text{Machine axis speed [Command unit/min]}}{\text{P5AA04 [Command unit/One machine rotation]}} \times \frac{\text{P5AA05 [on Motor]}}{\text{P5AA06 [on Machine]}}$$

Minimum speed to avoid intermittent output:

Minimum speed command is 1 command unit/unit scan. When outputting slower speed than this, the output will be intermittent on the waveform.

Minimum speed [Command unit/min] = 1 [Command unit/ms] × 60 [sec/min] × 1000 [ms/sec] × unit scan time [ms]

Precision of feedback speed 1 and 2:

Precision of feedback speed 1 and 2 output to the system variable is as follows:

- Precision of feedback speed 1
  Feedback speed, based on the unit [pulse/ms], is ultimately converted into the divisions of the "minimum speed" mentioned above, and will be output.
  Therefore, the "minimum speed" will be the resolution of the feedback speed 1.

  Ex) When the unit cycle is 4 [ms]:
  Minimum speed [command unit/min] = $1 \times 60 \times 1000 \times 4$
  $= 24000$ [command unit/min]

  From the above, the feedback speed 1 will change in the unit of 24000 [command unit/min].
- Precision of feedback speed 2
  Precision of feedback speed [r/min] = 1[pulse/1ms] $\times$ 1000 $\times$ 60/(encoder resolution [pulse/r] $\times$ 4)/unit cycle [ms]

  Ex) When encoder resolution is 16384 [pulse/r] and unit cycle is 4 [ms]:
  Precision of feedback speed [r/min] = $1 \times 1000 \times 60/(16384 \times 4)/4$
  $= 0.228$ [r/min] = 0.22 [r/min]

  From the above, the feedback speed 2 will change in the unit of 0.22 [r/min].

  Setting rated 1000 [r/min] when the unit is [%], it will be in the unit of 0.22/1000 = 0.02%.

Speed indication for not causing [A94] when inputting the limit sensor signal:

When the limit sensor signal is input to the servo driver during rotations, the warning [A94: Data Setting Warning] may occur on NS115 due to communications delay. There is no deviation in positioning, yet the speed that causes the alarm is to be explained in the following:

Speed that causes A94 [Command unit/min] = Speed command MAX [Pulse]/delay in Communications cycle [ms] $\times$ gear reverse conversion [Command unit/ pulse] $\times$ 60 [sec/min] $\times$ 1000 [ms/sec]

- Speed command MAX: In case of NS115, it is fixed at 32767[pulse].
- Delay in Communications cycle: No. of times until MC Unit detects the limit sensor signal input (to be converted to Communications cycle) $\times$ communications cycle
  - When Communications cycle: Unit Cycle = 1:1, 9 scans
  - When Communications cycle: Unit Cycle = 1:2, 11 scans

  Note The delay of the NS115, 2 scans for the uplink and 1 scan for the downlink, is added to the value showed in *1-7 Performance*.
- Gear reverse conversion: Previous "Pulse a Command" unit conversion formula

  Example)
  When Communications cycle = 1ms, Unit Cycle = 2ms (1:2), No. of encoder pulses = 65536
  Command unit/One machine rotation = 10000, and gear ratio 1 = gear ratio 2 = 1:
  The speed that causes A94 = 32767/11*(10000/65536) $\times$ 60 $\times$ 1000 = Approximately 27271895 [Command unit/min]

4-2-5 Timing that Enables Transferred System Parameters

Note Make sure to turn the MC Unit power OFF once, and then ON again after system parameters have been transferred. The unit parameters and machine parameters will not change unless the power is turned back ON.

The parameters that are marked 'Yes' on the immediate updating columns can be changed without the power OFF/ON.

- A part of motion task parameters
- Axis – speed parameters
- A part of Axis – position parameters
- A part of Axis – machine parameters

4-3 Variables

There are six types of MC Unit variables as shown below:

- System variables
- Global general variables
- Input variables
- Output variables
- Position data
- Task variables

4-3-1 Overview of Variables

Name		Purpose	Size	Backup to FLASH ROM	R/W
Global variables					
	Position Data	Data to indicate positions.	10240 positions (40960byte)	YES	R/W
	System variables	Status of MC Unit such as operating modes, error logs, etc.	2048 words (4096byte)	NO	R
	Global general variables	Can be accessed from all the tasks, and used for Communicating data between operations and tasks.	8192 words (16384byte)	NO	R/W
	Input variables	Status of the input from CPU Unit or MECHATROLINK-II devices.	4096 words (8192byte)	NO	R/W
	Output variables	Outputs for CPU Unit or MECHATROLINK-II are executed from a program.	4096 words (8192byte)	NO	R or R/W
Variables exclusively for tasks					
	Task variables	Can be used only in each task, and are used as workspace, etc. during operations.	128words × 8tasks (2048byte)	NO	R/W

Note

(1) For Position Data, see *4-4 Position Data* (page 93).

(2) For System variables, see *4-5 System Variables* (page 96).

(3) For Input variables and Output variables, see *4-6 I/O Variables* (page 143).

(4) CAM Data will not be treated as a variable.

Rules for Writing Variables

Use the following format to write variables.

Put "#" in front of variables.

#	V	T	hhhh	[b]

V: Variable type
T: Data access type
hhhh: Addresses of Data (in hexadecimal)
b: Bit number for bit-type data access (in hexadecimal)

Example)

```
#PL0000 = 10000;
MOVE_[J01]#PL0000;
```

Variable Type and Address Range

Use 4-digit hexadecimal notation for data addresses.

Data addresses indicate the first address of integer data regardless of the access type.

Type	Notation	Address range
Position Data	PLhhhh	PL0000 - PL27FF
System variables	S*hhhh	SW0000 - SW07FF
Global general variables	M*hhhh	MW0000 - MW1FFF
Input variables	I*hhhh	IW0000 - IW0FFF
Output variables	O*hhhh	OW0000 - OW0FFF
Task variables	D*hhhh	DW0000 - DW007F

Note Task variables can use 128 words in each task.

Data Access Type

There are four data access types as shown in the following table.

Data Access Type Table

Type	Notation	Numerical range	Remark
Bit type	B	1 (ON), 0 (OFF)	
Integer type	W	–32768 to +32767 (8000 Hex to 7FFF Hex)	Signed word data (16-bit)
Double-length integer type	L	–2147483648 to +2147483647 (80000000 Hex to 7FFFFFFF Hex)	Signed double-length data (32-bit)
Real number type	F	±(1.175E-38 to 3.402E+38), 0	Single-precision floating decimal point (32-bit)

Precautions When Accessing the Same Address with Different Access Type

The variables at the same address share the same physical space.

	Bit type	Integer type	Double-length integer type	Real number type
The beginning of the global general variable	MB0000b	MW0000	ML0000	MF0000
	MB0001b	MW0001		
	MB0002b	MW0002	ML0002	MF0002
	MB0003b	MW0003		

Note Odd-number addresses cannot be specified with Double-length integer type or Real number type. Make sure to specify even-number addresses.

Followings are the examples:

- (1) ML0000 = 1234 --- Write 1234 in the Double-length integer type.
- (2) MF0000 = 1234 --- Write 1234 in the real number type.

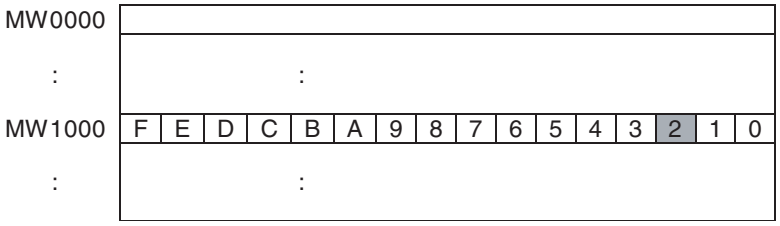
The variables of the same address share the same physical space even though the types are different. Therefore, the memory image after execution of (1) and (2) will be as described in the table below. If the same address is accessed using a different access type, a different value will be read. So it needs special attention.

Case	Original value	In hexadecimal	Display in different type
(1)	1234	000004D2hex	1.729202E-042 (Real number type)
(2)	1.234000E+003	449A4000hex	1150959616 (Integer type)

Bit Specification

If the bit type is selected for data access, the bit position in 16-bit word data needs to be specified with "Bit No.".

Example) "MB10002" indicates the second bit of MW1000.



4-4 Position Data

There are 10240 of position data that can be used. In a motion program, positioning is executed by specifying a position directly or by specifying a position in the position data (indirect specification). Position data is transferred between an MC Unit and the support tool by using a support tool (MC-Miel) or IOWR/IORD instructions.

4-4-1 Position Data Address

Specify position data at the following addresses in MC Unit memory. Specify the addresses in hexadecimal when using IOWR/IORD instructions.

Data	IORD/IOWR control Address range	No. of transferred words
Position Data	0000 to 27FF Hex (decimal:0000 to10239)	1 word: 0002 Hex, 2 words: 0004 Hex, 3 words: 0006 Hex, 4 words: 0008 Hex

In MC Unit programming, the position data address is specified as a type of variable as shown below:

PL<Address No.>: Specify 0000 to 27FF as the address No.

(Example)
MOVE_[J1]#PL01FF

4-4-2 Position Data Configuration

Each position data is comprised of two words (4 bytes). Though the position data of the MC Unit does not have a decimal point decimal, however, a decimal point is added to the data based on the setting of "Position command decimal point position (P5AA02)" in Axis-machine parameters.

Data Range

−2147483648 to +2147483647 (80000000 Hex to 7FFFFFFF Hex)

	15	00
j+0	Position Data (Signed 32-bit, lower 16 bits)	
j+1	Position Data (Signed 32-bit, upper 16 bits)	

Example 1: Position data 12345 (00003039 Hex)

	15 12	11 08	07 04	03 00
j+0	3	0	3	9
j+1	0	0	0	0

When "Units (P5AA01)" of Axis-machine parameters is "0: mm" and "Position command decimal point position (P5AA02)" is "3: 0.001", the position data 12345 is handled as 12.345mm.

Example 2: Position data −12345 (FFFFCFC7 Hex)

	15 12	11 08	07 04	03 00
j+0	C	F	C	7
j+1	F	F	F	F

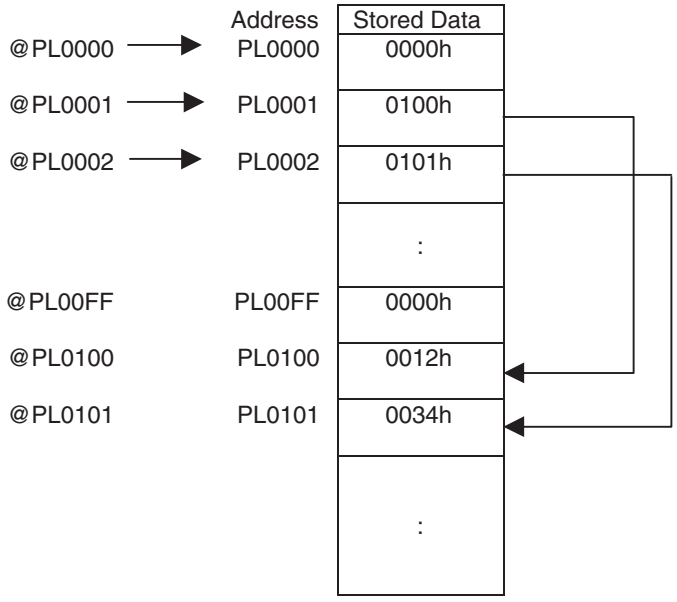
When "Units (P5AA01)" of Axis-machine parameters is "1: inch" and "Position command decimal point position (P5AA02)" is "2: 0.01", the position data -12345 is handled as −123.45inch.

4-4-3 Indirect Specification

Indirect specification can be used only for position data.

1,2,3...

1. Add the symbol @ in front of position data. The stored data at the address specified with the position data with @ is the address of the stored data to be used.
   - As shown below, @PL0001 specifies the stored data 0012 of the position data PL0100.



2. Indirect specification can be also used as an operand of a command. MOVE_[J1] @PL0100 (= MOVE_[J1]#PL0012)
3. Indirect specification can be used only for reading, not for writing.

@PL0001 = 0001 → Not possible

@PL0001 = #PL0100 + 00000001 → Not possible

#PL0001 = #PL00FF → Possible
MOVE_[J1]@PL0001
(The same as MOVE_[J1]#PL0100)

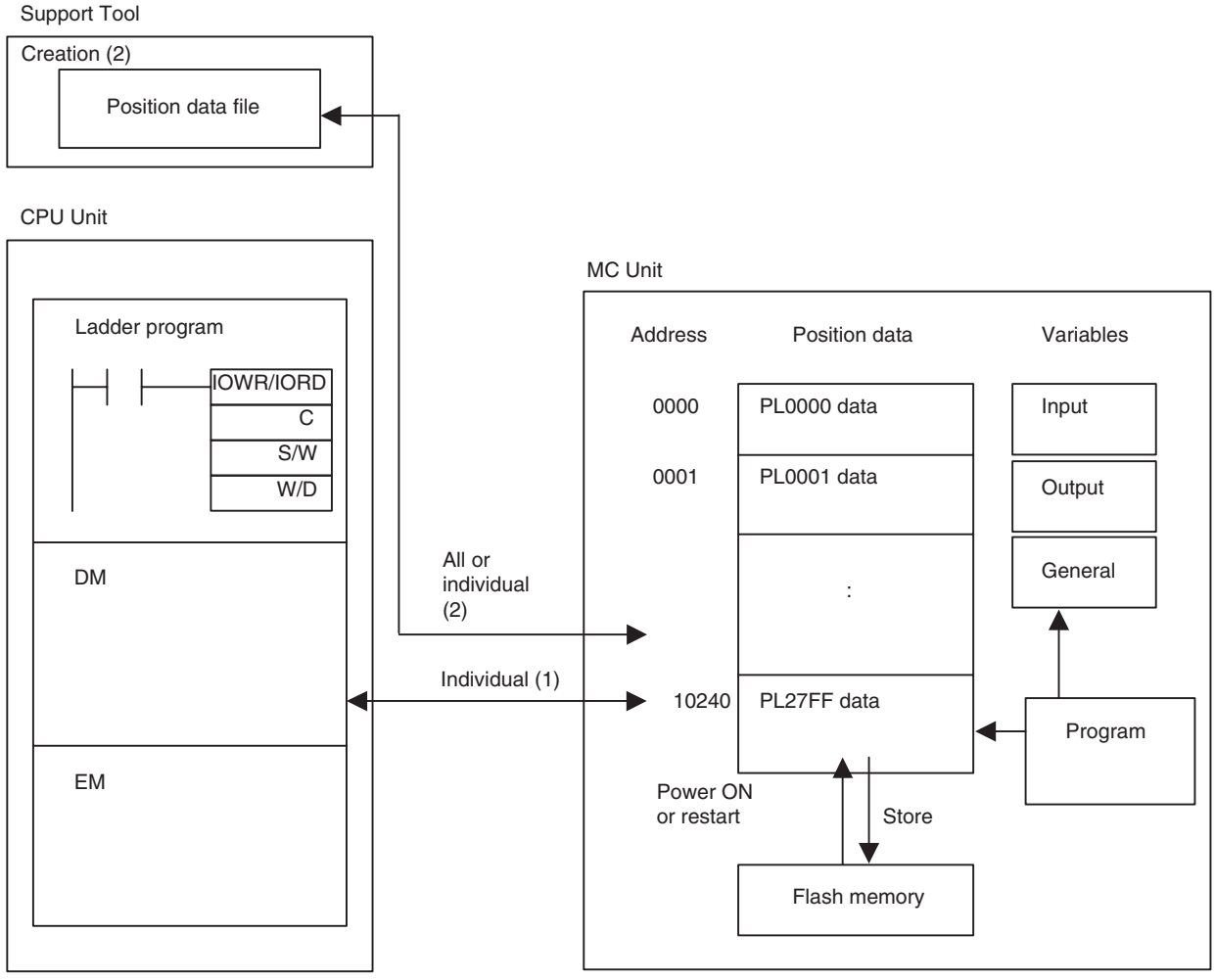
#PL0001 = @PL0100 + 00000001 → Possible
(The same as #PL0012 + 00000001)

4. The address range check is performed when executing the command. If the specified address is outside of the range, the alarm [2003h: Variable address error] will occur and the program will be stopped.

4-4-4 Methods Used to Read, Write and Transfer Position Data

Position data is created or transferred with the following methods.

No.	Method	Range
1	Position data is read or written using the IORD or IOWR instruction.	Individual
2	Data can be loaded and saved using the support tool.	All or individual



4-5 System Variables

4-5-1 System Variables

System variables are all in read-only area; they cannot be written.

When reading with the IORD instruction, the size is always two words (4 bytes).

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0000	3000	Unit	Unit Scan Cycle	Outputs Unit Scan Cycle (SH4)	0.5ms	When power is turned ON
SW0001		Unit	MECHATROLINK-II Communication Cycle	Outputs the MECHATROLINK-II Communication Cycle	0.5ms	When power is turned ON
SW0002	3001	Unit	Operation Mode	Outputs the MC Unit operation mode 0: RUN mode 1: CPU mode 2: Tool mode	Nil	When operation mode is changed
SW0003			Reserved	Reserved	Reserved	Reserved
SW0004	3002	Unit	Forced Stop Request from the Tool: Detail of the request	Indicates forced stop request from the tool. Bit00: Axis: task stop Bit01: Axis, task stop cancel Bit06: Cam Data buffer copy Bit07: Program buffer copy	Nil	FINS: Task Control setting
SW0005			Forced Stop Request from the Tool: Object 1	Indicates forced stop request from the tool. Bit00-07: 0/1 Motion task 1-8With/without forced stop request Bit08: 0/1 Reserved	Nil	FINS: Task Control Setting
SW0006	3003		Forced Stop Request from the Tool: Object 2	Indicates forced stop request from the tool. Bit00-31: 0/1 Axis 1-32With/without forced stop request	Nil	FINS: Task Control Setting
SW0007						
SW0008	3004		Reserved	Reserved	Reserved	Reserved
SW0009			Status of Forced Stop from the Tool: Object 1	Indicates status of forced stop from the tool. Bit00-07: 0/1 Motion task 1-8in progress/being stopped Bit08: 0/1 Reserved	Nil	Unit Scan
SW000A	3005		Status of Forced Stop from the Tool: Object 2	Indicates status of forced stop from the tool. Bit00-31: 0/1 Axis 1-32in progress/being stopped	Nil	Unit Scan
SW000B						
SW000C	3006	Unit	No. of Unit Scan Executions	Indicates the No. of system scan executions.	Time	Unit Scan
SW000D						
SW000E	3007	Unit	No. of Self-diagnosis executions	Indicates the No. of self-diagnosis executions in background.	Time	When executing Self-diagnosis
SW000F						
SW0010	3008	Unit	Error log: No. of stored records	Outputs No. of error logs after the power has been turned ON. (For FINS responses 0-20	Record	Error occurrence
SW0011			Error log: No. of actual records	Outputs No. of error logs after the power has been turned ON. (For system management 0-64000	Record	Error occurrence

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0012	3009	Unit	Error log 1: Error code	Outputs error code of the Error log	Nil	Error occurrence
SW0013			Error log 1: Detailed Information	Outputs detailed information of Error log	Nil	Error occurrence
SW0014	300A		Error log 1: Minute, Second	Outputs the time when error occurred (Minute, Second)	Minute, Second (BCD)	Error occurrence
SW0015			Error log 1: Day of the Month, Hour	Outputs the time when error occurred (Day of the Month, Hour)	Day of the Month, Hour (BCD)	Error occurrence
SW0016	300B		Error log 1: Year, Month	Outputs the time when error occurred (Year, Month)	Year, Month (BCD)	Error occurrence
SW0017			Reserved	Reserved	Reserved	Reserved
SW0018	300C	Unit	Error log 2:	Same as for Error log 1	Same as for Error log 1	Same as for Error Log 1
SW0019						
SW001A	300D					
SW001B						
SW001C	300E					
SW001D			Reserved	Reserved	Reserved	Reserved
SW001E	300F	Unit	Error log 3:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW001F						
SW0020	3010					
SW0021						
SW0022	3011					
SW0023			Reserved	Reserved	Reserved	Reserved
SW0024	3012	Unit	Error log 4:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW0025						
SW0026	3013					
SW0027						
SW0028	3014					
SW0029			Reserved	Reserved	Reserved	Reserved
SW002A	3015	Unit	Error log 5:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW002B						
SW002C	3016					
SW002D						
SW002E	3017					
SW002F			Reserved	Reserved	Reserved	Reserved
SW0030	3018	Unit	Error log 6:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW0031						
SW0032	3019					
SW0033						
SW0034	301A					
SW0035			Reserved	Reserved	Reserved	Reserved
SW0036	301B	Unit	Error log 7:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW0037						
SW0038	301C					
SW0039						
SW003A	301D					
SW003B			Reserved	Reserved	Reserved	Reserved
SW003C	301E	Unit	Error log 8:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW003D						
SW003E	301F					
SW003F						
SW0040	3020					
SW0041			Reserved	Reserved	Reserved	Reserved

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0042	3021	Unit	Error log 9:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW0043						
SW0044	3022					
SW0045						
SW0046	3023					
SW0047			Reserved	Reserved	Reserved	Reserved
SW0048	3024	Unit	Error log 10:	Same as Error log 1	Same as for Error log 1	Same as for Error log 1
SW0049						
SW004A	3025					
SW004B						
SW004C	3026					
SW004D			Reserved	Reserved	Reserved	Reserved
SW004E	3027	Unit	Error log 11:	Same as Error log 1	Same as for Error log 1	Same as for Error log 1
SW004F						
SW0050	3028					
SW0051						
SW0052	3029					
SW0053			Reserved	Reserved	Reserved	Reserved
SW0054	302A	Unit	Error log 12:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW0055						
SW0056	302B					
SW0057						
SW0058	302C					
SW0059			Reserved	Reserved	Reserved	Reserved
SW005A	302D	Unit	Error log 13:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW005B						
SW005C	302E					
SW005D						
SW005E	302F					
SW005F			Reserved	Reserved	Reserved	Reserved
SW0060	3030	Unit	Error log 14:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW0061						
SW0062	3031					
SW0063						
SW0064	3032					
SW0065			Reserved	Reserved	Reserved	Reserved
SW0066	3033	Unit	Error log 15:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW0067						
SW0068	3034					
SW0069						
SW006A	3035					
SW006B			Reserved	Reserved	Reserved	Reserved
SW006C	3036	Unit	Error log 16:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW006D						
SW006E	3037					
SW006F						
SW0070	3038					
SW0071			Reserved	Reserved	Reserved	Reserved

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0072	3039	Unit	Error log 17:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW0073						
SW0074	303A					
SW0075						
SW0076	303B					
SW0077			Reserved	Reserved	Reserved	Reserved
SW0078	303C	Unit	Error log 18:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW0079						
SW007A	303D					
SW007B						
SW007C	303E					
SW007D			Reserved	Reserved	Reserved	Reserved
SW007E	303F	Unit	Error log 19:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW007F						
SW0080	3040					
SW0081						
SW0082	3041					
SW0083			Reserved	Reserved	Reserved	Reserved
SW0084	3042	Unit	Error log 20:	Same as for Error log 1	Same as for Error log 1	Same as for Error log 1
SW0085						
SW0086	3043					
SW0087						
SW0088	3044					
SW0089			Reserved	Reserved	Reserved	Reserved
SW008A	3045	Unit	Reserved	Reserved	Reserved	Reserved
SW008B						
SW008C	3046					
SW008D						
SW008E	3047					
SW008F						
SW0090	3048	Unit	Clock Data: Minute, Second	Outputs the clock Data (Minute, Second) received from CPU.	Minute, Second (BCD)	In the process of cyclic service
SW0091		Unit	Clock Data: Day of the Month, Hour	Outputs the clock Data (Day of the Month, Hour) received from CPU.	Day of the Month, Hour (BCD)	In the process of cyclic service
SW0092	3049	Unit	Clock Data: Year, Month	Outputs the clock Data (Year, Hour) received from CPU.	Year, Month (BCD)	In the process of cyclic service
SW0093		Unit	Day of the week	Outputs the Clock Data (Day of the Week) received from CPU.	Day of the week (BCD)	In the process of cyclic service
SW0094	304A		Reserved	Reserved		
SW0095			Reserved	Reserved		
SW0096	304B	Unit	Reserved	Reserved	Reserved	Reserved
SW0097						
SW0098	304C	Unit	Release date: Main side: Month, Day	Displays the system release date (month and day) on the main side.	Month, day (BCD)	When power is turned ON.
SW0099			Release date: Main side: Year, Tracking code	Displays the system release date (year and Tracking code) on the main side.	Year, Tracking code (BCD)	When power is turned ON.
SW009A	304D	Unit	Release date: Sub side: month, day	Displays the system release date (month and day) on the sub side.	Month, day (BCD)	When power is turned ON.
SW009B			Release date: Sub side: Year, Tracking code	Displays the system release date (year and Tracking code) on the sub side.	Year, Tracking code (BCD)	When power is turned ON.

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW009C	304E	Unit	Reserved	Reserved	Reserved	Reserved
SW009D						
SW009E	304F					
SW009F						
SW00A0	3050					
SW00A1						
SW00A2	3051	Unit	Total No. of programs	Outputs total No. of programs 256	Program	Always
SW00A3			Remaining No. of programs	Outputs the remaining No. of programs that can be saved 0-256	Program	Always
SW00A4	3052		Total memory capacity of the program area	Outputs total memory capacity of the program area 2,097,152 (2MB)	Byte	Always
SW00A5						
SW00A6	3053		Remaining memory capacity of the program area	Outputs remaining memory capacity of the program area 0-2,097,152 (2MB)	Byte	Always
SW00A7						
SW00A8	3054		Total quantities of Cam Data	Outputs the total quantities of Cam Data 32	Set	Always
SW00A9			Remaining Quantities of Cam Data	Outputs the remaining quantities of Cam Data that can be stored 0-32	Set	Always
SW00AA	3055		Total memory capacity of Cam Data area	Outputs the whole memory capacity of Cam Data area 131,072 (128KB)	Byte	Always
SW00AB						
SW00AC	3056		Remaining memory capacity of Cam Data area	Outputs the remaining memory capacity of Cam Data area 0-131,072 (128KB)	Byte	Always
SW00AD						
SW00AE	3057	Unit	Allocation valid axis	Indicates the axis whose allocation is valid and recognized by MC Unit. 0-31bit: 1st to 32nd axis 0: invalid/1: valid	Nil	When power is turned ON
SW00AF						

Motion Tasks

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW00B0	3058	Motion Task	Task status 1: Main program No.	Outputs the program No. of the Main Program currently being executed 0-499, 2000	No.	When a program is started
SW00B1			Task status 1: Sub-program No.	Outputs the program No. of the Sub-program currently being executed 500-999	No.	When GOSUB command is being executed
SW00B2	3059		Task status 1: Single execution command block No.1	Outputs the block No. of single execution command currently being executed 0 (Not executing), 1-800	Block	When single execution command is stepping
SW00B3			Task status 1: Multiple execution command block No.1	Outputs the block No. of multiple execution command currently being executed 0 (Not executing), 1-800	Block	When multiple execution command is stepping
SW00B4	305A		Task status 1: Single execution command block No.2	Outputs the block No. of single execution command in each parallel branch (Not executing), 1-800	Block	When single execution command is stepping
SW00B5			Task status 1: Multiple execution command block No.2	Outputs the block No. of multiple execution command in each parallel branch 0 (Not executing), 1-800	Block	When multiple execution command is stepping
SW00B6	305B		Task status 1: Single execution command block No.3	Outputs the block No. of single execution command in each parallel branch 0 (Not executing), 1-800	Block	When single execution command is stepping
SW00B7			Task status 1: Multiple execution command block No.3	Outputs the block No. of multiple execution command in each parallel branch 0 (not executing), 1-800	Block	When multiple execution command is stepping
SW00B8	305C		Task status 1: Single execution command block No.4	Outputs the block No. of single execution command in each parallel branch 0 (Not executing), 1-800	Block	When single execution command is stepping
SW00B9			Task status 1: Multiple execution command block No.4	Outputs the block No. of multiple execution command in each parallel branch 0 (Not executing), 1-800	Block	When multiple execution command is stepping
SW00BA	305D		Task status 1: Single execution command block No.5	Outputs the block No. of single execution command in each parallel branch 0 (Not executing), 1-800	Block	When single execution command is stepping
SW00BB			Task status 1: Multiple execution command block No.5	Outputs the block No. of multiple execution command in each parallel branch 0 (Not executing), 1-800	Block	When multiple execution command is stepping
SW00BC	305E		Task status 1: Single execution command block No.6	Outputs the block No. of single execution command in each parallel branch 0 (Not executing), 1-800	Block	When single executing command is stepping
SW00BD			Task status 1: Multiple execution command block No.6	Outputs the block No. of multiple execution command in each parallel branch 0 (Not executing), 1-800	Block	When multiple execution command is stepping
SW00BE	305F		Task status 1: Single execution command block No7	Outputs the block No. of single execution command in each parallel branch 0 (Not executing), 1-800	Block	When single execution command is stepping
SW00BF			Task status1: Multiple execution command block No.7	Outputs the block No. of multiple execution command in each parallel branch 0 (Not executing), 1-800	Block	When multiple execution command is stepping
SW00C0	3060		Task status 1: Single execution command block No.8	Outputs the block No. of single execution command in each parallel branch 0 (Not executing), 1-800	Block	When single execution command is stepping
SW00C1			Task status1: Multiple execution command block No.8	Outputs the block No. of multiple execution command in each parallel branch 0 (Not executing), 1-800	Block	When multiple execution command is stepping
SW00C2	3061		Reserved	Reserved		
SW00C3			Reserved	Reserved		

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW00C4	3062		Reserved	Reserved	Reserved	Reserved
SW00C5						
SW00C6	3063					
SW00C7						
SW00C8	3064					
SW00C9						
SW00CA	3065					
SW00CB						
SW00CC	3066					
SW00CD						
SW00CE	3067					
SW00CF						
SW00D0	3068	Motion task	Task status 2:	Same as for Task status 1	Same as for Task status 1	Same as for Task status 1
SW00D1						
SW00D2	3069					
SW00D3						
SW00D4	306A					
SW00D5						
SW00D6	306B					
SW00D7						
SW00D8	306C					
SW00D9						
SW00DA	306D					
SW00DB						
SW00DC	306E					
SW00DD						
SW00DE	306F					
SW00DF						
SW00E0	3070					
SW00E1						
SW00E2	3071					
SW00E3						
SW00E4	3072		Reserved	Reserved	Reserved	Reserved
SW00E5						
SW00E6	3073					
SW00E7						
SW00E8	3074					
SW00E9						
SW00EA	3075					
SW00EB						
SW00EC	3076					
SW00ED						
SW00EE	3077					
SW00EF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW00F0	3078	Motion task	Task status 3:	Same as for Task status 1:	Same as for Task status 1	Same as for Task status 1
SW00F1						
SW00F2	3079					
SW00F3						
SW00F4	307A					
SW00F5						
SW00F6	307B					
SW00F7						
SW00F8	307C					
SW00F9						
SW00FA	307D					
SW00FB						
SW00FC	307E					
SW00FD						
SW00FE	307F					
SW00FF						
SW0100	3080					
SW0101						
SW0102	3081					
SW0103						
SW0104	3082		Reserved	Reserved	Reserved	Reserved
SW0105						
SW0106	3083					
SW0107						
SW0108	3084					
SW0109						
SW010A	3085					
SW010B						
SW010C	3086					
SW010D						
SW010E	3087					
SW010F						
SW0110	3088	Motion task	Task status 4:	Same as for Task status 1:	Same as for Task status 1	Same as for Task status 1
SW0111						
SW0112	3089					
SW0113						
SW0114	308A					
SW0115						
SW0116	308B					
SW0117						
SW0118	308C					
SW0119						
SW011A	308D					
SW011B						
SW011C	308E					
SW011D						
SW011E	308F					
SW011F						
SW0120	3090					
SW0121						
SW0122	3091					
SW0123						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0124	3092		Reserved	Reserved	Reserved	Reserved
SW0125						
SW0126	3093					
SW0127						
SW0128	3094					
SW0129						
SW012A	3095					
SW012B						
SW012C	3096					
SW012D						
SW012E	3097					
SW012F						
SW0130	3098	Motion task	Task status 5:	Same as for Task status 1:	Same as for Task status 1	Same as for Task status 1
SW0131						
SW0132	3099					
SW0133						
SW0134	309A					
SW0135						
SW0136	309B					
SW0137						
SW0138	309C					
SW0139						
SW013A	309D					
SW013B						
SW013C	309E					
SW013D						
SW013E	309F					
SW013F						
SW0140	30A0					
SW0141						
SW0142	30A1					
SW0143						
SW0144	30A2		Reserved	Reserved	Reserved	Reserved
SW0145						
SW0146	30A3					
SW0147						
SW0148	30A4					
SW0149						
SW014A	30A5					
SW014B						
SW014C	30A6					
SW014D						
SW014E	30A7					
SW014F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0150	30A8	Motion task	Task status 6:	Same as for Task status 1:	Same as for Task status 1	Same as for Task status 1
SW0151						
SW0152	30A9					
SW0153						
SW0154	30AA					
SW0155						
SW0156	30AB					
SW0157						
SW0158	30AC					
SW0159						
SW015A	30AD					
SW015B						
SW015C	30AE					
SW015D						
SW015E	30AF					
SW015F						
SW0160	30B0					
SW0161						
SW0162	30B1					
SW0163						
SW0164	30B2		Reserved	Reserved	Reserved	Reserved
SW0165						
SW0166	30B3					
SW0167						
SW0168	30B4					
SW0169						
SW016A	30B5					
SW016B						
SW016C	30B6					
SW016D						
SW016E	30B7					
SW016F						
SW0170	30B8	Motion task	Task status 7:	Same as for Task status 1:	Same as for Task status 1	Same as for Task status 1
SW0171						
SW0172	30B9					
SW0173						
SW0174	30BA					
SW0175						
SW0176	30BB					
SW0177						
SW0178	30BC					
SW0179						
SW017A	30BD					
SW017B						
SW017C	30BE					
SW017D						
SW017E	30BF					
SW017F						
SW0180	30C0					
SW0181						
SW0182	30C1					
SW0183						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0184	30C2		Reserved	Reserved	Reserved	Reserved
SW0185						
SW0186	30C3					
SW0187						
SW0188	30C4					
SW0189						
SW018A	30C5					
SW018B						
SW018C	30C6					
SW018D						
SW018E	30C7					
SW018F						
SW0190	30C8	Motion task	Task status 8:	Same as for Task status 1:	Same as for Task status 1	Same as for Task status 1
SW0191						
SW0192	30C9					
SW0193						
SW0194	30CA					
SW0195						
SW0196	30CB					
SW0197						
SW0198	30CC					
SW0199						
SW019A	30CD					
SW019B						
SW019C	30CE					
SW019D						
SW019E	30CF					
SW019F						
SW01A0	30D0					
SW01A1						
SW01A2	30D1					
SW01A3						
SW01A4	30D2		Reserved	Reserved	Reserved	Reserved
SW01A5						
SW01A6	30D3					
SW01A7						
SW01A8	30D4					
SW01A9						
SW01AA	30D5					
SW01AB						
SW01AC	30D6					
SW01AD						
SW01AE	30D7					
SW01AF						
SW01B0	30D8		Reserved	Reserved		
SW01B1						
SW01B2	30D9		Reserved	Reserved		
SW01B3						
SW01B4	30DA		Reserved	Reserved		
SW01B5						
SW01B6	30DB		Reserved	Reserved		
SW01B7						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW01B8	30DC		Reserved	Reserved		
SW01B9						
SW01BA	30DD		Reserved	Reserved		
SW01BB						
SW01BC	30DE		Reserved	Reserved		
SW01BD						
SW01BE	30DF		Reserved	Reserved		
SW01BF						
SW01C0	30E0		Reserved	Reserved		
SW01C1						
SW01C2	30E1		Reserved	Reserved		
SW01C3						
SW01C4	30E2		Reserved	Reserved		
SW01C5						
SW01C6	30E3		Reserved	Reserved		
SW01C7						
SW01C8	30E4		Reserved	Reserved		
SW01C9						
SW01CA	30E5		Reserved	Reserved		
SW01CB						
SW01CC	30E6		Reserved	Reserved		
SW01CD						
SW01CE	30E7		Reserved	Reserved		
SW01CF						
SW01D0	30E8		Reserved	Reserved	Reserved	Reserved
SW01D1						
SW01D2	30E9					
SW01D3						
SW01D4	30EA					
SW01D5						
SW01D6	30EB					
SW01D7						
SW01D8	30EC					
SW01D9						
SW01DA	30ED					
SW01DB						
SW01DC	30EE					
SW01DD						
SW01DE	30EF					
SW01DF						
SW01E0	30F0					
SW01E1						
SW01E2	30F1					
SW01E3						
SW01E4	30F2					
SW01E5						
SW01E6	30F3					
SW01E7						
SW01E8	30F4					
SW01E9						
SW01EA	30F5					
SW01EB						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW01EC	30F6		Reserved	Reserved	Reserved	Reserved
SW01ED						
SW01EE	30F7					
SW01EF						
SW01F0	30F8					
SW01F1						
SW01F2	30F9					
SW01F3						
SW01F4	30FA					
SW01F5						
SW01F6	30FB					
SW01F7						
SW01F8	30FC					
SW01F9						
SW01FA	30FD					
SW01FB						
SW01FC	30FE					
SW01FD						
SW01FE	30FF					
SW01FF						

Axis

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0200	3100	Axis	Axis 1 status: Current Coordinate System FB position	Outputs the FB position on coordinate system currently being selected −2147483648 to 2147483647 When "I/O" is specified in the parameter "P1AA02: MECHATROLINK-II device classification" and an address is specified in the parameter "P1AA05: Axis allocation first address", the content of I/O variables specified in P1AA05 is reflected in the data area with variable addresses SW0200 and SW0201.	Command unit	Unit scan
SW0201						
SW0202	3101		Axis 1 status: Machine Coordinate System FB position	Outputs the FB position on machine coordinate system −2147483648 to 2147483647 When "I/O" is specified in the parameter "P1AA02: MECHATROLINK-II device classification" and an address is specified in the parameter "P1AA05: Axis allocation first address", the content of I/O variables specified in P1AA05 is reflected in the data area with variable addresses SW0202 and SW0203.	Command unit	Unit scan
SW0203						
SW0204	3102		Axis 1 status: Current Coordinate System Command position	Outputs the command position on coordinate system currently being selected −2147483648 to 2147483647	Command unit	Unit scan
SW0205						
SW0206	3103		Axis 1 status: Machine Coordinate System Command position	Outputs the command position on machine coordinate system −2147483648 to 2147483647	Command unit	Unit scan
SW0207						
SW0208	3104		Axis 1 status: Counter latch position	Outputs the counter latch position on machine coordinate system −2147483648 to 2147483647	Command unit	At latch completion
SW0209						
SW020A	3105		Axis 1 status: Feed back Speed 1	Outputs the FB speed	Command unit/min	Unit scan
SW020B						
SW020C	3106		Axis 1 status: Feed Back Speed 2	Outputs the FB speed (% specification of motor rated speed or r/min)	0.01% of motor rated speed, or 0.01r/min	Unit scan
SW020D						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW020E	3107	Axis	Axis 1 status: Command Speed 1	Outputs command speed	Command unit/min	Unit scan
SW020F						
SW0210	3108		Axis 1 status: Command Speed 2	Outputs the command speed (% specification of motor rated speed or r/min)	0.01% of motor rated speed, or 0.01r/min	Unit scan
SW0211						
SW0212	3109		Axis 1 status: Errors	Outputs Errors	Pulse	Unit scan
SW0213						
SW0214	310A		Axis 1 Status: Torque command value	Outputs Torque command value * There are some cases where this parameter cannot be read.	0.01% of Max. motor torque (when Torque command in progress) or, 0.01% of motor rated torque. (When position/speed In progress)	Unit scan
SW0215						
SW0216	310B		Axis 1 status: Workpiece origin shift amount	Outputs the workpiece origin shift amount −2147483648 to 2147483647	Command unit	When coordinate system is selected
SW0217						
SW0218	310C		Axis 1 status: Origin margin in pulses	Outputs the distance between the final change position of the deceleration LS and origin determine signal (phase Z or origin LS). If deceleration LS is not used, outputs 0. −2147483648-2147483647	Command unit	When origin search is completed
SW0219						
SW021A	310D		Axis 1 status: Number of multi-turns	Outputs the number of times upper and lower limits on the machine coordinate system are exceeded. ABS encoder: Cleared to 0 at origin setting completion *If Movement exceeding the multi-turns limit is executed it is not guaranteed. INC encoder: Clear to 0 at origin search completion −2147483648 to 2147483647	Turn	Unit scan
SW021B						
SW021C	310E		Axis 1 status: MECHATROLINK-II Servo status	Servo status: Reflects the MECHATROLINK-II servo status.	Nil	Unit scan
SW021D				I/O monitor: Reflects the MECHATROLINK-II I/O monitor		
SW021E	310F		Axis 1 status: ABS position setting value 1Multi-turns value	ABS encoder multi-turns value at the origin setting.	Turn	When the power is turned ON When ABS setting is completed
SW021F						
SW0220	3110		Axis 1 status: ABS position setting value 2 No. of Initial incremental pulses	No. of Initial incremental pulses of ABS encoder at the origin setting.	Pulse	When the power is turned ON When ABS setting is complete
SW0221						
SW0222	3111		Reserved	Reserved	Reserved	Reserved
SW0223						
SW0224	3112					
SW0225						
SW0226	3113					
SW0227						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0228	3114	Axis	Axis 1 status: Command execution status	Outputs the latest command No. See *Command Code in Command Execution Status* on page 142	Nil	Unit scan
SW0229			Axis 1 status: Acceleration/deceleration status	Outputs acceleration/deceleration status in relations to real-time target speed including override 0:Others (Not moving, during Synchronization, etc.) 1: Accelerating 2: At Constant speed 3: Decelerating4: Passing	Nil	Unit scan
SW022A	3115		Axis 1 status: Latch status	Outputs counter latch status 0: No latch request 1: Parameter being overwritten 2: Latch being requested 3: Latch completed (next request: disabled) 4: Latch completed (next request: enabled) This status has the following influence on OW0440 bit10 0: SW022A = 0, 1, 2 1: SW022A = 3, 4	Nil	Unit scan
SW022B			Reserved	Reserved	Reserved	Reserved
SW022C	3116		Reserved	Reserved	Reserved	Reserved
SW022D						
SW022E	3117					
SW022F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0230	3118	Axis	Axis 2 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0231						
SW0232	3119					
SW0233						
SW0234	311A					
SW0235						
SW0236	311B					
SW0237						
SW0238	311C					
SW0239						
SW023A	311D					
SW023B						
SW023C	311E					
SW023D						
SW023E	311F					
SW023F						
SW0240	3120					
SW0241						
SW0242	3121					
SW0243						
SW0244	3122					
SW0245						
SW0246	3123					
SW0247						
SW0248	3124					
SW0249						
SW024A	3125					
SW024B						
SW024C	3126					
SW024D						
SW024E	3127					
SW024F						
SW0250	3128		Reserved	Reserved	Reserved	Reserved
SW0251						
SW0252	3129					
SW0253						
SW0254	312A					
SW0255						
SW0256	312B					
SW0257						
SW0258	312C		Axis 2 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0259						
SW025A	312D					
SW025B			Reserved	Reserved	Reserved	Reserved
SW025C	312E					
SW025D						
SW025E	312F					
SW025F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0260	3130	Axis	Axis 3 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0261						
SW0262	3131					
SW0263						
SW0264	3132					
SW0265						
SW0266	3133					
SW0267						
SW0268	3134					
SW0269						
SW026A	3135					
SW026B						
SW026C	3136					
SW026D						
SW026E	3137					
SW026F						
SW0270	3138					
SW0271						
SW0272	3139					
SW0273						
SW0274	313A					
SW0275						
SW0276	313B					
SW0277						
SW0278	313C					
SW0279						
SW027A	313D					
SW027B						
SW027C	313E					
SW027D						
SW027E	313F					
SW027F						
SW0280	3140		Reserved	Reserved	Reserved	Reserved
SW0281						
SW0282	3141					
SW0283						
SW0284	3142					
SW0285						
SW0286	3143					
SW0287						
SW0288	3144		Axis 3 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0289						
SW028A	3145					
SW028B			Reserved	Reserved	Reserved	Reserved
SW028C	3146					
SW028D						
SW028E	3147					
SW028F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0290	3148	Axis	Axis 4 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0291						
SW0292	3149					
SW0293						
SW0294	314A					
SW0295						
SW0296	314B					
SW0297						
SW0298	314C					
SW0299						
SW029A	314D					
SW029B						
SW029C	314E					
SW029D						
SW029E	314F					
SW029F						
SW02A0	3150					
SW02A1						
SW02A2	3151					
SW02A3						
SW02A4	3152					
SW02A5						
SW02A6	3153					
SW02A7						
SW02A8	3154					
SW02A9						
SW02AA	3155					
SW02AB						
SW02AC	3156					
SW02AD						
SW02AE	3157					
SW02AF						
SW02B0	3158		Reserved	Reserved	Reserved	Reserved
SW02B1						
SW02B2	3159					
SW02B3						
SW02B4	315A					
SW02B5						
SW02B6	315B					
SW02B7						
SW02B8	315C		Axis 4 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW02B9						
SW02BA	315D					
SW02BB			Reserved	Reserved	Reserved	Reserved
SW02BC	315E					
SW02BD						
SW02BE	315F					
SW02BF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW02C0	3160	Axis	Axis 5 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW02C1						
SW02C2	3161					
SW02C3						
SW02C4	3162					
SW02C5						
SW02C6	3163					
SW02C7						
SW02C8	3164					
SW02C9						
SW02CA	3165					
SW02CB						
SW02CC	3166					
SW02CD						
SW02CE	3167					
SW02CF						
SW02D0	3168					
SW02D1						
SW02D2	3169					
SW02D3						
SW02D4	316A					
SW02D5						
SW02D6	316B					
SW02D7						
SW02D8	316C					
SW02D9						
SW02DA	316D					
SW02DB						
SW02DC	316E					
SW02DD						
SW02DE	316F					
SW02DF						
SW02E0	3170		Reserved	Reserved	Reserved	Reserved
SW02E1						
SW02E2	3171					
SW02E3						
SW02E4	3172					
SW02E5						
SW02E6	3173					
SW02E7						
SW02E8	3174		Axis 5 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW02E9						
SW02EA	3175					
SW02EB			Reserved	Reserved	Reserved	Reserved
SW02EC	3176					
SW02ED						
SW02EE	3177					
SW02EF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW02F0	3178	Axis	Axis 6 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW02F1						
SW02F2	3179					
SW02F3						
SW02F4	317A					
SW02F5						
SW02F6	317B					
SW02F7						
SW02F8	317C					
SW02F9						
SW02FA	317D					
SW02FB						
SW02FC	317E					
SW02FD						
SW02FE	317F					
SW02FF						
SW0300	3180					
SW0301						
SW0302	3181					
SW0303						
SW0304	3182					
SW0305						
SW0306	3183					
SW0307						
SW0308	3184					
SW0309						
SW030A	3185					
SW030B						
SW030C	3186					
SW030D						
SW030E	3187					
SW030F						
SW0310	3188		Reserved	Reserved	Reserved	Reserved
SW0311						
SW0312	3189					
SW0313						
SW0314	318A					
SW0315						
SW0316	318B					
SW0317						
SW0318	318C		Axis 6 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0319						
SW031A	318D					
SW031B			Reserved	Reserved	Reserved	Reserved
SW031C	318E					
SW031D						
SW031E	318F					
SW031F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0320	3190	Axis	Axis 7 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0321						
SW0322	3191					
SW0323						
SW0324	3192					
SW0325						
SW0326	3193					
SW0327						
SW0328	3194					
SW0329						
SW032A	3195					
SW032B						
SW032C	3196					
SW032D						
SW032E	3197					
SW032F						
SW0330	3198					
SW0331						
SW0332	3199					
SW0333						
SW0334	319A					
SW0335						
SW0336	319B					
SW0337						
SW0338	319C					
SW0339						
SW033A	319D					
SW033B						
SW033C	319E					
SW033D						
SW033E	319F					
SW033F						
SW0340	31A0		Reserved	Reserved	Reserved	Reserved
SW0341						
SW0342	31A1					
SW0343						
SW0344	31A2					
SW0345						
SW0346	31A3					
SW0347						
SW0348	31A4		Axis 7 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0349						
SW034A	31A5					
SW034B			Reserved	Reserved	Reserved	Reserved
SW034C	31A6					
SW034D						
SW034E	31A7					
SW034F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0350	31A8	Axis	Axis 8 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0351						
SW0352	31A9					
SW0353						
SW0354	31AA					
SW0355						
SW0356	31AB					
SW0357						
SW0358	31AC					
SW0359						
SW035A	31AD					
SW035B						
SW035C	31AE					
SW035D						
SW035E	31AF					
SW035F						
SW0360	31B0					
SW0361						
SW0362	31B1					
SW0363						
SW0364	31B2					
SW0365						
SW0366	31B3					
SW0367						
SW0368	31B4					
SW0369						
SW036A	31B5					
SW036B						
SW036C	31B6					
SW036D						
SW036E	31B7					
SW036F						
SW0370	31B8		Reserved	Reserved	Reserved	Reserved
SW0371						
SW0372	31B9					
SW0373						
SW0374	31BA					
SW0375						
SW0376	31BB					
SW0377						
SW0378	31BC		Axis 8 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0379						
SW037A	31BD					
SW037B			Reserved	Reserved	Reserved	Reserved
SW037C	31BE					
SW037D						
SW037E	31BF					
SW037F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0380	31C0	Axis	Axis 9 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0381						
SW0382	31C1					
SW0383						
SW0384	31C2					
SW0385						
SW0386	31C3					
SW0387						
SW0388	31C4					
SW0389						
SW038A	31C5					
SW038B						
SW038C	31C6					
SW038D						
SW038E	31C7					
SW038F						
SW0390	31C8					
SW0391						
SW0392	31C9					
SW0393						
SW0394	31CA					
SW0395						
SW0396	31CB					
SW0397						
SW0398	31CC					
SW0399						
SW039A	31CD					
SW039B						
SW039C	31CE					
SW039D						
SW039E	31CF					
SW039F						
SW03A0	31D0		Reserved	Reserved	Reserved	Reserved
SW03A1						
SW03A2	31D1					
SW03A3						
SW03A4	31D2					
SW03A5						
SW03A6	31D3					
SW03A7						
SW03A8	31D4		Axis 9 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW03A9						
SW03AA	31D5					
SW03AB			Reserved	Reserved	Reserved	Reserved
SW03AC	31D6					
SW03AD						
SW03AE	31D7					
SW03AF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW03B0	31D8	Axis	Axis 10 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW03B1						
SW03B2	31D9					
SW03B3						
SW03B4	31DA					
SW03B5						
SW03B6	31DB					
SW03B7						
SW03B8	31DC					
SW03B9						
SW03BA	31DD					
SW03BB						
SW03BC	31DE					
SW03BD						
SW03BE	31DF					
SW03BF						
SW03C0	31E0					
SW03C1						
SW03C2	31E1					
SW03C3						
SW03C4	31E2					
SW03C5						
SW03C6	31E3					
SW03C7						
SW03C8	31E4					
SW03C9						
SW03CA	31E5					
SW03CB						
SW03CC	31E6					
SW03CD						
SW03CE	31E7					
SW03CF						
SW03D0	31E8		Reserved	Reserved	Reserved	Reserved
SW03D1						
SW03D2	31E9					
SW03D3						
SW03D4	31EA					
SW03D5						
SW03D6	31EB					
SW03D7						
SW03D8	31EC		Axis 10 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW03D9						
SW03DA	31ED					
SW03DB			Reserved	Reserved	Reserved	Reserved
SW03DC	31EE					
SW03DD						
SW03DE	31EF					
SW03DF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW03E0	31F0	Axis	Axis 11 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW03E1						
SW03E2	31F1					
SW03E3						
SW03E4	31F2					
SW03E5						
SW03E6	31F3					
SW03E7						
SW03E8	31F4					
SW03E9						
SW03EA	31F5					
SW03EB						
SW03EC	31F6					
SW03ED						
SW03EE	31F7					
SW03EF						
SW03F0	31F8					
SW03F1						
SW03F2	31F9					
SW03F3						
SW03F4	31FA					
SW03F5						
SW03F6	31FB					
SW03F7						
SW03F8	31FC					
SW03F9						
SW03FA	31FD					
SW03FB						
SW03FC	31FE					
SW03FD						
SW03FE	31FF					
SW03FF						
SW0400	3200		Reserved	Reserved	Reserved	Reserved
SW0401						
SW0402	3201					
SW0403						
SW0404	3202					
SW0405						
SW0406	3203					
SW0407						
SW0408	3204		Axis 11 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0409						
SW040A	3205					
SW040B			Reserved	Reserved	Reserved	Reserved
SW040C	3206					
SW040D						
SW040E	3207					
SW040F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0410	3208	Axis	Axis 12 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0411						
SW0412	3209					
SW0413						
SW0414	320A					
SW0415						
SW0416	320B					
SW0417						
SW0418	320C					
SW0419						
SW041A	320D					
SW041B						
SW041C	320E					
SW041D						
SW041E	320F					
SW041F						
SW0420	3210					
SW0421						
SW0422	3211					
SW0423						
SW0424	3212					
SW0425						
SW0426	3213					
SW0427						
SW0428	3214					
SW0429						
SW042A	3215					
SW042B						
SW042C	3216					
SW042D						
SW042E	3217					
SW042F						
SW0430	3218		Reserved	Reserved	Reserved	Reserved
SW0431						
SW0432	3219					
SW0433						
SW0434	321A					
SW0435						
SW0436	321B					
SW0437						
SW0438	321C		Axis 12 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0439						
SW043A	321D					
SW043B			Reserved	Reserved	Reserved	Reserved
SW043C	321E					
SW043D						
SW043E	321F					
SW043F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0440	3220	Axis	Axis 13 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0441						
SW0442	3221					
SW0443						
SW0444	3222					
SW0445						
SW0446	3223					
SW0447						
SW0448	3224					
SW0449						
SW044A	3225					
SW044B						
SW044C	3226					
SW044D						
SW044E	3227					
SW044F						
SW0450	3228					
SW0451						
SW0452	3229					
SW0453						
SW0454	322A					
SW0455						
SW0456	322B					
SW0457						
SW0458	322C					
SW0459						
SW045A	322D					
SW045B						
SW045C	322E					
SW045D						
SW045E	322F					
SW045F						
SW0460	3230		Reserved	Reserved	Reserved	Reserved
SW0461						
SW0462	3231					
SW0463						
SW0464	3232					
SW0465						
SW0466	3233					
SW0467						
SW0468	3234		Axis 13 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0469						
SW046A	3235					
SW046B			Reserved	Reserved	Reserved	Reserved
SW046C	3236					
SW046D						
SW046E	3237					
SW046F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0470	3238	Axis	Axis 14 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0471						
SW0472	3239					
SW0473						
SW0474	323A					
SW0475						
SW0476	323B					
SW0477						
SW0478	323C					
SW0479						
SW047A	323D					
SW047B						
SW047C	323E					
SW047D						
SW047E	323F					
SW047F						
SW0480	3240					
SW0481						
SW0482	3241					
SW0483						
SW0484	3242					
SW0485						
SW0486	3243					
SW0487						
SW0488	3244					
SW0489						
SW048A	3245					
SW048B						
SW048C	3246					
SW048D						
SW048E	3247					
SW048F						
SW0490	3248		Reserved	Reserved	Reserved	Reserved
SW0491						
SW0492	3249					
SW0493						
SW0494	324A					
SW0495						
SW0496	324B					
SW0497						
SW0498	324C		Axis 14 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0499						
SW049A	324D					
SW049B			Reserved	Reserved	Reserved	Reserved
SW049C	324E					
SW049D						
SW049E	324F					
SW049F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW04A0	3250	Axis	Axis 15 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW04A1						
SW04A2	3251					
SW04A3						
SW04A4	3252					
SW04A5						
SW04A6	3253					
SW04A7						
SW04A8	3254					
SW04A9						
SW04AA	3255					
SW04AB						
SW04AC	3256					
SW04AD						
SW04AE	3257					
SW04AF						
SW04B0	3258					
SW04B1						
SW04B2	3259					
SW04B3						
SW04B4	325A					
SW04B5						
SW04B6	325B					
SW04B7						
SW04B8	325C					
SW04B9						
SW04BA	325D					
SW04BB						
SW04BC	325E					
SW04BD						
SW04BE	325F					
SW04BF						
SW04C0	3260		Reserved	Reserved	Reserved	Reserved
SW04C1						
SW04C2	3261					
SW04C3						
SW04C4	3262					
SW04C5						
SW04C6	3263					
SW04C7						
SW04C8	3264		Axis 15 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW04C9						
SW04CA	3265					
SW04CB			Reserved	Reserved	Reserved	Reserved
SW04CC	3266					
SW04CD						
SW04CE	3267					
SW04CF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW04D0	3268	Axis	Axis 16 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW04D1						
SW04D2	3269					
SW04D3						
SW04D4	326A					
SW04D5						
SW04D6	326B					
SW04D7						
SW04D8	326C					
SW04D9						
SW04DA	326D					
SW04DB						
SW04DC	326E					
SW04DD						
SW04DE	326F					
SW04DF						
SW04E0	3270					
SW04E1						
SW04E2	3271					
SW04E3						
SW04E4	3272					
SW04E5						
SW04E6	3273					
SW04E7						
SW04E8	3274					
SW04E9						
SW04EA	3275					
SW04EB						
SW04EC	3276					
SW04ED						
SW04EE	3277					
SW04EF						
SW04F0	3278		Reserved	Reserved	Reserved	Reserved
SW04F1						
SW04F2	3279					
SW04F3						
SW04F4	327A					
SW04F5						
SW04F6	327B					
SW04F7						
SW04F8	327C		Axis 16 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW04F9						
SW04FA	327D					
SW04FB			Reserved	Reserved	Reserved	Reserved
SW04FC	327E					
SW04FD						
SW04FE	327F					
SW04FF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0500	3280	Axis	Axis 17 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0501						
SW0502	3281					
SW0503						
SW0504	3282					
SW0505						
SW0506	3283					
SW0507						
SW0508	3284					
SW0509						
SW050A	3285					
SW050B						
SW050C	3286					
SW050D						
SW050E	3287					
SW050F						
SW0510	3288					
SW0511						
SW0512	3289					
SW0513						
SW0514	328A					
SW0515						
SW0516	328B					
SW0517						
SW0518	328C					
SW0519						
SW051A	328D					
SW051B						
SW051C	328E					
SW051D						
SW051E	328F					
SW051F						
SW0520	3290		Reserved	Reserved	Reserved	Reserved
SW0521						
SW0522	3291					
SW0523						
SW0524	3292					
SW0525						
SW0526	3293					
SW0527						
SW0528	3294		Axis 17 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0529						
SW052A	3295					
SW052B			Reserved	Reserved	Reserved	Reserved
SW052C	3296					
SW052D						
SW052E	3297					
SW052F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0530	3298	Axis	Axis 18 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0531						
SW0532	3299					
SW0533						
SW0534	329A					
SW0535						
SW0536	329B					
SW0537						
SW0538	329C					
SW0539						
SW053A	329D					
SW053B						
SW053C	329E					
SW053D						
SW053E	329F					
SW053F						
SW0540	32A0					
SW0541						
SW0542	32A1					
SW0543						
SW0544	32A2					
SW0545						
SW0546	32A3					
SW0547						
SW0548	32A4					
SW0549						
SW054A	32A5					
SW054B						
SW054C	32A6					
SW054D						
SW054E	32A7					
SW054F						
SW0550	32A8		Reserved	Reserved	Reserved	Reserved
SW0551						
SW0552	32A9					
SW0553						
SW0554	32AA					
SW0555						
SW0556	32AB					
SW0557						
SW0558	32AC		Axis 18 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0559						
SW055A	32AD					
SW055B			Reserved	Reserved	Reserved	Reserved
SW055C	32AE					
SW055D						
SW055E	32AF					
SW055F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0560	32B0	Axis	Axis 19 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0561						
SW0562	32B1					
SW0563						
SW0564	32B2					
SW0565						
SW0566	32B3					
SW0567						
SW0568	32B4					
SW0569						
SW056A	32B5					
SW056B						
SW056C	32B6					
SW056D						
SW056E	32B7					
SW056F						
SW0570	32B8					
SW0571						
SW0572	32B9					
SW0573						
SW0574	32BA					
SW0575						
SW0576	32BB					
SW0577						
SW0578	32BC					
SW0579						
SW057A	32BD					
SW057B						
SW057C	32BE					
SW057D						
SW057E	32BF					
SW057F						
SW0580	32C0		Reserved	Reserved	Reserved	Reserved
SW0581						
SW0582	32C1					
SW0583						
SW0584	32C2					
SW0585						
SW0586	32C3					
SW0587						
SW0588	32C4		Axis 19 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0589						
SW058A	32C5					
SW058B			Reserved	Reserved	Reserved	Reserved
SW058C	32C6					
SW058D						
SW058E	32C7					
SW058F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0590	32C8	Axis	Axis 20 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0591						
SW0592	32C9					
SW0593						
SW0594	32CA					
SW0595						
SW0596	32CB					
SW0597						
SW0598	32CC					
SW0599						
SW059A	32CD					
SW059B						
SW059C	32CE					
SW059D						
SW059E	32CF					
SW059F						
SW05A0	32D0					
SW05A1						
SW05A2	32D1					
SW05A3						
SW05A4	32D2					
SW05A5						
SW05A6	32D3					
SW05A7						
SW05A8	32D4					
SW05A9						
SW05AA	32D5					
SW05AB						
SW05AC	32D6					
SW05AD						
SW05AE	32D7					
SW05AF						
SW05B0	32D8		Reserved	Reserved	Reserved	Reserved
SW05B1						
SW05B2	32D9					
SW05B3						
SW05B4	32DA					
SW05B5						
SW05B6	32DB					
SW05B7						
SW05B8	32DC		Axis 20 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW05B9						
SW05BA	32DD					
SW05BB			Reserved	Reserved	Reserved	Reserved
SW05BC	32DE					
SW05BD						
SW05BE	32DF					
SW05BF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW05C0	32E0	Axis	Axis 21 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW05C1						
SW05C2	32E1					
SW05C3						
SW05C4	32E2					
SW05C5						
SW05C6	32E3					
SW05C7						
SW05C8	32E4					
SW05C9						
SW05CA	32E5					
SW05CB						
SW05CC	32E6					
SW05CD						
SW05CE	32E7					
SW05CF						
SW05D0	32E8					
SW05D1						
SW05D2	32E9					
SW05D3						
SW05D4	32EA					
SW05D5						
SW05D6	32EB					
SW05D7						
SW05D8	32EC					
SW05D9						
SW05DA	32ED					
SW05DB						
SW05DC	32EE					
SW05DD						
SW05DE	32EF					
SW05DF						
SW05E0	32F0		Reserved	Reserved	Reserved	Reserved
SW05E1						
SW05E2	32F1					
SW05E3						
SW05E4	32F2					
SW05E5						
SW05E6	32F3					
SW05E7						
SW05E8	32F4		Axis 21 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW05E9						
SW05EA	32F5					
SW05EB			Reserved	Reserved	Reserved	Reserved
SW05EC	32F6					
SW05ED						
SW05EE	32F7					
SW05EF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW05F0	32F8	Axis	Axis 22 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW05F1						
SW05F2	32F9					
SW05F3						
SW05F4	32FA					
SW05F5						
SW05F6	32FB					
SW05F7						
SW05F8	32FC					
SW05F9						
SW05FA	32FD					
SW05FB						
SW05FC	32FE					
SW05FD						
SW05FE	32FF					
SW05FF						
SW0600	3300					
SW0601						
SW0602	3301					
SW0603						
SW0604	3302					
SW0605						
SW0606	3303					
SW0607						
SW0608	3304					
SW0609						
SW060A	3305					
SW060B						
SW060C	3306					
SW060D						
SW060E	3307					
SW060F						
SW0610	3308		Reserved	Reserved	Reserved	Reserved
SW0611						
SW0612	3309					
SW0613						
SW0614	330A					
SW0615						
SW0616	330B					
SW0617						
SW0618	330C		Axis 22 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0619						
SW061A	330D					
SW061B			Reserved	Reserved	Reserved	Reserved
SW061C	330E					
SW061D						
SW061E	330F					
SW061F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0620	3310	Axis	Axis 23 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0621						
SW0622	3311					
SW0623						
SW0624	3312					
SW0625						
SW0626	3313					
SW0627						
SW0628	3314					
SW0629						
SW062A	3315					
SW062B						
SW062C	3316					
SW062D						
SW062E	3317					
SW062F						
SW0630	3318					
SW0631						
SW0632	3319					
SW0633						
SW0634	331A					
SW0635						
SW0636	331B					
SW0637						
SW0638	331C					
SW0639						
SW063A	331D					
SW063B						
SW063C	331E					
SW063D						
SW063E	331F					
SW063F						
SW0640	3320		Reserved	Reserved	Reserved	Reserved
SW0641						
SW0642	3321					
SW0643						
SW0644	3322					
SW0645						
SW0646	3323					
SW0647						
SW0648	3324		Axis 23 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0649						
SW064A	3325					
SW064B			Reserved	Reserved	Reserved	Reserved
SW064C	3326					
SW064D						
SW064E	3327					
SW064F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0650	3328	Axis	Axis 24 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0651						
SW0652	3329					
SW0653						
SW0654	332A					
SW0655						
SW0656	332B					
SW0657						
SW0658	332C					
SW0659						
SW065A	332D					
SW065B						
SW065C	332E					
SW065D						
SW065E	332F					
SW065F						
SW0660	3330					
SW0661						
SW0662	3331					
SW0663						
SW0664	3332					
SW0665						
SW0666	3333					
SW0667						
SW0668	3334					
SW0669						
SW066A	3335					
SW066B						
SW066C	3336					
SW066D						
SW066E	3337					
SW066F						
SW0670	3338		Reserved	Reserved	Reserved	Reserved
SW0671						
SW0672	3339					
SW0673						
SW0674	333A					
SW0675						
SW0676	333B					
SW0677						
SW0678	333C		Axis 24 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0679						
SW067A	333D					
SW067B			Reserved	Reserved	Reserved	Reserved
SW067C	333E					
SW067D						
SW067E	333F					
SW067F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0680	3340	Axis	Axis 25 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0681						
SW0682	3341					
SW0683						
SW0684	3342					
SW0685						
SW0686	3343					
SW0687						
SW0688	3344					
SW0689						
SW068A	3345					
SW068B						
SW068C	3346					
SW068D						
SW068E	3347					
SW068F						
SW0690	3348					
SW0691						
SW0692	3349					
SW0693						
SW0694	334A					
SW0695						
SW0696	334B					
SW0697						
SW0698	334C					
SW0699						
SW069A	334D					
SW069B						
SW069C	334E					
SW069D						
SW069E	334F					
SW069F						
SW06A0	3350		Reserved	Reserved	Reserved	Reserved
SW06A1						
SW06A2	3351					
SW06A3						
SW06A4	3352					
SW06A5						
SW06A6	3353					
SW06A7						
SW06A8	3354		Axis 25 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW06A9						
SW06AA	3355					
SW06AB			Reserved	Reserved	Reserved	Reserved
SW06AC	3356					
SW06AD						
SW06AE	3357					
SW06AF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW06B0	3358	Axis	Axis 26 status	Same as for Axis 1 0status	Same as for Axis 1 status	Same as for Axis 1 status
SW06B1						
SW06B2	3359					
SW06B3						
SW06B4	335A					
SW06B5						
SW06B6	335B					
SW06B7						
SW06B8	335C					
SW06B9						
SW06BA	335D					
SW06BB						
SW06BC	335E					
SW06BD						
SW06BE	335F					
SW06BF						
SW06C0	3360					
SW06C1						
SW06C2	3361					
SW06C3						
SW06C4	3362					
SW06C5						
SW06C6	3363					
SW06C7						
SW06C8	3364					
SW06C9						
SW06CA	3365					
SW06CB						
SW06CC	3366					
SW06CD						
SW06CE	3367					
SW06CF						
SW06D0	3368		Reserved	Reserved	Reserved	Reserved
SW06D1						
SW06D2	3369					
SW06D3						
SW06D4	336A					
SW06D5						
SW06D6	336B					
SW06D7						
SW06D8	336C		Axis 26 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW06D9						
SW06DA	336D					
SW06DB			Reserved	Reserved	Reserved	Reserved
SW06DC	336E					
SW06DD						
SW06DE	336F					
SW06DF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW06E0	3370	Axis	Axis 27 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW06E1						
SW06E2	3371					
SW06E3						
SW06E4	3372					
SW06E5						
SW06E6	3373					
SW06E7						
SW06E8	3374					
SW06E9						
SW06EA	3375					
SW06EB						
SW06EC	3376					
SW06ED						
SW06EE	3377					
SW06EF						
SW06F0	3378					
SW06F1						
SW06F2	3379					
SW06F3						
SW06F4	337A					
SW06F5						
SW06F6	337B					
SW06F7						
SW06F8	337C					
SW06F9						
SW06FA	337D					
SW06FB						
SW06FC	337E					
SW06FD						
SW06FE	337F					
SW06FF						
SW0700	3380		Reserved	Reserved	Reserved	Reserved
SW0701						
SW0702	3381					
SW0703						
SW0704	3382					
SW0705						
SW0706	3383					
SW0707						
SW0708	3384		Axis 27 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0709						
SW070A	3385					
SW070B			Reserved	Reserved	Reserved	Reserved
SW070C	3386					
SW070D						
SW070E	3387					
SW070F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0710	3388	Axis	Axis 28 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0711						
SW0712	3389					
SW0713						
SW0714	338A					
SW0715						
SW0716	338B					
SW0717						
SW0718	338C					
SW0719						
SW071A	338D					
SW071B						
SW071C	338E					
SW071D						
SW071E	338F					
SW071F						
SW0720	3390					
SW0721						
SW0722	3391					
SW0723						
SW0724	3392					
SW0725						
SW0726	3393					
SW0727						
SW0728	3394					
SW0729						
SW072A	3395					
SW072B						
SW072C	3396					
SW072D						
SW072E	3397					
SW072F						
SW0730	3398		Reserved	Reserved	Reserved	Reserved
SW0731						
SW0732	3399					
SW0733						
SW0734	339A					
SW0735						
SW0736	339B					
SW0737						
SW0738	339C		Axis 28 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0739						
SW073A	339D					
SW073B			Reserved	Reserved	Reserved	Reserved
SW073C	339E					
SW073D						
SW073E	339F					
SW073F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0740	33A0	Axis	Axis 29 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0741						
SW0742	33A1					
SW0743						
SW0744	33A2					
SW0745						
SW0746	33A3					
SW0747						
SW0748	33A4					
SW0749						
SW074A	33A5					
SW074B						
SW074C	33A6					
SW074D						
SW074E	33A7					
SW074F						
SW0750	33A8					
SW0751						
SW0752	33A9					
SW0753						
SW0754	33AA					
SW0755						
SW0756	33AB					
SW0757						
SW0758	33AC					
SW0759						
SW075A	33AD					
SW075B						
SW075C	33AE					
SW075D						
SW075E	33AF					
SW075F						
SW0760	33B0		Reserved	Reserved	Reserved	Reserved
SW0761						
SW0762	33B1					
SW0763						
SW0764	33B2					
SW0765						
SW0766	33B3					
SW0767						
SW0768	33B4		Axis 29 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0769						
SW076A	33B5					
SW076B			Reserved	Reserved	Reserved	Reserved
SW076C	33B6					
SW076D						
SW076E	33B7					
SW076F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW0770	33B8	Axis	Axis 30 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0771						
SW0772	33B9					
SW0773						
SW0774	33BA					
SW0775						
SW0776	33BB					
SW0777						
SW0778	33BC					
SW0779						
SW077A	33BD					
SW077B						
SW077C	33BE					
SW077D						
SW077E	33BF					
SW077F						
SW0780	33C0					
SW0781						
SW0782	33C1					
SW0783						
SW0784	33C2					
SW0785						
SW0786	33C3					
SW0787						
SW0788	33C4					
SW0789						
SW078A	33C5					
SW078B						
SW078C	33C6					
SW078D						
SW078E	33C7					
SW078F						
SW0790	33C8		Reserved	Reserved	Reserved	Reserved
SW0791						
SW0792	33C9					
SW0793						
SW0794	33CA					
SW0795						
SW0796	33CB					
SW0797						
SW0798	33CC		Axis 30 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW0799						
SW079A	33CD					
SW079B			Reserved	Reserved	Reserved	Reserved
SW079C	33CE					
SW079D						
SW079E	33CF					
SW079F						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW07A0	33D0	Axis	Axis 31 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW07A1						
SW07A2	33D1					
SW07A3						
SW07A4	33D2					
SW07A5						
SW07A6	33D3					
SW07A7						
SW07A8	33D4					
SW07A9						
SW07AA	33D5					
SW07AB						
SW07AC	33D6					
SW07AD						
SW07AE	33D7					
SW07AF						
SW07B0	33D8					
SW07B1						
SW07B2	33D9					
SW07B3						
SW07B4	33DA					
SW07B5						
SW07B6	33DB					
SW07B7						
SW07B8	33DC					
SW07B9						
SW07BA	33DD					
SW07BB						
SW07BC	33DE					
SW07BD						
SW07BE	33DF					
SW07BF						
SW07C0	33E0		Reserved	Reserved	Reserved	Reserved
SW07C1						
SW07C2	33E1					
SW07C3						
SW07C4	33E2					
SW07C5						
SW07C6	33E3					
SW07C7						
SW07C8	33E4		Axis 31 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW07C9						
SW07CA	33E5					
SW07CB			Reserved	Reserved	Reserved	Reserved
SW07CC	33E6					
SW07CD						
SW07CE	33E7					
SW07CF						

Variable Address	IORD Address	Group	Name	Description	Unit	Update timing
SW07D0	33E8	Axis	Axis 32 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW07D1						
SW07D2	33E9					
SW07D3						
SW07D4	33EA					
SW07D5						
SW07D6	33EB					
SW07D7						
SW07D8	33EC					
SW07D9						
SW07DA	33ED					
SW07DB						
SW07DC	33EE					
SW07DD						
SW07DE	33EF					
SW07DF						
SW07E0	33F0					
SW07E1						
SW07E2	33F1					
SW07E3						
SW07E4	33F2					
SW07E5						
SW07E6	33F3					
SW07E7						
SW07E8	33F4					
SW07E9						
SW07EA	33F5					
SW07EB						
SW07EC	33F6					
SW07ED						
SW07EE	33F7					
SW07EF						
SW07F0	33F8		Reserved	Reserved	Reserved	Reserved
SW07F1						
SW07F2	33F9					
SW07F3						
SW07F4	33FA					
SW07F5						
SW07F6	33FB					
SW07F7						
SW07F8	33FC		Axis 32 status	Same as for Axis 1 status	Same as for Axis 1 status	Same as for Axis 1 status
SW07F9						
SW07FA	33FD					
SW07FB			Reserved	Reserved	Reserved	Reserved
SW07FC	33FE					
SW07FD						
SW07FE	33FF					
SW07FF						

Command Code in Command Execution Status

In the system parameter "Command execution status (SW0228 for axis 1)", one of the command codes in the table below will be displayed.

They are used to monitor the execution status of the operation in the program.

Classification	Command name	Command	Code	Remark
No operation	Not executing	---	0000h	
Axis movement	Positioning	MOVE	0001h	
	Linear interpolation	MOVEL	0002h	
	Circular interpolation	MOVEC	0003h	
	Origin search	DATUM	0004h	
	Interrupt feeding	MOVEI	0005h	
	Time-specified positioning	MOVET	0006h	
	Traverse	MOVETRAV	0007h	
	Electronic CAM single axis	CAM	0008h	
Axis operation	Link operation	MOVELINK	0015h	
	Electronic CAM Synchronous	CAMBOX	0016h	
	Electronic shaft	CONNECT	0017h	
	Trailing synchronization	SYNC	0018h	
	Travel distance superimpose	ADDAX	0019h	
	Speed command	SPEED	001Ah	
	Torque command	TORQUE	001Bh	
Axis operation end	Synchronization end	SYNCR	0029h	If there is no travel distance specification, the code of the synchronous command code is maintained.

Note With Target Position Change command (MOVEMODI), the command code of MOVE or MOVEL in the previous block is maintained.

MECHATROLINK-II Serve Status

The system parameter "MECHATROLINK-II servo status (SW021C, SW021D for axis 1)" shows the status of the servo driver.

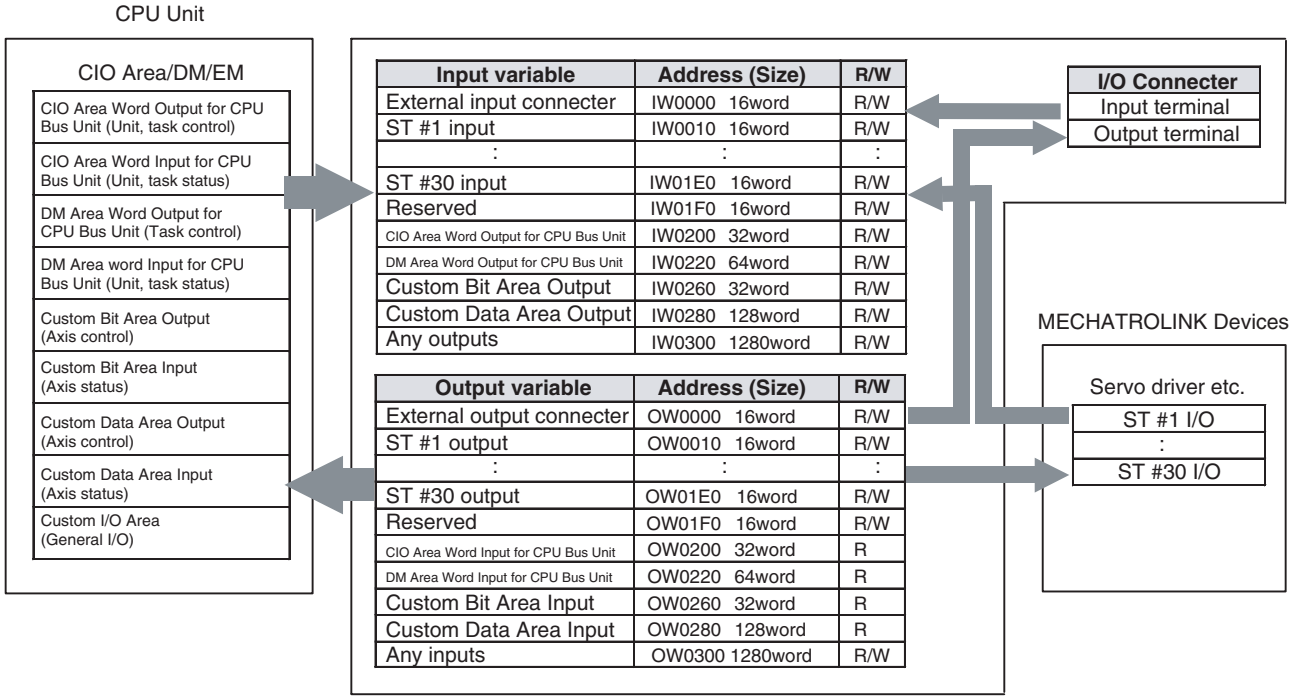
Address	Bit	Abbreviation	Name	ON/OFF
SW021C	D00-03	---	---	Always at 0
	D04	PON	Main power ON	0: Main power OFF
				1: Main power ON
	D05-08	---	---	Always at 0
	D09	T_LIM	Torque control	0: Not controlling torque
				1: Controlling torque
	D10	---	---	Always at 0
	D11	NEAR	Positioning proximity: In position control mode	0: Outside of the range of positioning proximity
				1: Within the range of positioning proximity
		V_LIM	Speed control: In torque control mode	0: Speed limit has not been detected.
				1: Speed limit has been detected.
	D12-13	---	---	Always be 0
	D14-15	---	Reserved	

Address	Bit	Abbreviation	Name	ON/OFF
SW021D	D00	P_OT	Forward rotation drive prohibit Input	0: OFF
				1: ON
	D01	N_OT	Reverse rotation drive prohibit Input	0: OFF
				1: ON
	D02	DEC	Origin search deceleration limit switch input	0: OFF
				1: ON
	D03	PA	Encoder phase-A input	0: OFF
				1: ON
	D04	PB	Encoder phase-B input	0: OFF
				1: ON
	D05	PC	Encoder phase-C input	0: OFF
				1: ON
	D06	EXT1	No. 1 external latch input	0: OFF
				1: ON
	D07	EXT2	No. 2 external latch input	0: OFF
				1: ON
	D08	EXT3	No. 3 external latch input	0: OFF
				1: ON
	D09	BRK	Brake output	0: Cancelled
				1: Locked
	D10-11	---	Reserved	
	D12	IO12	CN1 input signal selected in Pn81E.0.	0: OFF
				1: ON
	D13	IO13	CN1 input signal selected in Pn81E.1.	0: OFF
				1: ON
	D14	I014	CN1 input signal selected in Pn81E.2.	0: OFF
				1: ON
	D15	IO15	CN1 input signal selected in Pn81E.3.	0: OFF
				1: ON

4-6 I/O Variables

On the MC Unit, the following signals can be used as I/O variables; I/O connector signals of the MC Unit, the bit areas/data areas between the CPU Unit and the MC Unit, and I/O signals between MECHATROLINK-II devices and the MC Unit.

4-6-1 I/O Variables Overview



The R/W columns indicate the restriction on reading and writing from a program in the MC Unit. Of the output variables, the status output area cannot be written from the user program.

Writing data from a program in the MC Unit to the input variables linked to bit areas/data areas between the CPU Unit and the MC Unit enables the MC Unit to control the Unit, tasks, and axes.

Writing data from a program in the MC Unit to the output variables linked to the output signals of the MC Unit's I/O connector or MECHATROLINK-II output devices enables the MC Unit to control output signals.

4-6-2 List of Input Variables

Input Variables

Input variable	Size	PC21 Bus Cyclic area	Classification	Access
IW0000	1	---	MC Unit external input terminal	R/W
IW0001-IW000F	15	---	Reserved	R/W
IW0010-IW020F	512	---	MECHATROLINK-II input Axis 1-32	R/W
IW0210-IW02FF	240	---	Reserved	R/W
IW0300-IW0302	3	n – n+2	Unit control bit	R/W
IW0303-IW030F	13	---	Reserved	R/W
IW0310	1	m+20	Unit control data	R/W
IW0311-IW031F	15	---	Reserved	R/W
IW0320	1	n+3	Reserved	R/W
IW0321-IW032F	15	---	Reserved	R/W
IW0330	1	m+21	Reserved	R/W
IW0331-IW033F	15	---	Reserved	R/W
IW0340-IW0347	8	n+4 – n+11	Motion task 1-8 Control bit	R/W
IW0348-IW035F	24	---	Reserved	R/W

Input variable	Size	PC21 Bus Cyclic area	Classification	Access
IW0360-IW036F	16	m+22 – m+37	Motion task 1-8 Control data	R/W
IW0370-IW043F	208	---	Reserved	R/W
IW0440-IW045F	32	x – x+31	Axis 1-32 Control bit	R/W
IW0460-IW047F	32	---	Reserved	R/W
IW0480-IW049F	32	d – d+31	Axis1-32 Control Data	R/W
IW04A0-IW04BF	32	---	Reserved	R/W
IW04C0-IW04DF	32	---	Axis1-32 Feed forward correction	R/W
IW04E0-IW09FF	1312	---	Reserved	R/W
IW0A00-IW0A07	8	---	Acceleration/deceleration bank for motion task 1 to 8	R/W
IW0A08-IW0A3F	56	---	Reserved	R/W
IW0A40-IW0AFF	192	---	Reserved	R/W
IW0B00-IW0FFF	1280	Custom area	General I/O A-H	R/W

The column "Access" indicate the restriction on both read/ write from motion programs. Of the output variables, the status output area cannot be written from the user program.

Writing data from motion programs to the input variables allocated to the PLC bit area enables the MC Unit to control the Unit, tasks, and axes.

Writing data from motion programs to the output variables allocated to the MECHATROLINK-II output devices and the MC Unit external output terminals enables the MC Unit to control the signal outputs.

Details of Input Variables

Input variables indicate the data, which will be input to the MC Unit.

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW0000	00	1	---	MC Unit External Input Terminals	External deceleration stop input	Reflects the input from the external deceleration stop input terminal.
	01				Reserved	Reserved
	02				External general input 1	Reflects the input from the external general input 1 terminal.
	03				External general input 2	Reflects the input from the external general input 2 terminal.
	04-15				Reserved	Reserved
IW0001	00-15	15	---	Reserved	Reserved	Reserved
IW000F						

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW0010	00-15	16	---	MECHATROLINK-II Input Axis 1	MECHATROLINK-II Input Axis1 CH1	MECHATROLINK-II Input Axis1 CH1
IW0011					MECHATROLINK-II Input Axis1 CH2	MECHATROLINK-II Input Axis1 CH2
IW0012					MECHATROLINK-II Input Axis1 CH3	MECHATROLINK-II Input Axis1 CH3
IW0013					MECHATROLINK-II Input Axis1 CH4	MECHATROLINK-II Input Axis1 CH4
IW0014					MECHATROLINK-II Input Axis1 CH5	MECHATROLINK-II Input Axis1 CH5
IW0015					MECHATROLINK-II Input Axis1 CH6	MECHATROLINK-II Input Axis1 CH6
IW0016					MECHATROLINK-II Input Axis1 CH7	MECHATROLINK-II Input Axis1 CH7
IW0017					MECHATROLINK-II Input Axis1 CH8	MECHATROLINK-II Input Axis1 CH8
IW0018					MECHATROLINK-II Input Axis1 CH9	MECHATROLINK-II Input Axis1 CH9
IW0019					MECHATROLINK-II Input Axis1 CH10	MECHATROLINK-II Input Axis1 CH10
IW001A					MECHATROLINK-II Input Axis1 CH11	MECHATROLINK-II Input Axis1 CH11
IW001B					MECHATROLINK-II Input Axis1 CH12	MECHATROLINK-II Input Axis1 CH12
IW001C					MECHATROLINK-II Input Axis1 CH13	MECHATROLINK-II Input Axis1 CH13
IW001D					MECHATROLINK-II Input Axis1 CH14	MECHATROLINK-II Input Axis1 CH14
IW001E					MECHATROLINK-II Input Axis1 CH15	MECHATROLINK-II Input Axis1 CH15
IW001F					MECHATROLINK-II Input Axis1 CH16	MECHATROLINK-II Input Axis1 CH16
IW0020	00-15	16	---	MECHATROLINK-II Input Axis 2	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW002F						
IW0030	00-15	16	---	MECHATROLINK-II InputAxis3	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW003F						
IW0040	00-15	16	---	MECHATROLINK-II InputAxis4	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW004F						
IW0050	00-15	16	---	MECHATROLINK-II InputAxis5	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW005F						
IW0060	00-15	16	---	MECHATROLINK-II InputAxis6	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW006F						
IW0070	00-15	16	---	MECHATROLINK-II InputAxis7	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW007F						
IW0080	00-15	16	---	MECHATROLINK-II InputAxis8	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW008F						
IW0090	00-15	16	---	MECHATROLINK-II InputAxis9	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW009F						
IW00A0	00-15	16	---	MECHATROLINK-II InputAxis10	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW00AF						
IW00B0	00-15	16	---	MECHATROLINK-II InputAxis11	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW00BF						
IW00C0	00-15	16	---	MECHATROLINK-II InputAxis12	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW00CF						
IW00D0	00-15	16	---	MECHATROLINK-II InputAxis13	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW00DF						

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW00E0	00-15	16	---	MECHATROLINK-II InputAxis14	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW00EF						
IW00F0	00-15	16	---	MECHATROLINK-II InputAxis15	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW00FF						
IW0100	00-15	16	---	MECHATROLINK-II InputAxis16	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW010F						
IW0110	00-15	16	---	MECHATROLINK-II InputAxis17	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW011F						
IW0120	00-15	16	---	MECHATROLINK-II InputAxis18	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW012F						
IW0130	00-15	16	---	MECHATROLINK-II InputAxis19	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW013F						
IW0140	00-15	16	---	MECHATROLINK-II InputAxis20	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW014F						
IW0150	00-15	16	---	MECHATROLINK-II InputAxis21	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW015F						
IW0160	00-15	16	---	MECHATROLINK-II InputAxis22	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW016F						
IW0170	00-15	16	---	MECHATROLINK-II InputAxis23	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW017F						
IW0180	00-15	16	---	MECHATROLINK-II InputAxis24	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW018F						
IW0190	00-15	16	---	MECHATROLINK-II InputAxis25	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW019F						
IW01A0	00-15	16	---	MECHATROLINK-II InputAxis26	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW01AF						
IW01B0	00-15	16	---	MECHATROLINK-II InputAxis27	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW01BF						
IW01C0	00-15	16	---	MECHATROLINK-II InputAxis28	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW01CF						
IW01D0	00-15	16	---	MECHATROLINK-II InputAxis29	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW01DF						
IW01E0	00-15	16	---	MECHATROLINK-II InputAxis30	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW01EF						
IW01F0	00-15	16	---	MECHATROLINK-II InputAxis31	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW01FF						
IW0200	00-15	16	---	MECHATROLINK-II InputAxis32	Same as for MECHATROLINK-II Input Axis1	Same as for MECHATROLINK-II Input Axis1
IW020F						
IW0210	00-15	240	---	Reserved	Reserved	Reserved
IW02FF						

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW0300	00	1	n+0	Unit Control Bits	Unit alarm reset	0: No 1: Does not turn ON Unit alarm bit ↑: Clears the alarm occurring on the unit level : No
	01				System Parameter Save	0: No 1: No ↑: Saves system parameters in MC Unit's Flash ROM/ servo parameters in Flash ROM and EEPROM of servo driver : No
	02				Position Data Save	0: No 1: No ↑: Saves position data in Flash ROM ↓: No
	03				Teaching Condition Setting	0: No 1: No ↑: Sets teaching axis, reads teaching address ↓: No
	04				Teaching Type	0: Feedback present position 1: Command present position ↑: No ↓: No
	05				Teaching Execution	0: No 1: No ↑: Writes present positions in position data according to teaching type ↓: No
	06				Servo parameter Save	0: No 1: No ↑: Saves servo parameter to Flash ROM/ EEPROM in servo driver ↓: No
	07-11				Reserved	Reserved
	12-15				Present Value Monitor Select	Selects Data to be output to present value monitor 0: Zero output 1: FB position (selected coordinate system) 2: FB position (machine coordinate system) 3: Command position (selected coordinate system) 4:Command position (machine coordinate system) 5: FB speed 1 (speed command unit) 6: FB speed 2 (by parameters) 7: Command speed1 (Speed Command Unit) 8: Command speed 2 (depends on parameters) 9: Errors 10: Torque command 11-15: Reserved for system

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW0301	00-15	1	n+1	Unit Control Bits	Teaching Axis Setting 1-16	0: No 1: Specifies the axis as teaching object ↑: No ↓: No
IW0302	00-15	1	n+2		Teaching Axis Setting 17-32	0: No 1: Specifies the axis as teaching object ↑: No ↓: No
IW0303	00-15	13	---	Reserved	Reserved	Reserved
IW030F						
IW0310	00-15	1	m+20	Unit Control Data	Teaching Address	Specifies the teaching start address 0-10239
IW0311	00-15	15	---	Reserved	Reserved	Reserved
IW031F						
IW0320	00	1	n+3	Reserved		
	01					
	02					
	03-15				Reserved	Reserved
IW0321	00-15	15	---	Reserved	Reserved	Reserved
IW032F						
IW0330	00-15	1	m+21	Reserved	Reserved	Reserved
IW0331	00-15	15	---	Reserved	Reserved	Reserved
IW033F						

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW0340	00	1	n+4	Motion Task 1 Control	Motion Task Alarm Reset	0: No 1: Does not turn ON Motion task alarm bit ↑: Clears alarm occurring on motion task level ↓ No
	01				Motion Program Start	0: No 1: No ↑: Starts motion program according to specified Start mode ↓: No
	02-03				Start Mode	0,3: Reads program No. and executes program from top 1: Resumes program execution from middle of the block whose No. is being displayed as the running block No. 2: Resumes program execution from the next block to the one whose No. is being displayed as running block No.
	04				Deceleration Stop	0: No 1: Prohibits motion program start ↑: Executes deceleration stop regardless of the block ↓: No
	05				Block Stop	0: No 1: Prohibits motion program start ↑: Executes deceleration stop at the end of the block currently being executed ↓: No
	06				Single Block Operating Mode	0: Turns OFF single-block operating mode 1: Turns On single-block operating mode ↑: No ↓: No
	07				Task Override Enable	0: Disables task override value (Override: 100%) 1: Enables task override value ↑: No ↓: No
	08-15				Reserved	Reserved
IW0341	00-15	7	n+5	Motion Task 2 Control	Same as for Motion Task 1	Same as for Motion Task 1
IW0342			n+6	Motion Task 3 Control	Same as for Motion Task 1	Same as for Motion Task 1
IW0343			n+7	Motion Task 4 Control	Same as for Motion Task 1	Same as for Motion Task 1
IW0344			n+8	Motion Task 5 Control	Same as for Motion Task 1	Same as for Motion Task 1
IW0345			n+9	Motion Task 6 Control	Same as for Motion Task 1	Same as for Motion Task 1
IW0346			n+10	Motion Task 7 Control	Same as for Motion Task 1	Same as for Motion Task 1
IW0347			n+11	Motion Task 8 Control	Same as for Motion Task 1	Same as for Motion Task 1
IW0348	00-15	24	---	Reserved	Reserved	Reserved
IW035F						

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW0360	00-15	1	m+22	Motion Task 1 Control Data	Motion Task 1 Program No.	Specifies program No. to be executed by Motion Task 0-499
IW0361	00-15	1	m+23		Motion Task 1 Override	Sets override value to be used in motion program 0.00 to 327.67 [%] (unit: 0.01%)
IW0362	00-15	2	m+24	Motion Task 2 Control Data	Same as for Motion Task 1	Same as for Motion Task 1
IW0363			m+25			
IW0364	00-15	2	m+26	Motion Task 3 Control Data	Same as for Motion Task 1	Same as for Motion Task 1
IW0365			m+27			
IW0366	00-15	2	m+28	Motion Task 4 Control Data	Same as for Motion Task 1	Same as for Motion Task 1
IW0367			m+29			
IW0368	00-15	2	m+30	Motion Task 5 Control Data	Same as for Motion Task 1	Same as for Motion Task 1
IW0369			m+31			
IW036A	00-15	2	m+32	Motion Task 6 Control Data	Same as for Motion Task 1	Same as for Motion Task 1
IW036B			m+33			
IW036C	00-15	2	m+34	Motion Task 7 Control Data	Same as for Motion Task 1	Same as for Motion Task 1
IW036D			m+35			
IW036E	00-15	2	m+36	Motion Task 8 Control Data	Same as for Motion Task 1	Same as for Motion Task 1
IW036F			m+37			
IW0370	00-15	208	---	Reserved	Reserved	Reserved
IW043F						

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW0440	00	1	x+0	Axis 1 Control Bits	Axis Alarm Reset	0: No 1: Does not turn ON Axis alarm bit ↑: Clears alarm occurring on axis level, and clears alarm at MECHATROLINK-II slaves ↓: No
	01				Deceleration Stop	0: No 1: Prohibits JOG, STEP, Origin search, and Machine origin return in manual mode ↑: Deceleration stop (JOG, STEP, Origin search, and Machine origin return) ↓: No
	02				Servo Lock	0: No 1: No ↑: Starts servo-lock ↓: No
	03				Servo Unlock	0: No 1: Prohibits servo-lock ↑: Cancels servo-lock status ↓: No
	04				JOG	0: No 1: Continues JOG operation ↑: Starts JOG operation ↓: Stops JOG operation
	05				STEP	0: No 1: Continues STEP operation ↑: Starts STEP operation ↓: Stops STEP operation
	06				Origin Search	0: No 1: Continues origin search ↑: Starts origin search ↓: Stops origin search
	07				Machine Origin Return	0: No 1: Continues Machine origin return (PTP) ↑: Starts Machine origin return (PTP) ↓: Stops Machine origin return (PTP)
	08				Error Counter Reset	0: No 1: No ↑: Resets error counter *Command position = present position ↓: No
	09				Forced Origin	0: No 1: No ↑: Forces to set the present position to 0 to establish it as the origin (not during axis movement) ↓: No
	10				ABS Origin Setting	0: No 1: No ↑: Sets the ABS encoder origin ↓: No
	11				Axis Override Enable	0: Disables axis override value (Override: 100%) 1: Enables axis override value ↑: No ↓: No

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW0440	12	1	x+0	Axis 1 Control Bits	JOG/STEP Direction	0: JOG and STEP operation in + direction 1: JOG and STEP operation in - direction ↑: No ↓: No
	13				Axis Machine Lock	0: Cancels axis machine lock mode 1: Axis machine lock mode ↑: No ↓: No
	14				Reserved	Reserved
	15				Manual/Automatic Mode	0: Manual mode 1: Automatic mode ↑: Stops manual operation in progress with deceleration stop ↓: Stops automatic operation in progress with deceleration stop

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW0441	00-15	31	x+1	Axis 2 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0442			x+2	Axis 3 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0443			x+3	Axis 4 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0444			x+4	Axis 5 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0445			x+5	Axis 6 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0446			x+6	Axis 7 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0447			x+7	Axis 8 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0448			x+8	Axis 9 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0449			x+9	Axis 10 Control Bits	Same as for Axis 1	Same as for Axis 1
IW044A			x+10	Axis 11 Control Bits	Same as for Axis 1	Same as for Axis 1
IW044B			x+11	Axis 12 Control Bits	Same as for Axis 1	Same as for Axis 1
IW044C			x+12	Axis 13 Control Bits	Same as for Axis 1	Same as for Axis 1
IW044D			x+13	Axis 14 Control Bits	Same as for Axis 1	Same as for Axis 1
IW044E			x+14	Axis 15 Control Bits	Same as for Axis 1	Same as for Axis 1
IW044F			x+15	Axis 16 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0450			x+16	Axis 17 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0451			x+17	Axis 18 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0452			x+18	Axis 19 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0453			x+19	Axis 20 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0454			x+20	Axis 21 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0455			x+21	Axis 22 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0456			x+22	Axis 23 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0457			x+23	Axis 24 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0458			x+24	Axis 25 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0459			x+25	Axis 26 Control Bits	Same as for Axis 1	Same as for Axis 1
IW045A			x+26	Axis 27 Control Bits	Same as for Axis 1	Same as for Axis 1
IW045B			x+27	Axis 28 Control Bits	Same as for Axis 1	Same as for Axis 1
IW045C			x+28	Axis 29 Control Bits	Same as for Axis 1	Same as for Axis 1
IW045D			x+29	Axis 30 Control Bits	Same as for Axis 1	Same as for Axis 1
IW045E			x+30	Axis 31 Control Bits	Same as for Axis 1	Same as for Axis 1
IW045F			x+31	Axis 32 Control Bits	Same as for Axis 1	Same as for Axis 1
IW0460	00-15	32	---	Reserved	Reserved	Reserved
IW047F						
IW0480	00-15	1	d+0	Axis 1 Control Data	Axis 1 Override	Sets override value to be used for axis 0.00 to 327.67 [%] (unit: 0.01%)

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW0481	00-15	31	d+1	Axis 2 Control Data	Axis 2 Override	Same as for Axis 1
IW0482			d+2	Axis 3 Control Data	Axis 3 Override	Same as for Axis 1
IW0483			d+3	Axis 4 Control Data	Axis 4 Override	Same as for Axis 1
IW0484			d+4	Axis 5 Control Data	Axis 5 Override	Same as for Axis 1
IW0485			d+5	Axis 6 Control Data	Axis 6 Override	Same as for Axis 1
IW0486			d+6	Axis 7 Control Data	Axis 7 Override	Same as for Axis 1
IW0487			d+7	Axis 8 Control Data	Axis 8 Override	Same as for Axis 1
IW0488			d+8	Axis 9 Control Data	Axis 9 Override	Same as for Axis 1
IW0489			d+9	Axis 10 Control Data	Axis 10 Override	Same as for Axis 1
IW048A			d+10	Axis 11 Control Data	Axis 11 Override	Same as for Axis 1
IW048B			d+11	Axis 12 Control Data	Axis 12 Override	Same as for Axis 1
IW048C			d+12	Axis 13 Control Data	Axis 13 Override	Same as for Axis 1
IW048D			d+13	Axis 14 Control Data	Axis 14 Override	Same as for Axis 1
IW048E			d+14	Axis 15 Control Data	Axis 15 Override	Same as for Axis 1
IW048F			d+15	Axis 16 Control Data	Axis 16 Override	Same as for Axis 1
IW0490			d+16	Axis 17 Control Data	Axis 17 Override	Same as for Axis 1
IW0491			d+17	Axis 18 Control Data	Axis 18 Override	Same as for Axis 1
IW0492			d+18	Axis 19 Control Data	Axis 19 Override	Same as for Axis 1
IW0493			d+19	Axis 20 Control Data	Axis 20 Override	Same as for Axis 1
IW0494			d+20	Axis 21 Control Data	Axis 21 Override	Same as for Axis 1
IW0495			d+21	Axis 22 Control Data	Axis 22 Override	Same as for Axis 1
IW0496			d+22	Axis 23 Control Data	Axis 23 Override	Same as for Axis 1
IW0497			d+23	Axis 24 Control Data	Axis 24 Override	Same as for Axis 1
IW0498			d+24	Axis 25 Control Data	Axis 25 Override	Same as for Axis 1
IW0499			d+25	Axis 26 Control Data	Axis 26 Override	Same as for Axis 1
IW049A			d+26	Axis 27 Control Data	Axis 27 Override	Same as for Axis 1
IW049B			d+27	Axis 28 Control Data	Axis 28 Override	Same as for Axis 1
IW049C			d+28	Axis 29 Control Data	Axis 29 Override	Same as for Axis 1
IW049D			d+29	Axis 30 Control Data	Axis 30 Override	Same as for Axis 1
IW049E			d+30	Axis 31 Control Data	Axis 31 Override	Same as for Axis 1
IW049F			d+31	Axis 32 Control Data	Axis 32 Override	Same as for Axis 1

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW04A0	00-15	1	---	Axis 1 Control Data	Reserved	Reserved
IW04A1	00-15	31	---	Axis 2 Control Data	Reserved	Reserved
IW04A2				Axis 3 Control Data	Reserved	Reserved
IW04A3				Axis 4 Control Data	Reserved	Reserved
IW04A4				Axis 5 Control Data	Reserved	Reserved
IW04A5				Axis 6 Control Data	Reserved	Reserved
IW04A6				Axis 7 Control Data	Reserved	Reserved
IW04A7				Axis 8 Control Data	Reserved	Reserved
IW04A8				Axis 9 Control Data	Reserved	Reserved
IW04A9				Axis 10 Control Data	Reserved	Reserved
IW04AA				Axis 11 Control Data	Reserved	Reserved
IW04AB				Axis 12 Control Data	Reserved	Reserved
IW04AC				Axis 13 Control Data	Reserved	Reserved
IW04AD				Axis 14 Control Data	Reserved	Reserved
IW04AE				Axis 15 Control Data	Reserved	Reserved
IW04AF				Axis 16 Control Data	Reserved	Reserved
IW04B0				Axis 17 Control Data	Reserved	Reserved
IW04B1				Axis 18 Control Data	Reserved	Reserved
IW04B2				Axis 19 Control Data	Reserved	Reserved
IW04B3				Axis 20 Control Data	Reserved	Reserved
IW04B4				Axis 21 Control Data	Reserved	Reserved
IW04B5				Axis 22 Control Data	Reserved	Reserved
IW04B6				Axis 23 Control Data	Reserved	Reserved
IW04B7				Axis 24 Control Data	Reserved	Reserved
IW04B8				Axis 25 Control Data	Reserved	Reserved
IW04B9				Axis 26 Control Data	Reserved	Reserved
IW04BA				Axis 27 Control Data	Reserved	Reserved
IW04BB				Axis 28 Control Data	Reserved	Reserved
IW04BC				Axis 29 Control Data	Reserved	Reserved
IW04BD				Axis 30 Control Data	Reserved	Reserved
IW04BE				Axis 31 Control Data	Reserved	Reserved

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW04BF	00-15	31	---	Axis 32 Control Data	Reserved	Reserved
IW04C0	00-15	1	---	Axis 1 Control Data	Feed forward Correction	Sets feed forward correction value to be used in phase control (unit: 0.01%, % to correction value 100%)
IW04C1	00-15	31	---	Axis 2 Control Data	Axis 2 Feed forward Correction	Same as for Axis 1
IW04C2				Axis 3 Control Data	Axis 3 Feed forward Correction	Same as for Axis 1
IW04C3				Axis 4 Control Data	Axis 4 Feed forward Correction	Same as for Axis 1
IW04C4				Axis 5 Control Data	Axis 5 Feed forward Correction	Same as for Axis 1
IW04C5				Axis 6 Control Data	Axis 6 Feed forward Correction	Same as for Axis 1
IW04C6				Axis 7 Control Data	Axis 7 Feed forward Correction	Same as for Axis 1
IW04C7				Axis 8 Control Data	Axis 8 Feed forward Correction	Same as for Axis 1
IW04C8				Axis 9 Control Data	Axis 9 Feed forward Correction	Same as for Axis 1
IW04C9				Axis 10 Control Data	Axis 10 Feed forward Correction	Same as for Axis 1
IW04CA				Axis 11 Control Data	Axis 11 Feed forward Correction	Same as for Axis 1
IW04CB				Axis 12 Control Data	Axis 12 Feed forward Correction	Same as for Axis 1
IW04CC				Axis 13 Control Data	Axis 13 Feed forward Correction	Same as for Axis 1
IW04CD				Axis 14 Control Data	Axis 14 Feed forward Correction	Same as for Axis 1
IW04CE				Axis 15 Control Data	Axis 15 Feed forward Correction	Same as for Axis 1
IW04CF				Axis 16 Control Data	Axis 16 Feed forward Correction	Same as for Axis 1
IW04D0				Axis 17 Control Data	Axis 17 Feed forward Correction	Same as for Axis 1
IW04D1				Axis 18 Control Data	Axis 18 Feed forward Correction	Same as for Axis 1
IW04D2				Axis 19 Control Data	Axis 19 Feed forward Correction	Same as for Axis 1
IW04D3				Axis 20 Control Data	Axis 20 Feed forward Correction	Same as for Axis 1
IW04D4				Axis 21 Control Data	Axis 21 Feed forward Correction	Same as for Axis 1
IW04D5				Axis 22 Control Data	Axis 22 Feed forward Correction	Same as for Axis 1
IW04D6				Axis 23 Control Data	Axis 23 Feed forward Correction	Same as for Axis 1
IW04D7				Axis 24 Control Data	Axis 24 Feed forward Correction	Same as for Axis 1
IW04D8				Axis 25 Control Data	Axis 25 Feed forward Correction	Same as for Axis 1
IW04D9				Axis 26 Control Data	Axis 26 Feed forward Correction	Same as for Axis 1
IW04DA				Axis 27 Control Data	Axis 27 Feed forward Correction	Same as for Axis 1
IW04DB				Axis 28 Control Data	Axis 28 Feed forward Correction	Same as for Axis 1
IW04DC				Axis 29 Control Data	Axis 29 Feed forward Correction	Same as for Axis 1

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
IW04DD	00-15	31	---	Axis 30 Control Data	Axis 30 Feed forward Correction	Same as for Axis 1
IW04DE				Axis 31 Control Data	Axis 31 Feed forward Correction	Same as for Axis 1
IW04DF				Axis 32 Control Data	Axis 32 Feed forward Correction	Same as for Axis 1
IW04E0	00-15	1376	---	Reserved	Reserved	Reserved
IW09FF						
IW0A00	00-15	1	---	Motion task 1 control data	Acceleration/deceleration bank for motion task 1	Selects the system parameter to use for the interpolation feed acceleration/deceleration time. 1 to 10: Use P00M11 to P00M20 as the interpolation feed acceleration/deceleration time. Other value: Use P00M002 (interpolation feed acceleration time) or P00M003 (interpolation feed deceleration time).
IW0A01	00-15	7	---	Motion task 2 control data	Same as for motion task 1	Same as for motion task 1
IW0A02				Motion task 3 control data	Same as for motion task 1	Same as for motion task 1
IW0A03				Motion task 4 control data	Same as for motion task 1	Same as for motion task 1
IW0A04				Motion task 5 control data	Same as for motion task 1	Same as for motion task 1
IW0A05				Motion task 6 control data	Same as for motion task 1	Same as for motion task 1
IW0A06				Motion task 7 control data	Same as for motion task 1	Same as for motion task 1
IW0A07				Motion task 8 control data	Same as for motion task 1	Same as for motion task 1
IW0A08	00-15	56	---	Reserved	Reserved	Reserved
IW0A3F						
IW0A40	00-15	192	---	Reserved	Reserved	Reserved
IW0AFF						
IW0B00	00-15	160	a_A	General I/O A	General I/O A CH1-160	Reflects data from General I/O A (CPU to MC Unit)
IW0B9F						
IW0BA0	00-15	160	a_B	General I/O B	General I/O B CH1-160	Same as for General I/O A
IW0C3F						
IW0C40	00-15	160	a_C	General I/O C	General I/O C CH1-160	Same as for General I/O A
IW0CDF						
IW0CE0	00-15	160	a_D	General I/O D	General I/O D CH1-160	Same as for General I/O A
IW0D7F						
IW0D80	00-15	160	a_E	General I/O E	General I/O E CH1-160	Same as for General I/O A
IW0E1F						
IW0E20	00-15	160	a_F	General I/O F	General I/O F CH1-160	Same as for General I/O A
IW0EBF						
IW0EC0	00-15	160	a_G	General I/O G	General I/O G CH1-160	Same as for General I/O A
IW0F5F						
IW0F60	00-15	160	a_H	General I/O H	General I/O H CH1-160	Same as for General I/O A
IW0FFF						

4-6-3 List of Output Variables

Output variables

Input variable	Size	PC21 Bus Cyclic area	Classification	Access
OW0000	1	---	MC Unit external output terminal	R/W
OW0001-OW000F	15	---	Reserved	R/W
OW0010-OW020F	512	---	MECHATROLINK-II output Axis 1-32	R/W
OW0210-OW02FF	240	---	Reserved	R/W
OW0300-OW0303	4	n+12 – n+15	Unit status bits	R
OW0304-OW030F	12	---	Reserved	R
OW0310-OW0311	2	m+38 – m+39	Unit status data	R
OW0312-OW031F	14	---	Reserved	R
OW0320	1	n+3	Reserved	R
OW0321-OW032F	15	---	Reserved	R
OW0330-OW0331	1	m+21	Reserved	R
OW0332-OW033F	15	---	Reserved	R
OW0340-OW0347	8	n+17 – n+24	Motion task 1-8 Status bits	R
OW0348-OW035F	24	---	Reserved	R
OW0360-OW037F	32	m+42 – m+73	Motion task 1-8 Status data	R
OW0380-OW043F	192	---	Reserved	R
OW0440-OW045F	32	x+32 – x+63	Axis 1-32 Status bits	R
OW0460-OW047F	32	---	Reserved	R
OW0480-OW04DF	96	d+32 – d+127	Axis1-32 Status data	R
OW04E0-OW0AFF	1568	---	Reserved	R
OW0B00-OW0FFF	1280	Custom area	General I/O A-H	R/W

The column "Access" in the above table indicate the restrictions for Reading and Writing from motion programs. It is prohibited to write from a user's program in the status output area.

Writing data from motion programs to the input variables allocated to the bit area in the PLC enables the MC Unit to control the Unit, tasks and axes.

Writing data from motion programs to the output variables allocated to MECHATROLINK-II output devices and the MC Unit external output terminals enables the MC Unit to control the signal outputs.

Details of Output Variables

Output variables indicate the data that is output from the MC Unit.

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW0000	00	1	---	MC Unit External Output Terminal	External General Output 1	Sets output to external general output 1 terminal.
	01				External General Output 2	Sets output to external general output 2 terminal.
	02-15				Reserved	Reserved
OW0001	00-15	15	---	Reserved	Reserved	Reserved
OW000F						

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW0010	00-15	16	---	MECHATROLINK-II Output Axis 1	MECHATROLINK-II Output Axis 1 CH1	MECHATROLINK-II Output Axis 1 CH1
OW0011					MECHATROLINK-II Output Axis 1 CH2	MECHATROLINK-II Output Axis 1 CH2
OW0012					MECHATROLINK-II Output Axis 1 CH3	MECHATROLINK-II Output Axis 1 CH3
OW0013					MECHATROLINK-II Output Axis 1 CH4	MECHATROLINK-II Output Axis 1 CH4
OW0014					MECHATROLINK-II Output Axis 1 CH5	MECHATROLINK-II Output Axis 1 CH5
OW0015					MECHATROLINK-II Output Axis 1 CH6	MECHATROLINK-II Output Axis 1 CH6
OW0016					MECHATROLINK-II Output Axis 1 CH7	MECHATROLINK-II Output Axis 1 CH7
OW0017					MECHATROLINK-II Output Axis 1 CH8	MECHATROLINK-II Output Axis 1 CH8
OW0018					MECHATROLINK-II Output Axis 1 CH9	MECHATROLINK-II Output Axis 1 CH9
OW0019					MECHATROLINK-II Output Axis 1 CH10	MECHATROLINK-II Output Axis 1 CH10
OW001A					MECHATROLINK-II Output Axis 1 CH11	MECHATROLINK-II Output Axis 1 CH11
OW001B					MECHATROLINK-II Output Axis 1 CH12	MECHATROLINK-II Output Axis 1 CH12
OW001C					MECHATROLINK-II Output Axis 1 CH13	MECHATROLINK-II Output Axis 1 CH13
OW001D					MECHATROLINK-II Output Axis 1 CH14	MECHATROLINK-II Output Axis 1 CH14
OW001E					MECHATROLINK-II Output Axis 1 CH15	MECHATROLINK-II Output Axis 1 CH15
OW001F					MECHATROLINK-II Output Axis 1 CH16	MECHATROLINK-II Output Axis 1 CH16
OW0020	00-15	16	---	MECHATROLINK-II Output Axis 1 CH2	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW002F						
OW0030	00-15	16	---	MECHATROLINK-II Output Axis 1 CH3	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW003F						
OW0040	00-15	16	---	MECHATROLINK-II Output Axis 1 CH4	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW004F						
OW0050	00-15	16	---	MECHATROLINK-II Output Axis 1 CH5	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW005F						
OW0060	00-15	16	---	MECHATROLINK-II Output Axis 1 CH6	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW006F						
OW0070	00-15	16	---	MECHATROLINK-II Output Axis 1 CH7	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW007F						
OW0080	00-15	16	---	MECHATROLINK-II Output Axis 1 CH8	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW008F						
OW0090	00-15	16	---	MECHATROLINK-II Output Axis 1 CH9	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW009F						
OW00A0	00-15	16	---	MECHATROLINK-II Output Axis 1 CH10	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW00AF						
OW00B0	00-15	16	---	MECHATROLINK-II Output Axis 1 CH11	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW00BF						

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW00C0 OW00CF	00-15	16	---	MECHATROLINK-II Output Axis 1 CH12	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW00D0 OW00DF	00-15	16	---	MECHATROLINK-II Output Axis 1 CH13	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW00E0 OW00EF	00-15	16	---	MECHATROLINK-II Output Axis 1 CH14	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW00F0 OW00FF	00-15	16	---	MECHATROLINK-II Output Axis 1 CH15	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW0100 OW010F	00-15	16	---	MECHATROLINK-II Output Axis 1 CH16	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW0110 OW011F	00-15	16	---	MECHATROLINK-II Output Axis 1 CH17	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW0120 OW012F	00-15	16	---	MECHATROLINK-II Output Axis 1 CH18	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW0130 OW013F	00-15	16	---	MECHATROLINK-II Output Axis 1 CH19	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW0140 OW014F	00-15	16	---	MECHATROLINK-II Output Axis 1 CH20	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW0150 OW015F	00-15	16	---	MECHATROLINK-II Output Axis 1 CH21	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW0160 OW016F	00-15	16	---	MECHATROLINK-II Output Axis 1 CH22	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW0170 OW017F	00-15	16	---	MECHATROLINK-II Output Axis 1 CH23	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW0180 OW018F	00-15	16	---	MECHATROLINK-II Output Axis 1 CH24	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW0190 OW019F	00-15	16	---	MECHATROLINK-II Output Axis 1 CH25	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW01A0 OW01AF	00-15	16	---	MECHATROLINK-II Output Axis 1 CH26	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW01B0 OW01BF	00-15	16	---	MECHATROLINK-II Output Axis 1 CH27	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW01C0 OW01CF	00-15	16	---	MECHATROLINK-II Output Axis 1 CH28	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW01D0	00-15	16	---	MECHATROLINK-II Output Axis 1 CH29	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW01DF						
OW01E0	00-15	16	---	MECHATROLINK-II Output Axis 1 CH30	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW01EF						
OW01F0	00-15	16	---	MECHATROLINK-II Output Axis 1 CH31	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW01FF						
OW0200	00-15	16	---	MECHATROLINK-II Output Axis 1 CH32	Same as for MECHATROLINK-II Output Axis 1	Same as for MECHATROLINK-II Output Axis 1
OW020F						
OW0210	00-15	240	---	Reserved	Reserved	Reserved
OW02FF						
OW0300	00	1	n+12	Alarm Identification	Alarm Occurring	0: No alarm 1: An alarm occurred on MC Unit (linked to ERC indicator).
	01				Unit Alarm Occurring	0: No alarm 1: An alarm occurred on Unit level
	02				Reserved	
	03-10				Motion Task Alarm Occurring 1-8	0: No alarm 1: An alarm occurred on motion task level
	11-15				Reserved	Reserved
OW0301	00-15	1	n+13		Axis Alarm Occurring 1-16	0: No alarm 1: An alarm occurred on axis
OW0302	00-15	1	n+14		Axis Alarm Occurring 17-32	0: No alarm 1: An alarm occurred on axis

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW0303	00	1	n+15	Unit Status	Unit Ready	0: Unit is not ready to receive commands 1: Unit is ready to receive commands
	01				Unit Alarm	0: No alarm 1: An alarm occurred on Unit level
	02				F-ROM Save Completed	0: Saving neither parameters nor position data has been completed 1: Saving either parameters or position data has been completed (error completion included)
	03				Teaching Warning	0: Teaching condition setting and execution completed normally 1: Condition error, Command disabled, No origin, or address overflow
	04				Teaching Condition Setting Completed	0: When Teaching condition setting is OFF 1: Teaching condition setting completed (error completion included)
	05				Teaching Execution Completed	0: When teaching execution is OFF 1: Teaching execution completed (error completed included)
	06				MECHATROLINK-II Device Search Execution	0: Normal status 1: Started MECHATROLINK-II device search
	07				External Forced Stop Request	0: No external forced stop request from FINS, etc. (not from input variable) 1: External forced stop requested from FINS, etc. (not from input variable)
	08				External Forced Stop Status	0: No forced stop request, or processing for stopping 1: Stopped by forced stop request
	09				Reserved	Reserved
	10				Reserved	Reserved
	11				Reserved	Reserved
	12-15				Present Value Monitor Status	Displays the present value monitoring output status 0: Zero output 1: FB position (selected coordinate system) 2: FB position (machine coordinate system) 3: Command position (selected coordinate system) 4: Command position (machine coordinate system) 5: FB speed 1 (speed command unit) 6: FB speed 2 (depends on parameters) 7: Command speed 1 (speed command unit) 8: Command speed 2 (depends on parameters) 9: Error 10: Torque command 11-15: Reserved for system
OW0304	00-15	12	---	Reserved	Reserved	Reserved
OW030F						

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW0310	00-15	1	m+38	Unit Status Data	Unit Alarm Code	Outputs the alarm code for alarm occurring on Unit level
OW0311	00-15	1	m+39		Teaching Address Monitoring	Outputs an address currently being the teaching object
OW0312	00-15	14	---	Reserved	Reserved	Reserved
OW031F						
OW0320	00	1	n+16	Reserved		
	01					
	02-15				Reserved	Reserved
OW0321	00-15	15	---	Reserved	Reserved	Reserved
OW032F						
OW0330	00-15	1	m+40	Reserved		
OW0331	00-15	1	m+41			
OW0332	00-15	14	---	Reserved	Reserved	Reserved
OW033F						
OW0340	00	1	n+17	Motion Task 1 Status	Motion Task Alarm	0: No alarm occurring on motion task level 1: An alarm occurred on motion task level
	01				Motion Program Operating	0: Motion task is not executing motion program 1: Motion task is in program operation (Turned OFF after completion of deceleration/block stop)
	02				Motion Program Operation Completed	0: When program operation is started 1: Executed END command
	03				In Block Stop	0: Block not stopped 1: Block stopped
	04				Speed Clamp Warning	0: Speed not clamped 1: Speed clamped due to maximum speed limit
	05				Start Warning	0: Motion program operation started 1: Motion program operation could not be started (Axis declaration, Axis mode)
	06-15				Reserved	Reserved
OW0341	00-15	7	n+18	Motion Task 2 Status	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
OW0342			n+19	Motion Task 3 Status	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
OW0343			n+20	Motion Task 4 Status	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
OW0344			n+21	Motion Task 5 Status	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
OW0345			n+22	Motion Task 6 Status	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
OW0346			n+23	Motion Task 7 Status	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
OW0347			n+24	Motion Task 8 Status	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
OW0348	00-15	24	---	Reserved	Reserved	Reserved
OW035F						

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW0360	00-15	1	m+42	Motion Task 1 Status Data	Motion Task Alarm Code	Outputs the alarm code for alarm occurring on motion task level
OW0361	00-15	1	m+43		Executing Motion Program No.	The program No. of the program currently being executed by a motion task, or temporarily stopped is output
OW0362	00-15	1	m+44		Executing Motion Block No. (Single execution command)	The block No. of the single execution command currently being executed by a motion task, or temporarily stopped, is output.During execution of parallel branching, the block No. of the leftmost block is output
OW0363	00-15	1	m+45		Executing Motion Block No. (Multiple execution command)	The block No. of the multiple execution command currently being executed by a motion task, or temporarily stopped is output.During execution of parallel branching, the block No. of the leftmost block is output.
OW0364	00-15	28	m+46	Motion task 2 Status Data	Same as for Motion Task 1 Status Data	Same as for Motion Task 1 Status Data
OW0365			m+47			
OW0366			m+48			
OW0367			m+49			
OW0368			m+50	Motion task 3 Status Data	Same as for Motion Task 1 Status Data	Same as for Motion Task 1 Status Data
OW0369			m+51			
OW036A			m+52			
OW036B			m+53			
OW036C			m+54	Motion task 4 Status Data	Same as for Motion Task 1 Status Data	Same as for Motion Task 1 Status Data
OW036D			m+55			
OW036E			m+56			
OW036F			m+57			
OW0370			m+58	Motion task 5 Status Data	Same as for Motion Task 1 Status Data	Same as for Motion Task 1 Status Data
OW0371			m+59			
OW0372			m+60			
OW0373			m+61			
OW0374			m+62	Motion task 6 Status Data	Same as for Motion Task 1 Status Data	Same as for Motion Task 1 Status Data
OW0375			m+63			
OW0376			m+64			
OW0377			m+65			
OW0378			m+66	Motion task 7 Status Data	Same as for Motion Task 1 Status Data	Same as for Motion Task 1 Status Data
OW0379			m+67			
OW037A			m+68			
OW037B			m+69			
OW037C			m+70	Motion task 8 Status Data	Same as for Motion Task 1 Status Data	Same as for Motion Task 1 Status Data
OW037D			m+71			
OW037E			m+72			
OW037F			m+73			
OW0380	00-15	192	---	Reserved	Reserved	Reserved
OW043F						

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW0440	00	1	x+32	Axis 1 Status Bits	Axis Alarm	0: No alarm on axis or MECHATROLINK-II slave 1: An alarm occurred on axis or MECHATROLINK-II slave
	01				Machine Origin	0: Machine coordinate system FB position is outside of origin in-position range 1: Machine coordinate system FB position is within origin position in-position range
	02				Busy	0: None of the functions listed below is being executed 1: One of the functions listed below is being executed or command is ON (JOG, STEP, Origin search, Machine origin return, Error counter reset, Forced origin, or ABS origin setting)
	03				In Servo Lock	0: In Servo-lock 1: In Servo-unlock
	04				No Origin	0: Origin on machine coordinate system is determined 1: Origin on machine coordinate system is not determined
	05				Axis Operating	0: No axis operating command 1: Axis operating command being output
	06				Positioning Completed	0: Command value being output or outside of in-position range 1: Command value not being output and within in-position range
	07				Positioning Completed (No.2)	0: Command value being output or outside of NO.2 in-position range 1: Command value not being output and within No.2 in-position range
	08				Error Counter Warning	0: Error amount is within the range of error counter warning value 1: Error amount is outside (exceeded) of the range of error counter warning value
	09				Axis Machine Lock Status	0: Cancels axis machine lock mode 1: In axis machine lock mode
	10				Counter Latch Completed	0: Counter latch not completed 1: Counter latch completed
	11				MECHATROLINK Warning	0: No warning detected on MECHATROLINK-II device 1: Warning detected on MECHATROLINK-II device
	12				Reserved	Reserved
	13				Command Disabled/Enabled	0: Not allocated or implemented 1: Allocated and implemented (always "1" for virtual axis)
	14				Axis Not Used/Used	0: Axis not used 1: Axis in use (Manual: During JOG execution, etc., Automatic: Axis declared in a running program)
	15				In Manual/Automatic Mode	0: In manual mode 1: In automatic mode

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW0441	00-15	31	x+33	Axis 2 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0442			x+34	Axis 3 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0443			x+35	Axis 4 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0444			x+36	Axis 5 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0445			x+37	Axis 6 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0446			x+38	Axis 7 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0447			x+39	Axis 8 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0448			x+40	Axis 9 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0449			x+41	Axis 10 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW044A			x+42	Axis 11 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW044B			x+43	Axis 12 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW044C			x+44	Axis 13 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW044D			x+45	Axis 14 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW044E			x+46	Axis 15 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW044F			x+47	Axis 16 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0450			x+48	Axis 17 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0451			x+49	Axis 18 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0452			x+50	Axis 19 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0453			x+51	Axis 20 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0454			x+52	Axis 21 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0455			x+53	Axis 22 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0456			x+54	Axis 23 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0457			x+55	Axis 24 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0458			x+56	Axis 25 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW0459			x+57	Axis 26 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW045A			x+58	Axis 27 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW045B			x+59	Axis 28 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW045C			x+60	Axis 29 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW045D			x+61	Axis 30 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW045E			x+62	Axis 31 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits
OW045F			x+63	Axis 32 Status Bits	Same as for Axis 1 Status Bits	Same as for Axis 1 Status Bits

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW0460	00-15	32	---	Reserved	Reserved	Reserved
OW047F						
OW0480	00-15	1	d+32	Axis 1 Status Data	Axis Alarm Code	Output the alarm code for alarm occurring on axis or MECHATROLINK-II slave
OW0481	00-15	2	d+33		Present Value Monitor	Selected from the following 8 items for output 1: FB position (selected coordinate system) 2: FB position (machine coordinate system) 3: Command position (selected coordinate system) 4: Command position (machine coordinate system) 5: FB speed 6: Command speed 7: Error 8: Torque Command
OW0482			d+34			
OW0483	00-15	93	d+35	Axis 2 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW0484			d+36			
OW0485			d+37			
OW0486			d+38	Axis 3 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW0487			d+39			
OW0488			d+40			
OW0489			d+41	Axis 4 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW048A			d+42			
OW048B			d+43			
OW048C			d+44	Axis 5 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW048D			d+45			
OW048E			d+46			
OW048F			d+47	Axis 6 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW0490			d+48			
OW0491			d+49			
OW0492			d+50	Axis 7 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW0493			d+51			
OW0494			d+52			
OW0495			d+53	Axis 8 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW0496			d+54			
OW0497			d+55			
OW0498			d+56	Axis 9 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW0499			d+57			
OW049A			d+58			
OW049B			d+59	Axis 10 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW049C			d+60			
OW049D			d+61			
OW049E			d+62	Axis 11 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW049F			d+63			
OW04A0			d+64			
OW04A1			d+65	Axis 12 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04A2			d+66			
OW04A3			d+67			
OW04A4			d+68	Axis 13 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04A5			d+69			
OW04A6			d+70			

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW04A7	00-15	93	d+71	Axis 14 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04A8			d+72			
OW04A9			d+73			
OW04AA			d+74	Axis 15 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04AB			d+75			
OW04AC			d+76			
OW04AD			d+77	Axis 16 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04AE			d+78			
OW04AF			d+79			
OW04B0			d+80	Axis 17 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04B1			d+81			
OW04B2			d+82			
OW04B3			d+83	Axis 18 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04B4			d+84			
OW04B5			d+85			
OW04B6			d+86	Axis 19 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04B7			d+87			
OW04B8			d+88			
OW04B9			d+89	Axis 20 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04BA			d+90			
OW04BB			d+91			
OW04BC			d+92	Axis 21 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04BD			d+93			
OW04BE			d+94			
OW04BF			d+95	Axis 22 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04C0			d+96			
OW04C1			d+97			
OW04C2			d+98	Axis 23 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04C3			d+99			
OW04C4			d+100			
OW04C5			d+101	Axis 24 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04C6			d+102			
OW04C7			d+103			
OW04C8			d+104	Axis 25 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04C9			d+105			
OW04CA			d+106			
OW04CB			d+107	Axis 26 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04CC			d+108			
OW04CD			d+109			
OW04CE			d+110	Axis 27 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04CF			d+111			
OW04D0			d+112			
OW04D1			d+113	Axis 28 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04D2			d+114			
OW04D3			d+115			
OW04D4			d+116	Axis 29 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04D5			d+117			
OW04D6			d+118			
OW04D7			d+119	Axis 30 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04D8			d+120			
OW04D9			d+121			

Variable Address R: ■ R/W: ■	bit	Size	CPU Unit Word	Classification	Name	Specifications
OW04DA	00-15	93	d+122	Axis 31 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04DB			d+123			
OW04DC			d+124			
OW04DD			d+125	Axis 32 Status Data	Same as for Axis 1 Status Data	Same as for Axis 1 Status Data
OW04DE			d+126			
OW04DF			d+127			
OW04E0	00-15	1568	---	Reserved	Reserved	Reserved
OW0AFF						
OW0B00	00-15	160	a_A	General I/O A	General I/O A CH1-160	Sets Data to be output to general I/O A (MC Unit to CPU)
OW0B9F						
OW0BA0	00-15	160	a_B	General I/O B	General I/O B CH1-160	Same as for General I/O A
OW0C3F						
OW0C40	00-15	160	a_C	General I/O C	General I/O C CH1-160	Same as for General I/O A
OW0CDF						
OW0CE0	00-15	160	a_D	General I/O D	General I/O D CH1-160	Same as for General I/O A
OW0D7F						
OW0D80	00-15	160	a_E	General I/O E	General I/O E CH1-160	Same as for General I/O A
OW0E1F						
OW0E20	00-15	160	a_F	General I/O F	General I/O F CH1-160	Same as for General I/O A
OW0EBF						
OW0EC0	00-15	160	a_G	General I/O G	General I/O G CH1-160	Same as for General I/O A
OW0F5F						
OW0F60	00-15	160	a_H	General I/O H	General I/O H CH1-160	Same as for General I/O A
OW0FFF						

4-7 Present Position Preset

Using the IOWR instruction of the CPU unit, the present position can be preset to the desired value.

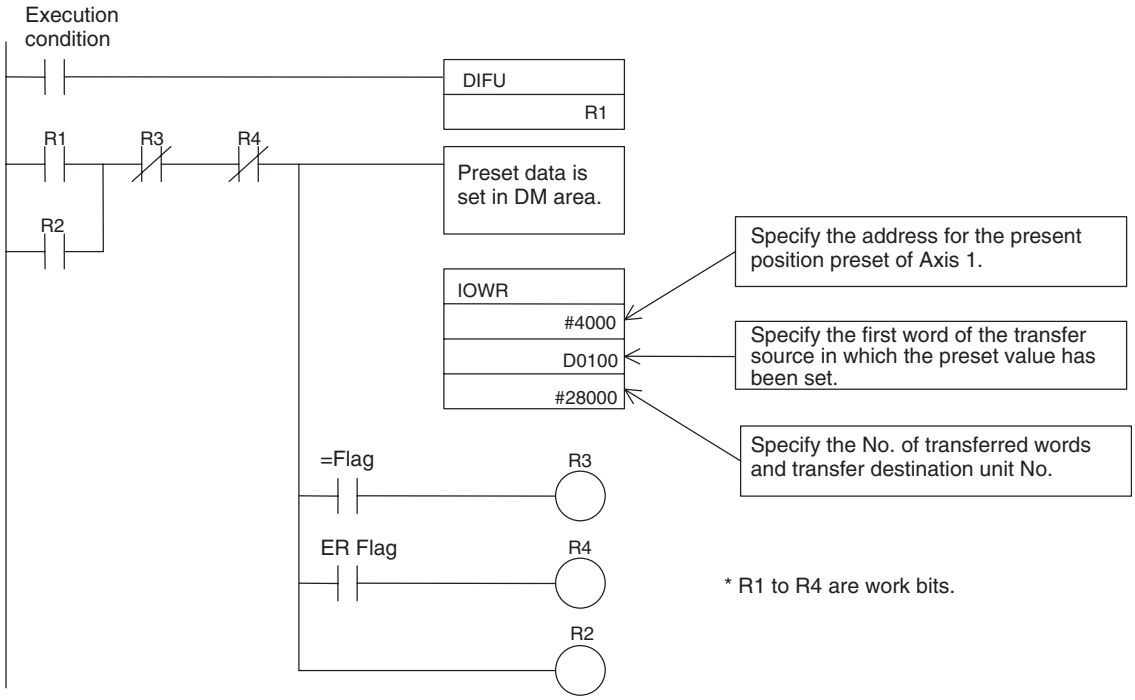
As for the IOWR instruction, refer to *5-2 IOWR Instruction to Transfer Data* (page 203).

Address of Present Position Preset

Axis No.	Address
1	4000
2	4001
:	:
31	401E
32	401F

Ladder Diagram Example

- The following shows the ladder diagram that executes the present position preset.
- MC Unit having the unit No. 0, the present position of Axis 1 is modified to the preset values in DM100 and 101.



Setting Content [DM]

D00100	86A0	← indicating 100000 [command unit]
D00101	0001	

⚠ **Caution** Executing the present position preset of a master axis during execution of synchronization with "Feedback value" specified in the master axis classification causes the MC Unit to operate the slave axis misconceiving that the master axis moved from the position before the preset to the one after the preset.

4-8 Servo Parameter

4-8-1 Servo Parameter Overview

Parameters in the servo driver can be edited using the support tool for MC Unit. It is also possible to read or write data from or to the servo driver using IORD/IOWR instructions of the CPU Unit.

These functions enable the PLC to manage the parameters of the servo driver.

Refer to the servo driver's manual for more details.

Note Servo parameters operate with the setting saved in the servo driver. Therefore, it will be required to setup parameters of a driver when the driver is replaced.

Basic Procedures for Using Support Tool (MC-Miel)

1,2,3... 1. Connect the servo driver and MC Unit together.

2. Select the axis to edit, then press the button marked "Servo driver a PC". Servo parameter data inside of the servo driver will be read. Pressing the "Parameter Initialize" button will bring the parameters in the edit window back to their default values.

3. To edit the parameters offline, read "MCH data file" stored in the personal computer.
4. If servo driver parameters are saved in the MC Unit, press the "Unit a PC" button to read the parameters from the Unit.
5. Press the "PC a Unit" button to save the edited parameters in the MC Unit and the servo driver.

Transfer Using IORD/ IOWR Instructions

Specify the address (7000 Hex - 78FF Hex) corresponding to the parameter No. (Pn000 - Pn8FF) of the serve driver. The three rightmost digits of the MC Unit address should match with the parameter No.

Parameter No.	MC Unit Address
Pn000	7000 Hex
Pn001	7001 Hex
:	:
Pn8FF	78FFHex

Note For details on IORD/IOWR instructions, refer to *5-2 IOWR Instruction to Transfer Data* (page 203) and *5-3 IORD Instruction to Transfer Data* (page 210).

4-8-2 Data Configuration and Contents of Servo Parameters

The parameters with the combination of W-series servo driver and NS115 are classified as shown below.

Classification	Shade in the list
Parameters exclusively for the linear motor	
Parameters of unused functions	
Parameters to be overwritten by the MC Unit	
Parameters that operate only with fixed values	Fixed value

<User's constant No.>

S: System reserved constant

R: Reserved constant (Do not change the setting.)

N: Disable constant (Do not change the setting because nothing will be changed.)

<Enable condition>

●: Always enabled (Called Online User Constant)

❍: Enable when DEN=1 (Do not change when DEN=0. If changed, proper operations are not guaranteed.) (Called Online User Constant)

Δ: Restoring the power/CONFIG is required. (Called Offline User Constant)

Type	User constant No.		Name		Size	Unit	Lower limit	Upper limit	Support tool initial value	En-able
	Pn000		Basic function selection switch		2	---	0000H	1FF1H	0000H	Δ
		0	Rotation direction select	0	CCW direction as forward rotation				0	Δ
				1	CW direction as forward rotation					Δ
		1	Control method	0-B	Setting has no effect. Do not set.				0	Δ
		2	Axis address	0-F	Sets an axis address for servo pack.				0	Δ
		3	Rotary/Linear startup select (Without an encoder)	0	Starts as a rotary type.				0	Δ
				1	Starts as a linear type.					

Type	User constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	En-able
	Pn001		Advanced function selection switch 1			2	---	0000H	1122H	0000H	Δ
		0	Stopping method in case of servo-OFF or servo alarm]	0	Stops the motor using the dynamic brake (DB).					0	Δ
				1	Stops the motor using the dynamic brake (DB), and then cancels the DB.						
				2	Makes the motor free-run status without using DB.						
		1	Stop method in case of Over travel (OT)	0	The same stopping method as for Pn001.0.					0	Δ
				1	Makes the motor decelerate to stop with the torque set in Pn406 as maximum torque, and the motor will be in servo-lock state.						
				2	Makes the motor decelerate to stop with the torque set in Pn406 as maximum torque, and the motor will be in free-run state.						
		2	AC/DC power supply input select	0	DC power supply input not supported: Input AC power supply to L1, L2, (or L3) terminal.					0	Δ
				1	DC power supply input supported: Input DC power supply to (+) 1-(–) terminal.						
		3	Warning code output select	0	ALO1, ALO2, and ALO3 output only alarm codes.					0	Δ
				1	ALO1, ALO2, and ALO3 output both alarm codes and warning codes. When outputting the warning codes, the ALM signal output stays ON (Normal).						
	Pn002		Advanced function selection switch 2			2	---	0000H	4113H	0000H	Δ
		0	Speed/position control option (T-REF alloca-tion)	0	Nil					0	Δ
				1	Uses T-REF as external torque limit input.						
				2	Uses T-REF as torque feed forward input.						
				3	Uses T-REF terminal as external torque limit input when P-CL and N-CL are enabled.						
		1	Torque control option (V-REF allocation)	0	Nil					0	Δ
				1	Uses V-REF as external speed limit input.						
		2	Absolute encoder usage	0	Uses an absolute encoder as an absolute encoder.					0	Δ
				1	Uses an absolute encoder as an incremental encoder.						
		3	Fully-closed PG pulse usage	0	Not Used					0	Δ
				1	Uses without phase-C.						
				2	Uses with phase-C.						
				3	Uses in reverse rotation mode without phase-C.						
				4	Use as reverse rotation mode with phase-C.						

Type	User constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
	Pn003		Advanced function selection switch 3			2	---	0000H	00FFH	0002H	●
		0	Analog monitor 1	0	Motor rotation speed Rotary: 1V/1000r/min, Linear: 1V/1000mm/s					2	●
				1	Speed command Rotary: 1V/1000r/min, Linear: 1V/1000mm/s						
				2	Torque/thrust command: 1V/100%						
				3	Position error: 0.05V/1 command unit						
				4	Position error: 0.05V/100 command unit						
				5	Command pulse frequency [r/min conversion] Rotary: 1V/1000r/min, Linear: 1V/1000mm/s						
				6	Motor rotation speed × 4 Rotary: 1V/250r/min × 10 Linear: 1V/100mm/s						
				7	Motor rotation speed × 8 Rotary: 1V/125r/min × 100 Linear: 1V/10mm/s						
				8 R	Reserved						
				9 R	Reserved						
				A R	Reserved						
				B R	Reserved						
				C R	Reserved						
				D R	Reserved						
				E R	Reserved						
				F R	Reserved						
		1	Analog monitor 2	0-F	Same as above					0	●
		2	Reserved		---					0	
		3	Reserved		---					0	
	Pn004	S	Reserved			2	---	0000H	1210H	0200H	Δ
		0	Reserved		---					0	
		1 R	Reserved constant	0						0	Δ
				1							
		2 R	Reserved constant	0						0 Automatically set to 2	Δ
				1							
		3 R	Reserved constant	0						0	Δ
				1							
	Pn005		Advanced function selection switch 5			2	---	0000H	0001H	0000H	Δ
		0	Brake control function select	0	Controls the brake by servo.					0	Δ
				1	Controls the brake by controller.						
		1	Reserved		---					0	
		2	Reserved		---					0	
		3	Reserved		---					0	
Linear	Pn080		Function select application switch			2	---	0000H	0011H	0000H	Δ
		0	Pole sensor select	0	With					0	Δ
				1	Without						
		1	Motor rotation direction select	0	Phase A advances in direction order of phases U, V, and W.					0	Δ
				1	Phase B advances in direction order of phases U, V, and W.						
		2	Reserved		---					0	
		3	Reserved		---					0	
	Pn100		Speed loop gain			2	Hz	1	2000	40	●
	Pn101		Speed loop integration time constant			2	0.01ms	15	51200	2000	●
	Pn102		Position loop gain			2	1/s	1	2000	40	●

Type	User constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
	Pn103		Inertia ratio			2	%	0	10000	0	●
	Pn104		Speed loop gain 2			2	Hz	1	2000	40	●
	Pn105		Speed loop integration time constant 2			2	0.01ms	15	51200	2000	●
	Pn106		Position loop gain 2			2	1/s	1	2000	40	●
Rotary	Pn107		Bias			2	r/min	0	10000	0	●
	Pn108		Bias additional width			2	Pulse	0	250	7	●
	Pn109		Feed forward			2	%	0	100	0	●
	Pn10A		Feed forward filter time constant			2	0.01ms	0	6400	0	●
	Pn10B		Advanced gain-related switch			2	---	---	---	0000H	●
		0	Mode switch select	0	Internal torque command is the switching condition.(Level setting: Pn10C)					0	●
				1	Speed command is the switching condition.(Level setting: Pn10D)						
				2	Acceleration is the switching condition.(Level setting: Pn10E)						
				3	Error pulse is the switching condition.(Level setting: Pn10F)						
				4	No mode switching function						
		1	Speed loop control method	0	PI control					0	●
				1	IP control						
		2	Reserved		---					0	
		3^R	Reserved	0	---					0	
				1	---						
				2	---						
	Pn10C		Mode switch (Torque command)			2	%	0	800	200	●
Rotary	Pn10D		Mode switch (Speed command)			2	r/min	0	10000	0	●
Rotary	Pn10E		Mode switch (Acceleration)			2	10r/min/s	0	3000	0	●
	Pn10F		Mode switch (Error pulse)			2	Pulse	0	10000	0	●
	Pn110		Real-time auto tuning-related switch			2	---	0000H	3212H	0010H	●
		0	Online auto tuning method	0	Tuning just at beginning of an operation.					0	●
				1	Always tuning						
				2	No auto tuning						
		1	Speed FB compensation function select	0	With					1	●
				1	Without						
		2	Viscous friction compensation function select	0	Friction compensation: Nil					0	●
				1	Friction compensation: Small						
				2	Friction compensation: Large						
		3^R	Reserved	0	---					0	●
				1	---						
				2	---						
				3	---						
	Pn111		Speed FB compensation			2	---	1	100	100	●
	Pn112	R	Reserved			2	%	0	1000	100	●
	Pn113	R	Reserved			2	0.1Hz	0	10000	1000	●
	Pn114	R	Reserved			2	---	0	400	200	●
	Pn115	R	Reserved			2	0.1ms	0	1000	32	●
	Pn116	R	Reserved			2	0.1ms	0	1000	16	●
	Pn117	R	Reserved			2	%	20	100	100	●
	Pn118	R	Reserved			2	%	50	100	100	●
	Pn119	R	Reserved			2	1/s	1	2000	60	●
	Pn11A	R	Reserved			2	0.1%	1	2000	1000	●
	Pn11B	R	Reserved			2	Hz	1	150	50	●
	Pn11C	R	Reserved			2	Hz	1	150	70	●

Type	User constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
	Pn11D	R	Reserved			2	%	0	150	100	●
	Pn11E	R	Reserved			2	%	0	150	100	●
	Pn11F		Position integration time constant			2	ms	0	2000	0	●
	Pn120	R	Reserved			2	0.01ms	0	51200	0	●
	Pn121	R	Reserved			2	Hz	1	250	50	●
	Pn122	R	Reserved			2	Hz	0	250	0	●
	Pn123	R	Reserved			2	%	0	100	0	●
Linear	Pn180		Bias			2	mm/s	0	450	0	●
Linear	Pn181		Mode switch (Speed Command)			2	mm/s	0	5000	0	●
Linear	Pn182		Mode switch (Acceleration rate)			2	mm/s^2	0	3000	0	●
	Pn200	S	Position control command mode select switch			2	---	0000H	1239H	0100H	Δ
		0^N	Command pulse mode	0-9	Disabled					0	Δ
		1^N	Clear signal mode	0-3	Disabled					0	Δ
		2^S	Clear operation	1	Does not clear the error counter.(Cleared only with the CLR signal)					0 Automatically set to 1	Δ
				Other	Do not set. (It is automatically set to 1.)						
		3^N	Filter select	0-1	Disabled					0	Δ
Rotary	Pn201	PG dividing ratio				2	---	16	16384	16384	Δ
	Pn202	Electronic gear ratio (numerator)				2	---	1	65535	1	Δ
	Pn203	Electronic gear ratio (denominator)				2	---	1	65535	1	Δ
	Pn204	Reserved				2	0.01ms	0	6400	0	●
Rotary	Pn205	Multi-turns limit setting *1				2	rev	0	65535	65535	Δ
Rotary	Pn206	No. of full-closed pulses				2	P/R	25	65535	16384	Δ
	Pn207	S	Position command function switch			2	---	0000H	0011H	0010H	Δ
		0	Reserved	0	---					0	Δ
				1	---						
		1^S	Position control option	1	Uses V-REF as the speed feed forward input.					1	Δ
				0	Do not set. (It is automatically set to 1.						
		2-3	Reserved		---					0	
	Pn208		Reserved			2	0.01ms	0	6400	0	
Linear	Pn280		Linear scale pitch			2	um	0	65535	0	Δ
Linear	Pn281		Encoder output resolution			2	Pulse/ Scale pitch (Pn280)	1	256	20	Δ
	Pn300	N	Speed command input gain			2	0.01V/ Rated speed	15	3000	600	●
Rotary	Pn301	N	Internal speed setting 1			2	r/min	0	10000	100	●
Rotary	Pn302	N	Internal speed setting 2			2	r/min	0	10000	200	●
Rotary	Pn303	N	Internal speed setting 3			2	r/min	0	10000	300	●
Rotary	Pn304		JOG speed			2	r/min	0	10000	500	●
	Pn305		Soft start acceleration time			2	ms	0	10000	0	●
	Pn306		Soft start deceleration time			2	ms	0	10000	0	●
	Pn307		Speed command filter time constant			2	0.01ms	0	65535	40	●
	Pn308		Speed FB filter time constant			2	0.01ms	0	65535	0	●
Linear	Pn380	N	Internal speed setting 1			2	mm/s	0	5000	10	●
Linear	Pn381	N	Internal speed setting 2			2	mm/s	0	5000	20	●
Linear	Pn382	N	Internal speed setting 3			2	mm/s	0	5000	30	●
Linear	Pn383		JOG speed			2	mm/s	0	5000	50	●
	Pn400	N	Torque/Thrust gain			2	0.1V/ Rated torque	10	100	30	●

Type	User constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
	Pn401		Torque/Thrust filter time constant			2	0.01ms	0	65535	100	●
Rotary	Pn402		Forward torque limit			2	%	0	800	800	●
Rotary	Pn403		Reverse torque limit			2	%	0	800	800	●
	Pn404		External input forward torque/Thrust limit			2	%	0	800	100	●
	Pn405		External input reverse torque/Thrust limit			2	%	0	800	100	●
	Pn406		Emergency stop torque/Thrust			2	%	0	800	800	●
Rotary	Pn407		Speed limit in torque control			2	r/min	0	10000	10000	●
	Pn408		Torque/Thrust control function switch			2	---	0000H	0001H	0000H	●
		0	Notch filter function select	0	Nil					0	●
				1	Uses the notch filter for torque command.						
		1	Reserved		---					0	
		2	Reserved		---					0	
		3	Reserved		---					0	
	Pn409		Notch filter frequency			2	Hz	50	2000	2000	●
Linear	Pn480		Speed limit during thrust control			2	mm/s	0	5000	5000	●
Linear	Pn481		Magnetic pole detection speed loop gain			2	Hz	1	2000	40	●
Linear	Pn482		Magnetic pole detection speed loop integral time			2	0.01ms	15	51200	3000	●
Linear	Pn483		Forward rotation thrust limit			2	%	0	800	30	●
Linear	Pn484		Reverse rotation thrust limit			2	%	0	800	30	●
	Pn500		Positioning completed width			2	Command unit (pulse for / COIN output)	0	250	7	●
Rotary	Pn501		Clamp at zero level			2	r/min	0	10000	10	●
Rotary	Pn502		Rotation detection level			2	r/min	1	10000	20	●
Rotary	Pn503		Speed conformity signal detection width			2	r/min	0	100	10	●
	Pn504		NEAR signal width			2	Command unit (pulse for / NEAR output)	1	250	7	●
	Pn505		Error counter overflow level			2	256 pulse	1	32767	1024	●
	Pn506		Brake command-Servo OFF delay time			2	10ms	0	50	0	●
Rotary	Pn507		Brake command output speed level			2	r/min	0	10000	100	●
	Pn508		Servo OFF-Brake command wait time			2	10ms	10	100	50	●
	Pn509		Temporary power interruption hold time			2	ms	20	1000	20	●

Type	User constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
Sequence related constant	Pn50A	S	Input signal select 1			2	---	0000H	FFFFH	2881H	Δ
		0^S	Input signal allocation mode	1	Custom setting					1	
				0	Do not set. (It is automatically set to 1.)						
		1^S	/S-ON signal mapping	8	Do not set. (It is automatically set to 8.)					8	
		2^S	/P-CON signal mapping	8	Do not set. (It is automatically set to 8.)					8	
		3	POT signal mapping	0	Input from SI0 (CN1-40) input terminal.					2	Δ
				1	Input from SI1 (CN1-41) input terminal.						
				2	Input from SI2 (CN1-42) input terminal.						
				3	Input from SI3 (CN1-43) input terminal.						
				4	Input from SI4 (CN1-44) input terminal.						
				5	Input from SI5 (CN1-45) input terminal.						
				6	Input from SI6 (CN1-46) input terminal.						
				7	Fixed at "enable" the signal.						
				8	Fixed at "disable" the signal.						
				9	Input reverse signal from SI0 (CN1-40) input terminal.						
				A	Input reverse signal from SI1 (CN1-41) input terminal.						
				B	Input reverse signal from SI2 (CN1-42) input terminal.						
				C	Input reverse signal from SI3 (CN1-43) input terminal.						
				D	Input reverse signal from SI4 (CN1-44) input terminal.						
				E	Input reverse signal from SI5 (CN1-45) input terminal.						
				F	Input reverse signal from SI6 (CN1-46) input terminal.						
	Pn50B	S	Input signal select 2			2	---	0000H	FFFFH	8883H	Δ
		0^S	N-OT signal mapping	0-F	Same as above.					3	Δ
		1^S	/ALM-RST signal mapping	8	Same as above. Do not set. (It is automatically set to 8.					8	
		2^S	/P-CL signal mapping	0-F	Same as above					8	Δ
		3^S	/N-CL signal mapping	0-F	Same as above					8	Δ
	Pn50C	S	Input signal select 3			2	---	0000H	FFFFH	8888H	
		0^S	/SPD-D signal mapping	8	Same as above. Do not set. (It is automatically set to 8.)					8	
		1^S	/SPD-A signal mapping	8	Same as above. Do not set. (It is automatically set to 8.)					8	
		2^S	/SPD-B signal mapping	8	Same as above. Do not set. (It is automatically set to 8.)					8	
		3^S	/C-SEL signal mapping	8	Same as above. Do not set. (It is automatically set to 8.)					8	
	Pn50D	S	Input signal select 4			2	---	0000H	FFFFH	8888H	
		0^S	/ZCLAMP) signal mapping	8	Same as above. Do not set. (It is automatically set to 8.)					8	
		1^S	/INHIBIT signal mapping	8	Same as above. Do not set. (It is automatically set to 8.)					8	
		2^S	/G-SEL signal mapping	8	Same as above. Do not set. (It is automatically set to 8.)					8	
		3^S	P-DET signal mapping	8	Same as above. Do not set. (It is automatically set to 8.)					8	

Type	User constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
Sequence related constant	Pn50E		Output signal select 1			2	---	0000H	3333H	3001H	Δ
		0	/COIN signal mapping	0	Not used					1	Δ
				1	Output from SO1 (CN-25, 26) output terminal.						
				2	Output from SO2 (CN-27, 28) output terminal.						
				3	Output from SO3 (CN-29, 30) output terminal.						
		1	/V-CMP signal mapping	0-3	Same as above.					0	Δ
		2	/TGON signal mapping	0-3	Same as above.					0	Δ
		3	/S-RDY signal mapping	0-3	Same as above.					3	Δ
	Pn50F		Output signal select 2			2	---	0000H	3333H	0200H	Δ
		0	/CLT signal mapping	0-3	Same as above.					0	Δ
		1	/VLT signal mapping	0-3	Same as above.					0	Δ
		2	/BK signal mapping	0-3	Same as above.					2	Δ
		3	/WARN signal mapping	0-3	Same as above.					0	Δ
	Pn510		Output signal select 3			2	---	0000H	0033H	0000H	Δ
		0	/NEAR signal mapping	0-3	Same as above.					0	Δ
		1	/C-PHASE signal mapping	0-3	Same as above.					0	Δ
		2	Reserved	0	---					0	
		3	Reserved	0	---					0	

Type	User constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
Sequence related constant	Pn511		Output signal select 5			2	---	0000H	FFFFH	6541H	Δ
		0	/DEC signal mapping	0	Input from SI0 (CN1-40) input terminal.					1	Δ
				1	Input from SI1 (CN1-41) input terminal.						
				2	Input from SI2 (CN1-42) input terminal.						
				3	Input from SI3 (CN1-43) input terminal.						
				4	Input from SI4 (CN1-44) input terminal.						
				5	Input from SI5 (CN1-45) input terminal.						
				6	Input from SI6 (CN1-46) input terminal.						
				7	Fixed at "enable" the signal.						
				8	Fixed at "disable" the signal.						
				9	Input reverse signal from SI0 (CN1-40) input terminal.						
				A	Input reverse signal from SI1 (CN1-41) input terminal.						
				B	Input reverse signal from SI2 (CN1-42) input terminal.						
				C	Input reverse signal from SI3 (CN1-43) input terminal.						
				D	Input reverse signal from SI4 (CN1-44) input terminal.						
				E	Input reverse signal from SI5 (CN1-45) input terminal.						
				F	Input reverse signal from SI6 (CN1-46) input terminal.						
		1	/EXT1 signal mapping	4	Input from SI4 (CN1-44) input terminal.					4	Δ
				5	Input from SI5 (CN1-45) input terminal.						
				6	Input from SI6 (CN1-46) input terminal.						
				7	Fix the signal 'enable'.						
				8	Fix the signal 'disable'.						
				D	Input reverse signal from SI4 (CN1-44) input terminal.						
				E	Input reverse signal from SI5 (CN1-45) input terminal.						
				F	Input reverse signal from SI6 (CN1-46) input terminal.						
				0-3 9-F	Fixed at "disable" the signal.						
		2	/EXT2 signal mapping	0-F	Same as above.					5	Δ
		3	/EXT3 signal mapping	0-F	Same as above.					6	Δ
	Pn512		Output signal reverse			2	---	0000H	0111H	0000H	Δ
		0	Output signal reverse for SO1 (CN1-25, 26)	0	Not reversed					0	Δ
				1	Reversed						
		1	Output signal reverse for SO1 (CN1-27, 28)	0,1	Same as above.					0	Δ
		2	Output signal reverse for SO1 (CN1-29, 30)	0,1	Same as above.					0	Δ
		3	Reserved	0	---					0	Δ
Rotary	Pn51A		Motor-load deviation level between positions			2	Pulse	1	32767	10	●
	Pn51E		Deviation counter overflow warning detection level			2	%	0	100	100	●
Linear	Pn580		Clamp level at zero.			2	mm/s	0	5000	10	●
Linear	Pn581		Rotation detection level			2	mm/s	1	5000	20	●
Linear	Pn582		Speed conformity signal detection width			2	mm/s	0	100	10	●
Linear	Pn583		Brake command output speed level			2	mm/s	0	5000	100	●

Type	User constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
	Pn600		Regenerative resistor capacity (set the capacity when connecting an external regenerative resistor)			2	10W	0	1000	0	●
	Pn601	R	Reserved constant			2	---	0	1000	0	●
Communications	Pn800		Communication control			2	---	0000H	0F73H	0000H	●
		0	MECHATROLINK-II communications check mask (For debugging)	0	Normal					0	●
				1	Communication error (A.E6) ignored.						
				2	WDT error (A.E5) ignored						
				3	Communication error (A.E6) and WDT error (A.E5) both ignored.						
		1	Warning check mask (For debugging)	0	Normal					0	●
				1	Data setting warning (A.94) ignored						
				2	Command warning (A.95) ignored.						
				3	A.94 and A.95 ignored.						
				4	Communication error (A.96) ignored.						
				5	A.94 and A.96 ignored.						
				6	A.95 and A.96 ignored.						
				7	A.94, A95, and A96 ignored.						
		2	Communication error count when single transfer	0-F	Detect the communication error (A.E6) twice in a row plus the setting value.					0	●
		3	Reserved	0	---					0	
Sequence relations	Pn801		Advanced function select 6 (Soft LS)			2	---	0000H	0113H	0003H	●
		0	Software limit function	0	Software limit enabled					3	●
				1	Forward software limit disabled						
				2	Reverse software limit disabled						
				3	Both Forward/reverse software limits disabled						
		1	Reserved	0	---					0	●
		2	Software limit checked by commands.	0	No software limit check by commands.					0	●
				1	Software limit check by a command is conducted.						
		3	Reserved	0	---					0	
	Pn802		Reserved constant			2	---	0000H	0000H	0000H	Δ
		0	Reserved	0	---					0	Δ
		1	Reserved	0	---					0	Δ
		2	Reserved	0	---					0	
		3	Reserved	0	---					0	
	Pn803		Origin position range			2	Command unit	0	250	10	●
Position relations	Pn804 Pn805		Positive software limit value			4	Command unit	$-2^{30}+1$	$2^{30}-1$	8192*99999	●
	Pn806 Pn807		Negative software limit value			4	Command unit	$-2^{30}+1$	$2^{30}-1$	−8192*99999	●
	Pn808 Pn809		ABS PG origin position Offset *5			4	Command unit	$-2^{30}+1$	$2^{30}-1$	0	●

Type	User constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
Acceleration/ deceleration	Pn80A		First-stop linear acceleration constant.			2	10000 Command unit /s^2	1	65535	100	❍
	Pn80B		Second-stop linear acceleration constant.			2	10000 Command unit /s^2	1	65535	100	❍
	Pn80C		Acceleration rate switching speed			2	100 Command unit /s^2	0	65535	0	❍
	Pn80D		First-stop linear deceleration constant.			2	10000 Command unit /s^2	1	65535	100	❍
	Pn80E		Second-stop linear deceleration constant.			2	10000 Command unit /s^2	1	65535	100	❍
	Pn80F		Deceleration rate switching speed.			2	100 Command unit /s^2	0	65535	0	❍
Acceleration/ deceleration filter	Pn810		Exponential acceleration / deceleration bias.			2	Command unit /s^2	0	32767	0	❍
	Pn811		Exponential acceleration / deceleration time constant			2	0.1ms	0	5100	0	❍
	Pn812		Moving average time			2	0.1ms	0	5100	0	❍
Monitor	Pn813		Option monitor			2	---	0000H	0099H	0032H	●
		0	Option monitor 1 select	0	Follows the analog monitor 1 (Pn003.0)					2	●
				1	Follows the analog monitor 1 (Pn003.1)						
				2	Initial multi-turns data (IMTDATA)						
				3	Encoder count direct value (PGCNT: after multiplication by 4)						
				4	Motor PG initial multi-turns data direct value.						
				5	Motor PG counter direct value.						
				6	Motor PG count latch direct value.						
				7	Reserved						
				8	Full-closed PG counter direct value.						
				9	Full-closed PG counter latch direct value.						
		1	Option monitor 2 select	0-9	Same as above.					3	●
		2	Reserved	0	---					0	
		3	Reserved	0	---					0	

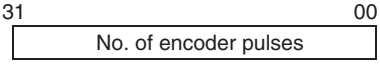
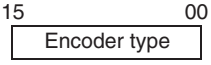
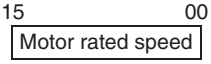
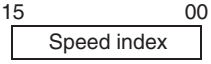
Type	User constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
Command supplement	Pn814 Pn815		Final travel distance for external positioning			4	Command unit	$-2^{30}+1$	$2^{30}-1$	100	❍
	Pn816		Origin return mode setting			2	---	0000H	0001H	0000H	❍
		0	Origin return direction	0	Forward rotation direction					0	❍
				1	Reverse rotation direction						
		1	Reserved	0	---					0	
		2	Reserved	0	---					0	
		3	Reserved	0	---					0	
	Pn817		Origin return approach speed 1			2	100 Command unit/s	0	65535	50	❍
	Pn818		Origin return approach speed 2			2	100 Command unit/s	0	65535	5	❍
	Pn819 Pn81A		Origin return final travel distance			4	Command unit	$-2^{30}+1$	$2^{30}-1$	100	❍
	Pn81B		Backlash compensation amount			2	0.1 Command unit	−32768	32767	0000H	●
	Pn81C		Reserved			2	---			0000H	
	Pn81D		Compensation function select			2	---	0000H	0001H	0000H	Δ
	Pn81E		Input signal monitor select			2	---	0000H	7777H	0000H	●
		0	IO12 mapping	0	No allocations					0	●
				1	Monitors SI0 (CN1-40) input terminal.						
				2	Monitors SI1 (CN1-41) input terminal.						
				3	Monitors SI2 (CN1-42) input terminal.						
				4	Monitors SI3 (CN1-43) input terminal.						
				5	Monitors SI4 (CN1-44) input terminal.						
				6	Monitors SI5 (CN1-45) input terminal.						
				7	Monitors SI6 (CN1-46) input terminal.						
		1	IO13 mapping	0-7	Same as above.					0	●
		2	IO14 mapping	0-7	Same as above.					0	●
		3	IO15 mapping	0-7	Same as above.					0	●
	Pn81F		Reserved			2	---			0000H	
	Pn820 Pn821		Forward latch possible range			4	Command unit	-2^{31}	$2^{31}-1$	00000000H	●
	Pn822 Pn823		Reverse latch possible range			4	Command unit	-2^{31}	$2^{31}-1$	00000000H	●

4-8-3 Motor Parameters

The values for the following parameters are automatically set when the motor model is selected on the support tool. Some of the parameters need to be adjusted in the following cases.

- When using an absolute encoder as an incremental encoder (related parameter: 9003h)
- When using the axis as an infinite length axis in the system with an absolute encoder (related parameter: 900Ch)

In the initial value column, the upper value is in hexadecimal and the lower value in parenthesis is in decimal.

No.	Name	Configuration and explanation	Type	Initial value	Unit	Immediate updating
9001	No. of encoder pulses	 • Sets the No. of encoder pulses for 1 motor rotation. (Ex) With 13-bit encoder: 8192 pulses = 2000 Hex With 16-bit encoder: 65536 pulses = 10000 Hex **Note** Selecting the motor model automatically sets this parameter.	Bit	00000000 (0)	---	No
9002	Encoder type	 • Sets the encoder type. 0000 Hex: Incremental encoder 0100 Hex: Absolute encoder **Note** Selecting the motor model automatically sets this parameter. **Note** Entering numerical value cannot change this parameter.	Bit	0000 (0)	---	No
9003	Absolute encoder usage	 • Sets the usage of an absolute encoder. 0000 Hex: Use it as an absolute encoder 0001 Hex: Use it as an incremental encoder Supplementary: When using an absolute encoder as an incremental encoder, the present position does not show 0 at switching ON the MC Unit. This is a normal condition because the MC Unit is counting the initial incremental pulses of the absolute encoder.	Bit	0000 (0)	---	No
9004	Rated rotation speed	 • Sets the motor rated speed. **Note** Selecting the motor model automatically sets this parameter. **Note** Entering numerical value cannot change this parameter.	Data	0000 (0)	100r/min	No
9005	Rated speed index	 • Sets the unit system for the rated speed. **Note** Make sure to set this parameter to 0000 Hex.	Data	0000 (0)	---	No

No.	Name	Configuration and explanation	Type	Initial value	Unit	Immediate updating
9006	Max. rapid speed	15 00 Max. speed • Sets the max. speed of the motor. **Note** Selecting the motor model automatically sets this parameter. **Note** Entering numerical value cannot change this parameter.	Data	0000 (0)	100r/min	No
9007	Max. rapid speed index	15 00 Max. speed unit • Sets the unit system for the max. speed. **Note** Make sure to set this parameter to 0000 Hex.	Data	0000 (0)	---	No
9008	Rated torque (reserved)	31 00 Rated torque • Sets the rated torque of the motor. **Note** Selecting the motor model automatically sets this parameter. **Note** Entering numerical value cannot change this parameter.	Data	00000000 (0)	0.0001N·m	--
9009	Max. torque (reserved)	31 00 Max. torque • Sets the max. torque of the motor. **Note** Selecting the motor model automatically sets this parameter. **Note** Entering numerical value cannot change this parameter.	Data	00000000 (0)	0.0001N·m	--
900A	Latch range (+) No.	15 00 + Latch range • This is the address of + Latch range. **Note** Selecting the motor model automatically sets this parameter. **Note** Entering numerical value cannot change this parameter.	Data	0000 (0)	---	No
900B	Latch range (–) No.	15 00 – Latch range • This is the address of – Latch range. **Note** Selecting the motor model automatically sets this parameter. **Note** Entering numerical value cannot change this parameter.	Data	0000 (0)	---	No

No.	Name	Configuration and explanation	Type	Initial value	Unit	Immediate updating
900C	Multi-turn limit	15 00 Multi-turn • Sets the No. of multi-turns of an absolute encoder. When using an axis as an infinite length axis, make sure to set the same value set in Pn205 of the servo driver. • Setting range 0 to FFFF Hex (0 to 65535)	Data	FFFF (65535)	---	No
900D	Position loop gain address	15 00 Position loop gain address • This is the address of the position loop gain. **Note** Selecting the motor model automatically sets this parameter. **Note** Entering numerical value cannot change this parameter.	Data	0000 (0)	---	No
900E	Position loop gain index	15 00 Position loop gain index • Sets the unit system for the position loop gain. **Note** Selecting the motor model automatically sets this parameter. **Note** Entering numerical value cannot change this parameter.	Data	0000 (0)	---	No

4-8-4 Setting Method Using Combination of W-Series and NS115

This section explains the servo driver's parameter setting method with combination of W-series servo driver and NS115.

The following user constants are expressed as restricted constant, determined constant, expansion constant, and disabled constant.

Determined constant: To be reset to the settings in the following table if the value is outside of the setting value when the power is turned ON.

Approximately three seconds will be added during the re-setting.

Expansion constant: This is the parameter to expand a function when installing the NS115.

Disabled constant: Neither alarm nor warning occurs even when changed.

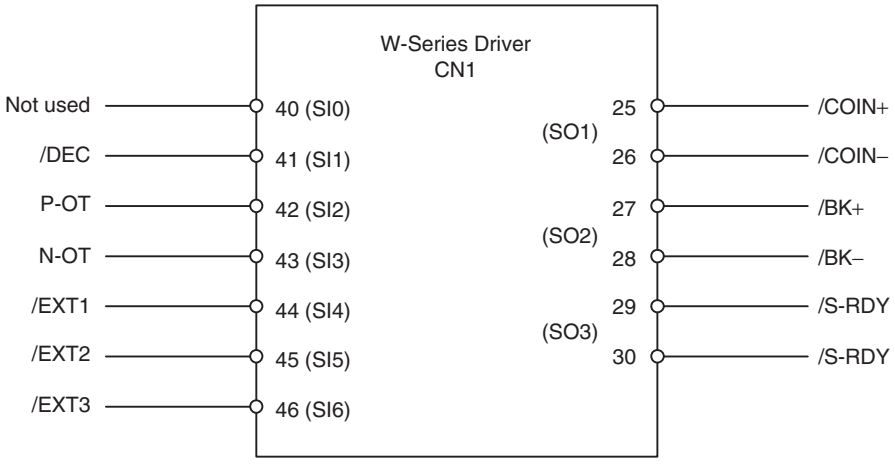
User constant No.	Name	Content	Setting	Remark
Pn004.1	Electronic gear conversion of the feedback count in position control	No conversion	0	Determined constant
Pn004.2	Control mode switch	Execute	1	Determined constant
Pn004.3	Access cycle S-shape filter	Disable	0	Determined constant
Pn200.2	Clear operation	Clears only with CLR command.	1	Determined constant
Pn207.1	Position control option	Speed feed forward on V-REF	1	Determined constant
Pn50A.0	Input allocation	Input signal custom setting	1	Determined constant
Pn50A.1	/SVON	Disable	8	Determined constant
Pn50B.1	/ALMRST	Disable	8	Determined constant
Pn50C	/SPD-D, -A, -B, /C-SEL	Disable	8888	Determined constant

User constant No.	Name	Content	Setting	Remark
Pn50D	/ZCLAMP, /INH, /G-SEL, /P-DET	Disable	8888	Determined constant
Pn002.3	Full-closed encoder usage			Expansion constant
Pn005	Advanced function select switch 5			Expansion constant
Pn206	No. of Full-closed encoder pulses			Expansion constant
Pn511	Input signal select 5			Expansion constant
Pn200.0	Command pulse mode		0	Disabled constant
Pn200.1	Clear signal mode		0	Disabled constant
Pn200.3	Filter select		0	Disabled constant
Pn300	Speed command input gain			Disabled constant
Pn301,2,3	Internal setting speed 1, 2, 3			Disabled constant
Pn400	Torque command input gain			Disabled constant

I/O Signal (W-series CN1) Setting

The standard setting of I/O signals (CN1) when the NS115 is mounted is described below.

Make sure that it has been changed to the standard setting prior to use.



User's constant No.	Content	W-series default setting	Default setting with NS115 mounted	Support tool initial value
Pn50A	Input signal select 1	8100H	8881H	2881H
Pn50B	Input signal select 2	6548H	6588H	8883H
Pn511	Input signal select 5	8888H	8888H	6541H
Pn50E	Output signal select 1	3211H	3211H	3001H
Pn50F	Output signal select 2	0000H	0000H	0200H
Pn510	Output signal select 3	0000H	0000H	0000H

Expanded Function

The following functions will become available by mounting NS115.

1,2,3...

1. Full-closed control
2. Input signal select

Full-closed Control

The full-closed control setting can be performed using the following user constants.

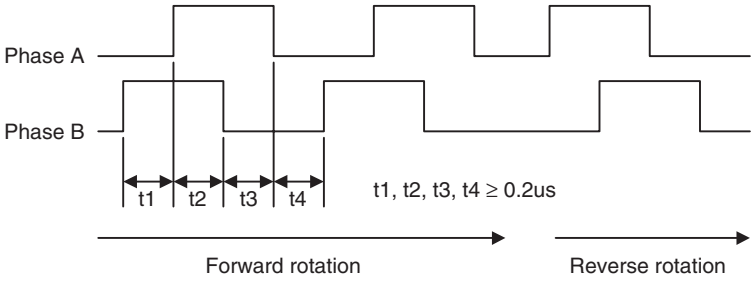
Type	User's constant No.		Name			Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
Function select constant	Pn002		Advanced function select switch 2			2	---	0000H	4112H	0000H	Δ
		3	Full-closed encoder usage	0	Not used					0	Δ
				1	Used without phase-C						
				2	Used with phase-C						
				3	Used in reverse rotation mode without phase-C						
				4	Used in reverse rotation mode with phase-C						
Position relations	Pn206		No. of full-closed encoder pulses			2	P/R (×1)	512	65535	16384	Δ

Related user's constant

Pn202	Electronic gear (numerator)
Pn203	Electronic gear (denominator)

<Full-closed System Specifications>

- Full-closed encoder pulse mode
  5V differential line driver output (EIA Standard RS-422A compliance)
- Full-closed encoder pulse signal mode
  Two pulses with phase difference of 90 degree: Phase-A, Phase-B
  Latch pulse (origin pulse): Phase-C (can be used)
  Maximum receivable frequency: 1Mbps (per one phase)



<No. of Full-closed Encoder Pulses Setting>

- Set the No. of full-closed encoder pulses per one motor rotation with the value (x1 multiplication).
- If an integer cannot be obtained, set the closest integer.
- There will be deviations in the speed monitors of position loop gain, feed forward, and command pulse, but no position deviation should result.

<Position Management>

- The full-closed control does not support an absolute position encoder, but an incremental encoder.
- If the encoder that is attached on the motor is an absolute encoder, the usage is the same as for an incremental encoder.

Setting for Reverse Rotations

Motor rotation direction seen from the load side during forward rotation command	Phase relations of the full-closed PG input during forward rotation	Pn000.0 setting	Pn002.3 setting	Full-closed PG input phase relations during CCW direction rotation seen from the load side
CCW direction	Diagram 8.3	0	1,2	Diagram 8.3
	Diagram 8.4		3,4	Diagram 8.4
CW direction	Diagram 8.3	1	1,2	Diagram 8.4
	Diagram 8.4		3,4	Diagram 8.3

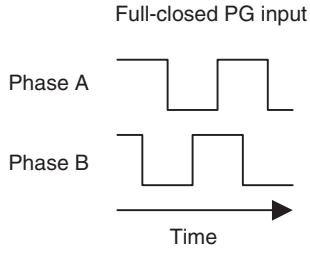


Diagram 8.3

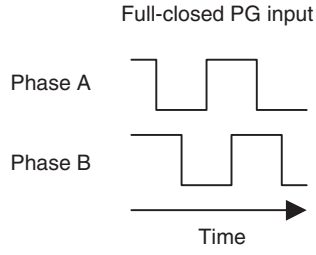
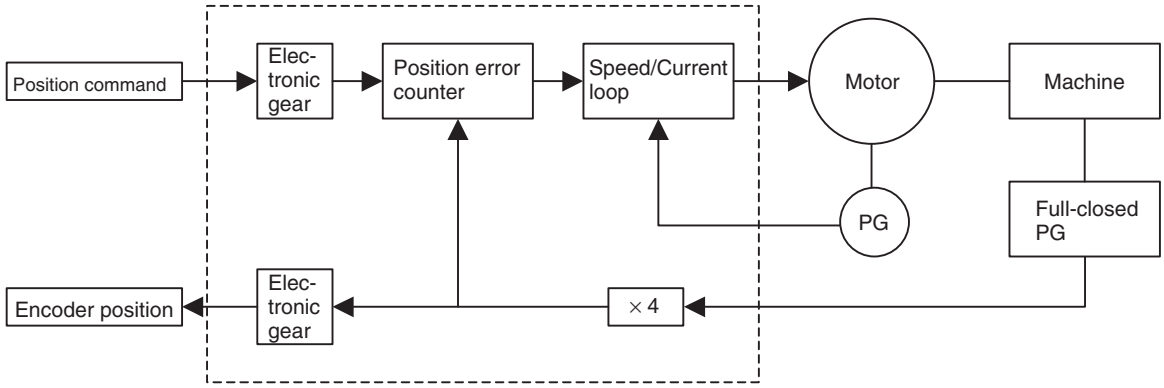


Diagram 8.4

Electronic gear



Input Signal Select 5

Through the following user constants setting, it is possible to allocate the signals in the table below to the CN1 input signals.

Type	User's constant No.		Name		Size	Unit	Lower limit	Upper limit	Support tool initial value	Enable
	Pn511		Input signal select 5		2	---	0000H	FFFFH	6541H	Δ
		0	/DEC signal mapping	0	Input from SI0 (CN1-40) input terminal				1	Δ
				1	Input from SI1 (CN1-41) input terminal					
				2	Input from SI2 (CN1-42) input terminal					
				3	Input from SI3 (CN1-43) input terminal					
				4	Input from SI4 (CN1-44) input terminal					
				5	Input from SI5 (CN1-45) input terminal					
				6	Input from SI6 (CN1-46) input terminal					
				7	Fixed at "enabled" the signal.					
				8	Fixed at "disabled" the signal.					
				9	Input reverse signal from SI0 (CN1-40) input terminal.					
				A	Input reverse signal from SI1 (CN1-41) input terminal.					
				B	Input reverse signal from SI2 (CN1-42) input terminal.					
				C	Input reverse signal from SI3 (CN1-43) input terminal.					
				D	Input reverse signal from SI4 (CN1-44) input terminal.					
				E	Input reverse signal from SI5 (CN1-45) input terminal.					
				F	Input reverse signal from SI6 (CN1-46) input terminal.					
		1	/EXT1 signal mapping	4	Input from SI4 (CN1-44) input terminal.				4	Δ
				5	Input from SI5 (CN1-45) input terminal.					
				6	Input from SI6 (CN1-46) input terminal.					
				7	Fixed at "enabled" the signal.					
				8	Fixed at "disabled" the signal.					
				D	Input reverse signal from SI4 (CN1-44) input terminal					
				E	Input reverse signal from SI5 (CN1-45) input terminal.					
				F	Input reverse signal from SI6 (CN1-46) input terminal.					
				0-3 9-C	Fixed at "disabled" the signal.					
		2	/EXT2 signal mapping	0-F	Same as above.				5	Δ
		3	/EXT3 signal mapping	0-F	Same as above.				6	Δ

4-9 CAM Data

CAM data indicates the entire CAM tables used in the commands CAM (Electronic Cam, Single axis) and CAMBOX (Electronic Cam, Synchronous). The CAM tables are used either separately or all at once from a motion program.

Cam Data Configuration

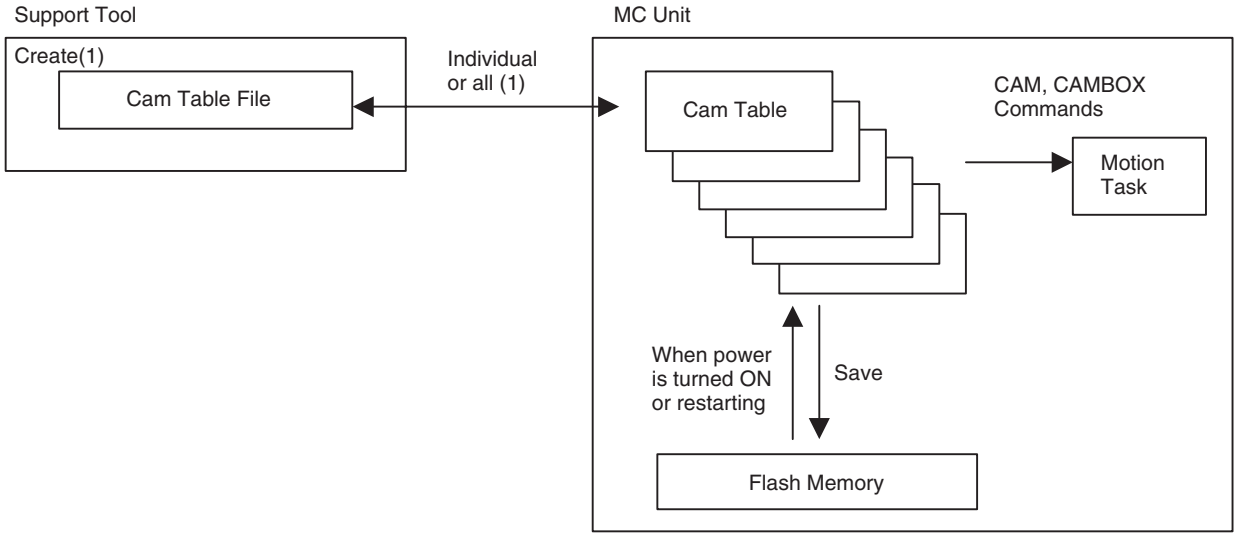
The tables below describe the data configuration of CAM data.

Item	Data
Total capacity	128k byte
No. of Cam tables	1-32
Maximum No. of data sets per CAM table	16000 sets

Data	Size	Range	Length
Cam table No.	2 byte	1-32	Fixed length
No. of data sets	2 byte	1-16,000	
Title	64 byte	ASCII	
Password	8 byte	ASCII	
CAM data size	4 byte	12-128,004 (Byte size below decimal point)	
Decimal point position	2 byte	0-65535	
Reserved	2 byte	---	
Phase	4 byte (integer	–2147483648-+2147483647	Flexible length
Displacement	4 byte (integer)	–2147483648-+2147483647	
:		:	
Phase	4 byte (integer)	–2147483648-+2147483647	
Displacement	4 byte (integer)	–2147483648-+2147483647	

Methods to Create/Write/Read

No.	Method	Range
1	Create/load/save from MC Unit support tool	Individual, All



SECTION 5
Data Transfer and Storage

This section describes how to transfer data between the CPU Unit and the CS1W-MCH71 Motion Control Unit and how data is stored.

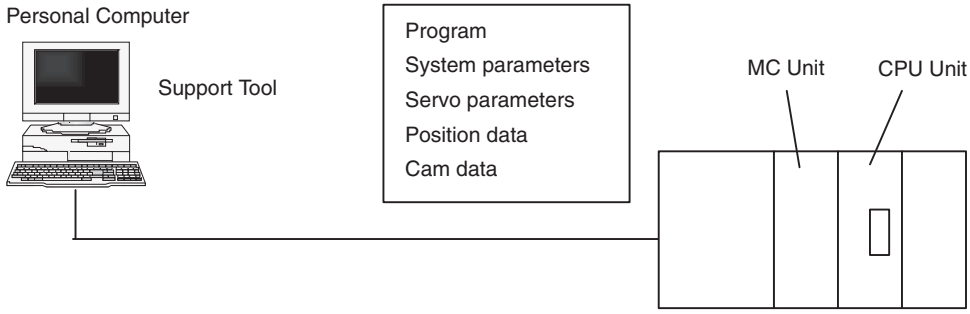
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5-1 Data Transfer and Storage

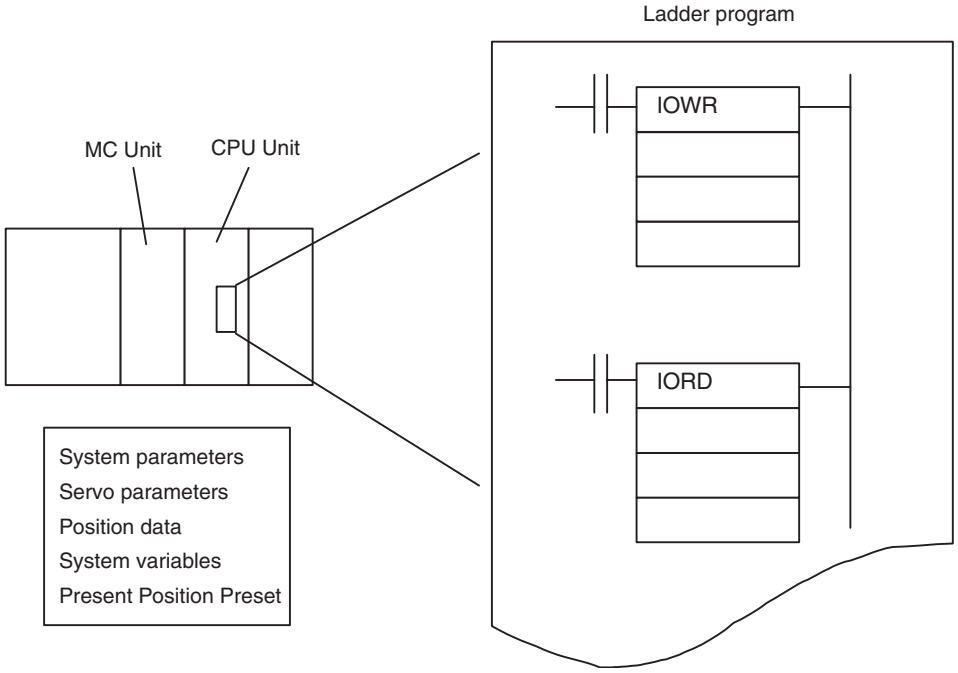
5-1-1 Data Transfer Overview

The following methods are available for transferring data between CPU and MC Units.

1,2,3... 1. Download or upload data from Support tool
Programs, system parameters, servo parameters, position data, Cam data created with Support tool, can be downloaded to or uploaded from the MC Unit.
The system parameters, servo parameters, and position data in the MC Unit can be uploaded to MC-Miel. Servo parameters can be transferred to the memory in the servo driver.



2. Read and write data in the MC Unit directly using IOWR/IORD instructions in the ladder program
The IOWR/IORD instructions can be used to read or write data while the CPU Unit is running.



Note Make sure that parameters and data are appropriate to operate.

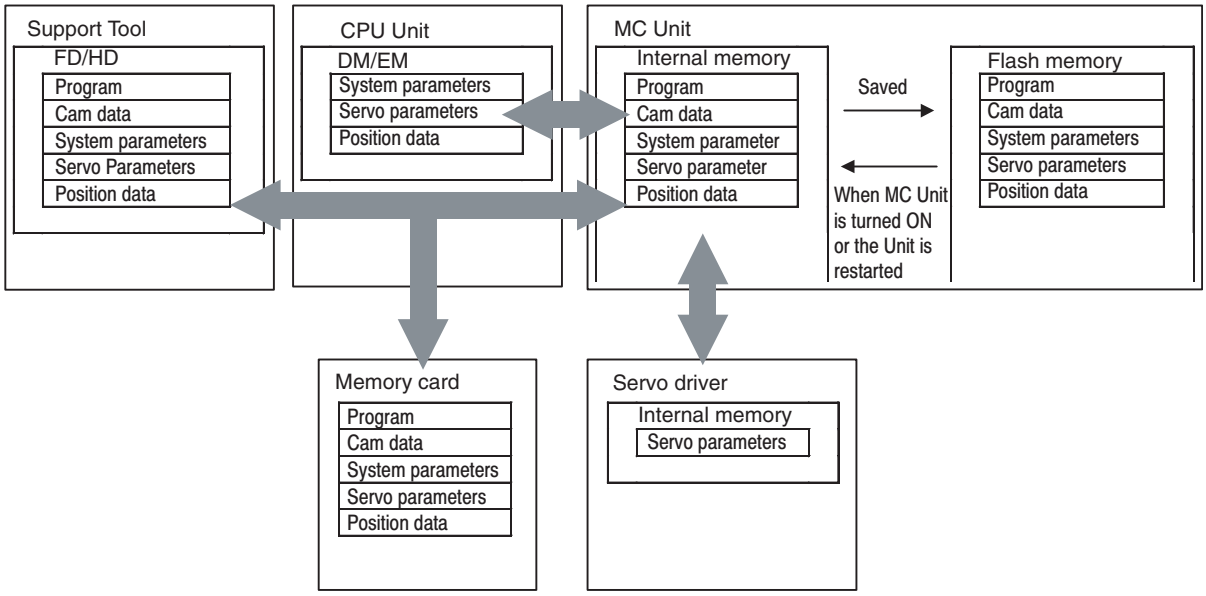
5-1-2 Data Storage Overview

Transferred data and parameters are written to the internal memory of the MC Unit where they will be used for operation, but they will be lost if the MC Unit is turned OFF or the MC Unit is restarted from the CPU Unit. The data must be saved in the flash memory using the bit area to keep the data in the MC Unit.

Refer to *5-4 Saving Data* (page 216) for more details on storing data in flash memory.

Once data has been saved, it is stored in the flash memory of the MC Unit. The data will be available from the next time the MC Unit is turned ON or the MC Unit is restarted.

These data simply transferred without being saved will be lost when the MC Unit is turned OFF or the Unit is restarted.



Note

(1) Data that has been saved in the flash memory will be automatically read to the internal memory when the MC Unit is turned ON or the Unit is restarted.

(2) Do not turn OFF the MC Unit or restart the Unit while data is being saved. Doing so may damage the flash memory in the MC Unit. It may take up to 30 seconds to save data.

(3) Data cannot be saved while data is being transferred or the Unit is busy.

(4) Flash memory has a limited service life. Data can be written up to 100,000 times.

5-1-3 Types of Data for Transfer and Storage

The following types of data can be transferred using MC-Miel, or directly by executing IOWR/IORD instructions.

Refer to *SECTION 4 MC Unit Internal Data Configuration and Setting* (page 50) for details on the data and addresses.

Yes: Possible No: Not possible Save: Saved in Flash Memory

Data	Content	Data configuration	Read/Write/Save					
			Support Tool (See note 1.)			IOWR/IORD		
			Read	Write	Save	Read	Write	Save
Programs	Programs for MC Unit	-	Yes	Yes	Yes	No	No	No
Cam data	Data for Electronic Cam	-	Yes	Yes	Yes	No	No	No
Variables								
Position data	Data indicating positions	2 words/ position	Yes	Yes	Yes	Yes	Yes	See note 2.
System variable	Status for MC Unit	2 words/ position	No	No	No	Yes	No	No
Global general variable	These variables can be accessed from all tasks	-	No	No	No	No	No	No
Input variable	Input status from CPU Unit, MECHATROLINK-II devices	-	No	No	No	No	No	No
Output variable	Output from programs to CPU Unit or MECHATROLINK-II devices	-	See*3	No	No	No	No	No
Task variable	These variables can be used only in each task	-	No	No	No	No	No	No
Present position preset	Sets present position preset value for each axis	2 words/ position	No	No	No	No	Yes	No
System parameters								
Unit	System parameters are: Unit parameters, Task parameters, Axis-parameters, Number of axes to use, number of tasks, feed rate, operation range, and etc. data for the system is stored.	2 words/ position	Yes	Yes	Yes	Yes	Yes	See note 2.
Motion task								
Axis: allocations								
Axis: speed								
Axis: position								
Axis: origin								
Axis: machine								
Reserved								
Axis specification for servo parameter (See note 4.)	Specify axis to be accessed	2 words/ position	No	No	No	Yes	Yes	No
Servo parameter	Parameters for servo driver	2 words/ position	Yes	Yes	Yes	Yes	Yes	See note 2.

Note

(1) From MC-Miel, all the data are read or written at the same time. The data cannot be read or written partially.

(2) Turn ON either the bit “Parameter Save” or “Position Data Save” in PC Interface Area to save in Flash Memory.

(3) Alarm codes can be read.

(4) To read/write servo parameters, specify the axis in advance.

(5) Parameters changed with MC Unit programs cannot be saved.

5-1-4 Transfer and Storage of Servo Parameters

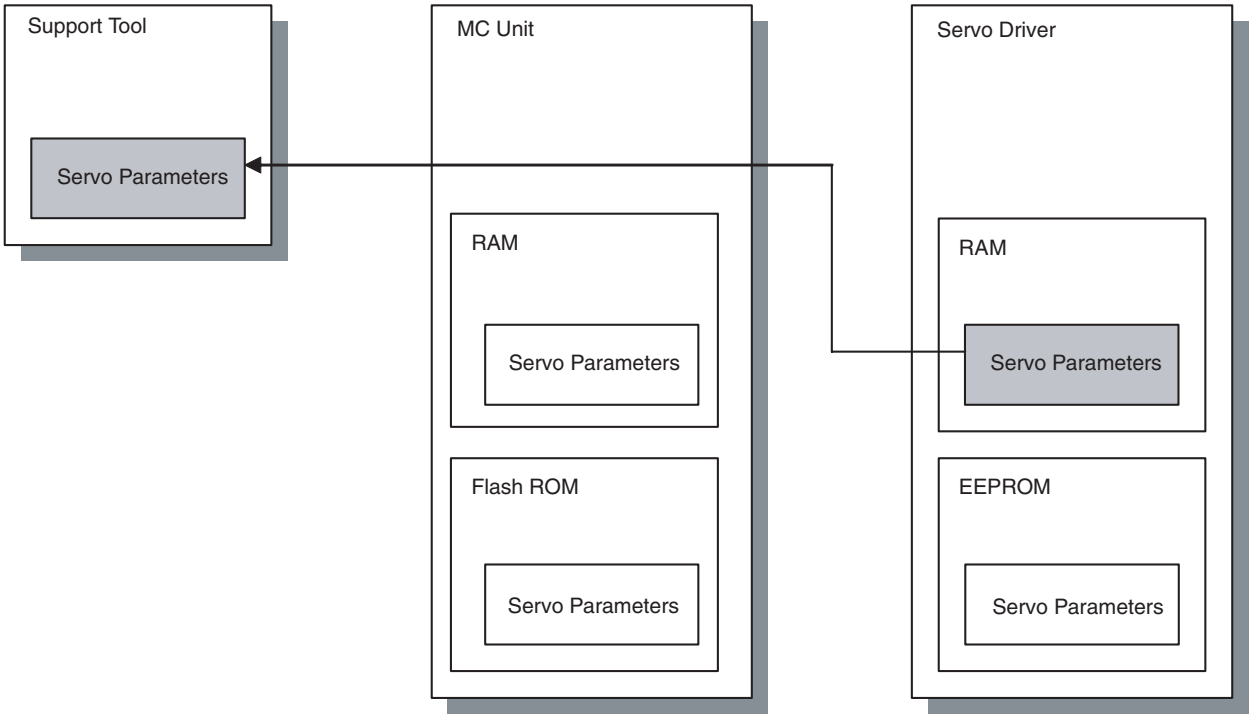
The following table shows the methods for transferring and saving servo parameters.

No.	Trigger	Operation	Object
1	Support tool	Read	RAM of the servo driver
2			RAM of the MC Unit
3	IORD instruction of the CPU Unit		RAM of the servo driver
4	Support tool	Write	RAMs of the servo driver and the MC Unit
5	IOWR instruction of the CPU Unit		RAMs of the servo driver and the MC Unit
6	PARAM instruction of the MC Unit		RAM of the servo driver
7	Support tool	Save	EEPROM of the servo driver and Flash ROM of the MC Unit
8	The “Parameter Save” bit		EEPROM of the servo driver and Flash ROM of the MC Unit

Overview of Operation and Data

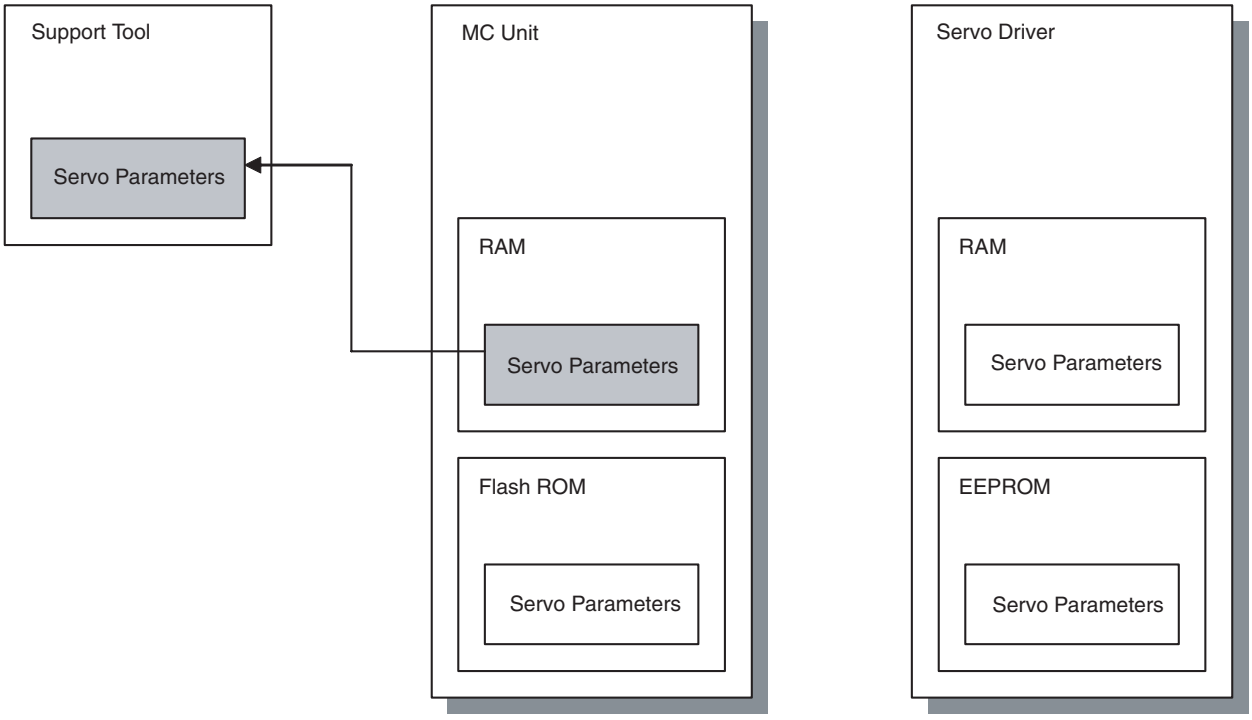
1,2,3... 1. Reading from Servo Driver Using Support Tool

Servo parameters are read from the servo driver. The servo parameters in the MC Unit will not be affected.



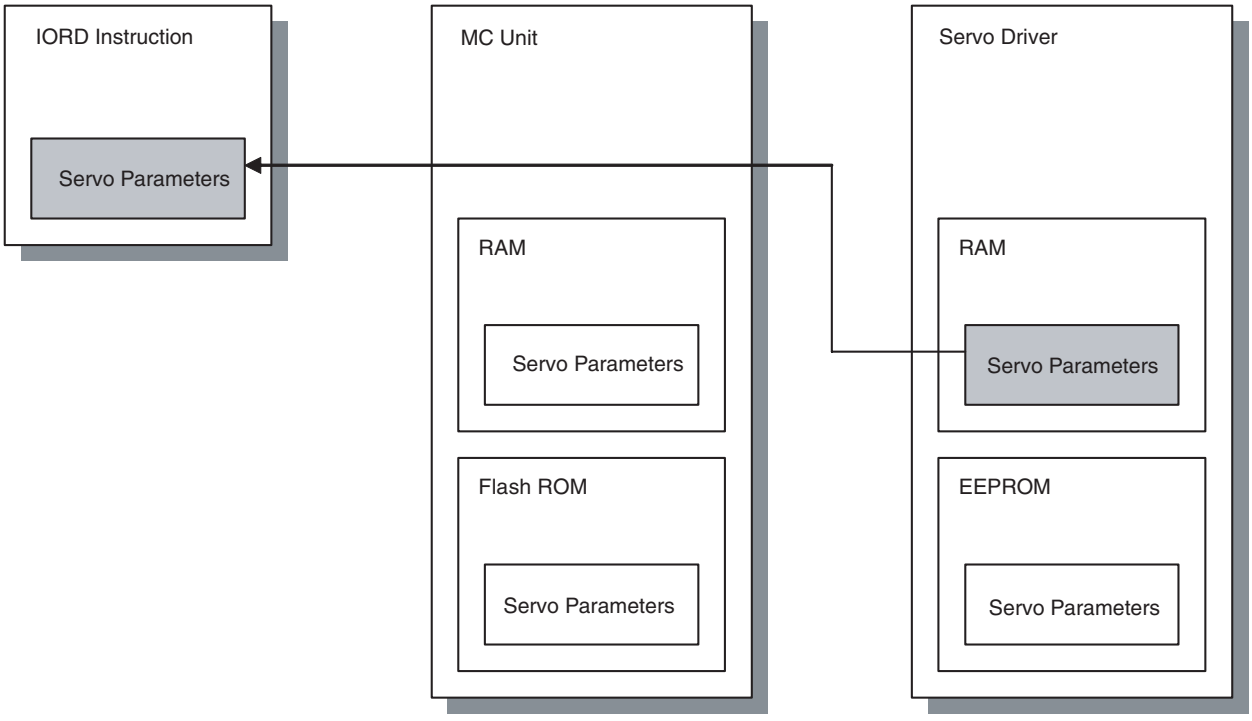
2. Reading from MC Unit Using FINS Commands

   The servo parameters are read from the RAM of the MC Unit.

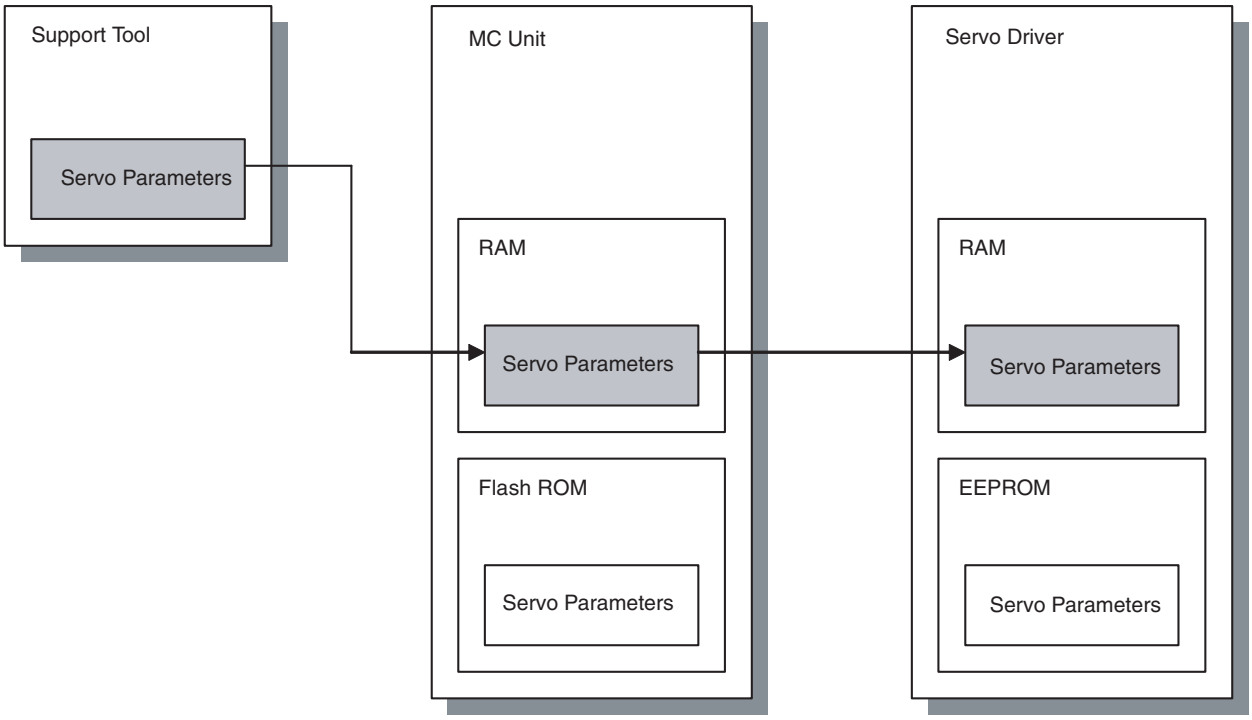


3. Reading by IORD Instruction

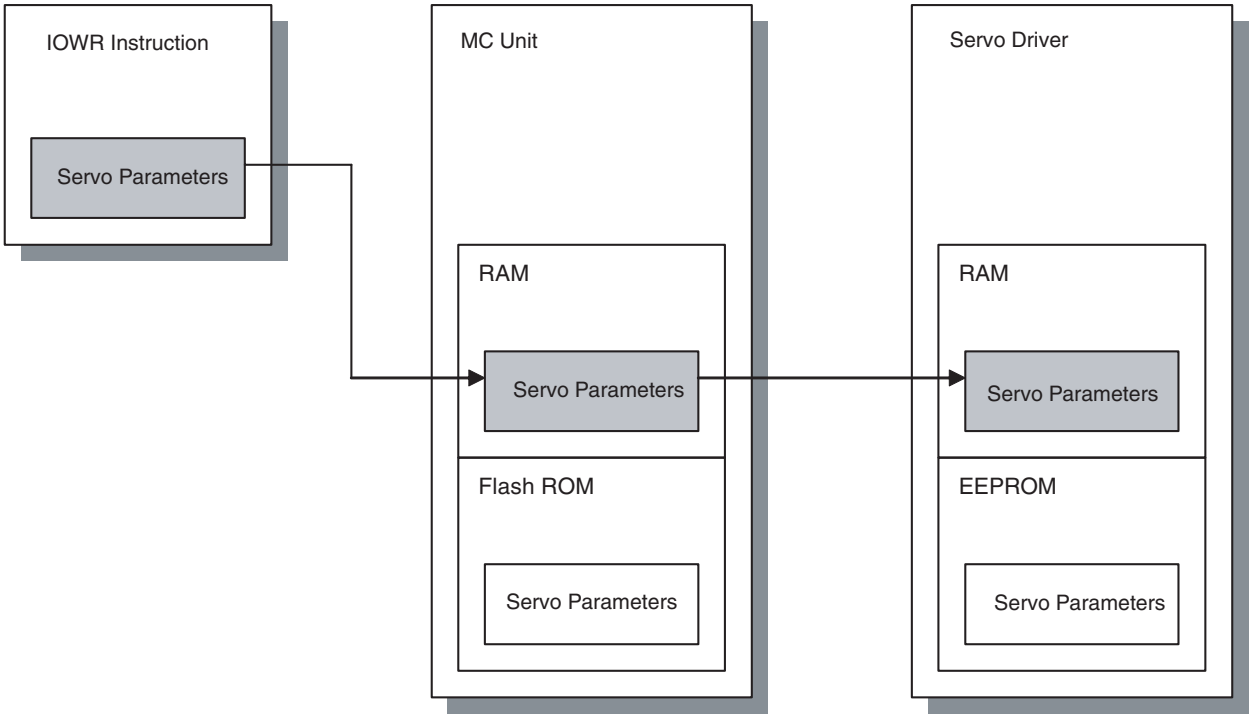
   Servo parameters are read from the servo driver. The servo parameters in the MC Unit will not be affected.



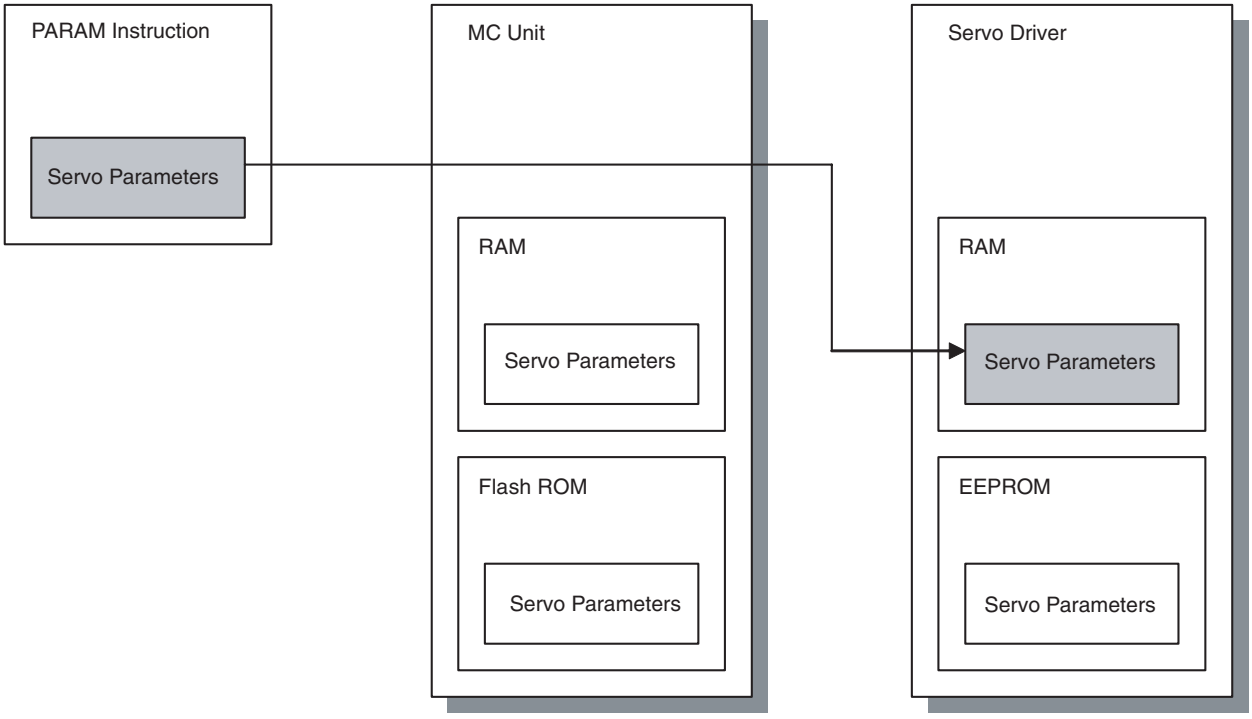
4. Writing by Support Tool
   - The servo parameters will be written in both the MC Unit and servo driver.
   - The written servo parameters will be the object of Flash ROM save.
   - Writing is executed regardless of whether it is immediately enabled or enabled when the power is turned ON.



5. Writing by IOWR Instruction
   - The servo parameters are written in the RAMs of both the MC Unit and the servo driver.
   - Writing is executed regardless of whether it is immediately enabled or enabled when the power is turned ON.



6. Writing by PARAM Command
   - This is just a temporary writing, so it will not be the object of Flash ROM save.
   - Only the servo parameters in the RAM of the servo driver will be overwritten.
   - Writing is executed regardless of whether it is immediately enabled or enabled when the power is turned ON.

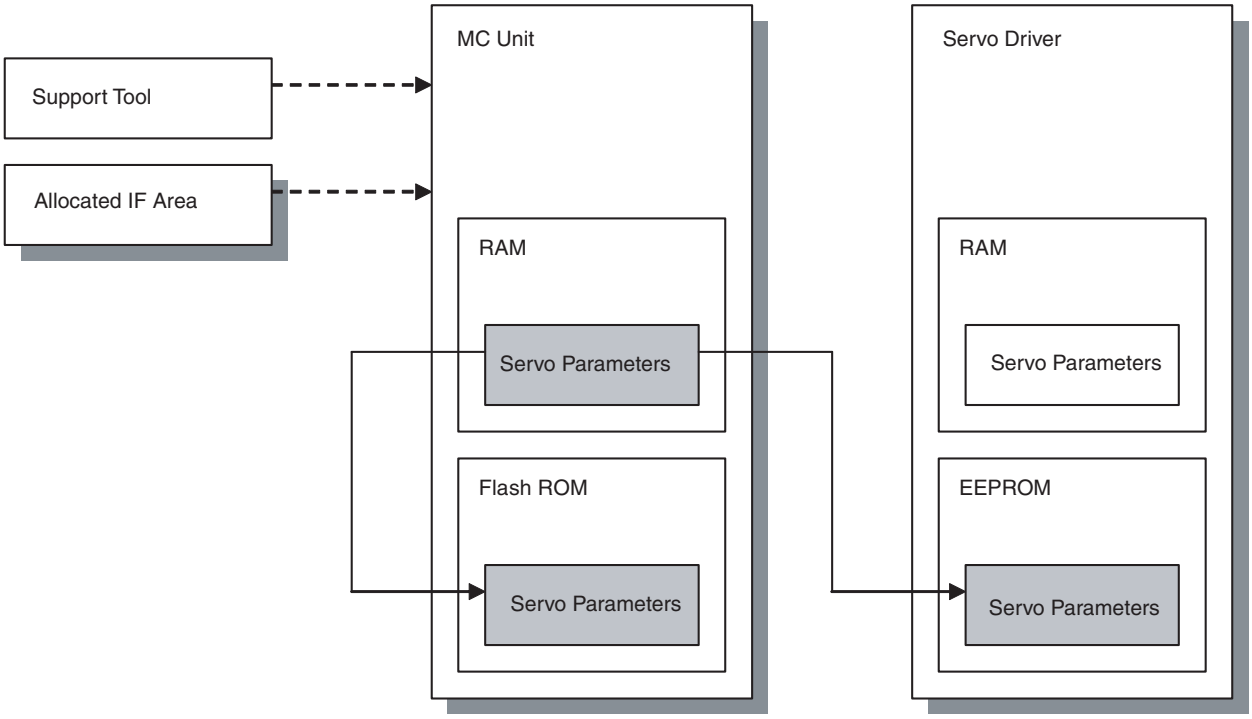


   - Contents of EEPROM and RAM in the servo driver will be identical with each other. (They are not identical while change is in process, however, they will be identical after writing.)
   - When a servo parameter that is not immediately enabled is changed, the parameter that was written would be different from the one having been read.

7. Saving by Support Tool

8. Saving by Allocated IF Area

   Saves the servo parameters of the MC Unit to servo driver's EEPROM and MC Unit's Flash ROM.



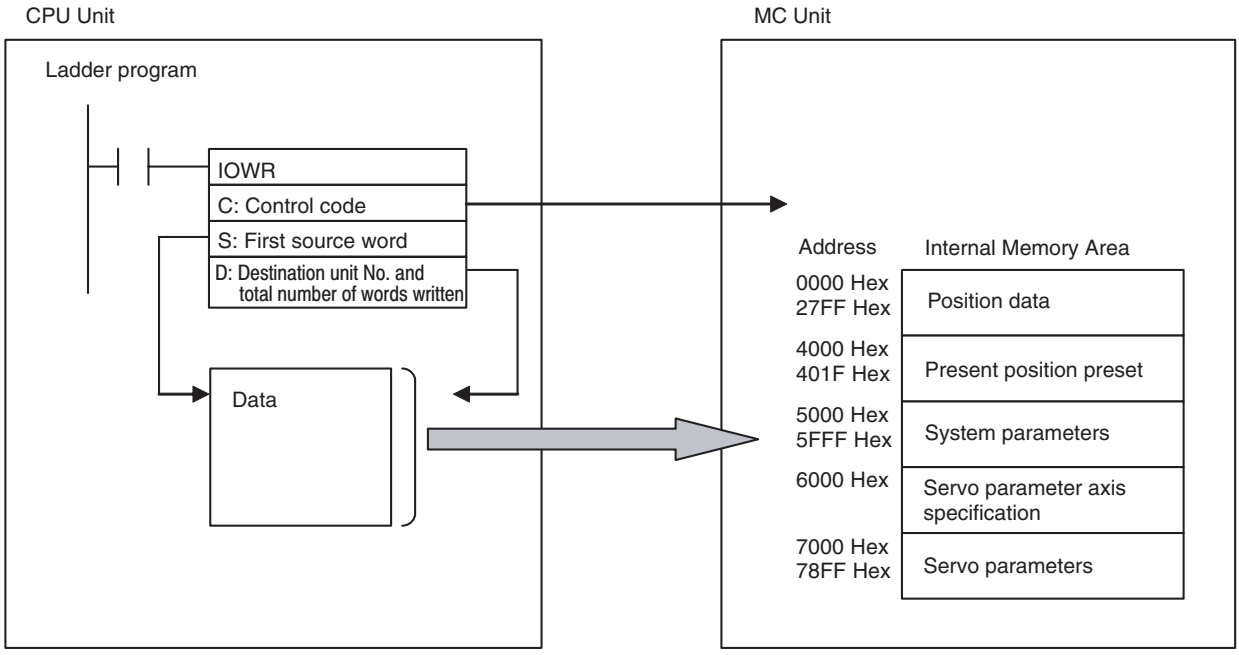
Precautions when Replacing a Servo Driver

Servo parameters stored in the servo driver are used for actual operations. For that reason, make sure to read the servo parameters before the replacement, and restore them into the newly replaced servo driver.

5-2 IOWR Instruction to Transfer Data

5-2-1 Overview

Position data, system parameters, and servo parameters can be written to the MC Unit by executing the CPU Unit's IOWR instruction. Present position preset is also executed by IOWR instruction.



Procedure for Writing Data

1) IOWR Instruction Setting
C: Indicates the first destination address in the MC Unit memory area for data storage
S: Indicates the first word No. of the CPU Unit area where data has been set
D: Indicates the destination MC Unit No. and total number of words of data to be written

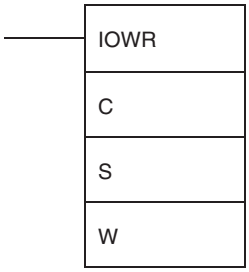
↓

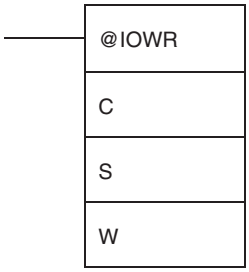
2) Data Setting
Sets the data to the area specified with S

↓

3) Data Writing
Execute the IOWR instruction

5-2-2 IOWR: Intelligent I/O Write





<table>
<tr><th>Operand</th><th>Description</th></tr>
<tr><td>C: Control code</td><td>MC Unit address (Hex)

Specifies the first address in the MC Unit where data will be written (in hexadecimal).</td></tr>
<tr><td>S: First source word</td><td>First source word

Specifies the first word in the CPU Unit from which data is to be transferred. Refer to CS1 manual for each word detail.
<table>
<tr><th>Area</th><th>Value used for specification</th></tr>
<tr><td>C/O Area (I/O bits, etc.)</td><td>0000-6143</td></tr>
<tr><td>Work Area</td><td>W000-511</td></tr>
<tr><td>Holding Bit area</td><td>H000-511</td></tr>
<tr><td>Auxiliary area</td><td>A000-959</td></tr>
<tr><td>Timer Area</td><td>T0000-4095</td></tr>
<tr><td>Counter Area</td><td>C0000-4095</td></tr>
<tr><td>DM Area</td><td>D00000-32767</td></tr>
<tr><td>EM Area</td><td>E00000-32767</td></tr>
<tr><td>DM Area with bank designation</td><td>En_00000-32767 (n=0 to C)</td></tr>
<tr><td>Indirect DM/EM (BIN)</td><td>@D00000-32767
@E00000-32767
@En_00000-32767 (n=0 to C)</td></tr>
<tr><td>Indirect DM/EM (BCD)</td><td>*D00000–32767
*E00000-32767
*En_00000-32767 (n=0 to C)</td></tr>
</table></td></tr>
<tr><td>D: Destination unit number and total number of words written</td><td>Total number of words transferred (Hex) | Destination unit number (Hex)

Total number of words transferred (Hex) Destination unit number (Hex)
Specifies the total number of transferred words (No. of transferred words) and unit number of data transfer destination (destination unit No.).
Total number of words to transfer: 0002 to 0008Hex (8 Words)
• System parameter: 0002 Hex
• Servo parameter axis specification:0002 Hex
• Servo parameter: 0002 Hex
• Position data: 0002, 0004, 0006, 0008 Hex
(Up to 4 synchronous writing is possible)
• Present position preset: 0002 Hex
Destination unit number
• 8000-800F Hex
Example)
Transferring three of position data (6words) to unit number 3:
#00068003 (total number of words transferred: 0006 [6words], unit No.8003 [No.3])</td></tr>
</table>

5-2-3 Flags

Name	Symbol	ON	OFF
Error Flag	ER	• The total No. of words transferred in D is not between 0000 and 0008 Hex. • The unit No. in D is not between 8000 and 800F Hex. • The specified CPU Bus Unit does not support the IOWR instruction. • The specified CPU Bus Unit has a setting error or Unit error. • An error has occurred. • Position data to be transferred was not in the specified format or not within acceptable range. • The specified address does not exist in the MC Unit. • Data in the specified MC Unit address is read-only data. • The specified No. of position data words to be transferred was not a multiple of two. • The No. of system parameter words to be transferred was not two. • The value of the MC Unit address plus the number of words transferred divided by 2 exceeded 27FFHex (upper position data limit 10240). • More than 8 words were specified for position data transfer.	• The conditions other than the ones described on the left
Equals Flag	=	• The IOWR was completed successfully.	• The IOWR was not completed normally. • A previous transfer has not been completed.

5-2-4 Precautions When Using IOWR

When transferring data by IOWR instruction, make sure to transfer the data with the total number of transferred words (2 to 8words). Do not start or end transferring in the middle of the data. Doing so will turn ON the ER flag.

5-2-5 IOWR Program Example

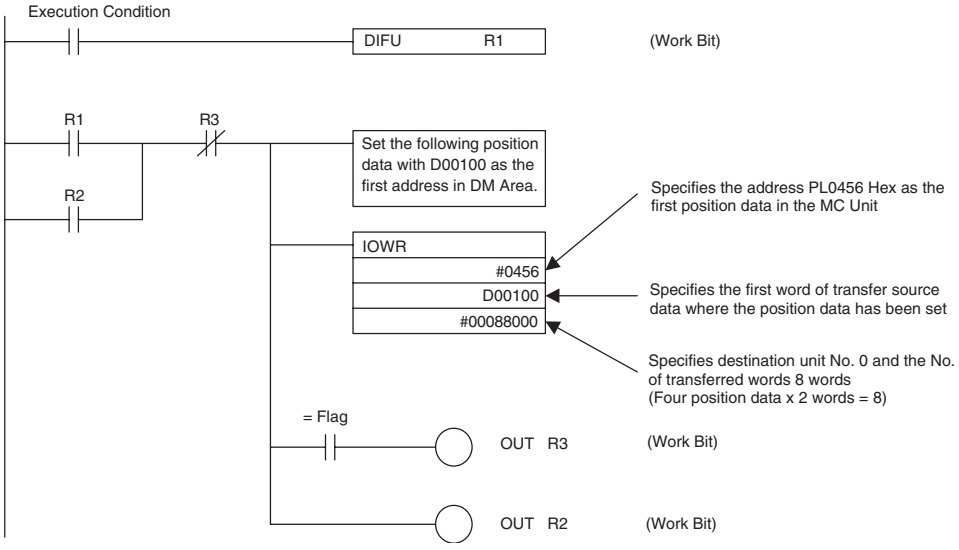
This section provides a detailed example of data transfer when the MC Unit is mounted on a CS-series PLC and the unit number is set to zero. In this example, it is assumed that operands in the IOWR and the transferred data are correct.

When debugging, create a ladder program that refers to the ER flag or the [Alarm] bit (n+12 words bit 00).

Example 1) Transfer four of position data to the data addresses PL0456 Hex to PL0459 Hex in the MC Unit.

Position data to be transferred		Destination addresses
34567890	→	PL0456
12345678	→	PL0457
–38765432	→	PL0458
123456	→	PL0459

Ladder Program Example

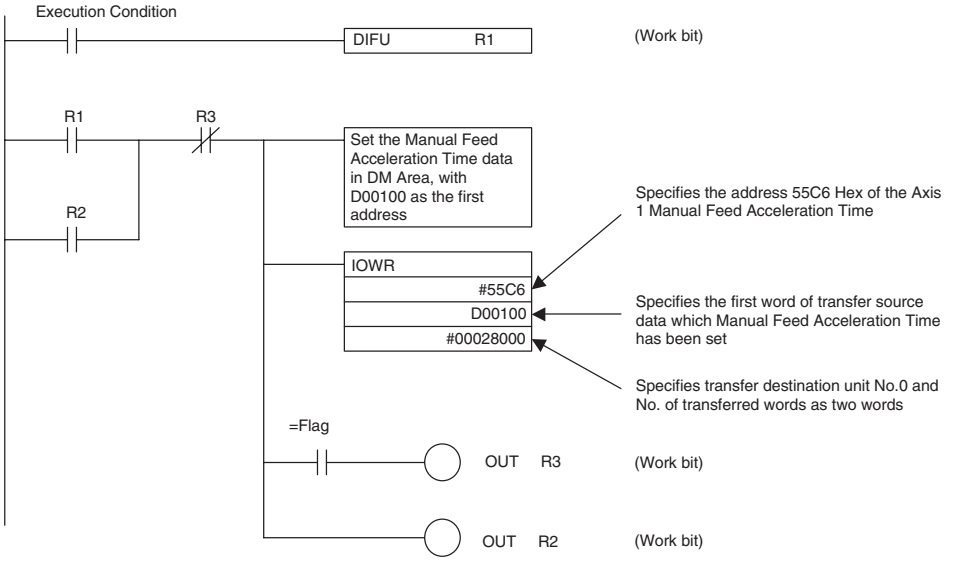


Data Settings [DM]

D00100	BF15	← 3456789
D00101	0034	
D00102	614E	← 12345678
D00103	00BC	
D00104	FC88	← –38765432
D00105	FDB0	
D00106	E240	← 123456
D00107	0001	

Example 2) Change the manual feed acceleration time to 500 [ms]

Ladder Program Example



Data Settings [DM]

D00100	01F4	← 500 [ms]
D00101	0000	

Example 3) Write the servo parameters using IOWR instruction

- To write the servo parameters, the servo parameter axis has to be specified in advance. Write the axis No. in 6000h of IORD/IOWR control code (address in the MC Unit).
- The setting value for the servo parameter axis specification is to be [Axis No. - 1] as shown below:

Axis No.	Setting value for specifying axis
1	0h
2	1h
3	2h
:	:
30	1Dh
31	1Eh
32	1Fh

- IORD/IOWR control addresses (address in MC Unit) corresponding to the parameter Nos. of the servo driver (Pn000 to Pn8FF) are as shown below:

Parameter No.	Address in MC Unit
Pn000	7000h
Pn001	7001h
Pn002	7002h
:	:
Pn8FD	78FDh
Pn8FE	78FEh
Pn8FF	78FFh

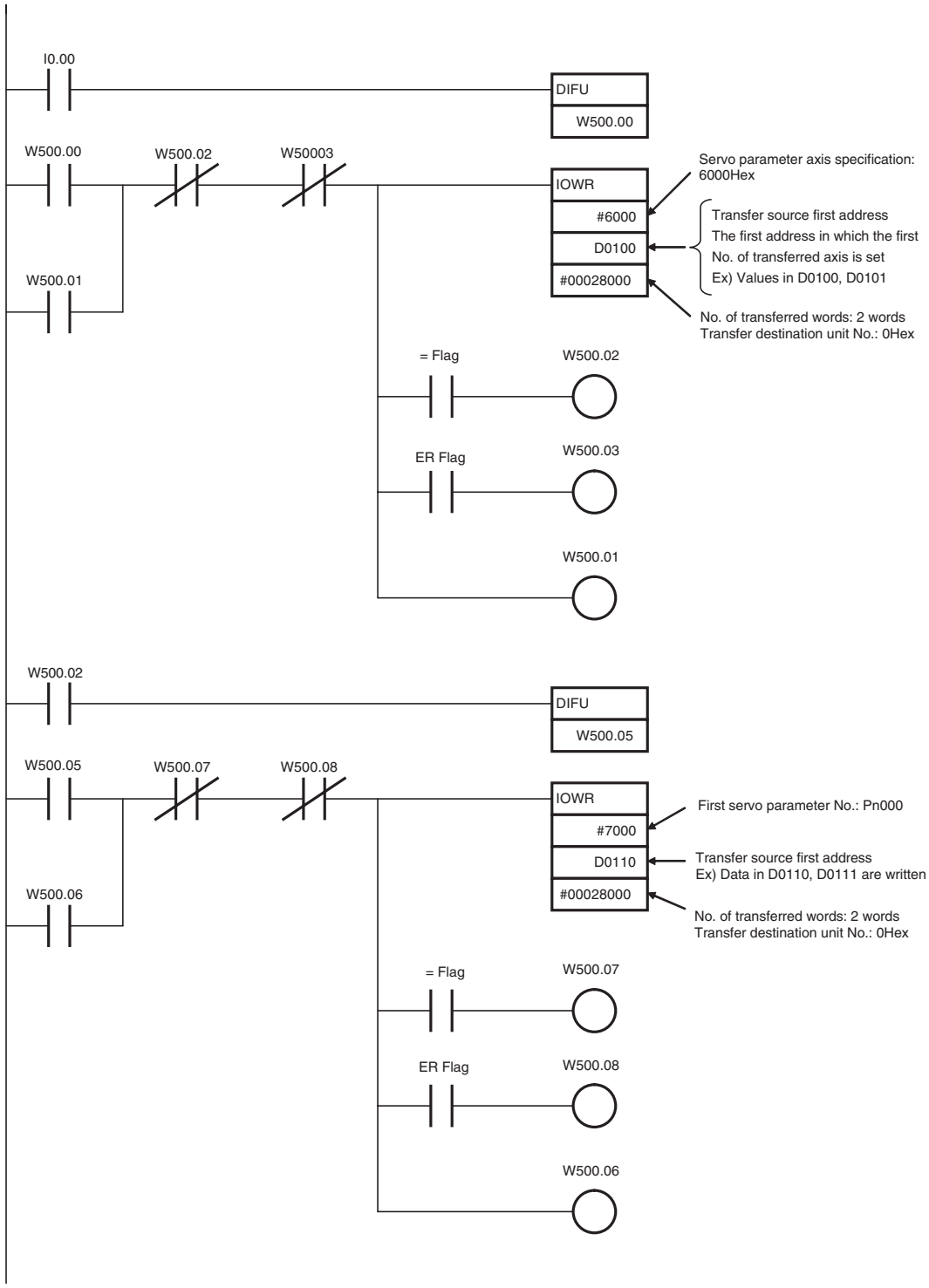
Procedure

1,2,3...

1. Set the data in the data area of the transfer source.
2. Specify the servo parameter axis.
3. Transfer the parameter setting values for the number needed.

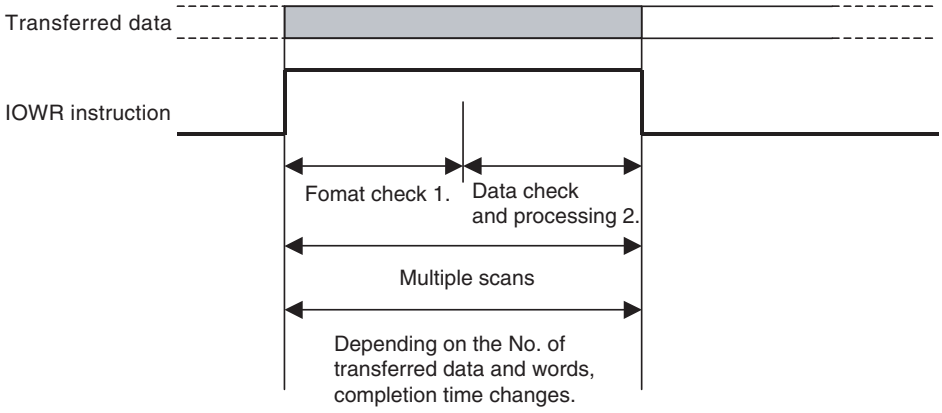
Ladder Program Example

The parameter axis for the servo driver is set to the values in D0100 and D0101. 2-word data in D0110 and D0111 are written in the servo driver parameter No. Pn000.



Timing Chart in Executing IOWR Instruction (Address Specification)

The following describes the timing and processing when IOWR instruction is executed.



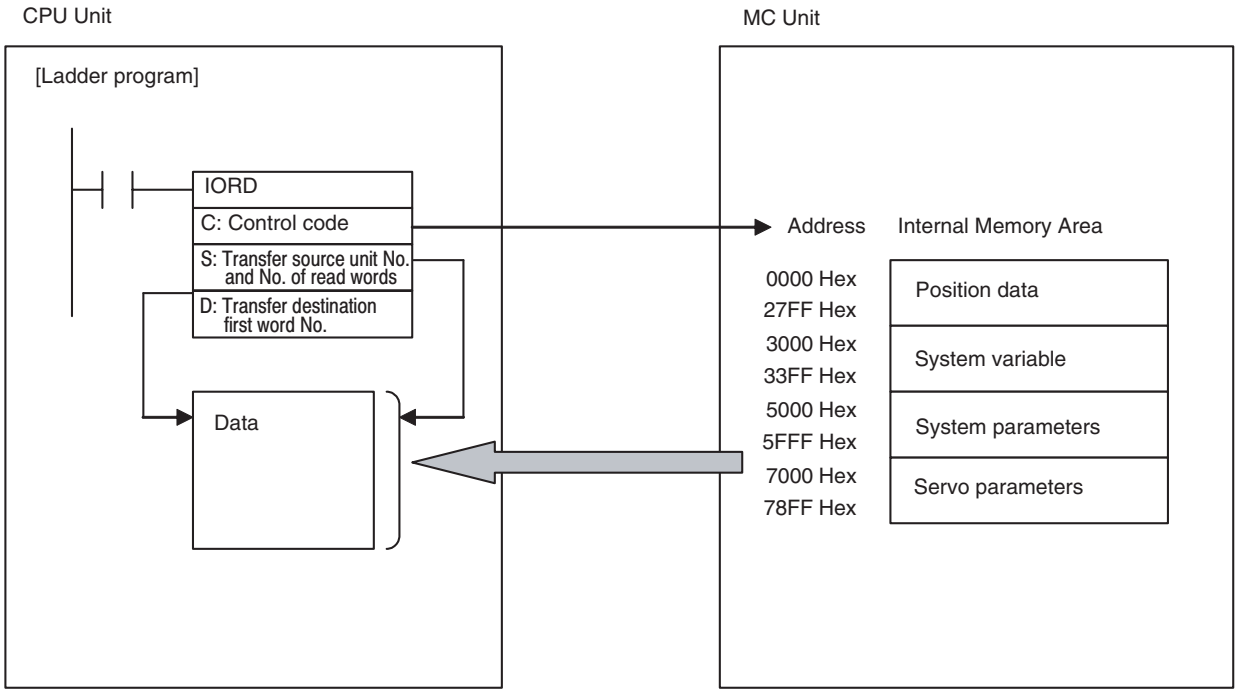
1,2,3...

1. At first, on the CPU Unit, check if specifications of IOWR instruction's operands are correct.
   (Format check) If they are not correct, the ER Flag will turn ON to interrupt the IOWR instruction.
2. And then, on the MC Unit, check if the data in operands is applicable for processing in the MC Unit. (Data check)
   If the data is applicable for processing, the =Flag will turn ON.
   If the data is not applicable for processing, the =Flag will not turn ON and the instruction will be interrupted.
   Transfer should be completed by the rise of the =Flag.

5-3 IORD Instruction to Transfer Data

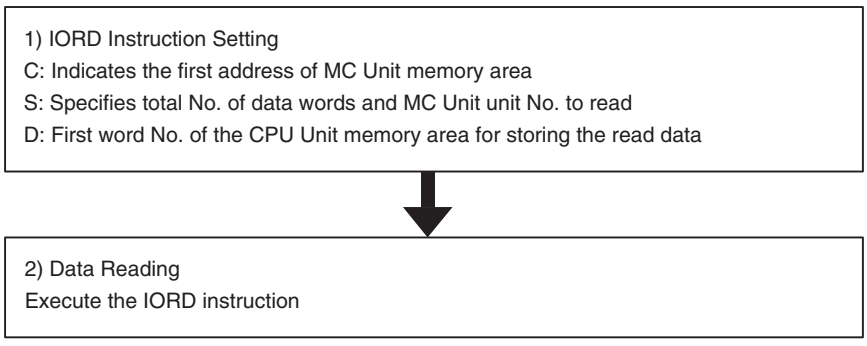
5-3-1 Overview

Position data, system variables, system parameters, and servo parameters can be read by executing the CPU Unit's IORD instruction.

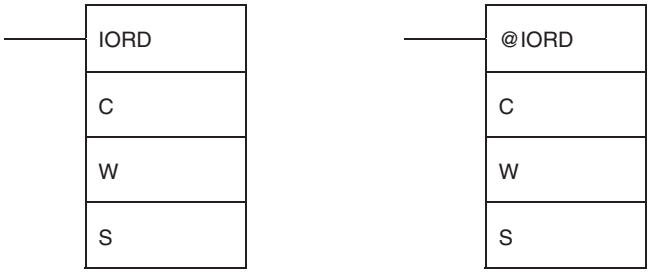


Note: To read servo parameters, it is necessary to specify the servo parameter axis in advance.

Procedure for Reading Data



5-3-2 IORD: Intelligent I/O Read



<table>
<tr><th>Operand</th><th>Description</th></tr>
<tr><td>C: Control code</td><td>MC Unit address (Hex)

Specifies the first address of the data in the MC Unit to be read.</td></tr>
<tr><td>D: No. of transferred words/
Transfer source unit No.</td><td>W+1 W
No. of transferred words (Hex) | Transfer source unit No. (Hex)

Specifies the total No. of transferred words (No. of transferred words) and unit number of data transfer destination (destination unit No.).
No. of transferred words: 0002 to 0008 Hex (8 words)
• System parameter:0002 Hex
• Servo parameter axis specification:0002 Hex
• Servo parameter:0002 Hex
• Position data:0002, 0004. 0006, 0008 Hex
(Up to 4 position data can be read simultaneously)
• System variables:0002, 0004, 0006, 0008 Hex
(Up to 4 position data can be read simultaneously)
Transfer source unit No.:
• 8000-800F Hex
Ex) When reading 3 position data (6 words) from the unit No.3, set as the operand as shown below:
#00068003 (No. of transferred words: 0006 [6 words], unit No. 8003 [No.3])</td></tr>
<tr><td>S: Transfer destination first word</td><td>Transfer destination first word No.

Transfer destination first word No.
Specifies the first word of the CPU Unit in which the data to be transferred has been set. Refer to the CS1 manuals for more details.
<table>
<tr><th>Area</th><th>Value used for specification</th></tr>
<tr><td>CIO Area</td><td>0000-6143</td></tr>
<tr><td>Work Area</td><td>W000-511</td></tr>
<tr><td>Holding Bit area</td><td>H000-511</td></tr>
<tr><td>Auxiliary area</td><td>A000-959</td></tr>
<tr><td>Timer Area</td><td>T0000-4095</td></tr>
<tr><td>Counter Area</td><td>C0000-4095</td></tr>
<tr><td>DM Area</td><td>D00000-32767</td></tr>
<tr><td>EM Area</td><td>E00000-32767</td></tr>
<tr><td>DM Area with bank designation</td><td>En_00000-32767 (n=0to C)</td></tr>
<tr><td>Indirect DM/EM (BIN)</td><td>@D00000-32767
@E00000-32767
@En_00000-32767 (n=0 to C)</td></tr>
<tr><td>Indirect DM/EM (BCD)</td><td>*D00000–32767
*E00000-32767
*En_00000-32767 (n=0 to C)</td></tr>
</table></td></tr>
</table>

5-3-3 Flags

Name	Symbol	ON	OFF
Error Flag	ER	• The No. of transferred words in D is not between 0000 and 0008 Hex. • The unit number data in D is not between 8000 and 800F Hex. • The specified CPU Bus Unit does not support the IORD instruction. • The specified Unit has a setting error or unit error. • The read position data was not in the specified format or not within acceptable range. • The specified MC Unit address does not exist. • The specified No. of position data words transferred was not a multiple of two. • The specified No. of system parameter words transferred was not a multiple of two. • The value of the MC Unit address plus the number of transferred words divided by 2 exceeded 27FF Hex (upper position data limit 10240). • More than 8 words were specified for position data transfer.	• The conditions other than the ones described on the left.
Equals Flag	=	• The IORD instruction was completed successfully.	• The IORD instruction was not completed normally. • A previous transfer has not been completed.

5-3-4 Precautions when Executing IORD Instruction

When transferring the data by IORD instruction, make sure to transfer the data with the total number of transferred words (2 to 8 words). Do not start or end transferring the data in the middle of the data. Doing so will turn ON the ER flag.

5-3-5 IORD Program Example

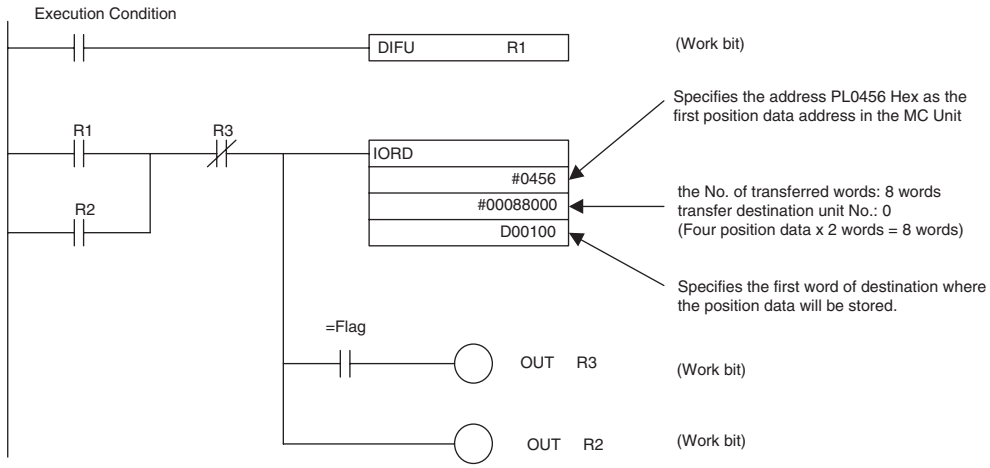
This section provides a detailed example of data transfer when the MC Unit is mounted on a CS-series PLC and the unit number is set to zero. In this example, it is assumed that operands in the IORD and the transferred data are correct.

When debugging, create a ladder program that refers to the ER flag or the [Alarm] bit (n+12 words bit 00).

Example 1) Read four position data (PL0456 to PL0459 Hex) in the MC Unit to the D00100 toD00107.

Position data to be read			Destination address
PL0456	4567890	→	D00100 to D00101
PL0457	12345678	→	D00102 to D00103
PL0458	–38765432	→	D00104 to D00105
PL0459	123456	→	D00106 to D00107

Ladder Program Example

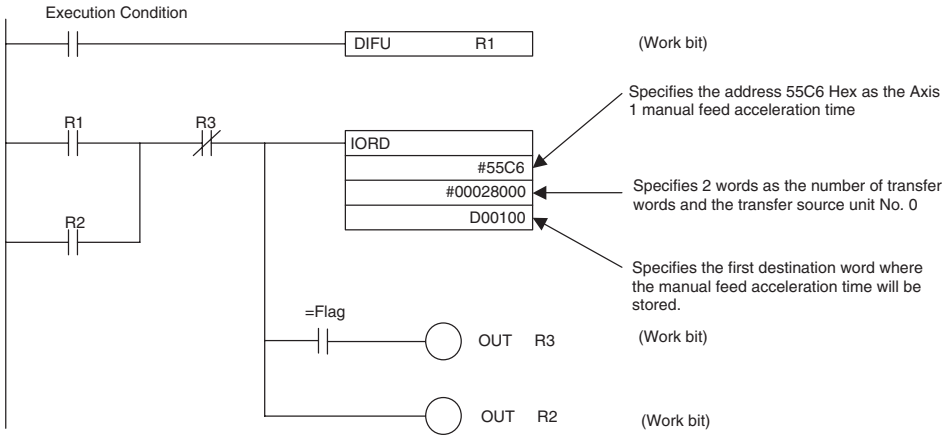


Data after Reading [DM]

D00100	BF15	← 3456789
D00101	0034	
D00102	614E	← 12345678
D00103	00BC	
D00104	FC88	← –38765432
D00105	FDB0	
D00106	E240	← 123456
D00107	0001	

Example 2) Read the Axis 1 Manual Feed Acceleration Time (500[ms]) to D00100 to D00101.

Ladder Program Example



Data after Reading [DM]

D00100	01F4	← 500 [ms]
D00101	0000	

Example 3) Read the servo parameters using IORD instruction

- To read the servo parameters, the servo parameter axis has to be specified for the IOWR instruction in advance. Write the axis No. in 6000h of IORD/IOWR control code (address in the MC Unit).

- Setting values for specifying the servo parameter axis are to be [Axis No. - 1] as shown below:

Axis No.	Setting value for axis specification
1	0h
2	1h
3	2h
:	:
30	1Dh
31	1Eh
32	1Fh

- IORD/IOWR control addresses (addresses in the MC Unit) corresponding to the parameter Nos. (Pn000 to Pn8FF) of the servo driver are as shown below:

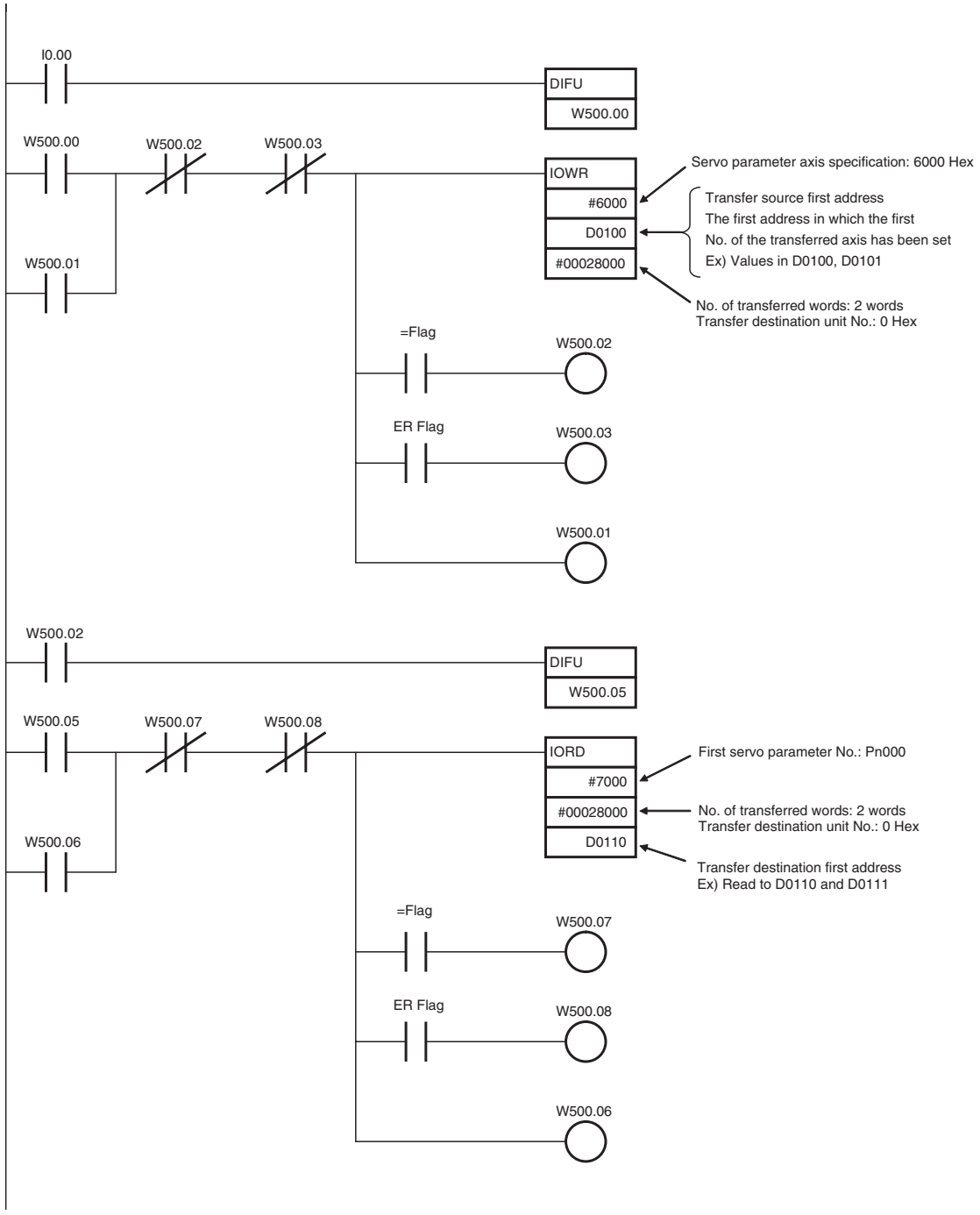
Parameter No.	Address in MC Unit
Pn000	7000h
Pn001	7001h
Pn002	7002h
:	:
Pn8FD	78FDh
Pn8FE	78FEh
Pn8FF	78FFh

Procedure

1,2,3... 1. Set the data in the data area of the transfer source.
2. Specify the servo parameter axis.
3. Read the parameter setting values for the number needed.

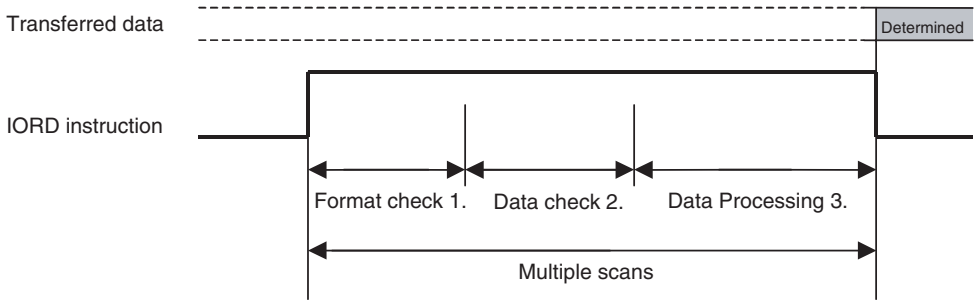
Ladder Program Example

The parameter axis of the servo driver is set to the values in D0100 and D0101. The value in the parameter Pn000 of the servo driver is read and stored in D0110 and D0111.



Timing Chart in Executing IORD Instruction (Address specification)

The following describes the timing and processing when executing IORD instruction.



1,2,3...

1. At first, on the CPU Unit, check if IORD instruction's operands specifications are correct. (Format check) If they are not correct, the ER Flag turns ON to interrupt the IORD instruction.
2. And then, on the MC Unit, check the data specified with the operands is applicable for processing in the MC Unit. (Data check)
   If the data is not applicable for processing, the =Flag will not turn ON and the instruction will be interrupted.
3. Finally, transfer the specified data from the MC Unit to the CPU Unit.
   When transfer is completed, the =Flag will be turned ON.

5-4 Saving Data

Data transferred to the MC Unit will be erased either when the power is turned OFF or when the MC Unit is restarted from the CPU Unit. To preserve the data that has been transferred, it must be saved to the Flash Memory in the MC Unit. Once it is saved in the Flash Memory, it can be read and used from the next time the power is turned ON or the Unit is restarted. When the data is saved, all the data including parameters existing at that point are saved.

1,2,3...

(1) Do not turn OFF the power or restart the CPU while data is being saved. It may cause a failure of the Flash Memory in the MC Unit, or cause the MC Unit to operate abnormally.

(2) Flash memory has a limited service life. Data can be written up to 100,000 times.

(3) Do not save any data during program operations or when motors are operating. Unexpected operation may result.

(4) It may take a maximum of 20 seconds to save the data into the Flash Memory.

5-4-1 Flash Memory

The data listed below can be saved in the Flash Memory.

- Programs
- Cam data
- System parameters
- Servo parameters
- Position data

5-4-2 Data Saving Procedure

The PC Interface Area (bit area) is used to save the transferred data in MC Unit.

Procedure

Saving parameters: n+0 word Bit 01

Saving position data: n+0 word Bit 02

Status

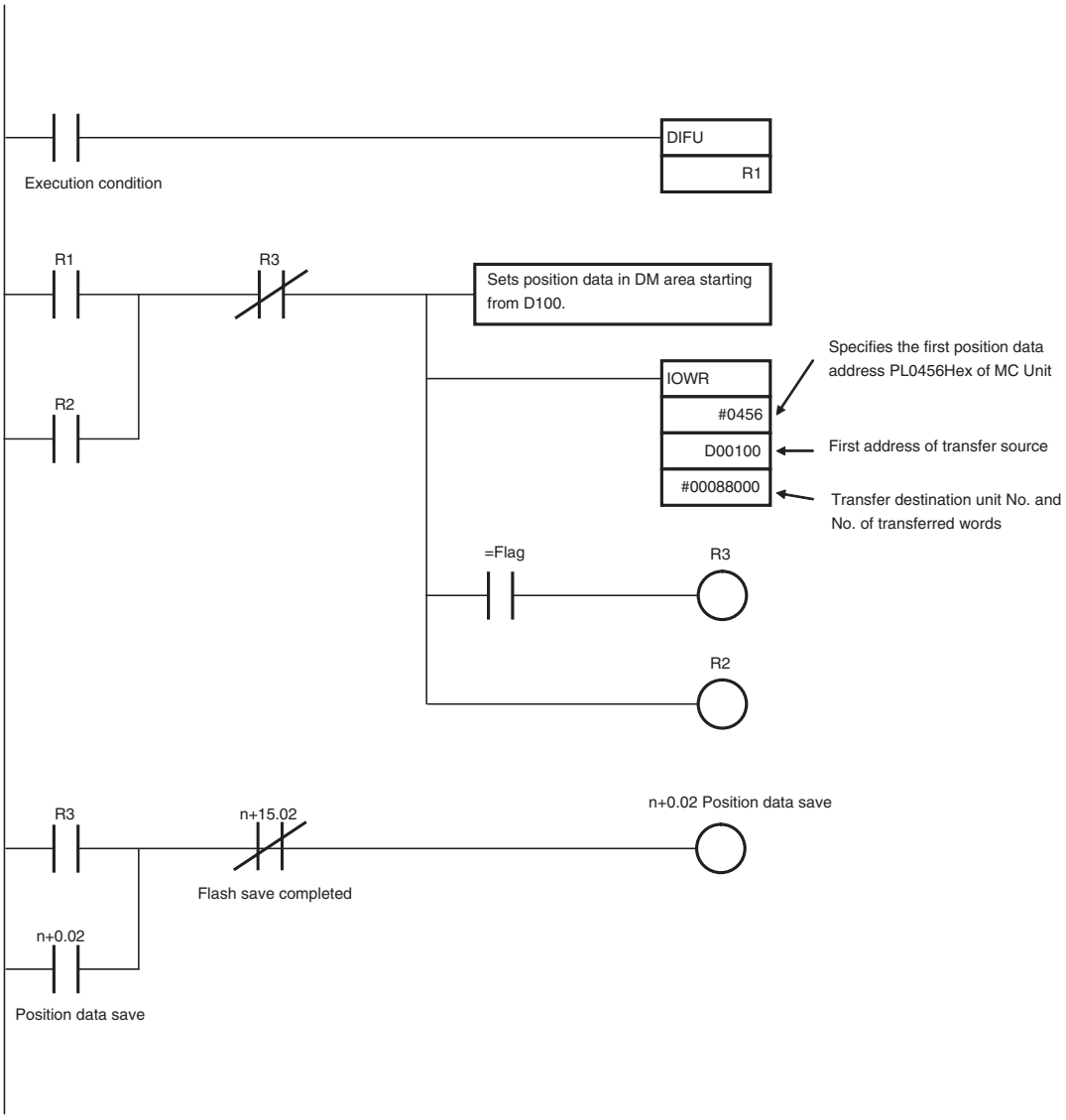
Flash save completed: n+15 word Bit 02

Refer to *SECTION 7 PC Interface Area* (page 339) for details.

5-4-3 Ladder Program Example of Saving the Data Transferred Using IOWR Instruction

In this example, Position data is transferred to the position data address in the MC Unit using the IOWR instruction. The transferred position data is then saved in the Flash Memory.

Ladder Program Example



SECTION 6
Programming

This section describes how to program CS1W-MCH71 Motion Control Unit operation, including the program configuration and the specific commands used in programming.

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6-1-1 Program and Task Configuration 220
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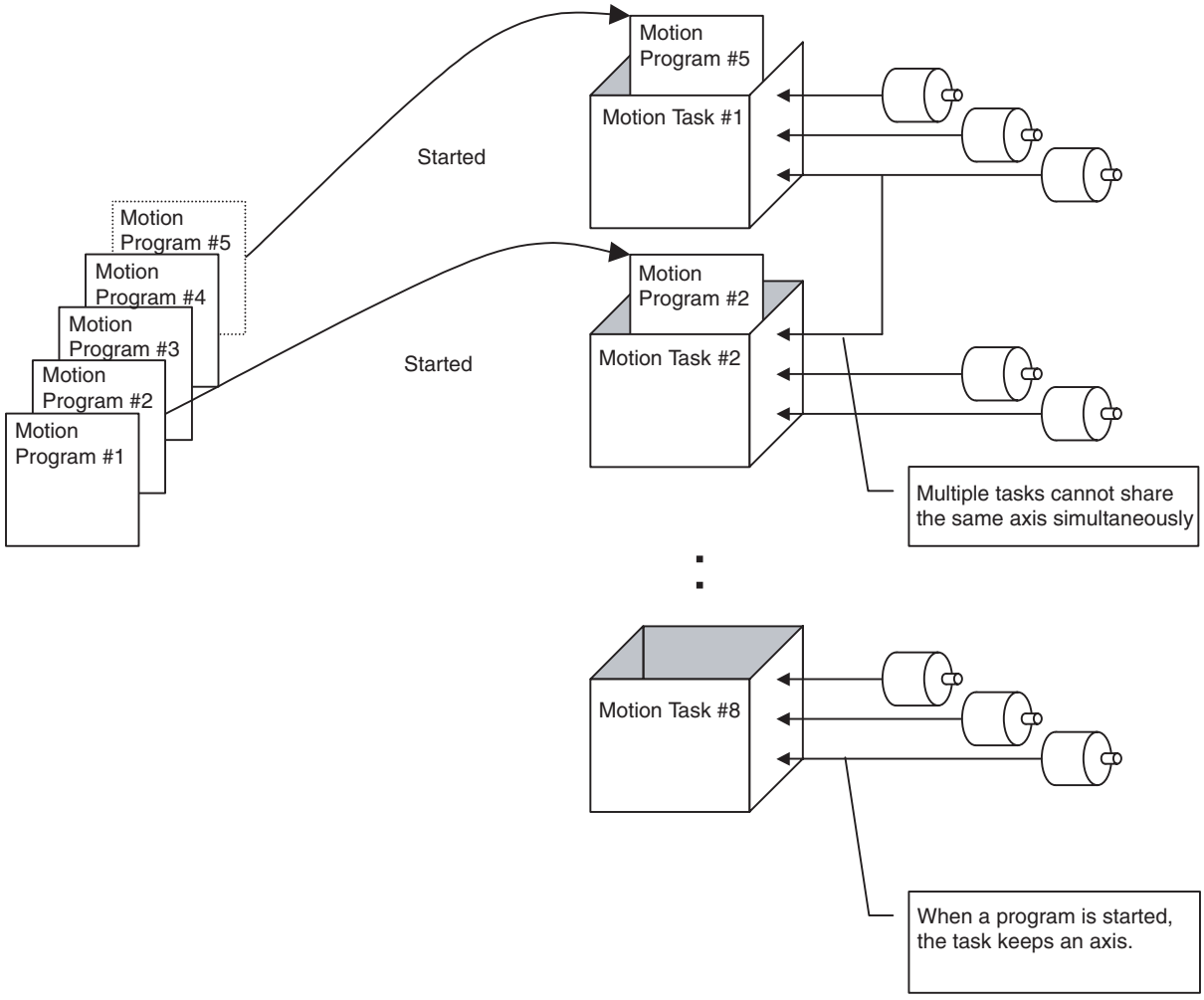
6-1 Program and Task Configuration

6-1-1 Program and Task Configuration

The "programs" are written by the user to control the application using the MC Unit. The "tasks" are units for work to execute the programs. The MC Unit can have up to 8 motion tasks for axis control.

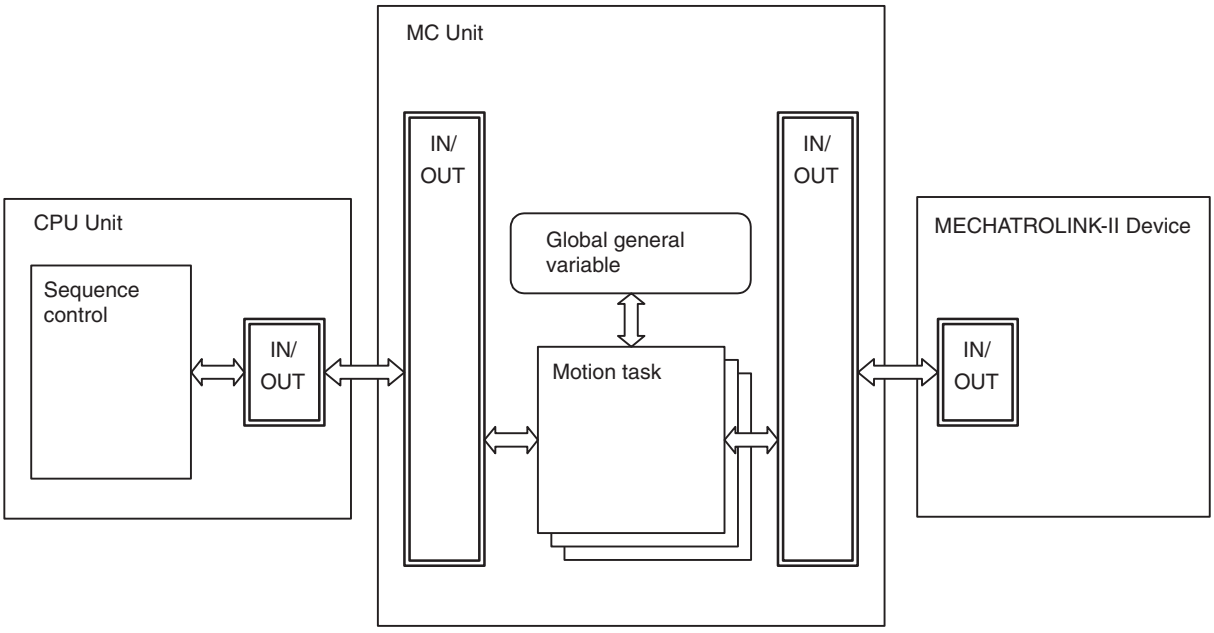
The motion tasks are primarily used to execute operations related to axis movement and through declaring axes to be used by the motion program, a motion task can have 1 to 32 axes. Note that the same one axis cannot be shared among several motion tasks simultaneously.

There is no need to use the motion tasks in the applications that use only the allocation bit area of the CPU Unit to operate, i.e. applications that do not require the motion program.



Exchanging Data Between Tasks

It is possible to exchange data between tasks through the global general variable. Since exchanging data between motion tasks is also possible through the global general variable, a simplified interlock can be provided.

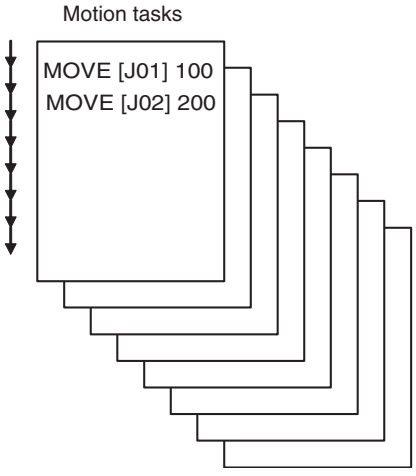


Programming Language

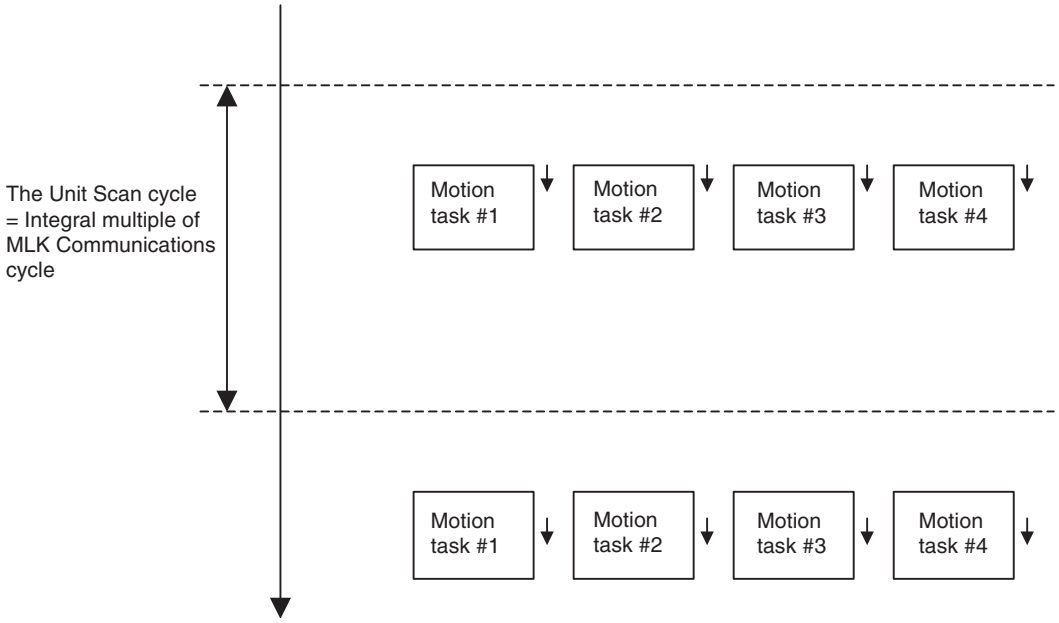
Motion tasks are described with the common language.

6-1-2 Task Execution Format

Motion tasks are executed stepwise, and a maximum of 8 tasks can be executed individually in parallel.



The Unit Scan cycle is to be integral multiple of the MECHATROLINK-II (MLK) communications cycle. All of the running motion tasks are executed in task-number order in each Unit Scan cycle.



MECHATROLINK-II (MLK) communication cycle and the Unit Scan cycle are determined automatically based on the number of axes, tasks, etc.

6-1-3 Advancement of the Motion Program

This section describes how execution of respective blocks advances (stepping or steps for processing). Each program is executed by a motion task separately, so the stepping of respective blocks can be considered independent as well.

Basic Concept

1,2,3...

1. The maximum number of branches for the Parallel Command is determined by the system parameter [No. of parallel branches (P00002)]. The parameter sets the upper limit on the number of commands that can be executed at one time, so this value restricts the maximum No. of parallel branches as well.
   When the number of parallel branches written in a motion program is smaller than the value in P00002, the value in P00002 is divided by the actual number of parallel branches to calculate the number of commands that can be executed simultaneously in each branch.
   Contrary to above, if the No. of parallel branches written in a motion program is greater, the alarm [200D:Rotation specification error] will occur during execution. Applicable setting value is the range of 1 to 8, and it is common in all motion tasks.
2. The number of motion commands that can be executed simultaneously in one Unit Scan is to be the same as the value explained in 1).
3. The commands used in motion tasks can be classified into two groups: [Single execution command] and [Multiple execution command].

- Single Execution Command

  In a motion task, two single execution commands cannot be executed simultaneously in one Unit Cycle. However, it is possible to execute it along with a multiple execution command or to execute it in another branch during parallel branch execution.

  Commands related to axis movements, etc. that takes time to finish the processing are usually of this type.

- Multiple Execution Command

  In a motion task, two or more multiple execution commands can be executed simultaneously in one Unit Cycle. A command of this type can be executed along with a single execution command or other multiple execution commands. Commands related to operations (arithmetic, logic, etc.) are usually of this type.

In the respective tables in this section, the word 'SINGLE' is used to indicate the [Single execution command], and 'MULTI' to indicate the [Multiple execution command].

Refer to the *6-2-1 Command List* (page 260) for the type of each command.

4. Multiple execution commands are executed under the following conditions:
   - When there are no commands being executed.
   - When a single execution command, which has a lower block number than that of the multiple execution command, is being executed. (A multiple execution command is not executed before any earlier single command not executed yet.)

Stepping in the Stop Mode

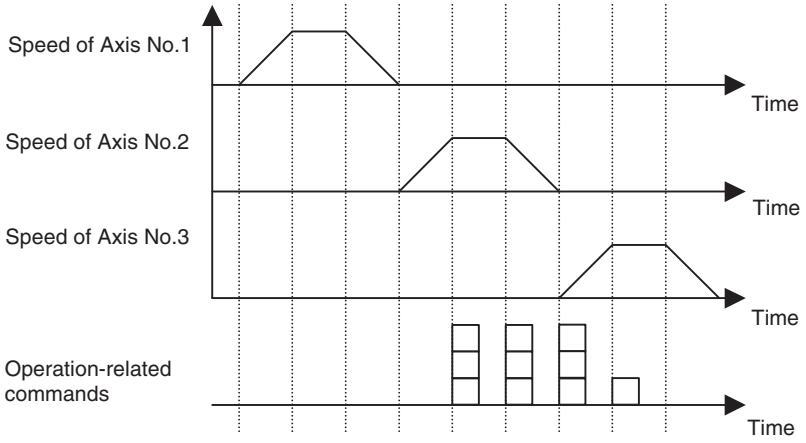
In the stop mode, the motion program advances following the 'Basic Concept' in the previous page.

Nevertheless, in the 'Single Block Operation Mode', regardless of SINGLE/ MULTI, one block is executed at a time.

Operation image:
It takes three cycles to execute one single execution command and the maximum number of simultaneous executions is set to four. No parallel branching.

No.	Command	Cycle									Comments
		1	2	3	4	5	6	7	8	9	
1	SINGLE	■	■	■							SINGLE execution
2	SINGLE				■	■	■				This is SINGLE, so execution begins after command No.1 is completed.
3	MULTI					■					This is MULTI, so it is executed along with command No.2.
4	MULTI					■					This is MULTI, so it is executed along with command No.2.
5	MULTI					■					This is MULTI, so it is executed along with command No.2. (The 4th command executed simultaneously)
6	MULTI						■				This is MULTI, so it is executed along with command No.2.
7	MULTI						■				This is MULTI, so it is executed along with command No.2.
8	MULTI						■				This is MULTI, so it is executed along with command No.2. (The 4th command executed simultaneously)
9	MULTI							■			
10	MULTI							■			
11	MULTI							■			
12	SINGLE							■	■	■	This is SINGLE, so execution begins after command No.2 is completed.
13	MULTI								■		This is MULTI, so it is executed along with command No. 12.

The diagram below is the operation image of the above table if 3 single execution commands are axis movement commands for Axis 1, 2, and 3 and all the multiple execution commands are operation-related (arithmetic, logic, etc.) commands.



Stepping in Pass Mode

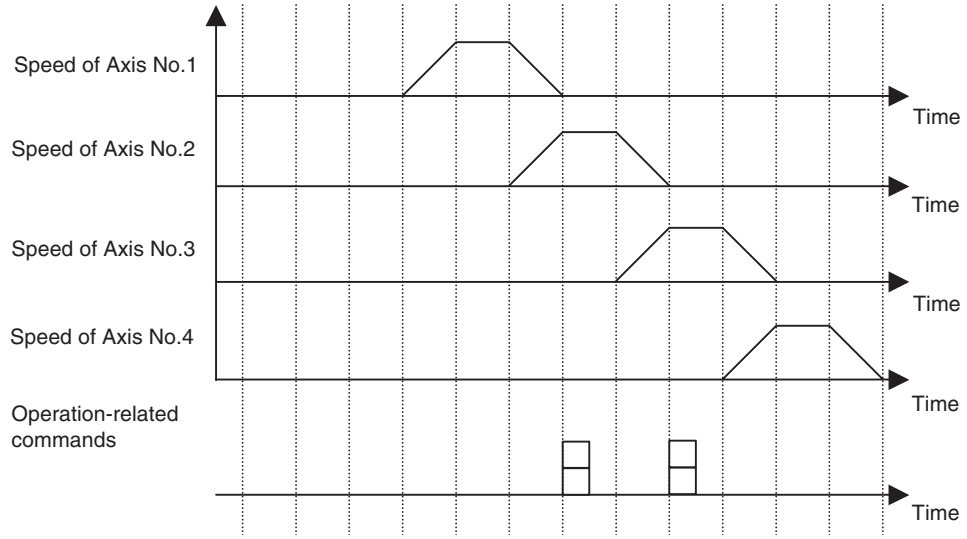
When a movement command is being executed in Pass Mode, execution of the next block starts when deceleration starts for the current block. Even with single execution commands, two blocks will be executed simultaneously in one cycle. Other single or multiple execution commands (besides the movement commands) operate just as they do in the Stop Mode

In the 'Single Block Operation Mode', regardless of SINGLE/MULTI, one block is executed at a time, so executions do not overlap even in a movement command.

Operation image:
It takes three cycles to execute one single execution command and the maximum number of simultaneous executions is set to four. No Parallel Branching.

No.	Command	Cycle												Comments
		1	2	3	4	5	6	7	8	9	10	11	12	
1	SINGLE (Not axis movement)	■	■	■										It does not overlap with No.2.
2	SINGLE (Axis movement)				■	■	■							Execution starts after command No.1 is completed.
3	SINGLE (Axis movement)						■	■	■					Execution starts when command No.2 starts deceleration.
4	MULTI							■						Executed during execution of command No.3.
5	MULTI							■						Executed during execution of command No.3.
6	SINGLE (Axis movement)								■	■	■			Execution starts when command No.3 starts deceleration.
7	MULTI									■				Executed during execution of command No.6.
8	MULTI									■				Executed during execution of command No.6.
9	SINGLE (Axis movement)										■	■	■	Execution starts when command No.6 starts deceleration.

The diagram below is the operation image of the above table if 4 single execution commands (No.2, 3, 6, and 9) are axis movement commands for Axis 1, 2, 3, and 4 and all the multiple execution commands are operation-related (arithmetic, logic, etc.) commands.



Stepping When Parallel Branch is executed

When parallel branch is executed, the branched program steps per sequence.

The execution of commands within the same scan is restricted by system parameters just as it is in the Stop Mode. When the number of parallel branches written in the motion program is smaller than the maximum number of simultaneous executions, the number of commands that can be executed simultaneously in a sequence can be obtained by dividing the maximum number of simultaneous executions by the number of parallel branches (the remainder to be omitted).

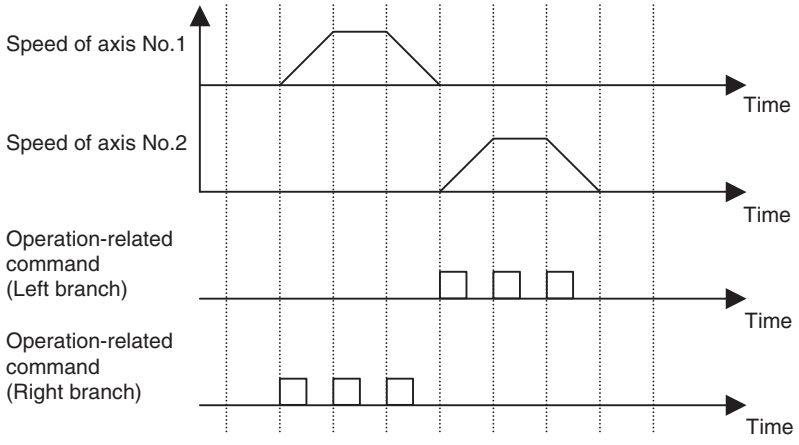
In the 'Single Block Operation Mode', regardless of SINGLE/MULTI, one block is executed at a time.

Operation image 1:
It takes three cycles to execute one single execution command and the maximum number of simultaneous executions is set to two. The number of parallel Branches is set to two. (In this case, the number of simultaneous executions per branch is one.)

No.	Command	Command	Cycle									Cycle								
			1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
1	PARALLEL		■									■								
2	SINGLE	MULTI		■	■	■							■							
3	MULTI	MULTI					■							■						
4	MULTI	MULTI						■							■					
5	MULTI	SINGLE							■							■	■	■		
6	JOINT	JOINT								■									■	
7	JWAIT										■									■

The following diagram can be applicable as for an operation image if the single execution commands moving axes 1 and 2 while the multiple execution commands perform calculations.

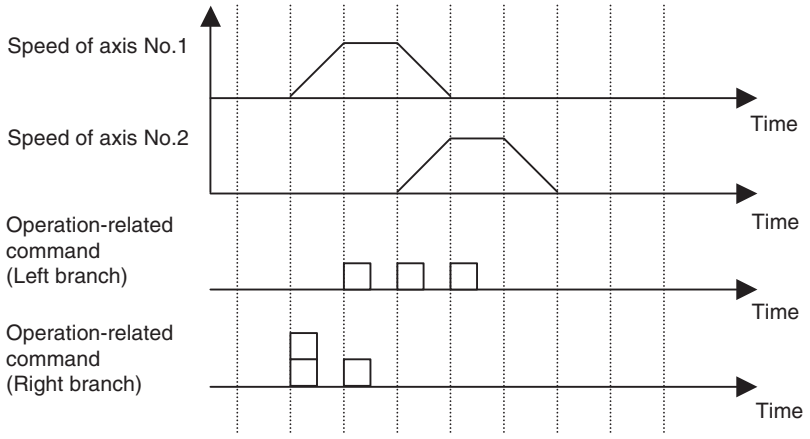
The diagram below is the operation image of the above table if 2 single execution commands are axis movement commands for Axis 1 and 2 and all the multiple execution commands are operation-related (arithmetic, logic, etc.) commands.



Operation Image (2):
It takes three cycles to execute one single execution command and the maximum number of simultaneous executions is set to four. The number of parallel branches is set to two. (In this case, the number of simultaneous executions per branch is two.)

No.	Command	Command	Cycle									Cycle								
			1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
1	PARALLEL		■									■								
2	SINGLE	MULTI		■	■	■							■							
3	MULTI	MULTI			■								■							
4	MULTI	MULTI				■								■						
5	MULTI	SINGLE					■							■	■	■				
6	JOINT	JOINT						■									■			
7	JWAIT								■									■		

The diagram below is the operation image of the above table if 2 single execution commands are axis movement commands for Axis 1 and 2 and all the multiple execution commands are operation-related (arithmetic, logic, etc.) commands.

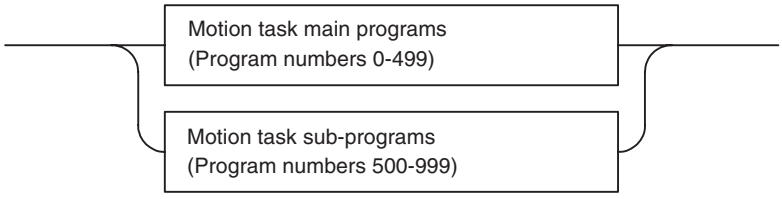


Note
(1) JOINT command is treated as a single execution command because it always waits for completion of the previous block execution.
(2) JWAIT command is treated as a single execution command because it always waits for completion of JOINT command's execution in each sequence.

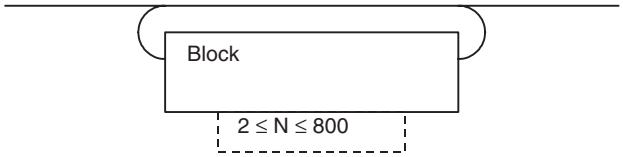
6-1-4 Program System

This section explains the program of the MC Unit.

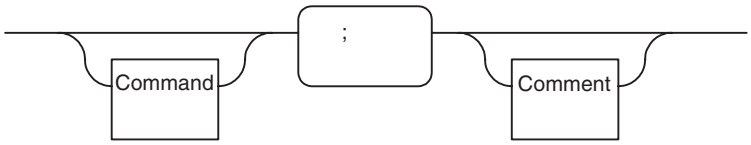
- Programs are composed of the motion task main programs and motion task sub-programs.



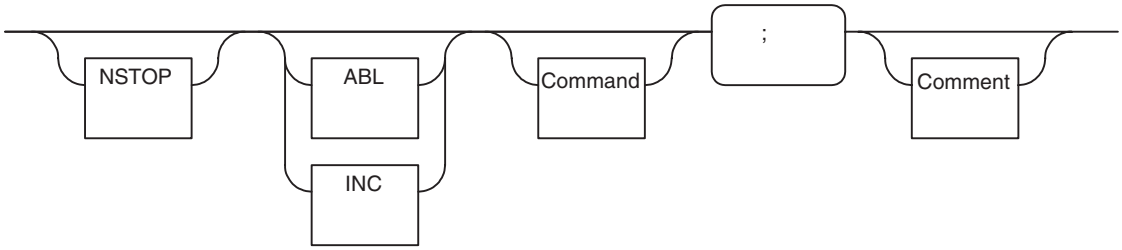
- A program can contain up to 800 blocks.



- A block contains a command, a semi-colon, and a comment (this may be omitted).



- An NSTOP command, and an ABL/INC command, can be added at the beginning of a block.



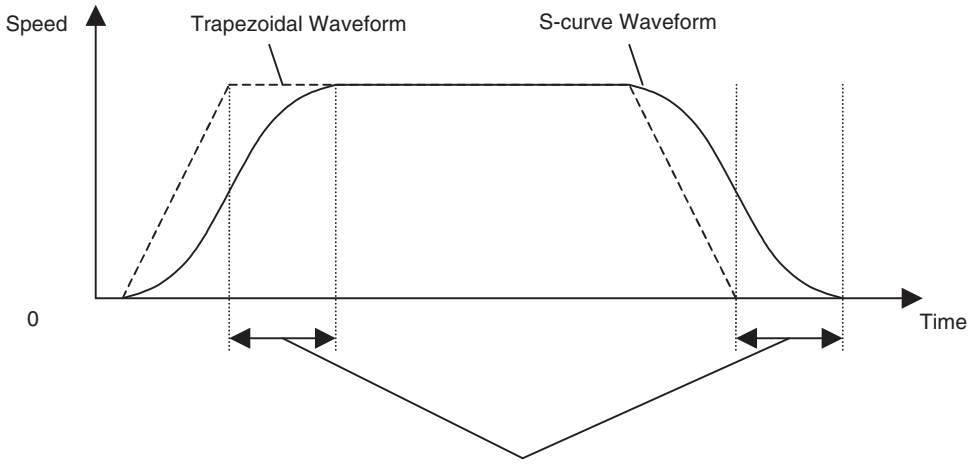
6-1-5 Axis Movement Operation

Acceleration/Deceleration Pattern

- Setting acceleration/deceleration patterns with the following system parameters makes it possible to select symmetrical/asymmetrical acceleration/deceleration patterns.
- Acceleration/deceleration time cannot be changed during axis movement.

No.	Name	Usage
P00M02	Interpolation feed acceleration time	Motion commands: MOVEL/MOVEC/MOVETRAV (Operand F sets the speed.)
P00M03	Interpolation feed deceleration time	
P2AA05	Rapid feed acceleration time	Motion commands: MOVE/MOVEI/DATUM/MOVET (Factors other than Operand F (parameters, etc.) set the speed)
P2AA06	Rapid feed deceleration time	
P2AA07	Manual feed acceleration time	Axis control bits: JOG/STEP/Machine origin return/Origin search
P2AA08	Manual feed deceleration time	

- S-curve acceleration/deceleration can be realized by multiplying movement averaging filter and trapezoidal acceleration/deceleration.



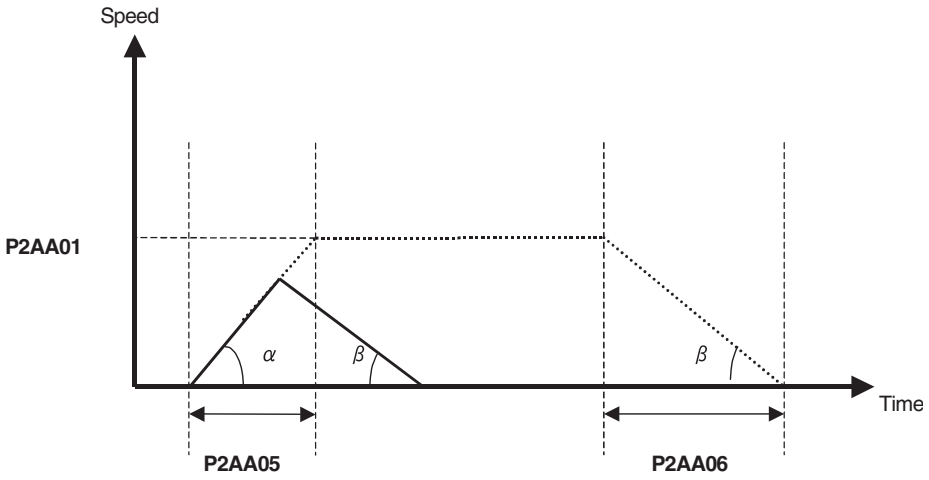
S-curve time constant = Delay until operation reaches the intended speed

- Enable/disable or S-curve time constant for S-shape acceleration/deceleration can be set using the following system parameters:

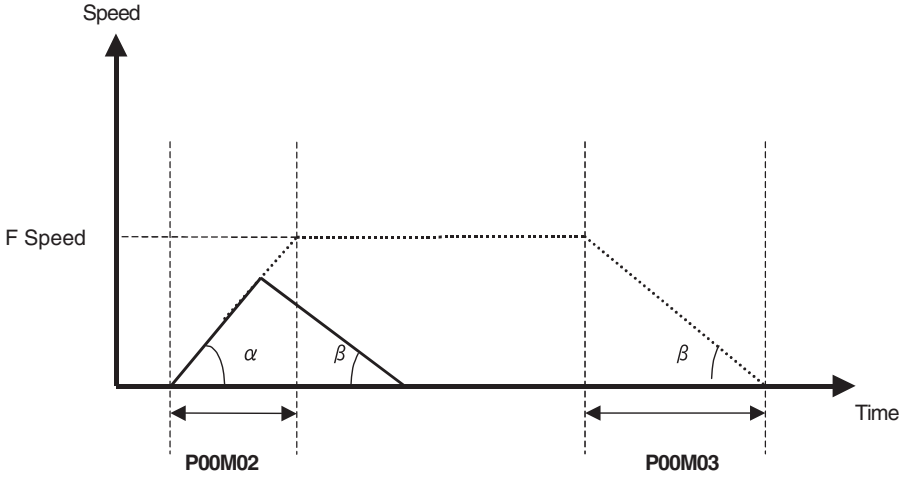
No.	Name	Usage
P00M04	Interpolation feed S-curve filter enable	Motion commands: MOVEL/MOVEC (Operand F sets the speed.)
P00M05	Interpolation S-curve time constant	
P2AA09	Rapid feed S-curve filter enable	Motion commands: MOVE/MOVEI/MOVET (Factors other than Operand F (parameters, etc.) set the speed)
P2AA11	Rapid feed time constant	
P2AA10	Rapid feed S-curve filter enable	Axis control bits: JOG/STEP
P2AA12	Manual feed time constant	

- If the travel time is less than the acceleration time plus the deceleration time, a triangular curve will be created, as shown below.

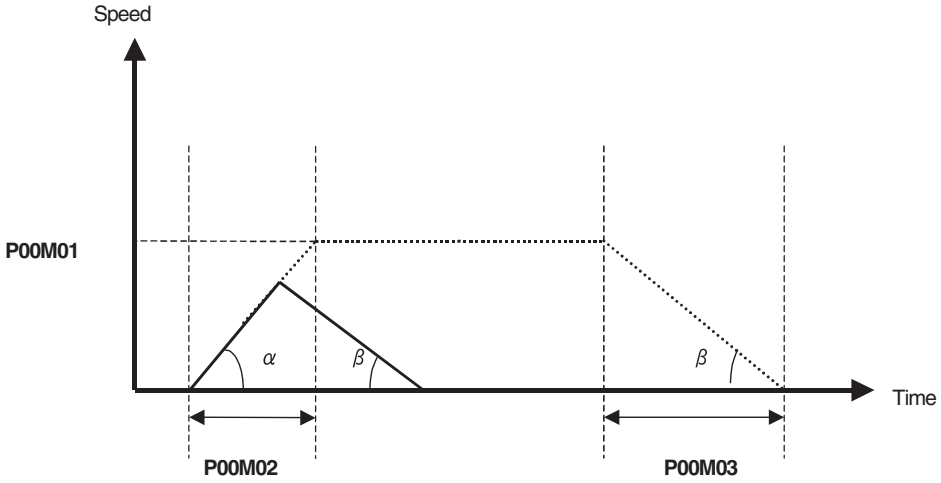
  Case 1:
  PTP Operation Commands (MOVE, MOVEI, DATUM, and MOVET)
  The rates of acceleration and deceleration will be maintained while moving in a triangular curve.
  P2AA01: Maximum rapid feed rate
  P2AA05: Rapid feed acceleration time
  P2AA06: Rapid feed deceleration time



Case 2:
Interpolation Commands (MOVEL, MOVEC, and MOVETRAV)
1) P00M06 (pass mode) = 0 or 1
The rates of acceleration and deceleration will be maintained while moving in a triangular curve.
F speed: Speed specified in the interpolation command
P00M02: Interpolation feed acceleration time
P00M03: Interpolation feed deceleration time



2) P00M06 (pass mode) = 2 or 3
The rates of acceleration and deceleration will be maintained while moving in a triangular curve.
This setting differs from P00M06 (pass mode) = 0 or 1 in that the maximum interpolation feed rate is used when calculating the acceleration and deceleration times.
P00M01: Maximum interpolation feed rate
P00M02: Interpolation feed acceleration time
P00M03: Interpolation feed deceleration time



- Relations between Axis Operation Function and Acceleration/Deceleration

Classification	Function	Acceleration time	Deceleration time	Time or Acceleration / Deceleration	S-curve filter select S-curve filter time constant
Axis movement	MOVE	P2AA05: Rapid feed acceleration time	P2AA06: Rapid feed deceleration time	Acceleration/deceleration	P2AA09: Rapid feed S-curve filter enable P2AA11: Rapid feed S-curve filter time constant
	MOVEL	P00M02: Interpolation feed acceleration time Refer to *Acceleration/ Deceleration Times and Pass Mode* (page 234) for details.	P00M03: Interpolation feed deceleration time Refer to *Acceleration/ Deceleration Times and Pass Mode* (page 234) for details.	Normally: time Pass Mode with fixed acceleration: Acceleration/deceleration	P00M04: Interpolation feed S-curve filter enable P00M05: Interpolation feed S-curve time constant
	MOVEC	P00M02: Interpolation feed acceleration time Refer to *Acceleration/ Deceleration Times and Pass Mode* (page 234) for details.	P00M03: Interpolation feed deceleration time Refer to *Acceleration/ Deceleration Times and Pass Mode* (page 234) for details.	Time	P00M04: Interpolation feed S-curve filter enable P00M05: Interpolation feed S-curve time constant
	DATUM	P2AA05: Rapid feed acceleration time	←	Acceleration/deceleration	---
	MOVEI	P2AA05: Rapid feed acceleration time	←	Acceleration/deceleration	P2AA09: Rapid feed S-curve filter enable P2AA11: Rapid feed S-curve time constant
	MOVET	P2AA05: Rapid feed acceleration time	←	Acceleration/deceleration	P2AA09: Rapid feed S-curve filter enable P2AA11: Rapid feed S-curve time constant
	MOVETRAV	P00M02: Interpolation feed acceleration time Refer to *Acceleration/ Deceleration Times and Pass Mode* (page 234) for details.	P00M03: Interpolation feed deceleration time Refer to *Acceleration/ Deceleration Times and Pass Mode* (page 234) for details.	Time	---
	CAM	Depending on the CAM table	Depending on the CAM table	Depending on the CAM table	---

Classification	Function	Acceleration time	Deceleration time	Time or Acceleration / Deceleration	S-curve filter select S-curve filter time constant
Axis operation start	MOVELINK	Calculated with operand A and other travel distances	Calculated with operand D and other travel distances	Depending on the travel distance. (Time image)	---
	CAMBOX	Depending on the CAM table	Depending on the CAM table	Depending on the CAM table	---
	CONNECT	---	---	---	---
	SYNC	P2AA05: Rapid feed acceleration time **Note** When trailing	←	Acceleration/deceleration **Note** When trailing	---
	ADDAX	---	---	---	---
	SPEED	Specified by operand T	Specified by operand T	Time	---
	TORQUE	Specified by operand T	Specified by operand T	Time	---
Axis operation end	SYNCR	P2AA05: Rapid feed acceleration time	P2AA06: Rapid feed deceleration time	Acceleration/deceleration	---
	ADDAXR	---	---	---	---
	SPEEDR	---	Specified by operand T	Acceleration/deceleration	---
	TORQUER	---	Specified by operand T	Acceleration/deceleration	---
Axis control bits	JOG	P2AA07: Manual feed acceleration time	P2AA08: Manual feed deceleration time	Acceleration/deceleration	P2AA10: Manual feed S-curve filter enable P2AA12: Manual feed S-curve time constant
	STEP	P2AA07: Manual feed acceleration time	P2AA08: Manual feed deceleration time	Acceleration/deceleration	P2AA10: Manual feed S-curve filter enable P2AA12: Manual feed S-curve time constant
	Origin search	P2AA07: Manual feed acceleration time	←	Acceleration/deceleration	---
	Machine origin return	P2AA07: Manual feed acceleration time	P2AA08: Manual feed deceleration time	Acceleration/deceleration	---

Operating Mode

Axis movement commands can be executed in either of two operating modes; one is Pass Mode and the other is Stop Mode. They can be changed using PASSMODE or STOPMODE command in a program.

Pass Mode:
In Pass Mode, when a consecutive operation has been specified, the program proceeds smoothly to the next operation without confirming completion of positioning.
Note that there are some commands that are always executed in Stop Mode.

Stop Mode:
In Stop Mode, when a consecutive operation has been specified, the program always confirms completion of positioning (in-position). Once positioning has been completed, the next operation is started.
For confirming positioning completion, either in-position range (set in the servo parameter) or No. 2 in-position range (set in system parameter) is used. Which range is to be used depends on each command.

The following table shows the relations between each command and operating modes.

Command	Function	Stop Mode	Pass Mode	Remark
MOVE	POSITIONING	❍	×	
MOVEL	LINEAR INTERPOLATION	□	❍	
MOVEC	CIRCULAR INTERPOLATION	□	❍	
DATUM	ORIGIN SEARCH	❍	×	
MOVEI	INTERRUPT FEEDING	❍	×	
MOVET	TIME-SPECIFIED POSITIONING	❍	×	
MOVETRAV	TRAVERSE	□	❍ or □	Stop Mode for linked traverse
CAM	ELECTRONIC CAM, SINGLE AXIS	❍	×	Acceleration/deceleration time is not known, so this command cannot be executed in Pass Mode.

❍: Executed according to the selected mode.

×: Always executed in Stop Mode.

□: The No. 2 in-position range is used.

Explanation of Pass Mode with fixed acceleration:

- The Pass Mode operation is usually performed based on acceleration or deceleration time, however, the Pass Mode with fixed acceleration can be used when the parameter [P00M06: Pass Mode select] is set to 2 or 3, and the MOVEL command is executed with only one axis specified.

Parameter No.	Name	Value
P00M06	Pass Mode Select	0: Based on interpolation acceleration time + Pass Mode with fixed acceleration disabled 1: Based on interpolation deceleration time + Pass Mode with fixed acceleration disabled 2: Based on interpolation acceleration time + Pass Mode with fixed acceleration enabled 3: Based on interpolation deceleration time + Pass Mode with fixed acceleration enabled

- Interpolation override in Pass Mode with fixed acceleration will be disabled during deceleration due to shortage of remaining travel distance. (The very last value will be held.)
- Under the following conditions in Pass Mode with fixed acceleration, the passing operation cannot be performed. The operation is stopped with deceleration once (does not wait for No.2 in-position, so it is not a Stop Mode operation), and proceeds to the next operation.

  Distance required for deceleration stop from current speed > Travel distance of the next block

Restrictions and Conditions for Pass Mode

The following setting and programming conditions must be met to enable continuous axis operation without stopping in pass mode.

1,2,3...

1. The number of parallel branches (P00002) divided by the number of parallel branches in the program must be 2 or higher.

   Ex) If P00002 is set to 4 and there are no parallel branches used in the program (i.e., if the number of branches in the program is 1), 4 divided by 1 equal 4, so this condition would be met.
2. Interpolation commands (MOVE, MOVEC, and MOVETRAV) must be used continuously.

Ex) Correct Notation	Incorrect Notation
MOVEL [J01] 100 [J02] 200;	MOVEL [J01] 100 [J02] 200;
MOVEL [J01] 200 [J02] 300;	#IWOA00=1; Not an interpolation command, so operation will not be continuous.
MOVEL [J01] 300 [J02] 400;	MOVEL [J01] 100 [J02] 200;
:	:

Pre-Ver. 2.0 MC Units

If the following conditions are met, multiple execution commands can be used between interpolation commands.

- The pass mode (P00M06) is set to 0 or 1.
- The operation begins with two consecutive interpolation commands.
- The operation time of one of the interpolation commands is longer than the processing time for the multiple execution command.

Ex)
```
PASSMODE;
MOVEL [J01] 100 F10000;
MOVEL [J02] 400 F10000:
WHILE #MW0000==0;
        INC MOVEL [J02] 100 F1000;
WEND;
```

MC Units with Ver. 2.0 or Later

If the following conditions are met, multiple execution commands can be used between interpolation commands. The only difference between the conditions here and those for Pre-Ver. 2.0 MC Unit is that the operation does not have to begin with two consecutive interpolation commands.

- The pass mode (P00M06) is set to 0 or 1.
- The operation time of one of the interpolation commands is longer than the processing time for the multiple execution command.

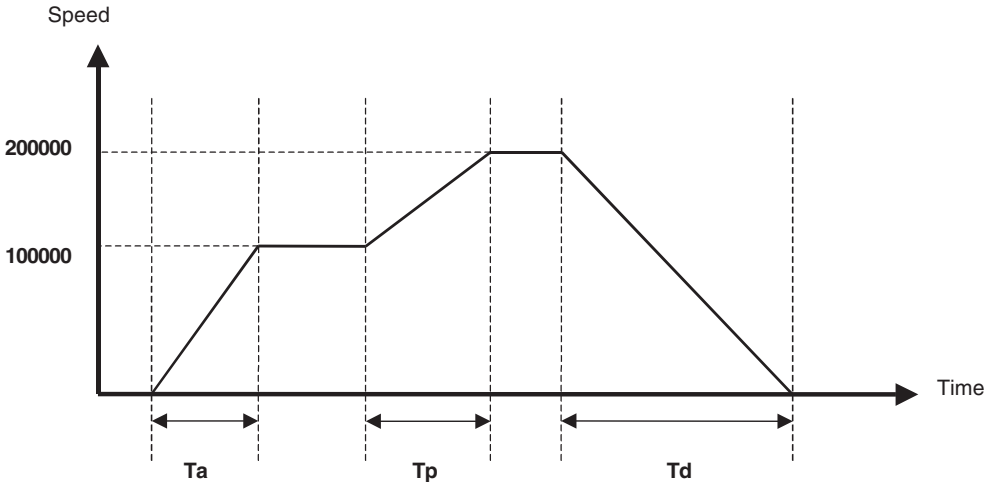
Ex)
```
PASSMODE;
WHILE #MW0000==0;
        INC MOVEL [J02] 100 F1000;
WEND;
```

Acceleration/Deceleration Times and Pass Mode for Pre-Ver. 2.0 MC Units

The following acceleration/deceleration times are used in pass mode.

Programming Example

```
PASSMODE;
MOVE [J01] 10000 F100000;
MOVE [J01] 20000 F200000;
END;
```



P00M06		Acceleration time (Ta)	Passing time (Tp)	Deceleration time (Td)
Value	Meaning			
0	Interpolation acceleration time + Pass mode with fixed acceleration disabled	P00M02	P00M02	P00M03
1	Interpolation deceleration time + Pass mode with fixed acceleration disabled	P00M02	P00M03	P00M03
2	Interpolation acceleration time + Pass mode with fixed acceleration enabled	P00M02	Acceleration: P00M02 Deceleration: P00M03	P00M03
3	Interpolation deceleration time + Pass mode with fixed acceleration enabled	P00M02	Acceleration: P00M02 Deceleration: P00M03	P00M03

Note Acceleration: When the current speed command is faster than the previous speed command
Deceleration: When the current speed command is slower than the previous speed command

Acceleration/Deceleration Times and Pass Mode for MC Units with Ver. 2.0 or Later

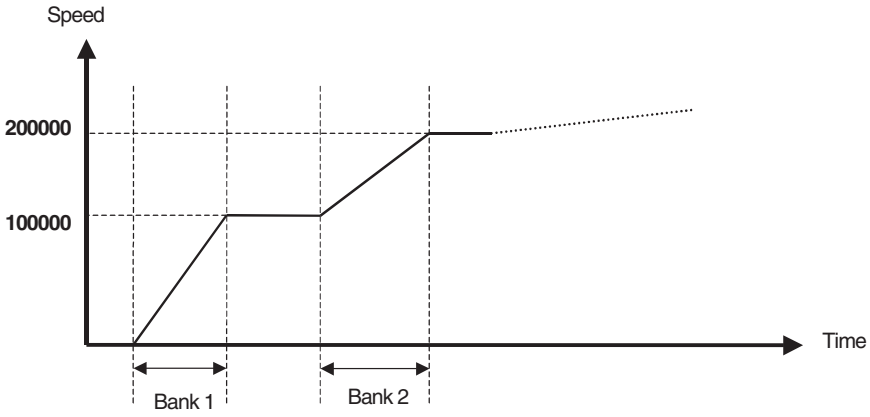
The acceleration/deceleration times for MC Units with Ver. 2.0 or later can be changed as required during pass operation. (This is not possible for Pre-Ver. 2.0 MC Units.)

Specifically, the numbers of the parameters where the acceleration/deceleration times are set are substituted for input variables to specify acceleration/deceleration times. This called bank selection. Bank selection is possible not only in pass mode, but also in stop mode.

```
PRGRAM P000 Q00000003;
PARAM P00111=100; Interpolation feed acceleration time bank 1 for task 1
PARAM P00112=200; Interpolation feed acceleration time bank 2 for task 1
:
PARAM P00120=1000; Interpolation feed acceleration time bank 10 for task 1
:
PASSMODE;
#IW0A00=1; Selects task 1 bank 1 acceleration/deceleration time
MOVE [J01] 1000 F100000; Accelerates using the selected acceleration/deceleration time
```

```
#IW0A00=2; Selects task 1 bank 2 acceleration/deceleration time
MOVE [J01] 20000 F200000; Passes using the selected acceleration/de-
celeration time
:
END;
```

Note P00111 to P00120 are task parameters. They can be set in advance from personal computer Support Software.



Parameters and Variables Used for Bank Selection

The following system parameters and input variables are used for bank selections.

System Parameters

The following ten parameters are provided for each task.

No.	Name	Setting range	Initial value	Unit
P00M11	Interpolation feed acceleration/deceleration time bank 1	0-60000	100	ms
P00M12	Interpolation feed acceleration/deceleration time bank 2	0-60000	100	ms
P00M13	Interpolation feed acceleration/deceleration time bank 3	0-60000	100	ms
P00M14	Interpolation feed acceleration/deceleration time bank 4	0-60000	100	ms
P00M15	Interpolation feed acceleration/deceleration time bank 5	0-60000	100	ms
P00M16	Interpolation feed acceleration/deceleration time bank 6	0-60000	100	ms
P00M17	Interpolation feed acceleration/deceleration time bank 7	0-60000	100	ms
P00M18	Interpolation feed acceleration/deceleration time bank 8	0-60000	100	ms
P00M19	Interpolation feed acceleration/deceleration time bank 9	0-60000	100	ms
P00M20	Interpolation feed acceleration/deceleration time bank 10	0-60000	100	ms

Input Variables

The following variables are used to specify banks for each task. If a value not between 0 and 10 is specified, the acceleration and deceleration times in P00M02 and P00M03 will be used.

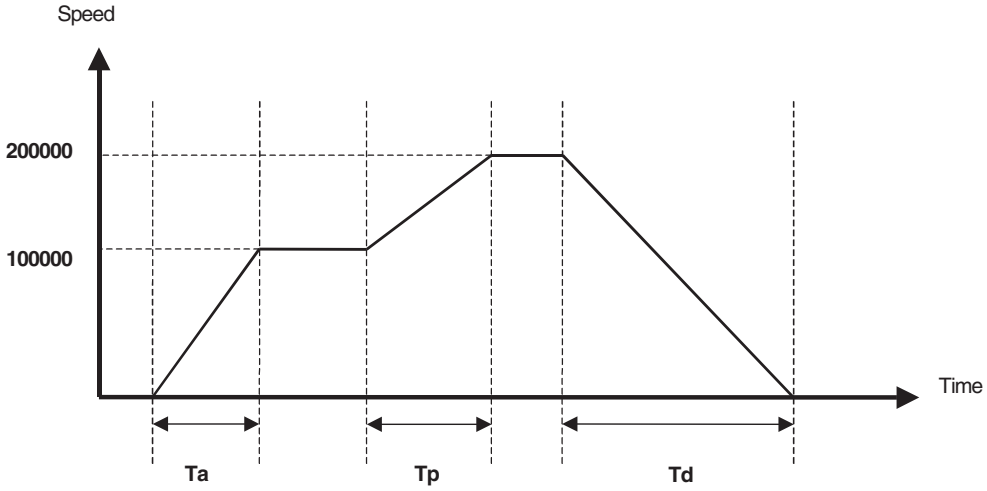
No.	Bits	Name	Setting range	Initial value
IW0A00	00-15	Acceleration/deceleration bank selection for motion task 1	0-10	0
IW0A01	00-15	Acceleration/deceleration bank selection for motion task 2	0-10	0
IW0A02	00-15	Acceleration/deceleration bank selection for motion task 3	0-10	0
IW0A03	00-15	Acceleration/deceleration bank selection for motion task 4	0-10	0
IW0A04	00-15	Acceleration/deceleration bank selection for motion task 5	0-10	0
IW0A05	00-15	Acceleration/deceleration bank selection for motion task 6	0-10	0
IW0A06	00-15	Acceleration/deceleration bank selection for motion task 7	0-10	0
IW0A07	00-15	Acceleration/deceleration bank selection for motion task 8	0-10	0

Acceleration/Deceleration Times and Bank Selections

The acceleration/deceleration times used in pass mode are described below.

Programming Example
PASSMODE;

#IW0A00=X; Selects task 1 bank X acceleration/deceleration time
MOVE [J01] 10000 F100000;
#IW0A00=Y; Selects task 1 bank Y acceleration/deceleration time
MOVE [J01] 20000 F200000;
END;



P00M06		Acceleration time (Ta)	Passing time (Tp)	Deceleration time (Td)
Value	Meaning			
0	Interpolation acceleration time + Pass mode with fixed acceleration disabled	Previously selected bank	Previously selected bank	Previously selected bank
1	Interpolation deceleration time + Pass mode with fixed acceleration disabled	P00M02	Previously selected bank	Previously selected bank
2	Interpolation acceleration time + Pass mode with fixed acceleration enabled	Previously selected bank	Acceleration: Previously selected bank Deceleration: P00M03	P00M03
3	Interpolation deceleration time + Pass mode with fixed acceleration enabled	P00M02	Acceleration: P00M02 Deceleration: Previously selected bank	Previously selected bank

Note Acceleration: When the current speed command is faster than the previous speed command
Deceleration: When the current speed command is slower than the previous speed command

Rapid Feed Rate

Rapid Feed Rate

The feed rate for the axis movement command MOVE and MOVEI can be set in the parameter [P2AA03: Rapid feed rate].

The speed can be changed using the same parameter [P2AA03: Rapid feed rate] before executing positioning.

Upper Limit of Command Value

The value set in the parameter [P2AA01: Maximum rapid feed rate] limits the speed after override, the speed specified in the operand V of MOVEI command, or the speed after override for MOVET command.

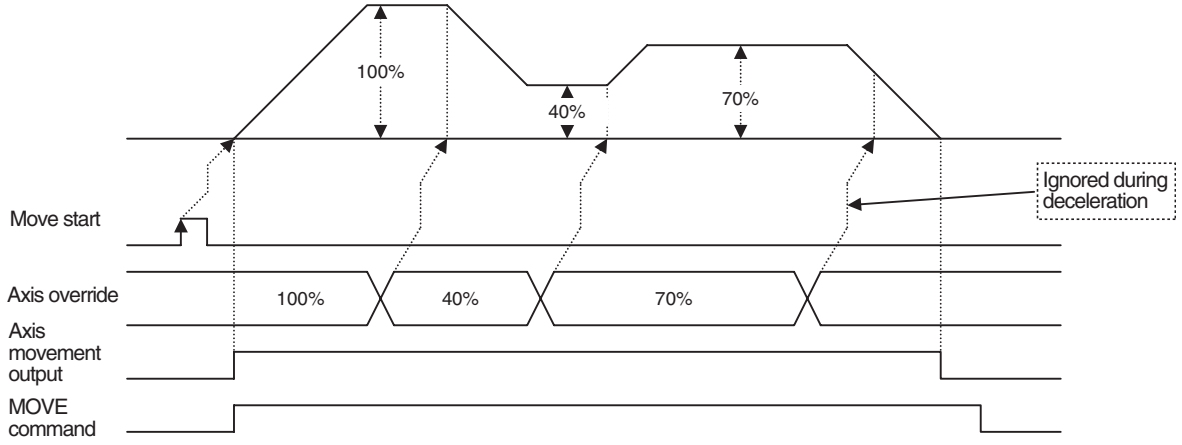
Override

The speed can be changed during operations by multiplying override to the rapid feed rate.

The axis override is used for rapid feed rate.

Range of the axis override is between 0 and 327.67%. When a value outside of the range is set, the override 0% is used.

For details of the axis override, see *7-4-4 Axis Control Bits, Axis Status Bits* (page 432).



Interpolation Feed Rate

Interpolation Feed Rate

The feed rate for the axis movement commands MOVEL, MOVEC, and MOVETRAV can be set in the Operand F in motion programs. Overwriting the value in F can change the feed rate though it is not valid during operations. During motion program execution, the previously specified interpolation speed will be held until the newly set speed is enabled. (Modal data.)

Upper Limit of Command Value

The value set in the parameter [P00M01: Maximum interpolation feed rate] limits the speed after override, the speed specified in the operand F.

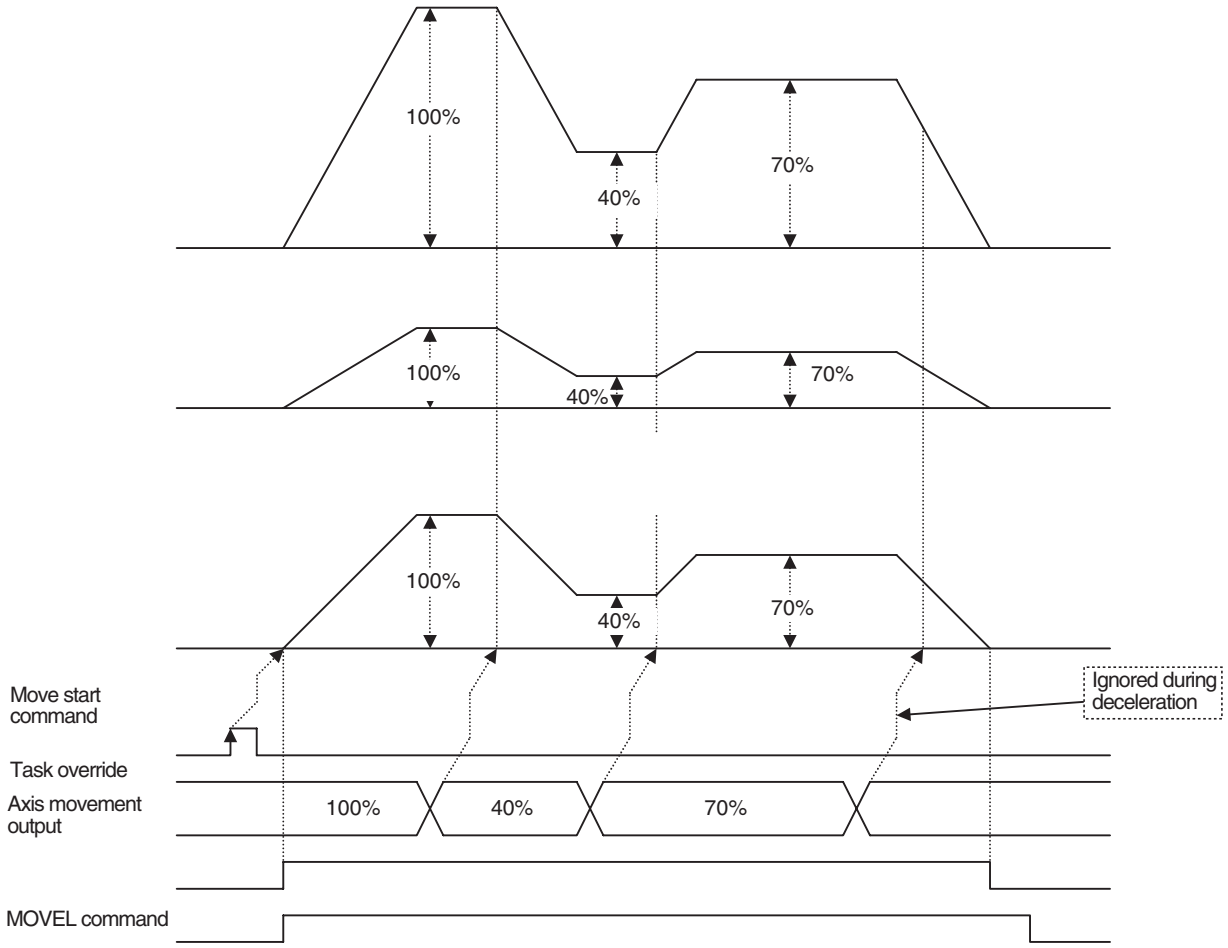
If the speed of axes exceeds the speed specified in the parameter [P2AA01: Maximum rapid feed rate], the speed will be limited as shown in the table below:

Command	Speed limit operation
MOVEL	Interpolation feed rate is limited in order to prevent the speed of the axis that has the longest travel distance from exceeding the speed specified in the parameter [P2AA01: Maximum rapid feed rate].
MOVEC	Speed of axes is not checked.
MOVETRAV	Interpolation feed rate is limited in order to prevent the speed of rotation axis from exceeding the speed specified in the parameter [P2AA01: Maximum rapid feed rate].

Override

Multiplying the override and the interpolation feed rate can change speed of the operation in progress. The task override is used for the interpolation feed rate. Range of the task override is between 0 and 327.67%. When a value outside of the range is set, the override 0% is used. If the distributed interpolation feed rates on the axes exceed the speeds specified in the parameter [P2AA01: Maximum rapid feed rate] for the axes, the maximum speed of the axis that has the longest travel distance (the fastest axis) will be used as the upper limit.

For details on the task override, see *7-4-3 Motion Task Control Bits* (page 404).



Commands using the Counter Latch Function

The following six commands use the counter latch function:

Command	Purpose for using counter latch function	Role of latch signal
DATUM: Origin search	Detects origin	The trigger to decide the final stop position
MOVEI: Interrupt feeding	Detects external signal input position	The trigger to decide the final stop position
MOVELINK: Link operation	Detects link start position	The trigger to start synchronization
CAMBOX: Electronic Cam, Synchronous	Detects link start position	The trigger to start synchronization
SYNC: Trailing Synchronization	Detects position of marker sensor ON.	The trigger to start synchronization
LATCH: Present position latch	Detects latch position	The trigger to store the latch position

With variables in the following table, whether or not the counter latch has been completed can be confirmed:

Variable	Specifications	Remark
Output variables: Axis status bits: bit 10 [Counter latch completed]	0: Started to execute function that requires counter latch 1: Completed counter latch	Relation to SW022A 0: SW022A = 0, 1, 2 1: SW022A = 3, 4
System variables: SW022A + 30 × (Axis No. − 1)	0: No latch request 1: Parameter being overwritten 2: Latch being requested 3: Latch completed (next request: disabled) 4: Latch completed (next request: enabled)	Only the latch signal input during "latch being requested" can be accepted.

Counter latch positions are stored in each variable shown in the following table:

Command: Function	Storage	Content
DATUM: Origin search MOVEI: Interrupt feeding MOVELINK: Link operation CAMBOX: Electronic Cam, Synchronous SYNC: Trailing Synchronization LATCH: Present position latch	System variablesSW0208 + 30 × (Axis No. − 1)	Counter latch position on machine coordinate system
	"Latch position storage address" in the operand of a command	Counter latch position on the currently selected coordinate system

Latch signals used for counter latch can be set in the following parameters:

Commands	Parameters	Value: Latch signals	
DATUM: Origin search	P4AA06: Origin determine signal	0: Phase-C (Z) 1: External input signal 1 2: External input signal 2 3: External input signal 3	
MOVEI: Interrupt feeding MOVELINK: Link operation CAMBOX: Electronic Cam, Synchronous SYNC: Trailing Synchronization	P5AA08: External input signal select 1	@@%%$$##h ## (MOVEI: Interrupt feeding) $$ (MOVELINK: Link operation) %% (CAMBOX: Electronic cam, Synchronous) @@ (SYNC: Trailing Synchronization)	0: Phase-C (Z) 1: External input signal 1 2: External input signal 2 3: External input signal 3
LATCH: Present position latch	P5AA09: External input signal select 2	000000##h ## (LATCH: Present position latch)	0: Phase Z(C) 1: External input signal 1 2: External input signal 2 3: External input signal 3

Simultaneous Commands (Overlap) to the Same One Axis

The operations when several commands are executed simultaneously on the same one axis are as follows:

Command executed simultaneously / Command currently being Executed		Classification		Axis movement								Axis operation												Axis operation cancel				Setting			
		Function/Name		Positioning	Linear interpolation	Circular interpolation	Origin search	Interrupt feeding	Time-specified positioning	Traverse	Electronic CAM, Single axis	Link operation		Electronic CAM, Synchronous		Electronic shaft		Trailing synchronization		Travel distance super impose		Speed control	Torque control	Trailing synchronization cancel	Travel distance super impose cancel	Speed control cancel	Torque control cancel	Target position change	Parameter value change	Workpiece coordinate system OFFSET change	Present value latch
Classification	Function/Name	Command	Stepping	MOVE	MOVEL	MOVEC	DATUM	MOVEI	MOVET	MOVETRAV	CAM	MOVELINK (M)	MOVELINK (S)	CAMBOX (M)	CAMBOX (S)	CONNECT (M)	CONNECT (S)	SYNC (M)	SYNC (S)	ADDAX (M)	ADDAX (S)	SPEED	TORQUE	SYNCR	ADDAXR	SPEEDR	TORQUER	MOVEMODI	PARAM	OFFPOS	LATCH
Axis movement	Positioning	MOVE		E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	B	B	B	B	A	A	A	A
	Linear interpolation	MOVEL		E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	B	B	B	B	G	A	A	A
	Circular interpolation	MOVEC		E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	B	B	B	B	B	A	A	A
	Origin search	DATUM		E	E	E	E	E	E	E	E	C	E	C	E	A	E	C	E	A	A	D	D	B	B	B	B	B	A	A	C
	Interrupt feeding	MOVEI		E	E	E	E	E	E	E	E	C	E	C	E	A	E	C	E	A	A	D	D	B	B	B	B	B	A	A	C
	Time-specified positioning	MOVET		E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	B	B	B	B	B	A	A	A
	Traverse	MOVETRAV		E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	B	B	B	B	B	A	A	A
	Electronic CAM, Single axis	CAM		E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	B	B	B	B	B	A	A	A
Axis operation	Link operation	MOVELINK (M)		A	A	A	C	C	A	A	A	C	F	C	F	A	F	C	F	A	A	A	A	B	B	I	I	B	A	A	C
		MOVELINK Slave	Q0 Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q1 Completed	E	E	E	E	E	E	E	E	A	A	A	A	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q2 Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q3 Completed	E	E	E	E	E	E	E	E	A	A	A	A	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q4 Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q5 Completed	E	E	E	E	E	E	E	E	A	A	A	A	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Not completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
	Electronic CAM, Synchronous	CAMBOX (M)		A	A	A	C	C	A	A	A	C	F	C	F	A	F	C	F	A	A	A	A	B	B	I	I	B	A	A	C
		CAMBOX slave	Q0 Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q1 Completed	E	E	E	E	E	E	E	E	A	A	A	A	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q2 Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q3 Completed	E	E	E	E	E	E	E	E	A	A	A	A	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q4 Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q5 Completed	E	E	E	E	E	E	E	E	A	A	A	A	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q8 Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q9 Completed	E	E	E	E	E	E	E	E	A	A	A	A	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q10 Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q11 Completed	E	E	E	E	E	E	E	E	A	A	A	A	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q12 Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Q13 Completed	E	E	E	E	E	E	E	E	A	A	A	A	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Not Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
	Electronic shaft	CONNECT Master		A	A	A	A	A	A	A	A	A	F	A	F	A	F	A	F	A	A	A	A	B	B	I	I	B	A	A	A
		CONNECT slave	Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	A	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Not Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
	Trailing synchronization	SYNC Master		A	A	A	C	C	A	A	A	C	F	C	F	A	F	C	F	A	A	A	A	B	B	I	I	B	A	A	C
		SYNC slave	Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A
			Not Completed	E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	A	B	B	B	B	A	A	A

Command executed simultaneously / Command currently being Executed		Classification		Axis movement								Axis operation												Axis operation cancel				Setting			
		Function/Name		Positioning	Linear interpolation	Circular interpolation	Origin search	Interrupt feeding	Time-specified positioning	Traverse	Electronic CAM, Single axis	Link operation		Electronic CAM, Synchronous		Electronic shaft		Trailing synchronization		Travel distance super impose		Speed control	Torque control	Trailing synchronization cancel	Travel distance super impose cancel	Speed control cancel	Torque control cancel	Target position change	Parameter value change	Workpiece coordinate system OFFSET change	Present value latch
Classification	Function/Name	Command	Stepping	MOVE	MOVEL	MOVEC	DATUM	MOVEI	MOVET	MOVETRAV	CAM	MOVELINK (M)	MOVELINK (S)	CAMBOX (M)	CAMBOX (S)	CONNECT (M)	CONNECT (S)	SYNC (M)	SYNC (S)	ADDAX (M)	ADDAX (S)	SPEED	TORQUE	SYNCR	ADDAXR	SPEEDR	TORQUER	MOVEMODI	PARAM	OFFPOS	LATCH
Axis operation	Travel distance superimpose	ADDAX Master		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	I	I	B	A	A	A
		ADDAX Slave		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	D	D	B	A	B	B	B	A	A	A
	Speed control	SPEED	Completed	A	D	D	D	D	D	D	D	A	D	A	D	A	D	A	D	A	D	A	A	B	B	A	B	B	A	A	A
			Not Completed	E	D	D	D	D	D	D	D	A	D	A	D	A	D	A	D	A	D	E	E	B	B	A	B	B	A	A	A
	Torque control	TORQUE	Completed	D	D	D	D	D	D	D	D	A	D	A	D	A	D	A	D	A	D	D	A	B	B	B	A	B	A	A	A
			Not Completed	D	D	D	D	D	D	D	D	A	D	A	D	A	D	A	D	A	D	D	E	B	B	B	A	B	A	A	A
Axis operation cancel	Trailing synchronization cancel	SYNCR		E	E	E	E	E	E	E	E	A	E	A	E	A	E	A	E	A	A	D	D	B	B	B	B	B	A	A	A
	Travel distance superimpose cancel	ADDAXR		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	D	D	B	B	B	B	B	A	A	A
	Speed control cancel	SPEEDR		D	D	D	D	D	D	D	D	A	D	A	D	A	D	A	D	A	D	D	D	B	B	B	B	B	A	A	A
	Torque control cancel	TORQUER		D	D	D	D	D	D	D	D	A	D	A	D	A	D	A	D	A	D	D	D	B	B	B	B	B	A	A	A
Setting	Target position change	MOVEMODI		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	Parameter value change	PARAM		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	Workpiece coordinate system OFFSET change	OFFPOS		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	Present value Latch	Present value Latch		A	A	A	C	C	A	A	A	C	A	C	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A	A	H

	Meaning
A	Can be executed.
B	The function executed later will be ignored.
C	Can be executed when no latch is requested. However, when latch is being requested and the function is executed, the alarm [301Ah:Counter latch resource violation] will occur and the program will be interrupted. Also, if the function is executed when writing the latch range parameters, the alarm [2016h: Same axis specification multiplicity] will occur, and the program will be interrupted.
D	Alarm [2014h: Control mode error] will occur, and the program will be interrupted.
E	Alarm [2016h: Same axis specification multiplicity] will occur, and the program will be interrupted.
F	Alarm [2018h: Synchronous slave axis specification error] will occur, and the program will be interrupted.
G	Only MOVEMODI during MOVEL: Can be executed if a single axis is specified for each command. Otherwise, the function executed later will be ignored.

	Meaning
H	Only latch cancel can be executed. Other cases will be as follows: When executed in parallel, the alarm [2016: Same axis specification multiplicity] will occur and the program will be interrupted. When executed in series, the alarm [301A: Counter latch resource violation] will occur and the program will be interrupted. When executed continuously, the alarm [2016: Same axis specification multiplicity] will occur and the program will be interrupted.
I	Only SPEEDR/TORQUER for the master axis: The function executed later will be ignored. Note that, however, if the master axis is under speed or torque control, SPEEDR/TORQUER will be executed to end the operation.

Changing Control Mode

There are three different types of control mode for the MC Unit; [Position control mode], [Speed control mode], and [Torque control mode].

Switching method and the behaviors are as shown below:

Mode before switch	Mode after switch	Switching method	Behavior
Position	Speed	• Execute SPEED command when the axis is being stopped.	When executing SPEED command during axis movement, the alarm [2014: Control mode error] will occur.
Position	Torque	• Execute TORQUE command when the axis is being stopped.	When executing TORQUE command during axis movement, the alarm [2014: Control mode error] will occur.
Speed	Position	• Execute a command for position control mode after SPEEDR command was executed to switch to the position control mode.	When executing a command for position control mode without executing SPEEDR command first, the alarm [2014: Control mode error] will occur.
		• Execute MOVE command.	When executing MOVE command without executing SPEEDR command, the speed of the operation changes smoothly.
Speed	Torque	• Execute TORQUE command after SPEEDR command was executed to switch to position control mode. • Execute TORQUE command.	When executing TORQUE command without executing SPEEDR command first, the torque command 0 is used after the switch because the torque command value in the speed control mode is unknown. To change torque smoothly, monitor the torque in speed control mode, and execute the block with torque command value that was monitored in TORQUE command of 0 torque change rate.
Torque	Position	• Execute TORQUER command	When executing a command (MOVE, etc.) for position control mode in torque control mode, the alarm [2014: Control mode error] will occur.
Torque	Speed	• Execute SPEED command after TORQUER command was executed to switch to position control mode.	When executing SPEED command in torque control mode, the alarm [2014: Control mode error] will occur.

To stop axis (speed=0) in speed control mode started by SPEED command, execute the SPEEDR command (speed control cancel).

The waveform at this point (i.e. when stopping) will follow the speed change rate specified in SPEEDR command.

Similarly, to stop axis (torque=0) in torque control mode started by TORQUE command, execute the TORQUER command (torque control cancel).

The waveform at this point (i.e. when stopping) will follow the torque change rate specified in TORQUER command.

Note As in the following cases, however, the operation is stopped (or started) without executing SPEEDR or TORQUER command. Therefore, the speed change rate or torque change rate specified in the previous SPEED or TORQUE command is used.

- When an alarm occurred
- When a program ended
- When a program was interrupted
- When a program was restarted after interruption.

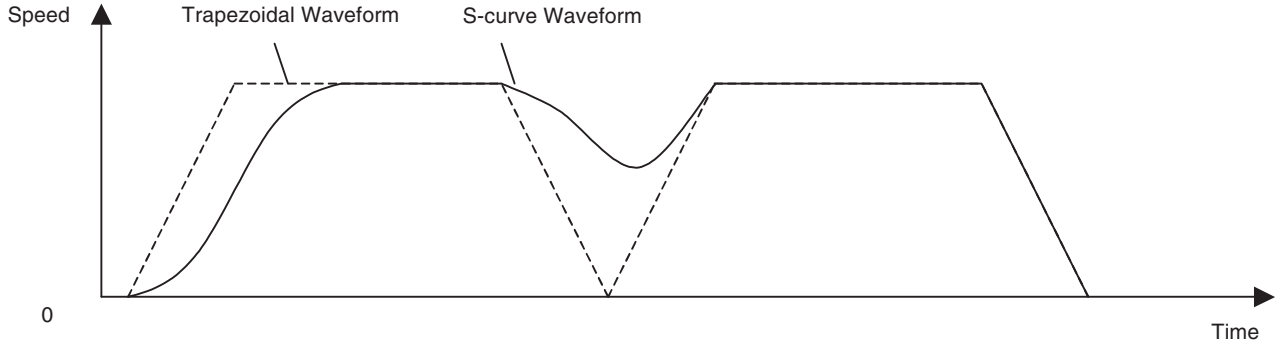
S-curve Filter & Stop Mode/Pass Mode

Movement averaging filter is used for the S-curve acceleration/deceleration of the MC Unit.

A command of the next block can be executed during S-curve deceleration. However, if the command is to be executed after completion of the previous command's output (as it should be for CAM, etc.), STOPMODE or PASSMODE command can be used to control the execution.

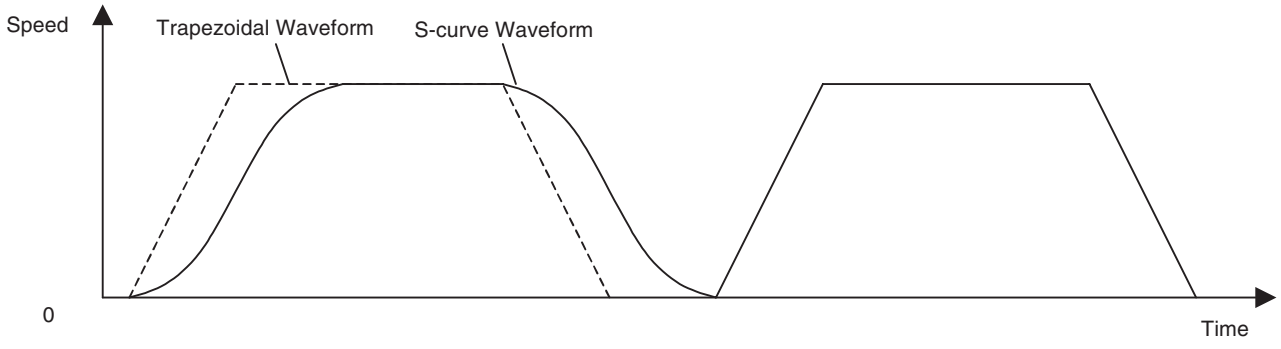
When MOVELaMOVE command was executed in Pass Mode:

Program example:
PROG P0001 Q00000001;
PASSMODE;
INC MOVEL [J01] 10000 F100000; Interpolation feed S-curve filter enable
INC MOVE [J01] 10000; Rapid feed S-curve filter disable
END;



When MOVELaMOVE command was executed in Stop Mode:

Program example:
PROG P0001 Q00000001;
STOPMODE;
INC MOVEL [J01] 10000 F100000;
INC MOVE [J01] 10000;
END;



6-1-6 Synchronous Command

There are five different types of synchronous commands.

- MOVELINK: Link operation start
- CAMBOX: Electronic cam, synchronous
- CONNECT: Electronic shaft
- SYNC: Trailing synchronization
- ADDAX: Travel distance superimpose

Master Axis

- Any MC Unit axis can be used as a master axis. Axis declaration by PROG command (program start) is not required for the axes to be used only as master axes.
- Whether to use the specified speed of the master axis or the feedback speed can be selected using the operand of each synchronous command.
- If a master axis is the virtual axis, feedback speed = specified speed.
- For the counter axis, specified speed = feedback speed.
- There is no limit on the number of slave axes per one master axis.
- The axis that is already operating as a slave axis can be specified as a master axis for another synchronous command.

Slave Axis

- Only the axes that are declared by PROG command (program start) can be used as slave axes.
- A master axis that is already operating cannot be specified as a slave axis for another synchronous command, except for that the master axis of ADDAX (Travel distance superimpose) command can be specified as a slave axis of another synchronous command.
- When a slave axis already in synchronization is specified as a slave axis for another master axis, the alarm [2016h: Same axis specification multiplicity] will occur. In the cases below, however, the alarm will not occur and a new synchronous operation will be established.

Operating axis	Overlapping command	Operation
MOVELINK slave axis	MOVELINK slave axis	Interrupts the current synchronization and establish a new synchronization.
	CAMBOX slave axis	
CAMBOX slave axis	MOVELINK slave axis	
	CAMBOX slave axis	
CONNECT slave axis	CONNECT slave axis	

Program Restart

When a program is stopped after establishing synchronization and resumed, the following operations will be as described below depending on the command.

MOVELINK, CAMBOX:

The latest interrupted synchronization is re-executed. Whether the condition for starting the synchronization is met or not met will be reflected when it is restarted.

CONNECT:

The latest interrupted synchronization is re-executed.

SYNC:

There is no re-execution after interruption.

ADDAX:

The latest interrupted synchronization is re-executed.

Note While a program is being stopped, synchronization is also being stopped. Therefore, there will be some position deviation between axes if the axis is moved.

Precautions in Using Synchronous Commands

The precautions are as follows:

1,2,3... 1. Start the master axis of a synchronous command only after all the slave axes have recognized and processed the command.

Especially when the master and slave axes are in different tasks, or in different blocks of parallel branching, provide interlocking, etc. so that the master axis starts operating only after all the slave axes have recognized and processed the command.

Program example

```
PROG P000 Q00000003;

MOVELINK [J02]#PL0002 [J01]20. A10. D10. Q5 I0. B0; Sync condition set
#MW0004 = 1;        MOVELINK execution notify flag to task 2 set

END;
```

```
PROG P001 Q00000004;

WAIT #MW0004 == 1;          MOVELINK execution of task 1 confirmed
MOVEL [J03]#PL0000 F#DL0000;        Starting master axis

END;
```

2. Set the resolution for the master axis of the synchronous command higher than the one of slave axes.

Since slave axes cannot operate with the unit system smaller than the one of the master axis, setting a larger travel distance for slave axes than the travel distance "1" of the master axis causes off-and-on operations. Make sure to set parameters so that "Master axis travel distance > Slave axes travel distance" is true.

In this case, the problem lies not in the resolution for 1 motor rotation on each motor, but in the relations on travel distances between the master and slave axes in synchronization.

An example is shown using the following parameters.

Parameter setting value			[J01]	[J02]
Axis parameter	P5AA02	Position command decimal point position	2	4
	P5AA04	Command unit/1 machine rotation	36000	100000
	P5AA05	Gear ratio 1 (motor rotation speed)	5	1
	P5AA06	Gear ratio 2 (machine rotation speed)	1	1
Motor parameter	9001h	No. of encoder pulses (×4)	65536	65536

Program

MOVELINK [J02]6000 [J01]100. A50. D50. Q5 I0. B0;

According to the conditions mentioned above, the travel distance (pulse) of each axis for linking distance will be as follows:

$$\text{Pulse [on motor]} = \text{Command unit [on machine]} \times \frac{\text{9001h [No. of encoder pulses/1 motor rotation]} \times \text{P5AA05 [on motor]}}{\text{P5AA04 [command unit/1 machine rotation]} \times \text{P5AA06 [on machine]}} \text{ --- (1)}$$

- No. of pulses for the linking distance of the master axis [J01]:
  When 100. of [J01] is converted from the immediate value to the command unit,
  Command unit = 100. / 0.01 (unit of P5AA02) = 10000 [on machine]
  Put the result in the formula (1):
  Pulse [on motor] =10000 [on machine] × (65536 × 5) / (36000 × 1)
  = 91022.22 = 91022 [pulse] --- (2)
- No. of pulses for the linking distance of the slave axis [J02]:
  Pulse [on motor] = 6000 [on machine] × (65536 × 1) / (36000 × 1)
  = 10922.6 = 10922 [pulse] --- (3)

  According to the results (2) and (3), the relations between the master axis [J01] and the slave axis [J02] on the travel distance (pulse) within the linking distance is:

  Master axis [J01] Slave axis [J02]
  91022 [pulse] > 10922 [pulse]

  In this case, the travel distance of the master axis is larger than the one of the slave axis. Thus, the condition "Master axis travel distance > Slave axis travel distance" is satisfied.

Processing Required When the Command Execution Completion for MOVELINK, CAMBOX Is Set to "At the Same Time with the Command Start"

By setting the link option of the synchronous commands MOVELINK and CAMBOX to "At the same time with the command start" for the command execution completion, the program can execute a single execution command (axis movement, etc.) on a slave axis different from the one previously used.

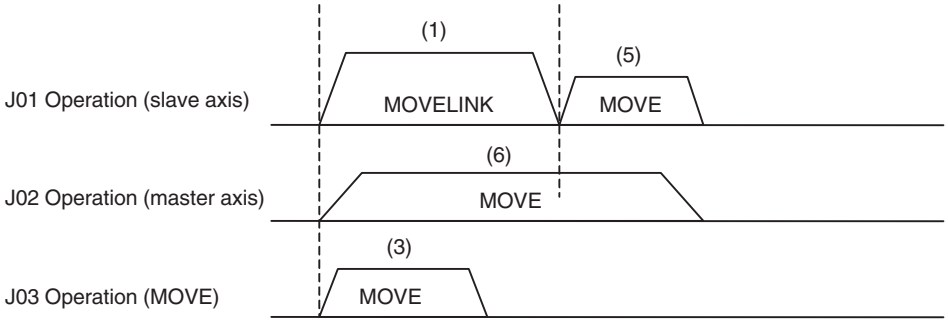
However, when a new single execution command such as axis movement, etc. is to be executed after completion of the previous synchronous operation, the operation of the new command is started (specifying the same slave axis as the one previously, or currently being used causes an alarm.) before the synchronous operation is completed unless a program that monitors completion of the synchronous operation is arranged. The following is the program example.

Program

Task 1
PROG P0001 Q00000005; Declaration of the program
(1)MOVELINK [J01]2000 [J02]1000 A200 D200 Q1; Synchronizes J01 with J02
(2)#MW0000 = 0055; Writes "55" to global variable 0000
(3)MOVE [J03]1500; Moves J03 to the position 1500
(4)WAIT #SW0228 == 0000; Stops stepping till J01 not being executed
(5)MOVE [J01]3000; Moves J01 to the position 3000
END;

Task 2
PROG P0001 Q00000002; Declaration of the program
(2)WAIT #MW0000 == 0055; Stops stepping till global variable 0000 becomes "55"
#MW0000 = 0; Writes "0" to global variable 0000
(6)MOVE [J02]2000; Moves J02 to the position 2000
END;

Timing chart



Explanation

1,2,3...

1. Having J02 as a master axis with the travel distance of 1000, J01 is moved to the position of 2000 through synchronization. In this operation, the acceleration interval of the slave axis is specified between the synchronization start position and 200 of the master axis travel distance while the deceleration interval is specified between the synchronization end position and 200 of the master axis travel distance. The program advances with the link option set to "1" (link operation is started at the same time as the command execution start, the command execution is completed at the same time as the command execution start).
2. Using the global variable #MW0000, the program notifies task 2 that MOVELINK block has been executed. (It is used as interlocking for the master axis.) As the response, task 2 resets the content of the global variable (#MW0000 = 0;), and then executes the command for (6).
3. J03 is executed simultaneously during the operation of J01.
4. Monitoring the command execution status of the system variable #SW0228 (for Axis 1), the advancement of task 1 is held until the command code becomes "0000" (no axis movement).
5. J01 is finished with the MOVELINK command of (1) after (4), another single execution command can be executed.

6-1-7 Modal Data

Data that is selected by the following commands, and that can be omitted later in the program, is called modal data.

Group	Command	Description
1	ABL/INC	Interprets the specified position either as an absolute value specification or as an incremental value specification.
2	PASSMODE/ STOPMODE	Sets the axis movement command operating mode to either Pass Mode or Stop Mode
3	Operand F	Sets the speed command value of the interpolation command in Operand F

Initializing

When power is turned ON or when program execution is started in Start Mode 0 without executing END command, initialization is executed according to the default settings of the parameters. Default setting parameter is maintained for each task.

Group	Command	Default value	Parameter No.
1	ABL/INC	ABL	P00M07 (M = 1-8)
2	PASSMODE/ STOPMODE	PASSMODE	P00M08 (M = 1-8)
3	Operand F	F=0	P00M09 (M = 1-8)

Calling Sub-program

If a sub-program has been called using the GOSUB command, all modal data is inherited. Also, when the operation returns to the main program from sub-program, all modal data is inherited.

Parallel Branching

If parallel branching has been executed using the PARALLEL command, modal data for all the branches is inherited.

Modal data that has been changed during each branch will not affect other branches.

When branches join together again, the modal data of the leftmost branch is inherited to subsequent blocks.

END Command Execution

The execution of END command does not initialize modal data.

6-1-8 Nesting

Nesting levels for nest-able commands are as follows:

Command	Motion task
GOSUB	5 layers
WHILE-WEND	10 layers
FOR-NEXT	10 layers
IF-ELS-ENDIF	10 layers

6-1-9 Unit for Time

The unit for time used for the following commands is [msec].

The minimum command unit is 1msec, however, the actual resolution is determined based on the system scan cycle (remainder to be omitted).

Command	Time
MOVET	Positioning time
CAM	Cam execution time
DWELL	Dwell time

6-1-10 Conditional Expression

Conditional expressions can be used for the following commands.

Command	Function
WAIT	Wait for Condition to be Met
STOPOP	Optional End
IF	Conditional Branching
WHILE	Repeat While

Conditional expressions are shown in the following table. Immediate values or variables are the only the objects of comparison. If other data types are used, the program cannot be downloaded.

Conditional Expression	Format
Equal to	(Immediate value or Variable)==(Immediate value or Variable)
Not equal to	(Immediate value or Variable)<>(Immediate value or Variable)
Greater than	(Immediate value or Variable)>(Immediate value or Variable)
Less than	(Immediate value or Variable)<(Immediate value or Variable)
Equal to or greater than	(Immediate value or Variable)>=(Immediate value or Variable
Equal to or less than	(Immediate value or Variable)<=(Immediate value or Variable)

6-1-11 Arithmetic Command

Data type

Bit Type:

- For the operation using data of bit type, every operand in the operation must be bit type.
- Integer immediate value [0] and [1] are treated as the bit type.

Other Types:

- Besides bit type, all other types observe the priority sequence described below.
  Real-number type > Long type > Word type
- Operation is performed with the type of the highest priority, and the operation result is converted to the type on the left and stored.
- Integer immediate value is treated as long type, and decimal immediate value is treated as real-number type.

B: Bit type, W: Word type, L: Long type, F: Real-number type, @: Indirect specification

Classification	Function	Command	Notation example	Operand	Range	Immediate value		Variable					
						Integer	Decimal point	R/W	B	W	L	F	@
Simple Arithmetic	Assign	=	#MW- = #MW-;	1st Term	---	No	No	Write	Yes	Yes	Yes	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	Yes	Yes	Yes	Yes	Yes
	Add	+	#MW- = #MW- + #MW-;	1st Term	---	No	No	Write	No	Yes	Yes	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
				3rd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
	Subtract	–	#MW- = #MW- - #MW-;	1st Term	---	No	No	Write	No	Yes	Yes	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
				3rd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
	Multiply	×	#MW- = #MW- * #MW-;	1st Term	---	No	No	Write	No	Yes	Yes	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
				3rd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
	Divide	/	#MW- = #MW- / #MW-;	1st Term	---	No	No	Write	No	Yes	Yes	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
				3rd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
	Quotient	%	#MW- = #MW- % #MW-;	1st Term	---	No	No	Write	No	Yes	Yes	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
				3rd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
	Exponent	^	#MW- = #MW- ^ #MW-;	1st Term	---	No	No	Write	No	Yes	Yes	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
				3rd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes

Classification	Function	Command	Notation example	Operand	Range	Immediate value		Variable					
						Integer	Decimal point	R/W	B	W	L	F	@
Logic operations	OR (Logical OR)	|	#MW- = #MW- | #MW-;	1st Term	---	No	No	Write	Yes	Yes	Yes	No	No
				2nd Term	LONGMIN-LONGMAX	Yes	Integer	Read	Yes	Yes	Yes	No	Yes
				3rd Term	LONGMIN-LONGMAX	Yes	Integer	Read	Yes	Yes	Yes	No	Yes
	XOR (Logical exclusive OR)	~	#MW- = #MW- ~ #MW-;	1st Term	---	No	No	Write	No	Yes	Yes	No	No
				2nd Term	LONGMIN-LONGMAX	Yes	Integer	Read	No	Yes	Yes	No	Yes
				3rd Term	LONGMIN-LONGMAX	Yes	Integer	Read	No	Yes	Yes	No	Yes
	AND (Logical AND)	&	#MW- = #MW- & #MW-;	1st Term	---	No	No	Write	Yes	Yes	Yes	No	No
				2nd Term	LONGMIN-LONGMAX	Yes	Integer	Read	Yes	Yes	Yes	No	Yes
				3rd Term	LONGMIN-LONGMAX	Yes	Integer	Read	Yes	Yes	Yes	No	Yes
	NOT (Reverse)	!	#MW- = !#MW-;	1st Term	---	No	No	Write	Yes	Yes	Yes	No	No
				2nd Term	LONGMIN-LONGMAX	Yes	Integer	Read	Yes	Yes	Yes	No	Yes
Functions	Absolute value	ABS	#MF- = ABS#MF-;	1st Term	---	No	No	Write	No	Yes	Yes	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
	Sine	SIN	#MF- = SIN#MF-;	1st Term	---	No	No	Write	No	Yes	No	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	No	Yes	No
	Cosine	COS	#MF- = COS#MF-;	1st Term	---	No	No	Write	No	Yes	No	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	No	Yes	No
	Tangent	TAN	#MF- = TAN#MF-;	1st Term	---	No	No	Write	No	No	No	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	No	No	Yes	No
	ARC Sine	ASIN	#MF- = ASIN#MF-;	1st Term	---	No	No	Write	No	No	No	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	No	No	Yes	No
	ARC Cosine	ACOS	#MF- = ACOS#MF-;	1st Term	---	No	No	Write	No	No	No	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	No	No	Yes	No
	ARC Tangent	ATAN	#MF- = ATAN#MF-;	1st Term	---	No	No	Write	No	Yes	No	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	No	Yes	No
	Square root	SQR	#MF- = SQR#MF-;	1st Term	---	No	No	Write	No	Yes	No	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	No	Yes	No
	Normal logarithm	EXP	#MF- = EXP#MF-;	1st Term	---	No	No	Write	No	Yes	No	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	No	Yes	No
	Natural logarithm	LOG	#MF- = LOG#MF-;	1st Term	---	No	No	Write	No	Yes	No	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	No	Yes	No

Classification	Function	Command	Notation example	Operand	Range	Immediate value		Variable					
						Integer	Decimal point	R/W	B	W	L	F	@
Functions	Decimal	FRAC	#MF- = FRAC#MF-;	1st Term	---	No	No	Write	No	No	No	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	No	No	Yes	No
	Sign	SGN	#MF- = SGN#MF-;	1st Term	---	No	No	Write	No	Yes	Yes	Yes	No
				2nd Term	Within the operation numerical value range	Yes	Yes	Read	No	Yes	Yes	Yes	Yes
Bit operations	Specified bit ON	SET	#MB- = SET#MB- & #MB-;	1st Term	---	No	No	Write	Yes	No	No	No	No
				Logic operation expression	---	---	---	---	---	---	---	---	---
	Specified bit OFF	RESET	#MB- = RESET#MB- & #MB-;	1st Term	---	No	No	Write	Yes	No	No	No	No
				Logic operation expression	---	---	---	---	---	---	---	---	---
	Shift right	SFTR	SFTR #MB-N-;	Object to be shifted	---	No	No	Write	No	Yes	Yes	No	No
				Shift amount	Object to be shifted is the word type:1 to 16 Object to be shifted is the long type:1 to 32	Yes	No	Read	No	Yes	No	No	No
	Shift left	SFTL	SFTL #MB-N-;	Object to be shifted	---	No	No	Write	No	Yes	Yes	No	No
				Shift amount	Object to be shifted is the word type:1 to 16 Object to be shifted is the long type:1 to 32	Yes	No	Read	No	Yes	No	No	No

Classification	Function	Command	Notation example	Operand	Range	Immediate value		Variable					
						Integer	Decimal point	R/W	B	W	L	F	@
Data Operations	BCD→BIN	BIN	#MW- = BIN#MW-;	1st Term	---	No	No	Write	No	Yes	Yes	No	No
				2nd Term	In BCD format, Word type: 0 to 9999 Long type: 0 to 99999999	Yes	Integer	Read	No	Yes	Yes	No	Yes
	BIN→BCD	BCD	#MW- = BCD#MW-;	1st Term	---	No	No	Write	No	Yes	Yes	No	No
				2nd Term	In BCD format, Word type: 0 to 9999 Long type: 0 to 99999999	Yes	Integer	Read	No	Yes	Yes	No	Yes
	Block transfer	XFER	XFER #MW- #MW- N-	Beginning of transfer source	---	No	No	Read	No	Yes	No	No	No
				Beginning of transfer destination	---	No	No	Write	No	Yes	No	No	No
				No. of transfers	Both transfer source and destination are, System variable: 1 to (2048 - address) Global general variable: 1 to (8192 - address) Input variable: 1 to (4096 - address) Output variable: 1 to (4096 - address) Task variable: 1 to (128 - address)	Yes	No	Read	No	Yes	No	No	No
	Clear	CLEAR	CLEAR #MW- N-	Beginning of clear	---	No	No	Write	No	Yes	No	No	No
				No. of clears	Global general variable: 1 to (8192 - address) Input variable: 1 to (4096 - address) Output variable: 1 to (4096 - address) Tasks variable: 1 to (128 - address)		Yes	No	Read	No	Yes	No	No

6-1-12 Data Used for Operand

Immediate Value

There are two kinds of immediate values; integer and decimal number.

The ranges for each immediate value are listed below.

- Integer: Value without decimal point
  Minimum value: –2147483648
  Maximum value: 2147483647

- Decimal number: Value with decimal point
  Minimum value: –2147483648.
  Maximum value: 2147483647.
  Maximum number of decimals: 30 digits
  Maximum number of digits excluding 0: 10 digits
  (Negative value: 2147483648, Positive value: 2147483647)

<Example> The decimal number with the greatest No. decimals is shown in the following table.

Number of digits after the decimal point			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Negative value	-	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4	7	4	8	3	6	4	8
Positive value	+	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4	7	4	8	3	6	4	7
Maximum number of digits excluding 0	←----------10 digits----------→																																
Maximum number of digits after the decimal point	←----------30 digits----------→																																

Variable

Depending on the operand, variables can be specified instead of immediate values.

Refer to *6-3 Command Details* (page 271).

6-1-13 Virtual Axis

The following table describes the differences between virtual axes and real axes.

Function item	Specifications	
Device type	Virtual axis = Virtual Servo axis only.	
Servo lock/unlock	Required as well as the real axis.	
ABS origin setting	Ignored	
Axis machine lock	Ignored	
IORD/IOWR of Servo parameters	PARAM command	Alarm [2019h: Parameter setting error] will occur and the program is stopped.
	IORD/IOWR	Error completion
	Support tool	Required as well as the real axis, Only writing into MC Unit possible.
Origin search	Same operation as machine origin return. (Positioning to the origin)	
Hardware OT	Does not operate because external input cannot be input.	
DATUM command	Same operation as execution of the following programs. (Same as when origin search is performed by control bits.) ORIGIN; Machine coordinate system select ABL MOVE [Jxx]0; Positioning to machine coordinate system origin.	
MOVEI command	Alarm [3015h: Axis classification error] occurs and the program is stopped.	
Master axis of SYNC command	Alarm [3015h: Axis classification error] occurs and the program is stopped.	
Link option requiring latch	Alarm [3015h: Axis classification error] occurs and the program is stopped.	
SPEED/SPEEDR command (Speed control)	Command is enabled as well as for the real axis.	
TORQUE/TORQUER command (Torque control)	Alarm [3015h: Axis classification error] occurs and the program is stopped.	
LATCH command	Alarm [3015h: Axis classification error] occurs and the program is stopped.	
Establishing machine coordinate system origin	The position where power is turned ON is determined as machine coordinate system origin. (Operates in [Origin at power ON] mode.) It is possible to determine a user-specified position as an origin using the axis control bit [Forced origin].	

Function item	Specifications	
Present value monitor	Present coordinate system FB position	= Present coordinate system command position
	Machine coordinate system FB position	= Machine coordinate system command position
	Present coordinate system command position	Same as for the real axis
	Machine coordinate system command position	Same as for the real axis
	Counter latch position	Always 0
	Feedback speed 1	= Command speed 1
	Feedback speed 2	Always 0
	Command speed 1	Same as for the real axis
	Command speed 2	Always 0
	Error	Always 0
	Torque command value	Always 0
	Workpiece origin shift amount	Same as for the real axis
	Origin margin	Always 0
	No. of multi-turns	Same as for the real axis
	MECHATROLINK servo status	Always 0
	Absolute position setting value	Always 0
Error on the communication path (Synchronous communication error, etc.)	Does not occur.	

6-1-14 I/O Axis

The following table describes the differences between axes allocated as I/O and as servo.

Function item	Specifications		
Axis control bits	All disabled except for "bit00: Axis alarm reset".		
Axis status bits	**bit**	**Name**	**ON/OFF status**
	00	Axis alarm	As usual, turns ON/OFF.
	01	Machine origin	Always OFF.
	02	Busy	Always OFF.
	03	Servo lock	Always OFF.
	04	No origin	Always OFF.
	05	Axis started	Always OFF.
	06	Positioning completed	Always OFF.
	07	Positioning completed (No.2)	Always OFF.
	08	Error counter warning	Always OFF.
	09	Axis machine lock status	Always OFF.
	10	Counter latch completed	Always OFF.
	11	M-10 Warning	Intelligent I/O turns ON/OFF, as usual.
	12	Reserved	Always OFF.
	13	Command disabled/enabled	As usual, turns ON/OFF.
	14	Axis not used/used	Always OFF.
	15	In manual/automatic mode	Always OFF.
Present value monitor	Always 0		
PROG axis declaration	If specified, the alarm [201Ah: Axis declaration error] will occur.		
Usage in each command	If axis No. is specified on axes other than the synchronous master axis, the alarm [2007h: Axis reservation disable] will occur.		

Function item	Specifications	
IORD/IOWR of Servo parameters	PARAM command	Alarm [2019h: Parameter setting error] will occur and the program is stopped.
	IORD/IOWR command	Error completion
	Support tool	Same as for axes without allocation, only reading from the MC Unit can be performed normally.
Present value preset with IOWR	Error completion	
Error on the communication path	Occurs.	

6-1-15 Parameters having Influence on Axis Operation

The list below shows the parameters that affect the axis operation executed by program.

Section	No.	Name
Unit	P00002	No. of Parallel Branches
Unit	P00004	Unit Function Select
M task	P00M01	Maximum Interpolation Feed rate
M task	P00M02	Interpolation Feed Acceleration Time
M task	P00M03	Interpolation Feed Deceleration Time
M task	P00M04	Interpolation S-curve filter enable
M task	P00M05	Interpolation S-curve Time Constant
M task	P00M06	Pass Mode Select
M task	P00M07	Modal Data Initial Value 1 Move Command Value Select
M task	P00M08	Modal Data Initial Value 2 Operating Mode Select
M task	P00M09	Modal Data Initial Value 3 Interpolation Feed rate
M task	P00M10	Interpolation Speed Multiplier with Decimal Point
Axis allocation	P1AA01	Physical axis setting
Axis speed	P2AA01	Maximum Rapid Feed rate
Axis speed	P2AA03	Rapid Feed rate
Axis speed	P2AA05	Rapid Feed Acceleration Time
Axis speed	P2AA06	Rapid Feed Deceleration Time
Axis speed	P2AA09	Rapid feed S-curve filter enable.
Axis speed	P2AA11	Rapid feed S-curve time constant
Axis position	P3AA07	No.2 In-position Range
Axis position	P3AA08	Feed Forward Gain Enabled/Disabled
Axis origin	P4AA01	Origin Search Method
Axis origin	P4AA02	Origin Search Start Direction
Axis origin	P4AA03	Phase-Z (C) Detection Direction
Axis origin	P4AA04	Origin Deceleration Method
Axis origin	P4AA06	Origin Determine Signal
Axis origin	P4AA07	Origin Search Feed rate
Axis origin	P4AA08	Origin Search Approach Speed
Axis origin	P4AA09	Origin Search Creep Speed
Axis origin	P4AA11	Origin Search Final Travel Distance
Axis origin	P5AA01	Units
Axis machine	P5AA02	Position Command Decimal Point Position
Axis machine	P5AA03	Speed Multiplier with Decimal Point
Axis machine	P5AA04	Command unit/One Machine Rotation
Axis machine	P5AA05	Gear Ratio 1 (Motor Rotation Speed)

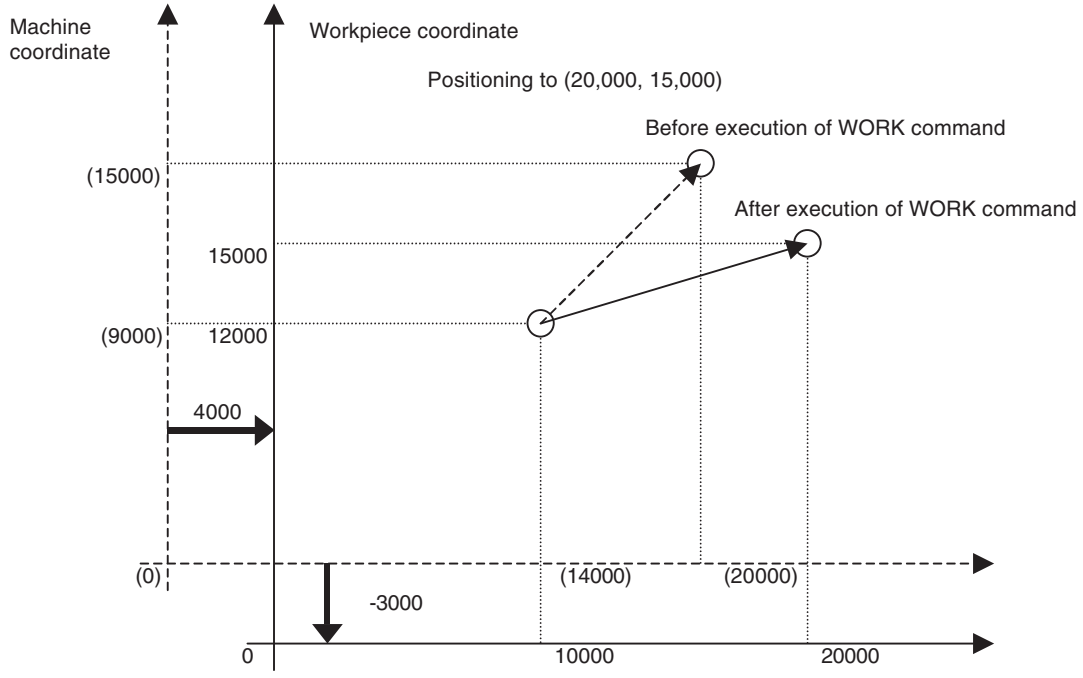
Section	No.	Name
Axis machine	P5AA06	Gear Ratio 2 (Machine Rotation Speed)
Axis machine	P5AA07	Axis Feed Mode
Axis machine	P5AA08	External Input Signal Select 1
Axis machine	P5AA09	External Input Signal Select 2

6-1-16 Coordinate System

There are two types of coordinate systems.

Machine coordinate system: Coordinate system determined by the origin search and origin setting. It is fixed for the system.

Workpiece coordinate system: Coordinate system determined by adding the offset to the machine coordinate system. It is unique to the work and there are 3 for each axis



Machine Coordinate System and Workpiece Coordinate System

Basics

- Offset for the workpiece coordinate system is set when the OFFPOS command is executed, and it is switched to the workpiece coordinate system by executing WORK command.
- Offset value (offset amount set by OFFPOS command) is the data for each axis. It has nothing to do with either motion programs or motion tasks.
- The coordinate system select (coordinate system type and No. that have been set by ORIGIN/ WORK command) is the data for each motion program. It has nothing to do with axes or motion tasks.

Starting a New Program Operation

If a new main program is started (the first execution after power is turned ON, or execution in the Start Mode = 0 or 3), the machine coordinate system is always used. Although the offset value is inherited from the previous program, the coordinate system select is not inherited.

Calling Sub-Program

When a sub-program is called, the offset value and coordinate system select are inherited to the sub-program.

When returning to the main program from the sub-program, all the modal data is inherited.

Parallel Branching

If parallel branching has been executed using the PARALLEL command, the offset value and coordinate system select for all the branches are inherited.

The offset value and coordinate system select that have been changed in a branch will affect other branches as well.

Executing End Command

If a program is ended using the END command, neither the offset value nor coordinate system select are initialized.

6-2 Command Overview

6-2-1 Command List

There are two types of commands for the MC Unit.

- Single Execution Command:

  In a motion task, two or more commands of this type cannot be executed together in one scan. It can be executed simultaneously, however, with multiple execution commands or with another single execution command in another branch of parallel branches.

  Commands related to movement are usually of this type.

- Multiple Execution Command:

  In a motion task, several commands of this type can be executed together in one scan. It can be executed simultaneously with a single execution command or other multiple execution commands in the same scan.

  Commands related to operation (arithmetic, logical, etc.) are usually of this type.

The meanings of the symbols in the motion task column are as follows:

Symbol	Meaning
S	Single Execution Command
M	Multiple Execution Command
x	Not executed as an independent command (no type).

Commands that can be used in the motion program are listed below:

Classification	Command/function name	Code	Applicable task	Summary	Completion condition (Proceed to next block)
			Motion		
Axis movement	POSITIONING	MOVE	@ S	Moves each axis independently.	In-position
	LINEAR INTERPOLATION	MOVEL	@ S	Moves axes with linear interpolation.	Travel distance output completed.
	CIRCULAR INTERPOLATION	MOVEC	@ S	Moves axes with circular interpolation.	Travel distance output completed.
	ORIGIN SEARCH	DATUM	@ S	Finds machine origin according to input signals.	In-position
	INTERRUPT FEEDING	MOVEI	@ S	Changes target position by means of input signals.	In-position
	TIME-SPECIFIED POSITIONING	MOVET	@ S	Performs positioning with specified time period.	In-position
	TRAVERSE	MOVETRAV	@ S	Executes winding (traverse) function of winder.	Travel distance output completed.
	ELECTRONIC CAM, SINGLE AXIS	CAM	@ S	Executes cam operation according to cam table.	In-position

Classification	Command/function name	Code	Applicable task	Summary	Completion condition (Proceed to next block)
			Motion		
Axis operation	LINK OPERATION	MOVELINK	@ S	Synchronizes the slave to the master based on travel distance of the master in acceleration and deceleration.	Depends on the link option.
	ELECTRONIC CAM, SYNCHRONOUS	CAMBOX	@ S	Executes cam operation according to cam table and master axis.	Depends on the link option.
	ELECTRONIC SHAFT	CONNECT	@ S	Synchronizes the slave to the master in a fixed ratio to the master axis.	Synchronization established.
	TRAILING SYNCHRONIZATION	SYNC	@ S	Executes trailing + synchronizes the slave to the master axis.	Synchronization established.
	TRAVEL DISTANCE SUPERIMPOSE	ADDAX	@ S	Superimposes travel distance between axes.	Synchronization established.
	SPEED CONTROL	SPEED	@ S	Outputs speed commands.	Specified speed reached.
	TORQUE CONTROL	TORQUE	@ S	Outputs torque commands.	Specified torque reached.
Axis operation cancel	SYNCHRONIZING END	SYNCR	@ S	Cancels MOVELINK, CAMBOX, CONNECT, or SYNC.	In-position
	TRAVEL AMOUNT SUPERIMPOSE CANCEL	ADDAXR	@ S	Cancels travel distance superimpose.	Synchronization cancelled.
	SPEED CONTROL CANCEL	SPEEDR	@ S	Cancels speed control	Switch to position control mode completed
	TORQUE CONTROL CANCEL	TORQUER	@ S	Cancels torque control	Switch to position control mode completed
Settings	TARGET POSITION CHANGE	MOVEMODI	@ M	Changes target position of an operating axis.	Target position change completed.
	ABSOLUTE SPECIFICATION	ABL	@ M	Treats coordinate values as absolute values.	Coordinate mode changed.
	INCREMENTAL SPECIFICATION	INC	@ M	Treats coordinate values as incremental values.	Coordinate mode changed.
	CHANGE PARAMETER VALUE	PARAM	@ S	Temporarily changes parameter values.	Parameter change completed.
	PASS MODE	PASSMODE	@ M	Connects interpolation blocks smoothly.	Mode change completed.
	STOP MODE	STOPMODE	@ M	Waits for in-position in each interpolation block.	Mode change completed.
	MACHINE COORDINATE SYSTEM SELECT	ORIGIN	@ S	Sets coordinate system to machine coordinate system.	Coordinate system change completed.
	WORKPIECE COORDINATE SYSTEM SELECT	WORK	@ S	Sets coordinate system to workpiece coordinate system.	Coordinate system change completed.
	WORKPIECE COORDINATE SYSTEM OFFSET CHANGE	OFFPOS	@ M	Changes workpiece coordinate system offset values.	Offset value change completed.
	PRESENT POSITION LATCH	LATCH	@ S	Latches the present position.	Latch request reception completed.
	SINGLE BLOCK IGNORED	NSTOP	@ X	Ignores single block mode.	---

Classification	Command/function name	Code	Applicable task	Summary	Completion condition (Proceed to next block)
			Motion		
Control	PROGRAM START	PROG	@ M	Indicates the start of program.	Program start processing completed.
	PROGRAM END	END	@ S	Indicates the end of program.	Program end processing completed.
	SUB-PROGRAM CALL	GOSUB	@ S	Calls sub-programs.	Sub-program call completed.
	SUB-PROGRAM END	RETURN	@ S	Ends sub-program, and returns to point where sub-program was called.	Return completed.
	DWELL TIME	DWELL	@ S	Waits for specified period of time, and then executes next block.	Dwell time elapsed.
	WAIT FOR CONDITION TO BE MET	WAIT	@ M	Waits for condition to be satisfied and executes the next block.	Condition satisfied.
	OPTIONAL END	STOPOP	@ S	Aborts next block when condition is satisfied.	Condition setting completed.
	CONDITIONAL BRANCHING	IF	@ M	Branches depending on conditions.	Condition check completed.
		ELS	@ M		---
		ENDIF	@ M		No block being executed.
	REPEAT WHILE	WHILE	@ M	Repeats until a given condition is satisfied.	Condition check completed.
		WEND	@ M		No block being executed.
	REPEAT FOR	FOR	@ M	Repeats for a given number of times (variable, constant, or immediate value).	Condition check completed.
		NEXT	@ M		No block being executed.
	PARALLEL EXECUTION	PARALLEL	@ S	Executes specified sections in parallel.	---
		JOINT	@ S		No block being executed (in branch).
		JWAIT	@ S		All JOINT execution completed.
	SELECTIVE EXECUTION	SWITCH	@ M	Executes specified sections selectively depending on conditions.	Condition check completed.
		CASE	@ M		---
		BREAK	@ M		No block being executed.
		DEFAULT	@ M		---
		SEND	@ M		No block being executed.
	NO OPERATION (SINGLE)	NOPS	@ S	No operation (as a single execution command).	---
	NO OPERATION (MULTIPLE)	NOPM	@ M	No operation (as a multiple execution command).	---

Classification	Command/function name	Code	Applicable task	Summary	Completion condition (Proceed to next block)
			Motion		
Simple arithmetic operations	ASSIGN	=	@ M	Assigns values to variables.	Result assigned.
	ADD	+	@ x	Performs addition.	Result assigned.
	SUBTRACT	–	@ x	Performs subtraction.	Result assigned.
	MULTIPLY	*	@ x	Performs multiplication	Result assigned.
	DIVIDE	/	@ x	Performs division.	Result assigned.
	REMAINDER	%	@ x	Finds the remainder of a division operation.	Result assigned.
	EXPONENT	^	@ x	Applies exponents.	Result assigned.
Logic operations	OR (LOGICAL OR)	|	@ x	Calculates logical OR.	Result assigned.
	XOR (LOGICAL EXCLUSIVE OR)	~	@ x	Calculates logical exclusive OR.	Result assigned.
	AND (LOGICAL AND)	&	@ x	Calculates logical AND.	Result assigned.
	NOT (REVERSE)	!	@ x	Reverses bits.	Result assigned.
Functions	ABSOLUTE VALUE	ABS	@ x	Finds the absolute value.	Result assigned.
	SINE	SIN	@ x	Finds the sine.	Result assigned.
	COSINE	COS	@ x	Finds the cosine.	Result assigned.
	TANGENT	TAN	@ x	Finds the tangent.	Result assigned.
	ARC SINE	ASIN	@ x	Finds the arc sine.	Result assigned.
	ARC COSINE	ACOS	@ x	Finds the arc cosine.	Result assigned.
	ARC TANGENT	ATAN	@ x	Finds the arc tangent.	Result assigned.
	SQUARE ROOT	SQR	@ x	Finds the square root.	Result assigned.
	EXPONENT	EXP	@ x	Finds the exponent.	Result assigned.
	NATURAL LOGARITHM	LOG	@ x	Finds the natural logarithm.	Result assigned.
	DECIMAL	FRAC	@ x	Finds the decimal portion.	Result assigned.
	SIGN	SGN	@ x	Returns 1 for 0 or greater, and -1 for negative values.	Result assigned.
Bit operations	SPECIFIED BIT ON	SET	@ x	Turns ON specified bits.	Bit operation completed.
	SPECIFIED BIT OFF	RESET	@ x	Turns OFF specified bits.	Bit operation completed.
	SHIFT RIGHT	SFTR	@ M	Shifts to right for specified amount.	Shift completed.
	SHIFT LEFT	SFTL	@ M	Shifts to left for specified amount.	Shift completed.
Data operations	BCD-TO-BIN	BIN	@ x	Converts BCD data to BIN data.	Result assigned.
	BIN-TO-BCD	BCD	@ x	Converts BIN data to BCD data.	Result assigned.
	BLOCK TRANSFER	XFER	@ M	Transfers data block.	All data transferred.
	CLEAR	CLEAR	@ M	Clears data block to zero.	All data cleared.

6-2-2 Command Format

The following notation is used for the format.

Symbol	Meaning
<>	Indicates the content, data
{ }	Optional operand, omissible
---N---	The operand that can be specified up to the number shown.
_	Required en quad

Classification	Name	Format
Axis movement	Positioning	MOVE_[<axis name>]<position command value>---8---
	Linear interpolation	MOVEL_[<axis name>]<position command value>---8---{F<Interpolation feed rate>};
	Circular interpolation	Center position specification: MOVEC_Q<rotation direction> [<horizontal axis name>]<horizontal axis position command value>[<vertical axis name>]<vertical axis position command value> I<horizontal axis center command> J<vertical axis center command> {[<linear axis name>]<linear axis command value>}{L<number of turns> }{F<interpolation feed rate>}; Radius specification: MOVEC_Q<rotation direction>[<horizontal axis name>]<horizontal axis position command value>[<vertical axis name>]<vertical axis position command value> R<radius> {[linear axis name>]<linear axis command value>}{F<interpolation feed rate>};
	Origin search	DATUM_[<axis name>]<offset value>---8---;
	Interrupt feeding	MOVEI_[<axis name>]<position command value> D<fixed feed amount>V<speed after signal input>;
	Time-specified positioning	MOVET_[<axis name>]<position command value>---8---T<positioning time>;
	Traverse	MOVETRAV_Q<operating mode>[<winding axis name>]<winding axis rotations> [<traverse axis name>]<traverse axis winding width> L<number of layers> {[<rotations at starting edge>]}{J<rotations at ending edge>}{F<winding axis speed>};
	Electronic cam, single axis	CAM_[<axis name>]<Cam table number>K<displacement data multiplier>T<execution time> {S<starting data number>}{E<ending data number>};
Axis operation	Link operation	MOVELINK_[<slave axis name>]<slave axis travel distance>[<master axis name>] <master axis travel distance>A<master axis travel distance in acceleration> D<master axis travel distance in deceleration>{Q<link option>{I<link start position>} {B<master axis classification>};
	Electronic cam, synchronous	CAMBOX_[<slave axis name>]<Cam table number>[<master axis name>]<link distance> K<displacement data multiplier>{S<starting data number>}{E<ending data number>} {Q<link option>}{[I<link start position>]{B<master axis classification>};
	Electronic shaft	CONNECT_[<slave axis name>]<gear ratio numerator>---8---[<master axis name>] <gear ratio denominator> {B<master axis classification>};
	Trailing synchronization	SYNC_[<slave axis name>]<catch-up position offset>[<master axis name>] <marker sensor ON position>{B<master axis classification>};
	Travel distance superimpose	ADDAX_[<slave axis name>][<master axis name>] {B<master axis classification>};
	Speed control	SPEED_[<axis name>]<speed command value>---8---T <speed change rate>;
	Torque control	TORQUE_[<axis name>]<torque command value>---8---T <torque change rate>;
Axis operation cancel	Synchronization cancel	SYNCR_[<slave axis name>]{<travel distance for deceleration stop>}---8---;
	Travel distance superimpose cancel	ADDAXR_{[<slave axis name>]---8---};
	Speed control cancel	SPEEDR_[<axis name>]---8--- T<speed change rate>;
	Torque control cancel	TORQUER_[<axis name>]---8--- T<torque change rate>;

Classification	Name	Format
Setting	Target position change	MOVEMODI_[<axis name>]<changed target position>---8---;
	Absolute specification	ABL; ABL_<other command>;
	Incremental specification	INC; INC_<other command>;
	Parameter value setting	PARAM_P<parameter number>=<parameter setting value>; PARAM_[<axis name>]<servo parameter number>=<parameter setting value>;
	Pass Mode	PASSMODE;
	Stop Mode	STOPMODE;
	Machine coordinate system select	ORIGIN;
	Workpiece coordinate system select	WORK_C<workpiece coordinate system number>;
	Workpiece coordinate system offset change	OFFPOS_C<workpiece coordinate system number>[<axis name>] <workpiece coordinate system offset amount>---8---;
	Present position latch	LATCH_[<axis name>]<latch position storing variable> {I<latch check start position>}{J<latch check end position.};
	Single block ignored	NSTOP_<other command>;

Classification	Name	Format
Control	Program start	PROG_P<program number> Q<axis declaration>;
	Program end	END;
	Sub-program call	GOSUB_P<sub-program number>;
	Sub-program End	RETURN;
	Dwell time	DWELL_T<dwell time>;
	Wait for condition to be met	WAIT_<conditional expression>;
	Optional end	STOPOP_<conditional expression>;
	Conditional branching	IF_<conditional expression>; <processing 1> {ELSE; <processing 2>} ENDIF;
	Repeat WHILE	WHILE_<conditional expression>; <processing> WEND;
	Repeat FOR	FOR_W<work register for repeat count> L<repeat end value>S<number of increment steps>; <processing>; NEXT;
	Parallel execution	PARALLEL_N<number of branches>; <processing 1> {JOINT; --- <processing N>} JWAIT;
	Selective execution	SWITCH_<conditional variable>; {CASE_<conditional constant>; <processing 1> BREAK; ---} {DEFAULT;} <processing N> SEND;
	No operation (single)	NOPS;
	No operation (multiple)	NOPM;
Simple arithmetic operation	Assign	<variable>= <numerical value>;
	Add	<variable>= <numerical value>+<numerical value>;
	Subtract	<variable>= <numerical value>-<numerical value>;
	Multiply	<variable>= <numerical value>*<numerical value>;
	Divide	<variable>= <numerical value>/<numerical value>;
	Reminder	<variable>= <numerical value>%<numerical value>;
	Exponent	<variable>= <numerical value>^<numerical value>;
Logic operation	OR (logical OR)	<variable>=<numerical value> | <numerical value>;
	XOR (logical exclusive OR)	<variable>=<numerical value> ~ < numerical value>;
	AND (logical AND)	<variable>=<numerical value> & <numerical value>;
	NOT (reverse)	<variable>=<numerical value> =! <numerical value>;

Classification	Name	Format
Functions	Absolute value	<variable>= ABS<numerical value>;
	Sine	<variable>= SIN<numerical value>;
	Cosine	<variable>= COS<numerical value>;
	Tangent	<variable>= TAN<numerical value>;
	ARC Sine	<variable>= ASINE<numerical value>;
	ARC Cosine	<variable>= ACOS<numerical value>;
	ARC Tangent	<variable>= ATAN<numerical value>;
	Square root	<variable>= SQR<numerical value>;
	Exponent	<variable>= EXP<numerical value>;
	Natural logarithm	<variable>= LOG<numerical value>;
	Decimal	<variable>= FRAC<numerical value>;
	Sign	<variable>= SGN<numerical value>;
Bit operations	Specified bit ON	<variable>= SET<logic operation expression>;
	Specified bit OFF	<variable>= RESET<logic operation expression>;
	Shift right	SFTR<shift object variable>_N<shift amount>;
	Shift left	SFTL<shift object variable>_N<shift amount>;
Data operations	BCD→BIN	<variable>= BIN<numerical value>;
	BIN→BCD	<variable>= BCD<numerical value>;
	Block transfer	XFER<transfer source first data>_<transfer destination first data>_N<number of transferred data>;
	Clear	CLEAR<first cleared data>_N<number of cleared data>;

6-2-3 Command List (Operand List)

The following table describes the operands that are used in commands.

Operand	Command: Meaning of the value	Remark
Axis name	MOVE: Position command value	These operands require distinction of axis names.
	MOVEL: Position command value	
	MOVEC: Position command value	
	DATUM: Origin offset	
	MOVEI: Position command value	
	MOVET: Position command value	
	MOVETRAV: Winding axis rotations	
	MOVETRAV: Traverse axis winding width	
	MOVELINK: Slave axis travel distance	
	MOVELINK: Master axis travel distance	
	CAM: Cam table number	
	CAMBOX: Cam table number	
	CAMBOX: Master axis linking distance	
	CONNECT: Gear ratio numerator	
	CONNECT: Gear ratio denominator	
	SYNCR: Travel distance for deceleration stop	
	ADDAX: <No numerical value specified>	
	SYNC: Catch-up position offset	
	SYNC: Marker sensor ON position	
	SPEED: Specified speed	
	SPEEDR: <No numerical value specified>	
	TORQUE: Specified torque	
	TORQUER: <No numerical value specified>	
	MOVEMODI: Changed target position	
	PARAM: Servo parameter number	
	OFFPOS: Workpiece coordinate system offset amount	
	LATCH: Latch position storing variable	
A	MOVELINK: Master axis travel distance at acceleration	Travel distance at acceleration.
B	MOVELINK: Master axis classification	Indicates the master axis classification in synchronization.
	CAMBOX: Master axis classification	
	CONNECT: Master axis classification	
	SYNC: Master axis classification	
	ADDAX: Master axis classification	
C	WORK: Workpiece coordinate system number	Indicates coordinate system number.
	OFFPOS: Workpiece coordinate system number	
D	MOVEI: Fixed feed amount	Indicates the travel distance for deceleration and incremental travel distance.
	MOVELINK: Master axis travel distance at deceleration	
E	CAM: Ending data number	Indicates the ending data number.
	CAMBOX: Ending data number	
F	MOVEL: Interpolation feed rate	Indicates interpolation feed rate.
	MOVEC: Interpolation feed rate	
	MOVETRAV: Winding axis speed	

Operand	Command: Meaning of the value	Remark
I	MOVEC: Horizontal axis center position	Indicates the first auxiliary position command.
	MOVETRAV: Rotations at starting edge	
	MOVELINK: Link start position	
	CAMBOX: Link start position	
	LATCH: Latch check start position	
J	MOVEC: Vertical axis center position	Indicates the second auxiliary position command.
	MOVETRAV: Rotations at ending edge	
	LATCH: Latch check end position	
K	CAM: Displacement data multiplier	Indicates coefficient like multiplier.
	CAMBOX: Displacement data multiplier	
L	MOVEC: Number of turns	Indicates the number of repetitions.
	MOVETRAV: Number of layers	
	FOR: Repeat end value	
N	PARALLEL: Number of branches	Indicates numerical values.
	SFTR: Shift amount	
	SFTL: Shift amount	
	XFER: Number of transferred data	
	CLEAR: Number of cleared data	
P	PARAM: Parameter number = parameter setting value	Indicates the parameter number and program number.
	PROG: Program number	
	GOSUB: Sub-program number	
Q	MOVEC: Rotation direction specification	Indicates option items.
	MOVETRAV: Operating mode	
	MOVELINK: Link option	
	CAMBOX: Link option	
	PROG: Axis declaration	
R	MOVEC: Radius	Indicates radius.
S	CAM: Starting data number	Indicates the start number and number of steps.
	CAMBOX: Starting data number	
	FOR: Number of increment steps	
T	MOVET: Positioning time	Indicates various times.
	CAM: Execution time	
	SPEED: Speed change rate	
	SPEEDR: Speed change rate	
	TORQUE: Torque change rate	
	TORQUER: Torque change rate	
	DWELL: Dwell time	
V	MOVEI: Speed after signal input	Indicates axis feed rate.
W	FOR: Work register for repeat count	Indicates work register.
Expression	WAIT: Conditional expression	Indicates expressions
	STOPOP: Conditional expression	
	IF: Conditional expression	
	WHILE: Conditional expression	
Variables, Constants	SWITCH: Conditional variable	Each variable and constant have specific meaning.
	CASE: Conditional constant	
	Various operational commands: Various	

6-2-4 Program Number and Axis Declaration

The program number and axes to be used in the program are specified in PROG command (Program Start). Refer to *Program Start (PROG)* on page 313.

Format

PROG_P <Program Number> {Q <Axis Declaration>};

Program Number

The table below shows the relations between the program number and main program/sub-program for motion tasks.

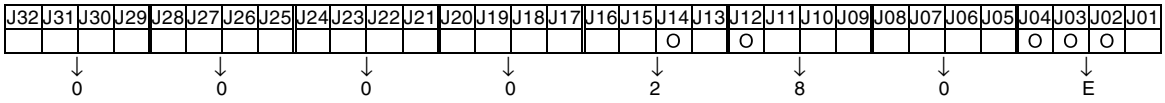
Program No.	Program
0000-0499	Main program for motion tasks
0500-0999	Sub-program for motion tasks

Axis Declaration

In "Axis Declaration", axes to be used in the program are specified with the bit train (32-bit) in hexadecimal corresponding to the physical axis numbers.

Program Example

When using the physical axes (numbers J02, J03, J04, J12, and J14) in the motion task main program "0000", the bit train for the axes to be used will be as shown below:



Therefore, in the PROG command, the following description is used:

PROG P000 Q0000280E;

6-2-5 Default Mode and Coordinate System

Various modes and coordinate systems can be used when executing commands.

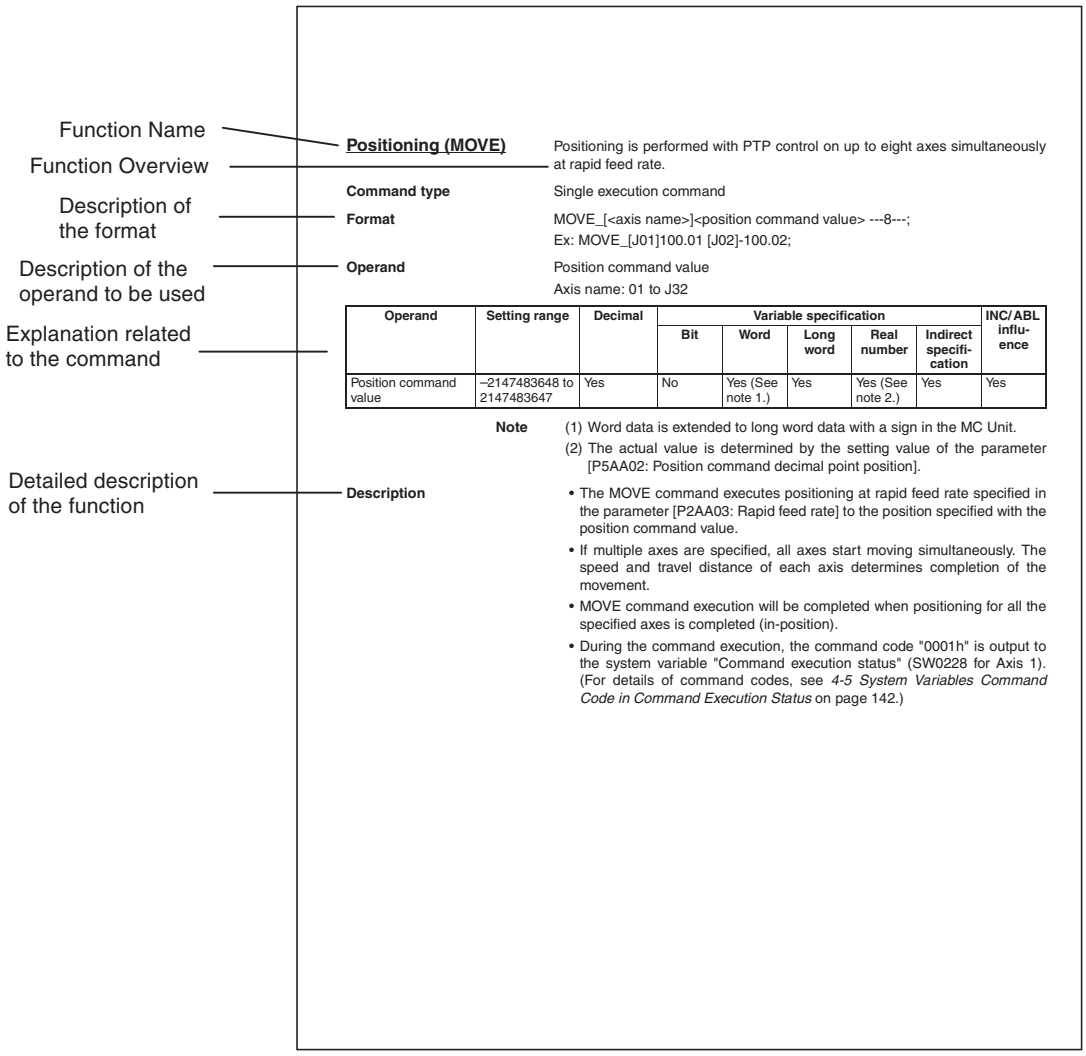
The following table shows the default settings for these.

Coordinate system		General description
Coordinate system	Machine coordinate system	Positioning is performed on the reference (machine) coordinate system (Default setting)
	Workpiece coordinate system	Positioning is performed on the workpiece coordinate system.
Travel distance specification	Absolute specification	Positioning is performed with absolute positions. (Default setting)
	Incremental specification	Positioning is performed with relative positions.
Operating mode	Stop Mode	For interpolation operations, the next operation is performed only after positioning is completed. (Default setting)
	Pass Mode	For interpolation operations, the next operation is performed without waiting for positioning to be completed.

6-3 Command Details

6-3-1 Expression in This Section

This section provides detailed descriptions of the commands. Command formats, operands and application are described and programming examples are provided.



The following notation is used for the format.

Note	Description
<>	Indicates the content, data
{ }	Optional operand, omissible
---N---	The operand that can be specified up to the number shown.
_	Required en quad

6-3-2 Axis Movement

This section describes the details of each command.

Positioning (MOVE) Positioning is performed with PTP control on up to eight axes simultaneously at rapid feed rate.

Command type Single execution command

Format MOVE_[<axis name>]<position command value> ---8---;

Ex: MOVE_[J01]100.01 [J02]-100.02;

Operand Position command value

Axis name: 01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Position command value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	Yes

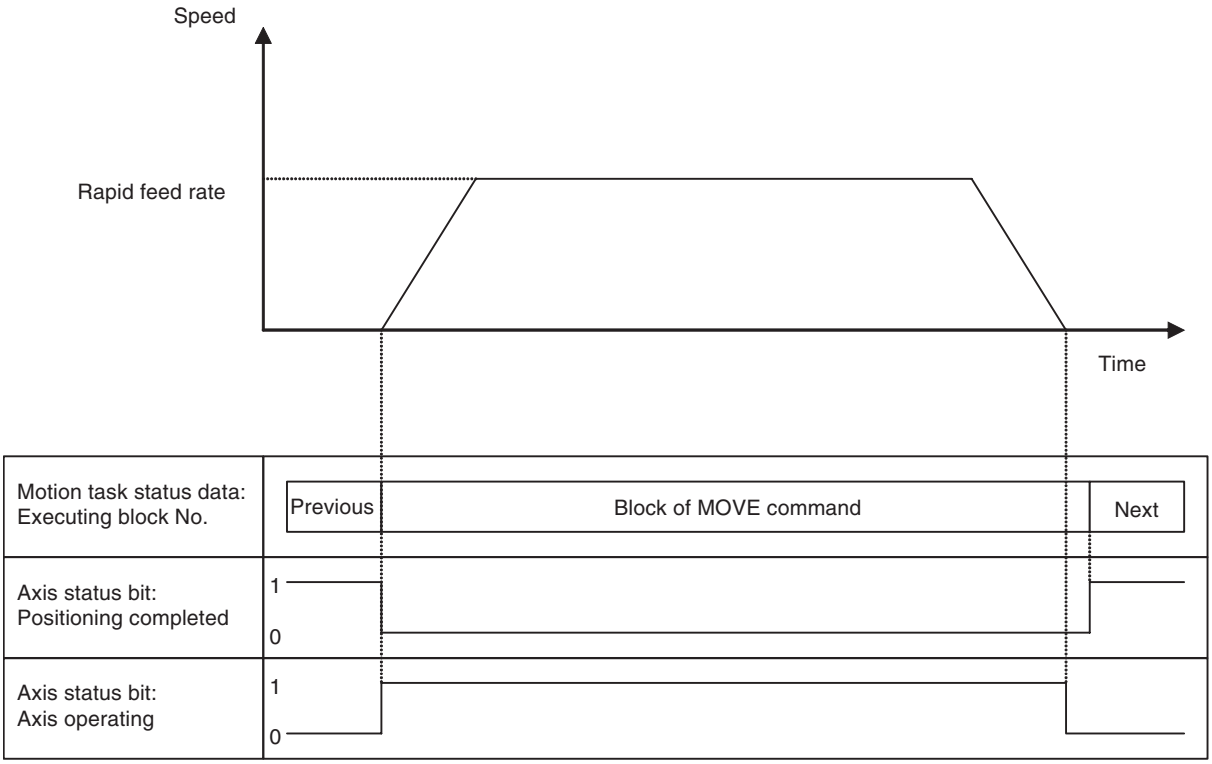
Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

Description

- The MOVE command executes positioning at rapid feed rate specified in the parameter [P2AA03: Rapid feed rate] to the position specified with the position command value.
- If multiple axes are specified, all axes start moving simultaneously. The speed and travel distance of each axis determines completion of the movement.
- MOVE command execution will be completed when positioning for all the specified axes is completed (in-position).
- During the command execution, the command code "0001h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)



Linear Interpolation (MOVEL)

Positioning is performed on up to eight axes with linear interpolation at the specified interpolation feed rate.

Command type

Single execution command

Format

MOVEL_[<axis name>]<position command value> ---8--- {F<interpolation feed rate>};

Ex: MOVEL_[J01]100.01 [J02]-100.02 F10000.25;

Operand

Position command value

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Position command value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	Yes
Interpolation feed rate	1 to 2147483647 (See note 3.)	Yes	No	Yes (See note 1.)	Yes	Yes (See note 4.)	Yes	No

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

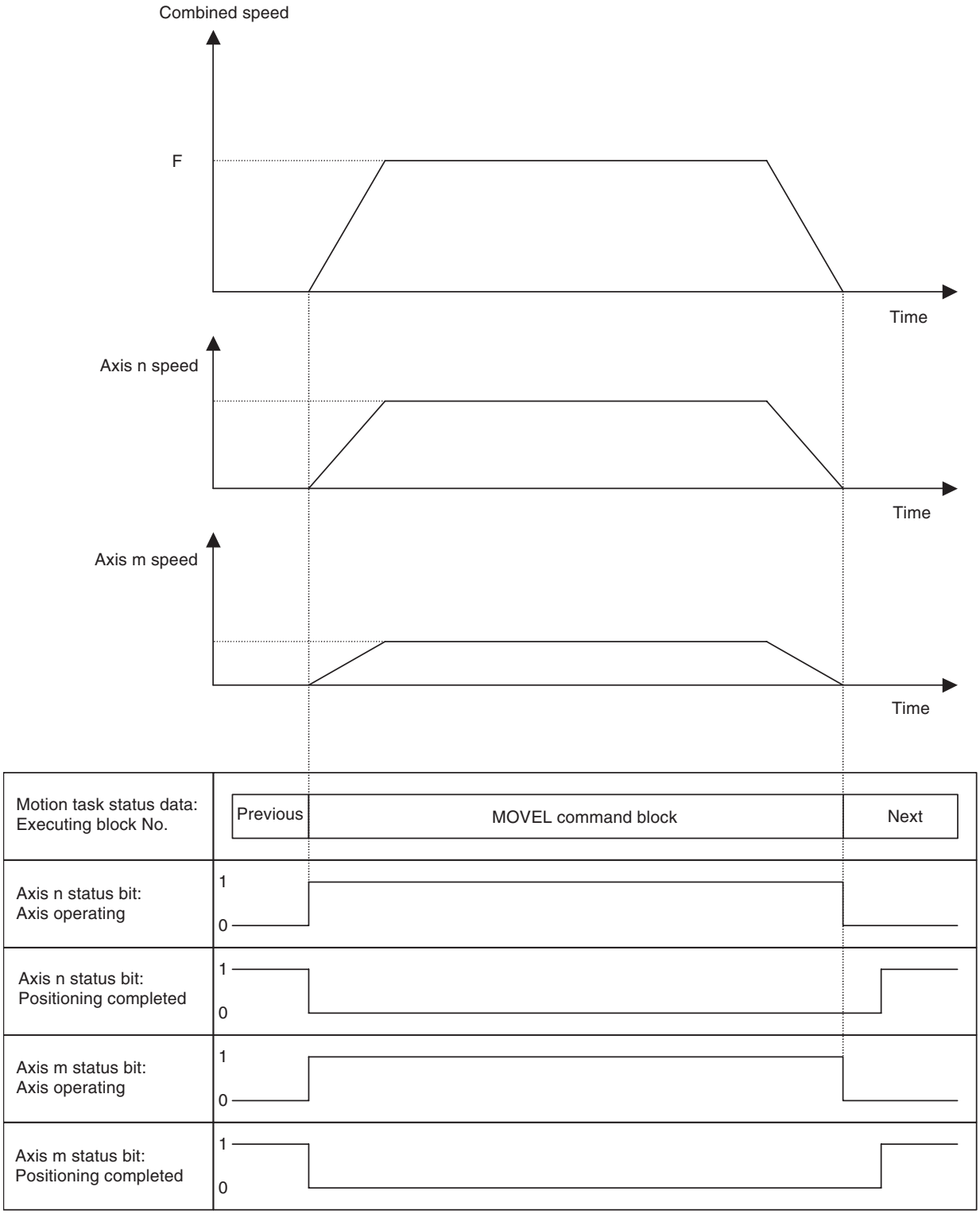
(2) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

(3) The maximum speed in actual operations will be limited by the maximum feed rate of the interpolation or axis.

(4) The actual value is determined by the setting value of the parameter [P00M10: Interpolation feed decimal point position].

Description

- The MOVEL command executes linear interpolation at the specified interpolation feed rate to the position specified with the position command value.
- The interpolation feed rate indicates the combined speed of all the specified axes.
- The MOVEL command execution will be completed when the travel distance command output for all the specified axes is completed (or No.2 in-position completion).
- During the command execution, the command code "0002h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)



Circular Interpolation (MOVEC)

This command executes positioning with circular interpolation on two axes at specified interpolation feed rate. Moreover, positioning with helical circular interpolation (2-axis circular interpolation + 1-axis linear interpolation) can be performed. Specifying the number of turns for helical circular interpolation can realize winding operation with multi-turns.

Command type

Single execution command

Format

Center position specification:

MOVEC_Q<rotation direction> [<horizontal axis name>]<horizontal axis position command value>
[<vertical axis name>]<vertical axis position command value>
I<horizontal axis center command> J<vertical axis center command>
{[<linear axis name>]<linear axis command value>}{L<number of turns>}{F<interpolation feed rate>};

Radius specification:

MOVEC_Q<rotation direction>[<horizontal axis name>]<horizontal axis position command value>
[<vertical axis name>]<vertical axis position command value> R<radius>
{[<linear axis name>]<linear axis command value>}{F<interpolation feed rate>};

Ex: Center position specification: MOVEC_Q1 [J01]100.00 [J02]200.00 I0 J0 F20000.00;
Radius specification: MOVEC_Q1 [J01]100.00 [J02]200.00 R50.00 F20000.00;

Operand

Center position specification

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Rotation direction	1, –1	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Horizontal axis position command value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	Yes
Vertical axis position command value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	Yes
Horizontal axis center command	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	See note 5.
Vertical axis center command	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	See note 5.
Linear axis command value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	Yes
Number of turns	1 to 2147483647/2πr –1 (Figures below decimal point to be omitted)	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Interpolation feed rate	1 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 4.)	Yes	No

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) Figures below the decimal point are to be omitted.

(3) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

(4) The actual value is determined by the setting value of the parameter [P00M10: Interpolation feed decimal point position].

(5) When P00004 bit01 = 0 (ABL specification disable), there is no influence and INC specification is always used.

Radius Specification

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Rotation direction	1, –1	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Horizontal axis position command value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	Yes
Vertical axis position command value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	Yes
Radius	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	Yes
Linear axis command value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	Yes
Interpolation feed rate	1 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 4.)	Yes	No

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) Figures below the decimal point are to be omitted.

(3) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

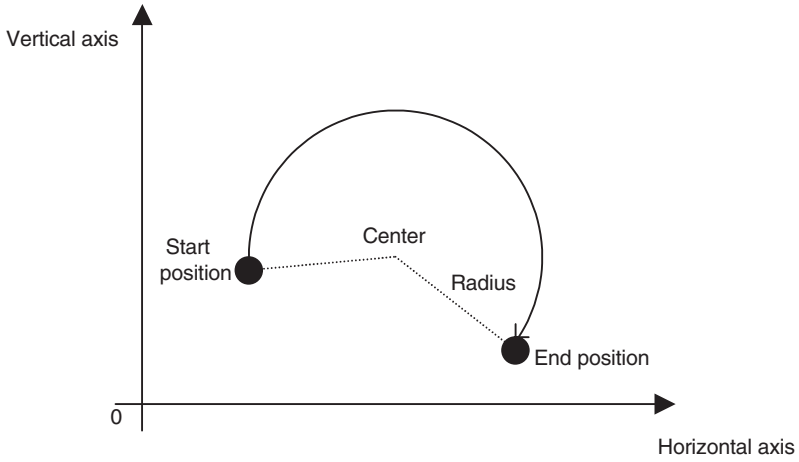
(4) The actual value is determined by the setting value of the parameter [P00M10: Interpolation feed decimal point position].

Description

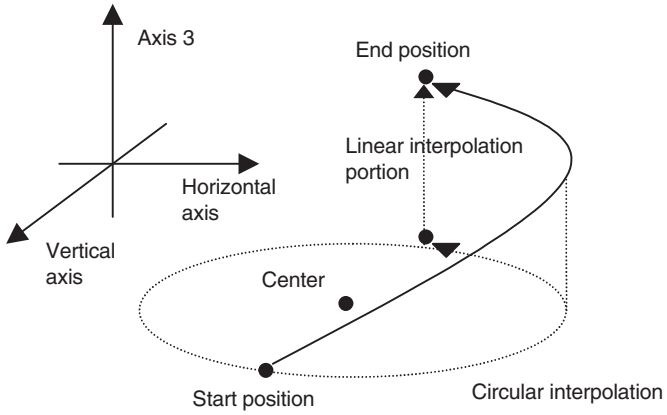
- The MOVEC command executes positioning with circular interpolation at the speed specified with [interpolation feed rate] to the position specified by [horizontal axis position command value] and [vertical axis position command value].
- The rotation direction is clockwise when Q = 1, and counter-clockwise when Q= -1.
- The circular arc center and radius are specified either by the center value or by the radius value.
- For the center position specification, [horizontal axis center command] and [the vertical axis center command] are handled as shown below by the parameter [P00004.bit01: Circular arc interpolation center position].

P00004.01	Handling of I/J
0: (ABL specification disabled)	The value in I or J is always treated as the travel distance from the present position.
1: (ABL specification enabled)	The value in I or J is treated as travel distance from specified position or present position depending on ABL/INC specification.

- When specifying the radius, [radius] is always treated as the distance to be moved from the present position.
- The unit system of the horizontal axis is used for the radius.



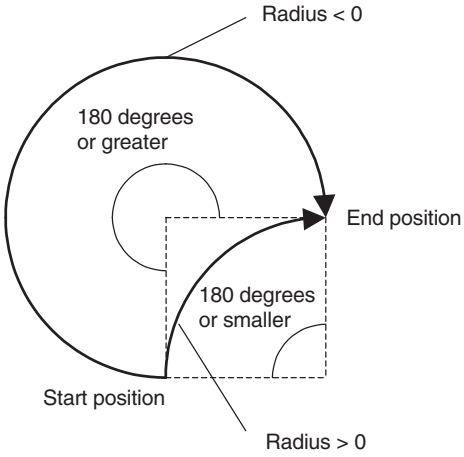
- When [Number of turns] is specified, multiple rotations will occur. In addition, multiple rotations can be specified only for center position specification. For radius specification, programs cannot be loaded (because the center position cannot be determined If the start position = the end position for radius specification.)
- The number of rotations excluding the circular arc from the start point to the end point is specified for [Number of turns]. When the start position is not equal to the end position, the travel distance per block will be circular arc of [Number of turns] + a. When the start position is equal to the end position, the travel distance per block will be circular arc of [Number of turns] + 1.
- If [Linear axis name] and [Linear axis command value] are added, helical circular interpolation can be realized. If [Number of turns] is specified to realize multiple rotations for helical circular interpolation, the end position has to be specified.



- [Interpolation feed rate] is handled as shown in the table below depending on the interpolation type and the setting of the parameter [P00004.bit00: Helical circular interpolation speed].

Interpolation type	P00004.00	Interpolation feed rate
Circular interpolation	0 or 1	Combined speed of the horizontal and vertical axes
Helical circular interpolation	0 (speed on the circumference)	Combined speed of the horizontal and vertical axes
Helical circular interpolation	1 (speed on the tangent)	Combined speed of the horizontal, vertical, and linear axes.

- In radius specification, if [Radius] is positive, the center angle will be 180 degrees or smaller. If [Radius] is negative, the center angle will be 180 degrees or greater.



- MOVEC command execution will be completed (or No.2 in-position complete) when the travel distance command output for all specified axes is completed.
- During the command execution, the command code "0003h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)
- When a circular arc cannot be drawn with the specified radius or center position, the radius is compensated to draw the arc. Having the radius in radius specification or the radius calculated with center specification as the initial value, the radius is increased to accomplish the radius at the end position along the rotating angle.
- When executing circular interpolation on the axis with S-curve filter setting, an arc larger than the specified arc may be drawn. The greater the S-curve time constant is, the greater the overshoot amount (= Specified arc - Actual arc) will be. Operate only after thorough adjustment is made.

Origin Search (DATUM)

The DATUM command performs an origin search for the specified axis.

Command type Single execution command

Format DATUM_[<axis name>]<offset value> ---8---;

Ex: DATUM_[J01]0 [J02]0;

Operand Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Offset value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 3.)

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

(3) There is no influence. ABL specification is always used.

Description

- DATUM command performs the origin search for the specified axis.
- Specifying the offset will set the origin of the machine coordinate system after an origin search to other than zero. (Specify zero to set it to zero.)
- The operation patterns and speeds are determined by the parameters shown in the table below:

No.	Name	Value	Content
P4AA01	Origin search method	0: Origin at power ON 1: Limit reversal 2: 2-level speed in one direction 3: 3-level speed in one direction	Sets the origin search method.
P4AA02	Origin search start direction	0: Same as phase-Z detection 1: Opposite to phase-Z detection	Sets the origin search start direction for origin search method 1.
P4AA03	Phase-Z (C) detection direction	0: Positive direction 1: Negative direction	Sets the phase-Z (C) detection direction for origin search method 1,2, and 3.
P4AA04	Origin deceleration method	0: Uses origin proximity 1: Uses CW and CCW	Specifies whether the origin proximity or limit input signal is used as origin proximity input signal for origin search method 1 and 3.
P4AA06	Origin determine signal	0: Phase-Z (C) 1: External input signal 1 2: External input signal 2 3: External input signal 3	Sets the signal to determine (latch) the origin.
P4AA07	Origin search feed rate	1 to 2147483647 *It is limited by 32767 command unit/unit scan.	Specifies the speed for the 1st level of the 3-level speed origin search.
P4AA08	Origin search approach speed	1 to 2147483647 *It is limited by 32767 command unit/unit scan.	Specifies the speed for the 2nd level of the 3-level speed origin search, or for the 1st level of the 2-level speed origin search.
P4AA09	Origin search creep speed	1 to 2147483647 *It is limited by 32767 command unit/unit scan.	Specifies the speed for the 3rd level of the 3-level speed origin search, or for the 2nd level of the 2-level speed origin search.
P4AA10	Machine coordinate origin offset	–2147483648 to 2147483647	Axis control bit: Offset for origin search Not used for DATUM command
P4AA11	Final travel distance in origin search	0 to 2147483647	Sets the final travel distance in origin search. This is added to the travel distance in the traveling direction.

- Operation patterns are specified in the parameter [P4AA01: Origin search method], and there are four different origin search methods as shown below:

Origin search method	Function
Origin at power ON	The position when the power is turned ON is defined as the origin. When DATUM is executed, the present position becomes the origin. There is no axis movement.
Limit reversal	It is durable even if the relations between the present position and the origin are not constant. Operation start: The operation is started in the origin search start direction at the origin search feed rate. CW/CCW input: The operation direction is reversed. Origin proximity signal input ON: Changes the speed to the origin search approach speed. Origin determine signal input ON after Origin proximity signal input OFF: Changes the speed to the origin search creep speed to travel for the final travel distance, and then defines the origin.
2-level speed in 1 direction	The relations between the present position and the origin must be constant. Operation start: The operation is started in the phase-Z detection direction at the origin search approach speed. Origin determine signal input: Changes the speed to the origin search creep speed to travel for the final travel distance, and then defines the origin.
3-level speed in 1 direction	The relations between the present position and the origin must be constant. Operation start: The operation is started in the phase-Z detection direction at the origin search feed rate. Origin proximity signal input ON: Changes the speed to the origin search approach speed. Origin determine signal input ON after Origin proximity signal input OFF: Changes the speed to the origin search creep speed to travel for the final travel distance, and then defines an origin.

- The machine coordinate origin is defined externally using the signal specified in the parameter [P4AA06: Origin determine signal] (Expect for the origin search method 0: Origin at power ON).
- After origin search completion, following settings are not canceled. The status before execution is maintained.
  - The workpiece coordinate system offset specified using OFFPOS command
  - The coordinate system number specified using ORIGIN or WORK command
- For the origin search executed for an axis using the absolute encoder, the machine coordinate origin is defined using an external signal as well.
- DATUM command execution will be completed when origin detection for all the specified axes is completed.
- During the command execution, the command code "0004h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)

Interrupt feeding (MOVEI)

When the signal specified in the parameter [P5AA08: External Input signal select 1] is turned ON, positioning is performed moving the specified axis for the specified feed amount.

Command type

Single execution command

Format

MOVEI_[<axis name>]<position command value> D<fixed feed amount> V<speed after signal input>;

Ex: MOVEI_[J01]1000.00 D2000.00 V50000.00;

Operand

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Position command value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	Yes
Fixed feed amount	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 3.)
Speed after signal input	1 to 147483647 (See note 4.)	Yes	No	Yes (See note 1.)	Yes	Yes (See note 5.)	Yes	No

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

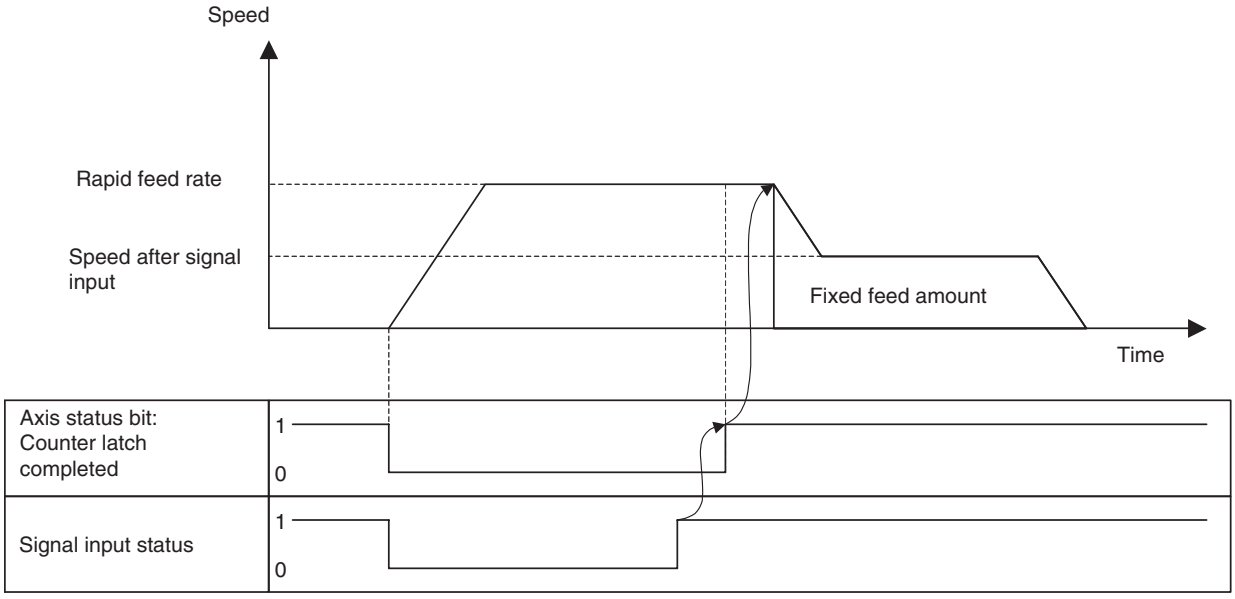
(3) There is no influence. INC specification is always used.

(4) The maximum speed in actual operations will be limited by the maximum feed rate of the interpolation or axis.

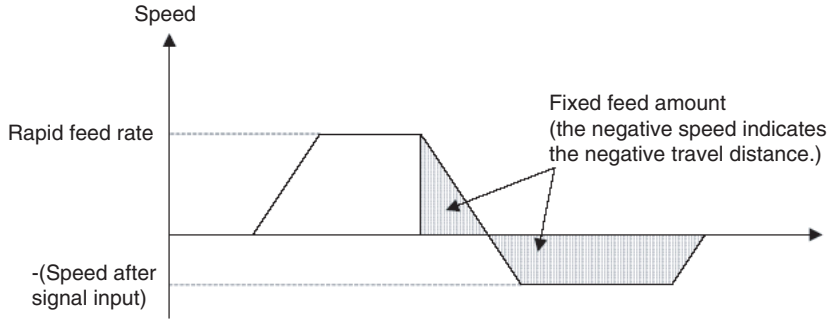
(5) Figures below the decimal point are to be omitted.

Description

- Positioning is executed to the position specified with the position command value at the speed specified in the parameter [P2AA03: Rapid feed rate].
- If a signal specified in the parameter [P5AA08: External input signal select 1] is input during positioning, positioning is executed at the speed specified with Speed after signal input and for the distance specified with Fixed feed amount.



- If the Fixed feed amount specified is smaller than the distance required from the signal input to the stop after deceleration, return operation is performed for the excessive distance after completion of deceleration stop.



- Only one axis can be specified in one block.
- MOVEI command execution will be completed when positioning for all the specified axes is completed (in-position).
- During the command execution, the command code "0005h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)

Time-Specified Positioning (MOVET)

Positioning is executed to the specified position within the specified time period.

Command type

Single execution command

Format

MOVET_[<axis name>]<position command value> ---8--- T<positioning time>;

Ex: MOVET_[J01]1000.00 [J02]2000.00 T100.00;

Operand

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Position command value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	Yes
Positioning time	0 to 3600000	No	No	Yes (See note 1.)	Yes	No	Yes	No

Note

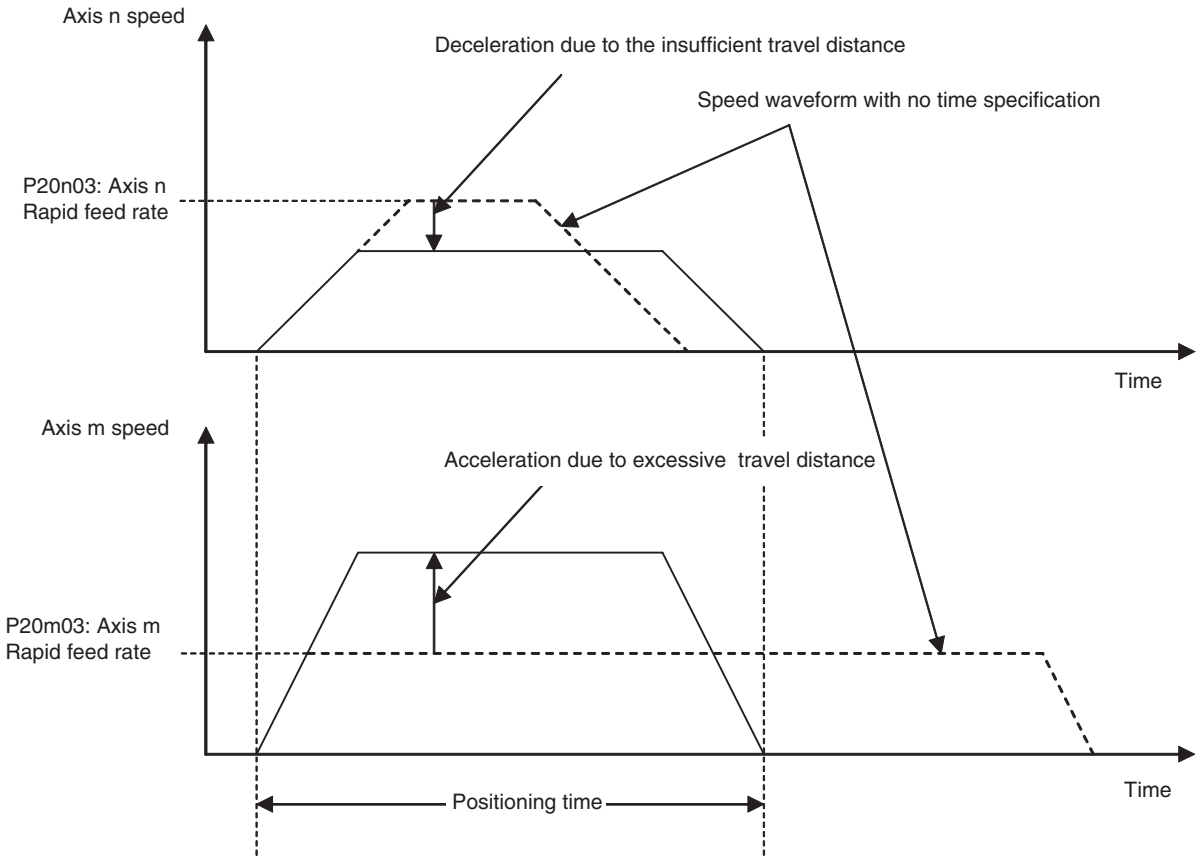
(1) Word data is extended to long word data with a sign in the MC Unit.

(2) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

Description

- Positioning is performed to the position specified with the position command value within the time period specified with the positioning time.
- Speed of each axis is determined by the following expression:
  [Speed of each axis] = Travel distance of each axis/positioning time
- When the speed determined by the expression above exceeds the speed specified in the parameter [P2AA01: Maximum rapid feed rate], the alarm [200B: Time specification error] will occur before the operation. The speed after override during an operation is limited by the speed specified in the parameter as well.

- The actual positioning time can be found using the following expression: [Actual positioning time] = Positioning time + [P2AA05: Rapid feed acceleration time] × [Speed of each axis]/[P2AA03: Rapid feed rate]
- In specifying deceleration, the parameter [P2AA06: Rapid feed deceleration time] is ignored. Instead, the parameter [P2AA05: Rapid feed acceleration time] is used. (Symmetric linear acceleration/deceleration is always performed.)
- The parameter [P2AA03: Rapid feed rate] is ignored.
- If the override is not 100.00%, the positioning time specified cannot be kept.
- Positioning time does not include the time required for completing in-position check.
- MOVET command execution will be completed when positioning for all the specified axes is completed (in-position).
- During the command execution, the command code "0006h" is output to the system variable "Command execution status" (SW0228 for axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)



Traverse (MOVETRAV)

This command is provided for traverse, winding machine operations.

Command type

Single execution command

Format

MOVETRAV_Q<operating mode> [<winding axis name>]<winding axis rotations>
[<traverse axis name>]<traverse axis winding width> L<number of layers>
{I<rotations at starting edge>}{J<rotations at ending edge>}{F<winding axis speed>};

Ex: MOVETRV_Q1 [J01]36000.00 [J02]40.00 L10 F2000.00;

Operand

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Operating mode	1,2,3, or 4	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Winding axis rotations	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	No (see note 4.)
Traverse axis winding width	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (see note 4.)
Number of layers	2147483647/ 360×10^{P5AA02} (See note 7.) Figures below decimal point to be omitted (See note 3.)	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Rotations at starting edge	0 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	No (see note 4.)
Rotations at ending edge	0 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	No (see note 4.)
Winding axis speed	1 to 2147483647 (See note 5.)	Yes	No	Yes (See note 1.)	Yes (see note 6.)	Yes (See note 3.)	Yes	No

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) Figures below the decimal point are to be omitted.

(3) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position.

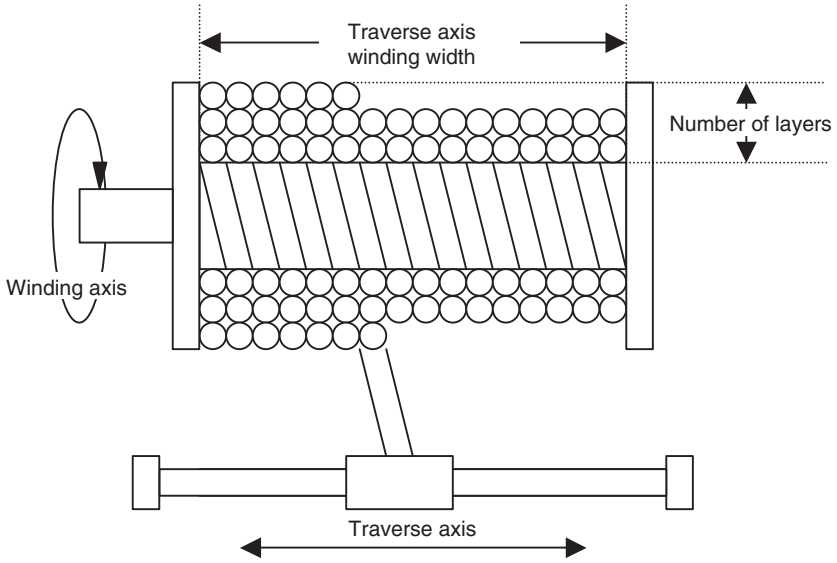
(4) There is no influence. INC specification is always used.

(5) The maximum speed in actual operations is limited by the maximum feed rate of the interpolation or axis.

(6) The actual value is determined by the setting value of the parameter [P00M10: Interpolation feed decimal point position].

(7) Position command decimal point position

Description



- Description of Operating mode is shown below. It cannot be specified with variables. When linked traverse is specified, only the blocks in the same operating mode can be linked.

  1: (Normal traverse, winding axis rotations = Rotations specification)

  2: (Normal traverse, winding axis rotations = Pitch specification)

  3: (Linked traverse, winding axis rotations = Rotations specification)

  4: (Linked traverse, winding axis rotations = Pitch specification)
- Winding axis rotations vary depending on operation mode.
  - Rotations specification: Winding axis rotations per layer. Unit is [deg].
  - Pitch specification: Traverse axis travel distance per winding axis rotation
    Unit is [command unit/rev].
  - When winding axis rotations = 0, the alarm [2009h: Position specification error] will occur.
- A positive or negative value specified in Winding axis rotations corresponds to the rotation direction CCW or CW respectively.

  Note The winding axis should be operated in the unlimited feed mode. (If it is operated in the limited feed mode, the alarm [3015h: Axis classification error] will occur.)
- Traverse axis winding width specifies the traverse width ([No. of winds per layer] × [No. of pitches]). Unit is [command unit].
- When Traverse axis winding width = 0, the alarm [2009h: Position specification error] will occur.
- Rotations at starting edge and Rotations at ending edge specify the amount of winding at starting and ending edges. Unit is [deg].
- Without specifying Rotations at starting edge and Rotations at ending edge, there will be no winding at the edges.
- The linked traverse allows up to 100 linked blocks, and the operation as a whole is executed in Stop Mode.
- The blocks, which were linked using the linked traverse function, are treated as one block.

- In the linked traverse, up to 5 blocks are interpreted per unit scan. If more than 5 blocks are linked, the time [(No. of linked blocks/5) × Unit scan] will be required for the interpretation (i.e. from completion of executing the previous block to start of the linked traverse operation. (It will take longer to start execution. The operation does not stop during the linked traverse.)
- Linked traverse always operates at the speed specified for the 1st traverse.
- MOVETRAV command execution will be completed when travel distance command output for all the specified axes is completed.
- During the command execution, the command code "0007h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)

Electronic Cam, Single Axis (CAM)

Positioning is performed within a specified execution time according to the specified CAM data.

Command type

Single execution command

Format

CAM_[<axis name>]<cam table number> K<displacement data multiplier> T<execution time>
{S<starting data number>}{E<ending data number>};

Ex: CAM_[J01]1 K100.00 T500;

Operand

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
CAM table number	±(1 to 32,100,200)	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Displacement data multiplier	–20000 to 20000	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	No
Execution time	0 to 3600000ms	No	No	Yes (See note 1.)	Yes	No	Yes	No
Starting data number	0 to note 4	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Ending data number	0 to note 4	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) Figures below the decimal point are to be omitted.

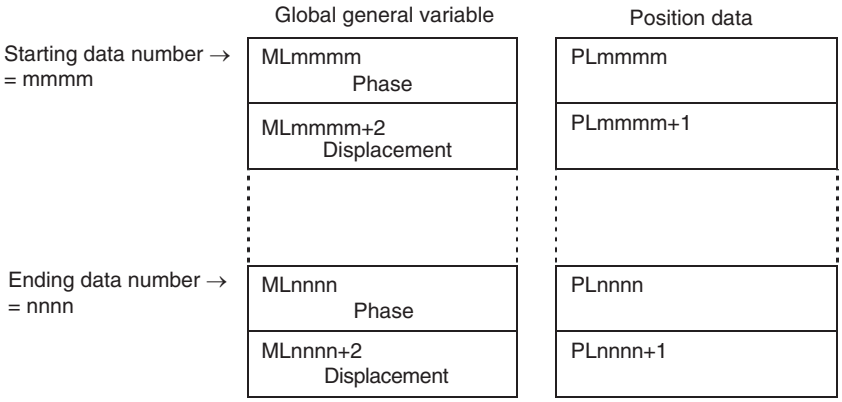
(3) The minimum command unit is 0.01%.

(4) When CAM table is specified: The greatest CAM data number in CAM table
When specifying with global variable: 8188 (1FFC Hex)
When specifying with position data: 10238 (27FE Hex)

Description

- Timed CAM operation is performed according to the CAM table specified with CAM table number.
- Select CAM table to be used in CAM table number.
  - 1-32: Selects the CAM table of the specified number from CAM data.
  - 100: Selects the global general variable as CAM table.
  - 200: Selects the position data as CAM table.

- If either the global variable or position data is used for CAM table, phase and displacement are to be specified as double-length integer type data.



- If a minus sign is added to the CAM table number, the CAM data is read tracing the data numbers in the reverse order.
- The range of Displacement data multiplier is from –200.00 to 200.0% (0.01% unit, limited to the values that can be obtained from the internal processing).
- When "0" is specified in Displacement data multiplier, the operation proceeds to the next block without any axis movement after Execution time specified in T elapses.
- If Starting data number specification is omitted, the starting data number will be 0.
- If Ending data number specification is omitted, the ending data number is the greatest data number in that table.
- If the specifications of [Starting data number] = [Ending data number] are made, the alarm [200Ch: Number specification error] will occur.
- The CAM operation from the starting position to the ending position is executed within the execution time specified in T (Execution time).
- When either of the following conditions is met, the phase will return to 0 (i.e. to the beginning or end of the table) and data is read.

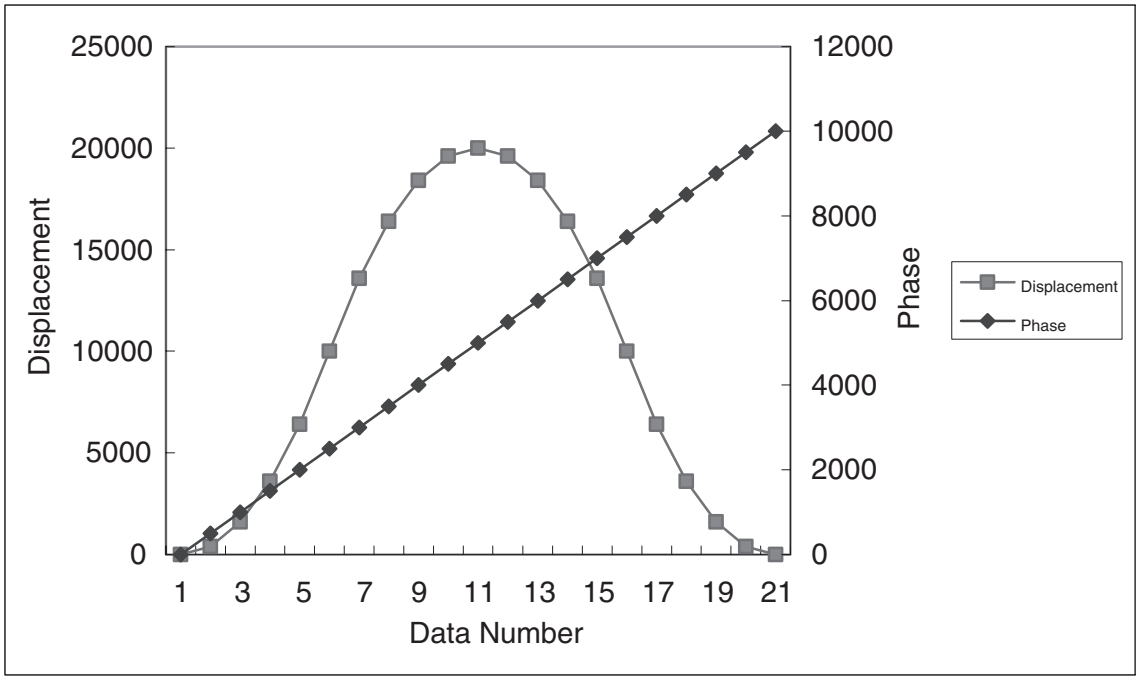
Data reading direction	Data number
Forward	(Starting data number) > (Ending data number)
Reverse	(Starting data number) < (Ending data number)

Note that this operation is executed only when the CAM data is used as the CAM table. If the specifications described above are made when the global general variable or position data is used as the CAM table, the alarm [200Ch: Number specification error] will occur.

- The data reading period is to be one cycle or less.
- The word "Displacement" means the increased value from the CAM command start point.

Data No.	Phase	Displacement
1	0	0
2	500	400
3	1000	1600
4	1500	3600
5	2000	6400
6	2500	10000

Data No.	Phase	Displacement
7	3000	13600
8	3500	16400
9	4000	18400
10	4500	19600
11	5000	20000
12	5500	19600
13	6000	18400
14	6500	16400
15	7000	13600
16	7500	10000
17	8000	6400
18	8500	3600
19	9000	1600
20	9500	400
21	10000	0



- CAM command execution will be completed when the command output for all the specified CAM data is completed.
- During the command execution, the command code "0008h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)

Phase and Displacement of CAM Data

Restriction on phase:

- To use the CAM data for "CAM (Electronic cam, single axis)" and "CAM-BOX (Electronic cam, synchronous)" commands, the phase data should be arranged in an ascending order (i.e. the greater the data number is, the larger the phase will be).

- When specifying the starting and ending points, the restriction varies depending on the used data as shown below:

Data	Restriction
CAM data	Even with the starting and ending points specified, the other data will not be ignored. Therefore, the conditions mentioned above have to be met even for the unused area.
Position data/global general variable	The data other than the starting and ending points specified will be ignored. Therefore, the conditions mentioned above do not have to be met for the unused area.

- When these conditions are not met, "CAM (Electronic cam, single axis)" and "CAMBOX (Electronic cam, synchronous)" commands may cause the axis to stop operating, or to operate in an unexpected way. To avoid accidents, make sure that the conditions are met.

Note The position data and global general variable can be used while being overwritten real-time. Therefore, the MC unit does not internally check the conditions for the restrictions mentioned above. (This also applies to the cam data.)

Restriction on the displacement:
Set it so that the value is within the setting range.

6-3-3 Command for Axis Operations/Operation Cancel

Link Operation (MOVELINK)

Positioning is performed synchronizing the slave axis to the specified master axis.

Command type Single execution command

Format MOVELINK_[<slave axis name>]<slave axis travel distance> [<master axis name>]
<master axis travel distance> A<master axis travel distance in acceleration > D<master axis travel distance in deceleration> {Q<link option>}{I<link start position >}
{B<master axis classification>};

Ex: MOVELINK_[J02]2000.00 [J01]100000.00 A2000.00 D2000.00;

Operand Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Slave axis travel distance	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 4.)
Master axis travel distance	0 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 4.)
Master axis travel distance in acceleration	0 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 4.)
Master axis travel distance in deceleration	0 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 4.)
Link option	0 to 5	No	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	No

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Link start position	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 5.)
Master axis classification	0 or 1	No	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	No

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

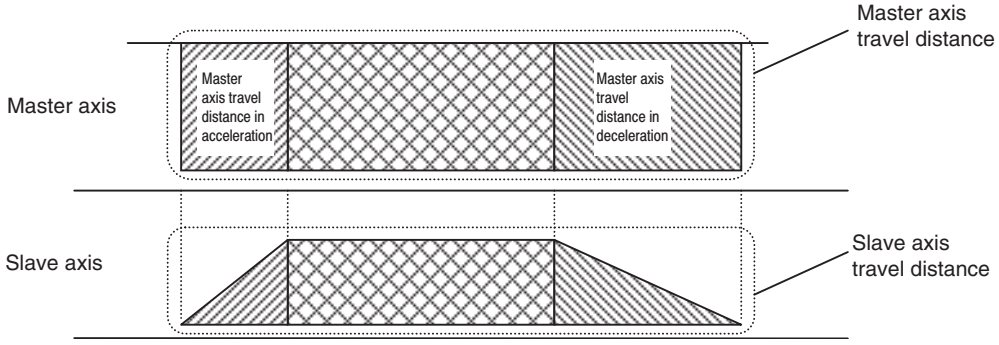
(3) Figures below the decimal point are to be omitted.

(4) There is no influence. INC specification is always used.

(5) There is no influence. ABL specification is always used.

Description

- Synchronous operation is performed with the specifications of acceleration at the beginning of synchronization, ratio in synchronization, and deceleration at synchronization completion.



- The travel distances of the master and slave axes for each interval is determined according to the Slave axis travel distance, Master axis travel distance, Master axis travel distance in acceleration, and Master axis travel distance in deceleration as shown in the table below:

Interval	Master axis	Slave axis
Acceleration	Master axis travel distance in acceleration	$[\text{Slave axis travel distance}] \times \dfrac{[\text{Master axis travel distance in acceleration}]}{2} \Big/ \left(\dfrac{[\text{Master axis travel distance in acceleration}]}{2} + \text{Master axis travel distance at constant speed} + \dfrac{[\text{Master axis travel distance in deceleration}]}{2} \right)$

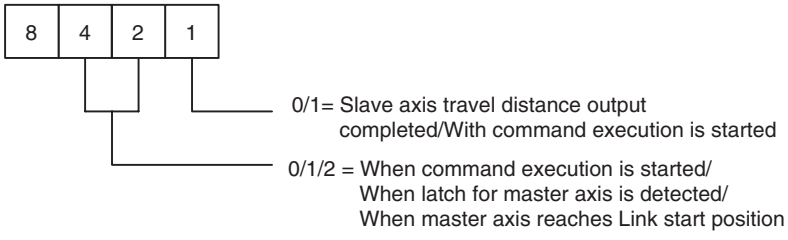
Interval	Master axis	Slave axis
Constant speed	Master axis travel distance- Master axis travel distance in acceleration- Master axis travel distance in deceleration	[Slave axis travel distance]- Slave axis travel distance in acceleration - Slave axis travel distance in deceleration
Deceleration	Master axis travel distance in deceleration	$[\text{Slave axis travel distance}] \times \dfrac{\dfrac{[\text{Master axis travel distance in deceleration}]}{2}}{\dfrac{[\text{Master axis travel distance in acceleration}]}{2} + \text{Master axis travel distance at constant speed} + \dfrac{[\text{Master axis travel distance in deceleration}]}{2}}$

When [Master axis travel distance] < [Master axis travel distance in acceleration] + [Master axis travel distance in acceleration], the actual master axis travel distance in acceleration + the actual master axis travel distance in deceleration = [Master axis travel distance] while maintaining the ratio between the acceleration and deceleration intervals. In this case, the master axis travel distance at constant speed is 0.

- Master axis input ignores signs, and it is treated as the absolute travel distance. Therefore, only the signs of [Slave axis travel distance] determine the direction of the slave axis operation. For example, if the master axis travel direction is reversed during synchronization, the slave axis travel direction will not change.
- The link option influences the following operations depending on the setting value.

Link option	Command execution completion	Link operation start
0 or omitted	When slave axis travel distance output is completed	When command execution is started
1	When command execution is started	When command execution is started
2	When slave axis travel distance output is completed	When latch for master axis is detected
3	When command execution is started	When latch for master axis is detected
4	When slave axis travel distance output is completed	When master axis reaches Link start position
5	When command execution is started	When master axis reaches Link start position

Note The bit image shown below:



- [Master axis classification] determines whether to synchronize the slave axis with the master axis command value or feedback value.

Master axis classification	Master axis value to synchronize with
0 or omitted	Command value
1	Feedback value

- Completion of command execution varies depending on the link option.
- During the command execution, the command code "0015h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)

Electronic Cam, Synchronous (CAMBOX)

The operation is executed based on the CAM table synchronizing the slave axis to the specified master axis.

Command type

Single execution command

Format

CAMBOX_[<slave axis name>]<cam table number> [<master axis name>]<link distance>
K<displacement data multiplier> {S<starting data number>}{E<ending data number>}[Q<link option>]
{I<link start position>}{B<master axis classification>;

Ex: CAMBOX_[J02]1 [J01]100.00 K100.00;

Operand

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
CAM table number	±(1 to 32, 100, 200)	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Link distance	0 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	No (See note 4.)
Displacement data multiplier	−20000 to 20000	Yes	No	Yes (See note 1.)	Yes	Yes (See note 5.)	Yes	No
Starting data number	0 to note 6	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Ending data number	0 to note 6	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Link option	1 to 5, 8 to 13	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Link start position	−2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	No (See note 7.)
Master axis classification	0 or 1	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) Figures below the decimal point are to be omitted.

(3) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

(4) There is no influence. INC specification is always used.

(5) The minimum command unit is 0.01%.
Real value = ((Value with decimal point or Variable of real number type)

× 102)
Figures below the decimal point are to be omitted.

(6) When CAM table is specified: The greatest CAM data number in CAM table
When specified with the global variable: 8188 (1FFC Hex)
When specified with the position data: 10238 (27FE Hex)

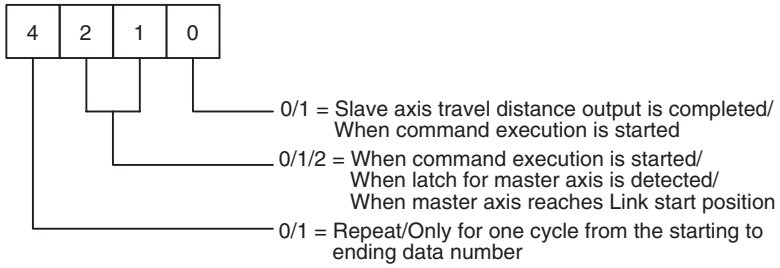
(7) There is no influence. ABL specification is always used.

Description

- The synchronous operation is executed based on the CAM table specified with CAM table number.
- The operands, CAM table number, Displacement data multiplier, Starting data number, and Ending data number are handled in the same manner as CAM command.
- Link distance specifies the master axis travel distance per phase cycle.
- Link option influences the following operations depending on the setting value:

Link option	Command execution completion	Link operation start	Repeat
0 or omitted	When slave axis travel distance output is completed	When command execution is started	Repeat
1	When command execution is started	When command execution is started	Repeat
2	When slave axis travel distance output is completed	When latch for master axis is detected	Repeat
3	When command execution is started	When latch for master axis is detected	Repeat
4	When slave axis travel distance output is completed	When master axis reaches Link start position	Repeat
5	When command execution is started	When master axis reaches Link start position	Repeat
8	When slave axis travel distance output is completed	When command execution is started	Only for one cycle from the starting to ending data number
9	When command execution is started	When command execution is started	Only for one cycle from the starting to ending data number
10	When slave axis travel distance output is completed	When latch for master axis is detected	Only for one cycle from the starting to ending data number
11	When command execution is started	When latch for master axis is detected	Only for one cycle from the starting to ending data number
12	When slave axis travel distance output is completed	When master axis reaches Link start position	Only for one cycle from the starting to ending data number
13	When command execution is started	When master axis reaches Link start position	Only for one cycle from the starting to ending data number

Note The bit image is shown below:



- When the master axis is in reverse rotation, the CAM data is read tracing the data numbers in the reverse order.
- When Link option is one of 8 to 13 (Only for one cycle from the starting to ending data number), the synchronization will be completed once the master axis travels for Link distance in + or – direction from the synchronization start position.
- But if the master axis reciprocates within the ranges of +Link distance] or -{Link distance}, the slave axis continues to move.
- The position of the master axis at link start can be specified with Link start position.
- Master axis classification determines whether to synchronize the slave axis with the master axis command value or feedback value.

Master axis classification	Master axis value to synchronize with
0 or omitted	Command value
1	Feedback value

- Command execution completion varies depending on the link option.
- During the command execution, the command code "0016h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)

Phase and Displacement of CAM Data

Restriction on phase:

- To use the CAM data for "CAM (Electronic cam, single axis)" and "CAMBOX (Electronic cam, synchronous)" commands, the phase data should be arranged in an ascending order (i.e. the greater the data number is, the larger the phase will be).
- When specifying the starting and ending points, the restriction varies depending on the used data as shown below.

Data	Restriction
CAM data	Even with the starting and ending points specified, the other data will not be ignored. Therefore, the conditions mentioned above have to be met even for the unused area.
Position data/Global general variable	The data other than the starting and ending points specified will be ignored. Therefore, the conditions mentioned above do not have to be met for the unused area.

- When these conditions are not met, "CAM (Electronic cam, single axis)" and "CAMBOX (Electronic cam, synchronous)" commands may cause the axis to stop operating, or to operate in an unexpected way. To avoid accidents, make sure that the conditions are met.

Note The position data and global general variable can be used while being overwritten real-time. Therefore, the MC unit does not internally check the conditions for the restrictions mentioned above. (This also applies to the cam data.)

Restriction on the displacement:
Set it so that the value is within the setting range.

Electronic Shaft (CONNECT)

Positioning is performed synchronizing the slave axis to the specified master axis based on the specified gear ratio.

Command type Single execution command

Format CONNECT_[<slave axis name>]<gear ratio numerator> ---8--- [<master axis name>]<gear ratio denominator> {B<master axis classification>};

Ex: CONNECT_[J02]1 [J03]2 [J04]3 [J01]100;

Operand Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Gear ratio numerator	–10000 to 10000	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Gear ratio denominator	1 to 10000	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Master axis classification	0 or 1	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No

Note
(1) Word data is extended to long word data with a sign in the MC Unit.
(2) Figures below the decimal point are to be omitted.

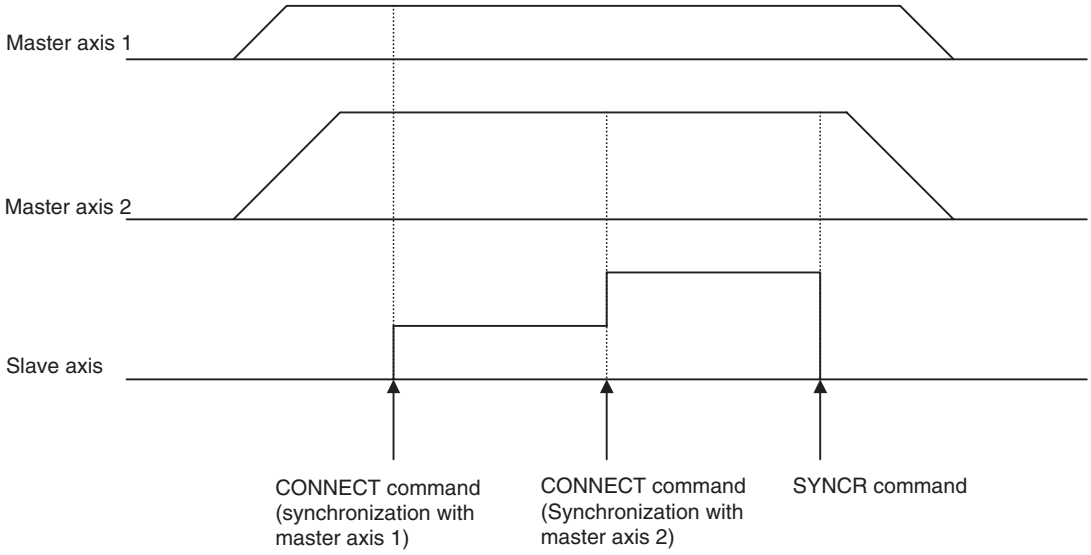
Description

- Synchronous operation is performed in the ratio Gear ratio numerator/ Gear ratio denominator.
- The value in Gear ratio denominator is common for all the slave axes. If there are different ratios within one block, they are to be reduced to a common denominator to set the ratios.
- A negative value can also be set for Gear ratio numerator, which can make the travel directions of the master and slave axes opposite.
- Master axis classification determines whether to synchronize the slave axis with the master axis command value or feedback value.

Master axis classification	Master axis value to synchronize with
0 or omitted	Command value
1	Feedback value

- If the speed obtained by multiplying the master axis speed and the gear ratio exceeds the speed specified in the parameter [P2AA01: Maximum rapid feed rate], the alarm [3011h: Synchronizing slave axis excessive speed] will occur.
- CONNECT command execution will be completed when the electronic shaft synchronization for all the specified axes are established.

• During the command execution, the command code "0017h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)



Trailing Synchronization (SYNC)

The Trailing Synchronization (SYNC) command performs trailing synchronization operation with a specified master axis.

Command type

Single execution command

Format

SYNC_[<slave axis name>]<catch-up position offset> [<master axis name>]<marker sensor ON position> {B<master axis classification>;

Ex: SYNC_[J02]100.00 [J01]20.0;

Operand

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Catch-up position offset	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 3.)
Marker sensor ON position	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 5.)
Master axis classification	0 or 1	No	No	Yes (See note 1.)	Yes	Yes (See note 4.)	Yes	No

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

(3) There is no influence. INC specification is always used.

(4) Figures below the decimal point are to be omitted.

(5) There is no influence. ABL specification is always used.

Description

• Synchronization proceeds in the order described below:

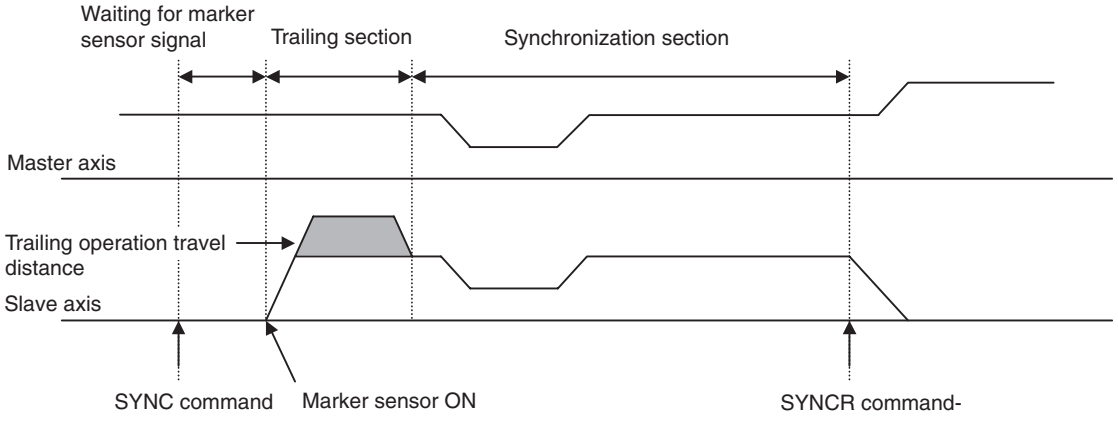
1. The slave axis will wait for the marker sensor signal after the execution is started. (It waits for the marker sensor signal input to the master axis.)

2. The slave axis will start trailing operation when the marker sensor signal is input. The trailing operation will be completed once the slave axis synchronizes with the position of the master axis (Marker sensor ON position + catch-up position offset).
3. The slave axis is operated synchronizing with the master axis in the ratio of 1 to 1.

- Catch-up position offset is specified as the distance from Marker sensor ON position on the coordinate system of the slave axis.
- Marker sensor ON position is specified as the position on the coordinate system of the slave axis.
- If the speed in synchronization exceeds the speed specified in the parameter [P2AA01: Maximum rapid feed rate], the alarm [3011h: Synchronizing slave axis excessive speed] will occur.
- Master axis classification determines whether to synchronize the slave axis with the master axis command value or feedback value.

Master axis classification	Master axis value to synchronize with
0 or omitted	Command value
1	Feedback value

- SYNC command execution will be completed when the trailing operation is completed and the synchronization is established.
- During the command execution, the command code "0018h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)



Synchronization Cancel (SYNCR)

Synchronous operation executed with the synchronous command is cancelled.

Command type

Single execution command

Format

SYNCR_[<slave axis name>]{<travel distance for deceleration stop>} ---8---;

Ex: SYNCR_[J02];

Operand Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Travel distance for deceleration stop	0 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 3.)

Note
(1) Word data is extended to long word data with a sign in the MC Unit.
(2) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].
(3) There is no influence. INC specification is always used.

Description

- Synchronization started with MOVELINK, CAMBOX, CONNECT, or SYNC command is canceled with deceleration stop.
- The slave axis not performing synchronous operation is ignored.
- The speed for deceleration stop follows the speed specified in the parameter [P2AA03: Rapid feed rate]. So, acceleration or deceleration may occur depending on the speed at the start of command execution.
- The deceleration for deceleration stop observes the speed determined by the setting values in the parameter [P2AA03: Maximum rapid feed rate] and [P2AA06: Rapid feed deceleration time].
- When Travel distance for deceleration stop is not specified, behavior will vary depending on the command.

Command	Behavior
MOVELINK	Immediate stop
CAMBOX	Immediate stop
CONNECT	Immediate stop
SYNC	Deceleration stop with the specified deceleration

- If Travel distance for deceleration stop is smaller than the distance required for deceleration stop from the current speed (speed of the previous scan), return operation is performed after the deceleration stop.
- SYNCR command execution will be completed when positioning (including the return operation) for all the specified axes are completed (in-position).
- During the command execution, the command code "0029h" is output to the system variable "Command execution status" (SW0228 for Axis 1). However, when the travel distance specification is omitted, the command code of the corresponding synchronous command is held. (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)

Travel Distance Superimpose/Travel Distance Superimpose Cancel (ADDAX/ADDAXR)

The travel distance of the specified master axis is superimposed onto the slave axis operation.

Command type Single execution command

Format

ADDAX_[<slave axis name>] [<master axis name>] {B<master axis classification>};
ADDAXR_{[<slave axis name>] ---8---};

Ex: ADDAX_[J02] [J01];
ADDAXR_[J02];

Operand Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Master axis classification	0 or 1	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No

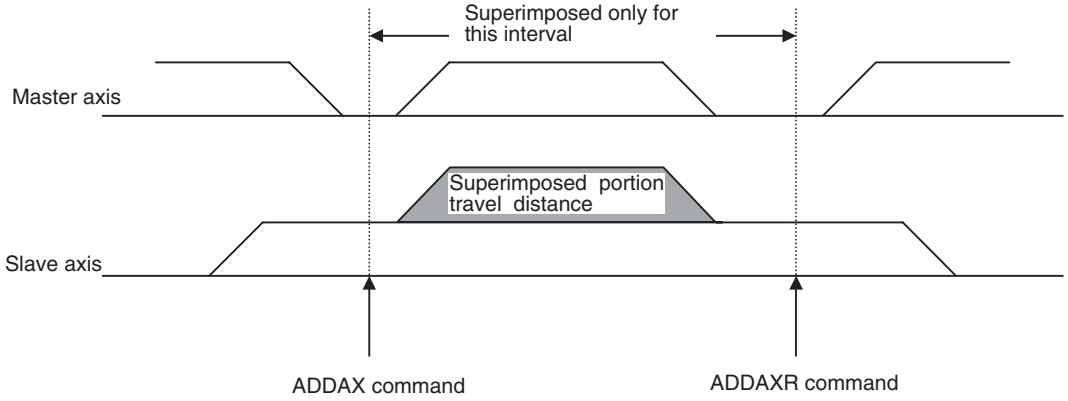
Note
(1) Word data is extended to long word data with a sign in the MC Unit.
(2) Figures below the decimal point are to be omitted.

Description

- The travel distance of the specified master axis is superimposed onto the slave axis operation.
- Master axis classification determines whether to synchronize the slave axis with the master axis command value or feedback value.

Master axis classification	Master axis value to synchronize with
0 or omitted	Command value
1	Feedback value

- Executing another ADDAX command on the axis that is already in superimposing operation can establish new superimposing relations (overwritten).
- If the speed in superimposition exceeds the speed specified in the parameter [P2AA01: Maximum rapid feed rate], the alarm [3011h: Synchronizing slave axis excessive speed] will occur.
- ADDAX command execution will be completed when superimposition is established.
- If Slave axis name is omitted in ADDAXR command, all the superimposition being executed in the same motion task will be cancelled.
- ADDAXR command execution will be completed when superimposition is cancelled.
- During the command execution, the command code "0019h" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)



Caution When a command that has waiting conditions such as Stop Mode is executed on the slave axis, the waiting conditions may not be satisfied in some cases.

See the following example:

```
Ex:
...
ADDAX [J02] [J01];
PARALLEL N2;
MOVE [J01]1000.;
JOINT;
MOVE [J02] 500;    ← J02 is the slave axis in the superimposition. Positioning only up to 500. is not sufficient for in-position, which means that the MOVE command cannot be completed. Practically, it will be completed after the movement of [J01] (2 lines before) is completed. To avoid waiting for completion of [J01], it is necessary to replace use MOVEL in Pass Mode, etc.
...
```

Speed Control/Speed Control Cancel (SPEED/SPEEDR)

The speed of the axis is controlled in the speed control mode.

Command type

Single execution command

Format

SPEED_[<axis name>]<speed command value> ---8--- T< speed change rate>;
SPEEDR_[<axis name>] ---8--- T<speed change rate>;

Ex: SPEED_[J01]100.00 [J02]100.00 T100;
SPEEDR_[J01] [J02] T100;

Operand

Axis Name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Speed command value	See note 1.	Yes	No	Yes (See note 2.)	Yes	Yes (See note 3.)	Yes	No (See note 4.)
Speed change rate	0 to 60000ms	No	No	Yes (See note 2.)	Yes	Yes	Yes	No

Note

(1) With Rated % specification (P00004 bit2=0):
This is the % specification for the motor rated rotations in the unit of 0.01%. The setting range is −500000 to 500000.
If the value I0000 is set, it is interpreted as 100% of the rated rotations.
The maximum speed in actual operations is limited by the maximum rotation speed of the motor.
With r/min specification (P00004 bit2=1):
This is the specification of rotations (r/min) in the unit of 0.01%. Setting range is −10000000 to 10000000.
If the value 300000 is set, it is interpreted as 3000r/min.
The maximum speed in actual operations is limited by the maximum rotation speed of the motor.

(2) Word data is extended to long word data with a sign in the MC Unit.

(3) With Rated % specification (P00004 bit2=0)
The minimum command unit is 0.01%.
The actual value = (Decimal immediate value or Variable of real number type) $\times 10^2$)
Figures below the decimal point are to be omitted.
In case of r/min specification (P00004 bt2=1)

The minimum command unit is 0.01%.
The actual value = ((Decimal immediate value or Variable of real number type) $\times 10^2$)
Figures below the decimal point are to be omitted.

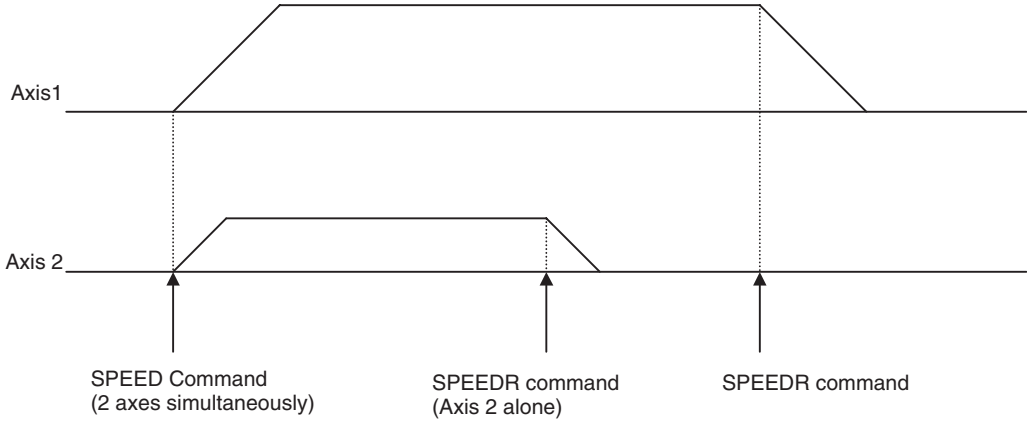
(4) There is no influence. ABL specification is always used.

Description

- The speed command is output to the specified axis.
- The speed command unit is specified in the parameter [P00004.bit02: Unit function select, Speed command value]
  [P00004.bit02] = 0 [0.01% of the rated speed]
  [P00004.bit02] = 1 [0.01r/min]
- If Speed change rate is set to 0, the specified speed is output instantly. (If the mode is switched from other mode to the speed control mode, this value can be used as the output speed default value.)
- The Speed change rate is enabled for all the specified axes.
- SPEED command execution will be completed when the speed command for all the specified axes reaches Speed command value.
- The SPEEDR command is processed as follows:
  (1) The speed command is decelerated for all specified axes according to the speed change rate and the speed command is output as 0.
  (2) The system waits until the feedback speed is 0.
  (3) The mode is switched to positioning control mode and the system waits for the completion of positioning.
  (4) Command execution is completed.
  For MC Units with Ver. 2.0 or Later, step (2) is as follows:
  (2) The system waits until the feedback speed is below the value set in P3AA09.
- During the command execution, the command code "001Ah" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)

Caution

The maximum time required from starting SPEED command to completing the command is 136ms + (Actual acceleration time/unit cycle).

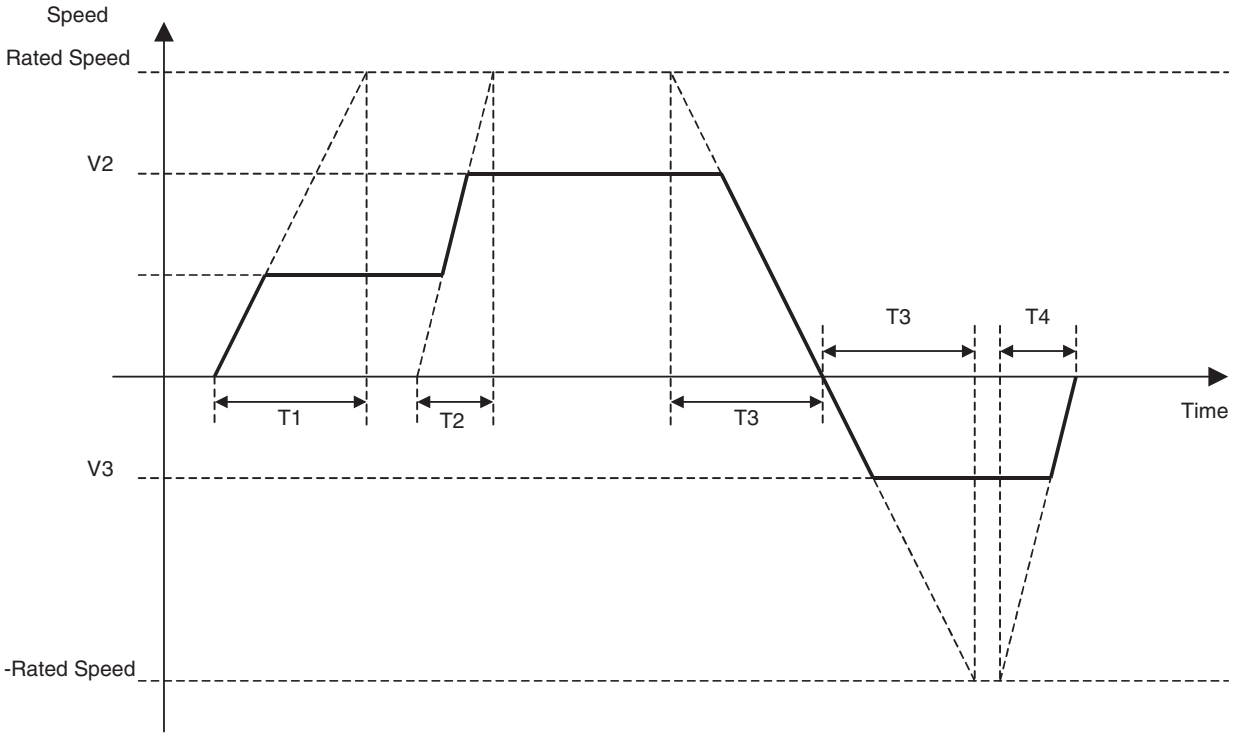


- If MOVE command is executed without SPEEDR command, the mode can be switched from the speed control mode to the position control mode. To change the speed of SPEED command being executed to the rapid feed rate of MOVE command smoothly, the system automatically reads the position loop gain before starting execution of SPEED command except for the following cases:
  1) When the position loop gain before execution of SPEED command is different from the position loop gain right after transition to the MOVE command.
  2) When the position loop gain could not be read successfully due to incorrect setting of the servo reading parameter.

  In order to prevent shock, follow the instructions below:
  - Do not use MOVE command right after acceleration or deceleration.
  - Set the unit cycle and communication cycle to be the same.
  - Decrease the speed specified in SPEED command.
- The Speed change rate of SPEED/SPEEDR specifies the time to reach the motor rated speed from zero.

```
Program Image

SPEED [J01]<V1> T<T1>; Speed control started
      :
SPEED [J01]<V2> T<T2>; Speed changed
SPEED [J01]<V3> T<T3>; Speed and direction changed
      :
SPEEDR [J01] T<T4>; Speed control completed
```



Torque Control/ Torque Control cancel (TORQUE/TORQUER)

The axes Torque can be controlled in Torque Control mode.

Command type

Single execution command

Format

TORQUE_[<axis name>]<torque command value> ---8--- T<torque change rate>;
TORQUER_[<axis name>] ---8--- T<torque change rate>;

Ex: TORQUE_[J01]100.00 [J02]100.00 T100;
TORQUER_[J01] [J02] T100;

Operand

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Torque command value	–10000 to 10000 (See note 1.)	No	No	Yes (See note 2.)	Yes	Yes (See note 3.)	Yes	No (See note 4.)
Torque change rate	0 to 60000ms	Yes	No	Yes (See note 2.)	Yes	No	Yes	No

Note

(1) This is the % specification for the maximum motor torque in the unit of 0.01%. When the value I0000 is set, it is interpreted as 100% of the maximum torque. The maximum motor torque limits the maximum torque in actual operations.

(2) Word data is extended to long word data with a sign in the MC Unit.

(3) The minimum command unit is 0.01%.
Real value = (Decimal immediate value or Variable of real number type) $\times 10^{2}$)
Figures below the decimal point are to be omitted.

(4) There is no influence. ABL specification is always used.

Description

- The torque command is output to the specified axis. (Torque value on the motor axis is controlled.)
- The torque command unit is fixed at 0.01% of the maximum torque.
- If Torque change rate is set to 0, the specified torque is output instantly (If the mode is switched from other mode to the torque control mode, this value can be used as the output torque default value.)
- Torque change rate is enabled for all the specified axes.
- TORQUE command execution will be completed when the torque command for all the specified axes reaches Torque command value.
- The TORQUER command is processed as follows:

  (1) The torque command is deceleration for all specified axes according to the torque change rate and the torque command is output as 0.

  (2) The system waits until the feedback speed is 0.

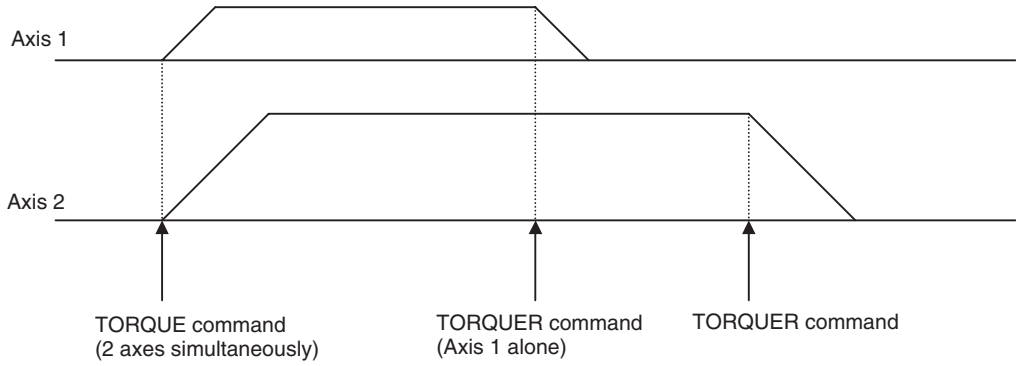
  (3) The mode is switched to positioning control mode and the system waits for the completion of positioning.

  (4) Command execution is completed.

  For MC Units with Ver. 2.0 or Later, step (2) is as follows:

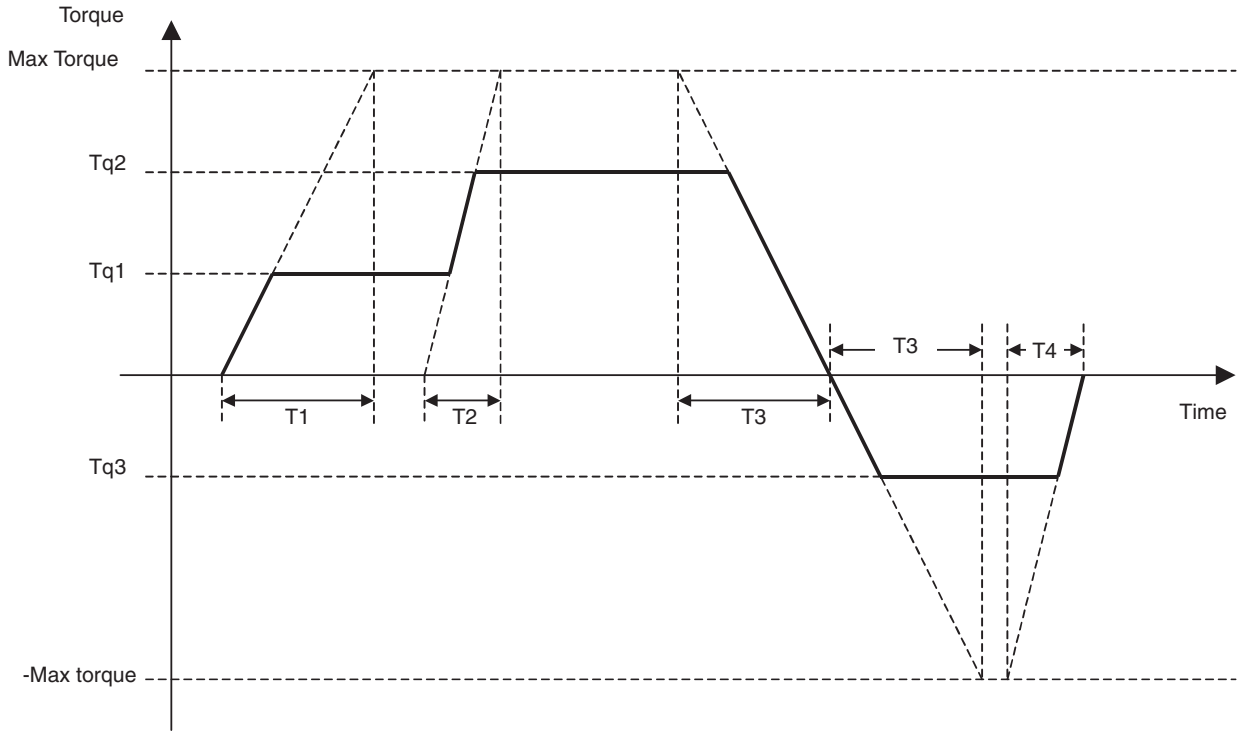
  (2) The system waits until the feedback speed is below the value set in P3AA09.

- During the command execution, the command code "001Bh" is output to the system variable "Command execution status" (SW0228 for Axis 1). (For details of command codes, see *4-5 System Variables Command Code in Command Execution Status* on page 142.)



- Torque change rate of TORQUE/TORQUER specifies the time to reach the motor maximum torque from 0.

```
Program image
TORQUE [J01]<Tq1> T<T1>; Torque control started
     :
TORQUE [J01]<Tq2> T<T2>; Torque changed
     :
TORQUE [J01]<Tq3> T<T3>; Torque and direction changed
     :
TORQUER [J01] T<T4>; Torque control completed
```



6-3-4 Setting Command

Target Position Change (MOVEMODI)

The target position of the positioning command currently being executed is changed.

Command type Multiple execution command

Format MOVEMODI_[<axis name>]<changed target position> --8--;
Ex: MOVEMODI_[J01]100.00 [J02]200.00;

Operand Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Changed target position	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 3.)

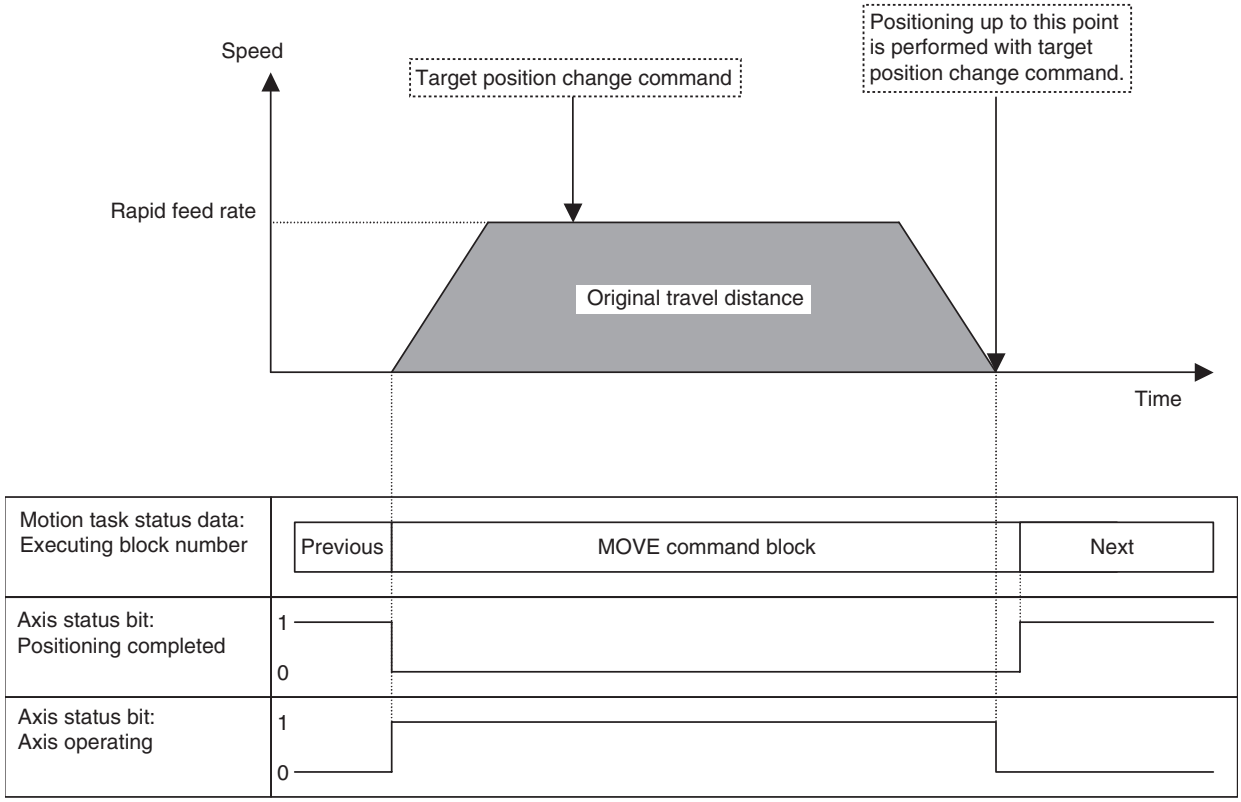
Note
(1) Word data is extended to long word data with a sign in the MC Unit.
(2) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].
(3) There is no influence. ABL specification is always used.

Description

- The target position of the axis being operated with MOVE command or MOVEL command of 1 axis specification in Stop Mode is changed to Changed target position.
- MOVEMODI command is ignored during execution of commands other than the above or when it is executed for the axis not operating.
- Changed target position is treated as the absolute position on the coordinate system currently being selected.
- If Changed target position has already been passed, return operation is performed.
- The relations between the remaining travel distance and acceleration/deceleration on the axis of MOVEMODI object are as shown in the table below:

Speed status	Remaining travel distance	
	When remaining travel distance is increased	When remaining travel distance is decreased
In acceleration	Keeps accelerating	If there is still sufficient travel distance left, acceleration is maintained. If there is not sufficient travel distance, deceleration stop is executed and return operation is performed.
At constant speed	Stays at constant speed	If there is still sufficient travel distance left, constant speed is maintained. If there is not sufficient travel distance, deceleration stop is executed and return operation is performed.
In deceleration (Due to insufficient remaining travel distance)	Stops decelerating and accelerates again	Deceleration stop is executed and return operation is performed.

- MOVEMODI command execution is completed when the target position is changed internally and completed successfully. There is no influence of the operation status of the axis whose target position has been changed.



Absolute Specification (ABL)

In axis operations, positioning is performed with absolute specification on each coordinate system.

Command type

Multiple execution command

Format

ABL;
ABL_<other command>;
Ex: ABL_MOVE [J01]1000.00 [J02]2000.00;

Operand

Nil

Description

Command values after ABL command are interpreted as absolute (target value) specification.

Incremental Specification (INC)

In axis operations, positioning is performed with relative specification.

Command type

Multiple execution command

Format

INC;
INC_<other command>;
Ex: INC_MOVE [J01]1000.00 [J02]2000.00;

Operand

Nil

Description

Command values after INC command are interpreted as incremental (incremental value) specification.

Change Parameter Value (PARAM)

The setting of the specified parameter is changed.

Command type

Single execution command

Format

PARAM_P<parameter number> = <parameter setting value>;
PARAM_[<axis name>]<servo parameter number> = <parameter setting value>;

Ex: PARAM P1=2;

Operand

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Parameter number	0 to 65535	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Parameter setting value	–2147483648 to 2147483647	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Servo parameter number	000 to 8FF [Hex]	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

Description

- System parameters or servo parameters are changed.
- Only one parameter can be changed per command.
- From a motion task, only system parameters related to the motion task itself and only system parameters or servo parameters related to the axis reserved by axis declaration can be changed.
- The parameters that can be changed using PARAM command are the ones that can be changed after power is turned ON (i.e. the parameters that can be changed without turning OFF the power once, then ON again). If a parameter that cannot be changed is changed, the alarm [2019h: Parameter setting error] will occur.
- Parameters changed using PARAM command remains enabled until any one of the following is executed:
  1. Power is turned ON or Unit is restarted.
  2. PARAM command is executed.
  3. Parameter is changed using IOWR instruction.
  4. Parameter is downloaded from a support tool.
- PARAM command execution will be completed when the parameter is overwritten successfully.

Caution

The following time is required from when the PARAM command execution starts until execution is completed.

Parameter type	Unit cycle Tm (ms)	Execution time (ms
Servo driver parameters	1 ms, 2 ms	{(20/Tm) × 3 + 2} × Tm to {(20/Tm) × 4 + 2} × Tm
	3 ms, 4 ms, 6 ms, or 8 ms	{(20/Tm) × 4 + 2} × Tm to {(20/Tm) × 5 + 2} × Tm
Other parameters	1 ms, 2 ms, 3 ms, 4 ms, 6 ms, or 8 ms	{(20/Tm) × 1 + 2} × Tm to {(20/Tm) × 2 + 2} × Tm

For example, when changing the interpolation feed speed for motion task parameters with a unit cycle of 2 ms, the execution time will be 24 to 44 ms.

Pass Mode (PASSMODE)

The operating mode is switched to Pass Mode.

Command type

Multiple execution command

Format

PASSMODE;

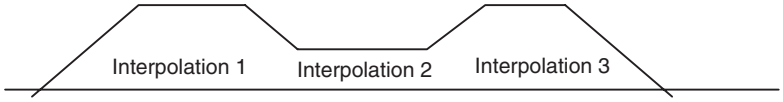
Ex: PASSMODE;

Operand

Nil

Description

- Interpolation blocks (MOVEL/MOVEC/MOVETRAV) after PASSMODE command are executed in Pass Mode.



- There are four modes for linking speeds, one of which can be selected in the parameter [P00M06: Pass mode select].

P00M06	Name	Operation
0	Interpolation acceleration time + Acceleration disabled	Operation proceeds to the next using interpolation acceleration time of the previous block.
1	Interpolation deceleration time+ Acceleration disabled	Operation proceeds to the next using interpolation deceleration time of the previous block.
2	Interpolation acceleration time+ Acceleration enabled	Operation proceeds to the next using interpolation acceleration time of the previous block. For 1-axis linear interpolation, speeds are changed with fixed acceleration/deceleration.
3	Interpolation deceleration time+ Acceleration enabled	Operation proceeds to the next using interpolation deceleration time of the previous block. For 1-axis linear interpolation, speeds are changed with fixed acceleration/deceleration.

Stop Mode (STOPMODE)

The operating mode is switched to Stop Mode.

Command type

Multiple execution command

Format

STOPMODE;

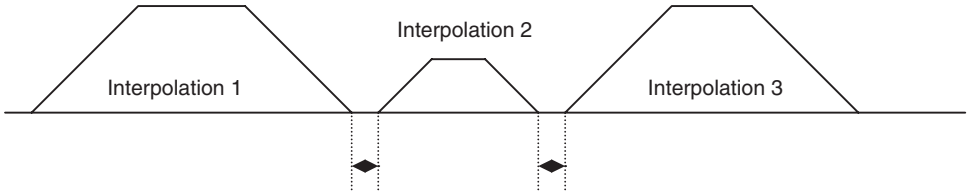
Ex: STOPMODE;

Operand

Nil

Description

Interpolation blocks (MOVEL/MOVEC/MOVETRAV) following STOPMODE command proceeds to the next block after entering No. 2 in-position range specified in the parameter [P3AA07: No.2 in-position range]. (Interpolation for the next block will start after speed decreases to 0 and positioning enters No.2 in-position range.)



Interpolation for the next block will be executed after the previous block enters No.2 in-position range.

Machine Coordinate System Select (ORIGIN)

Coordinate system is switched to the machine coordinate system.

Command type Single execution command

Format ORIGIN;

Ex: ORIGIN;

Operand Nil

Description

- Coordinate values after ORIGIN command are treated as values on the machine coordinate system.

  Note Defining an origin using origin search, etc. sets the machine coordinate system.
- All the axes that are declared with the previous PROG command (main PROG for main programs, sub PROG for subprograms) are the objects of ORIGIN command.
- The selected coordinate system will stay enabled until ORIGIN/WORK commands are executed, or until a new program execution is started.

Workpiece Coordinate System Select (WORK)

Coordinate system is switched to the workpiece coordinate system.

Command type Single execution command

Format WORK_C<workpiece coordinate system number>;

Ex: WORK_C1;

Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Workpiece coordinate system number	1, 2, or 3 (See note 3.)	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No

Note

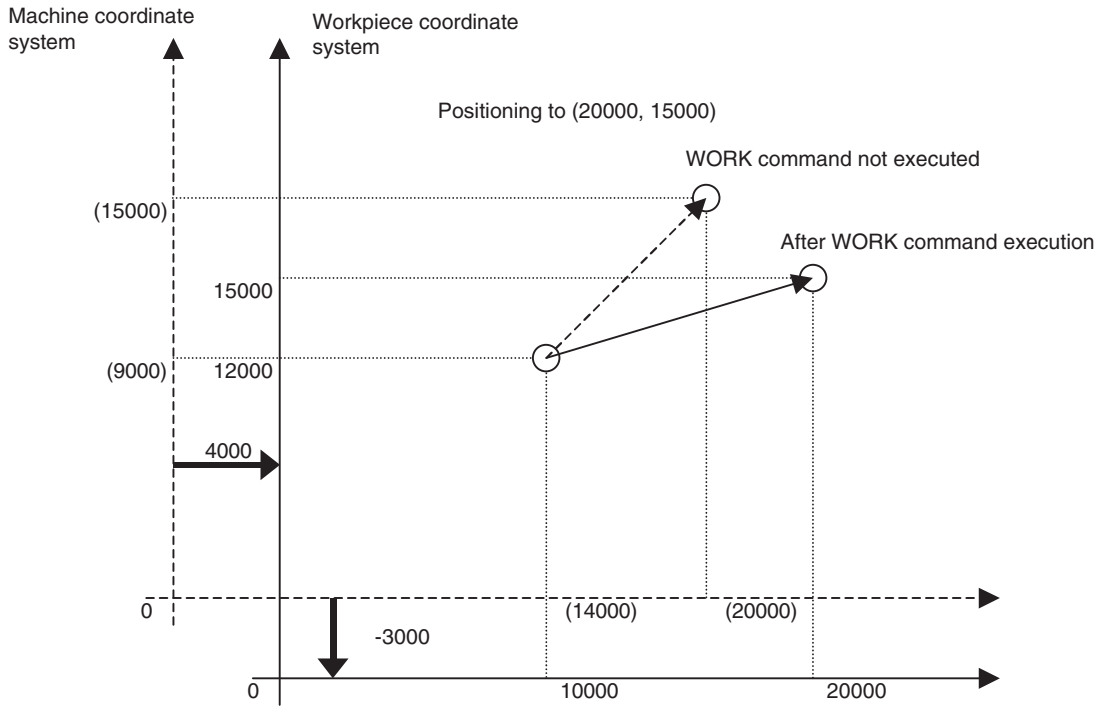
(1) Word data is extended to long word data with a sign in the MC Unit.

(2) Figures below the decimal point are to be omitted.

(3) There are three workpiece coordinate systems for each axis.

Description

- Coordinate values after WORK command are treated as values on the workpiece coordinate system.
- There are three workpiece coordinate systems for each axis, and they are specified using coordinate system numbers.
- All the axes that are declared with the previous PROG command (main PROG for main programs, sub PROG for subprograms) are the objects of WORK command.
- Workpiece coordinate system will stay enabled until ORIGIN/WORK is executed, or until a new program execution is started.
- Offsets for the workpiece coordinate systems against the machine coordinate system are set with OFFPOS command.



Workpiece Coordinate System Offset Change (OFFPOS)

The offset value of the workpiece coordinate system is changed.

Command type

Multiple execution command

Format

OFFPOS_C<workpiece coordinate system number> [<axis name>]<workpiece coordinate system offset value> ---8---;

Ex: OFFPOS_C1 [J01]10.00 [J02]-100.00;

Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Workpiece coordinate system number	1, 2, or 3	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Workpiece coordinate system offset value	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 3.)	Yes	No (See note 3.)

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) Figures below the decimal point are to be omitted.

(3) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

(4) There is no influence. INC specification is always used.

Description

- Offset value of the workpiece coordinate system is changed.
- The offset amount between the machine coordinate system origin and the workpiece coordinate system origin is specified in Workpiece coordinate system offset value.

- The workpiece coordinate system offset value specified will be enabled when WORK command is executed. It means that the offset value will not be reflected in the operation until WORK command is executed again when using the coordinate system specified with Workpiece coordinate system number.
- Workpiece coordinate system offset value specified will stay enabled until OFFPOS command is executed again.

Present Position Latch (LATCH)

The present position of the specified axis is stored.

Command type

Single execution command

Format

LATCH_[<axis name>]<latch position storing variable>{I<latch check start position>}
{J<latch check end position>};

Ex: LATCH_[J01]#DL0000;

Operand

Axis name: J01 to J32

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Latch position storing variable	R/W variable address	No	No	No	Yes	No	No	No
Latch check start position	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 3.)
Latch check end position	–2147483648 to 2147483647	Yes	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No (See note 3.)

Note

(1) Word data is extended to long word data with a sign in the MC Unit.

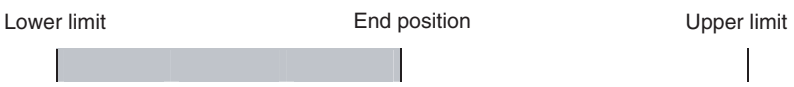
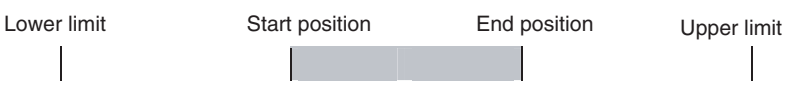
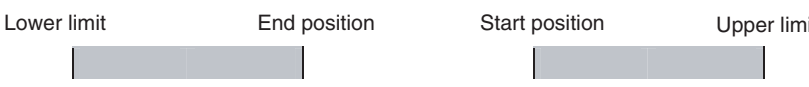
(2) The actual value is determined by the setting value of the parameter [P5AA02: Position command decimal point position].

(3) There is no influence. ABL specification is always used.

Description

- The position of the specified axis is stored.
- The latched position is assigned in Latch position storing variable.
- Latch signal is accepted only in the sections specified in Latch check start position and Latch check end position.
- The latch position assigned in Latch position storing variable, Latch check start position, and Latch check end position are values on the coordinate system currently being selected.
- Present position latch is performed as shown below depending on the relations between Latch check start position and Latch check end position.

Specification	Operation
Both start position and end position are omitted	Accepting section is not specified. 
Start position is omitted	Accepting section: Start position and after 

Specification	Operation
End position is omitted	Accepting section: End position and before 
Start position<End position	Accepting section: Start position and after, End position and before 
Start position>End position	Accepting section: End position and before, Start position and after 
Start position=End position	Ends latch check operation being executed 

Note Both lower and upper limits indicate the lower and upper limits of each coordinate system.

- The latch check operation is ended by one of the following operations:
  1. LATCH command is executed as Latch check start position = Latch check end position
  2. END Command execution
- LATCH command execution will be completed when latch check operation is started.

Caution

- It may take 260ms max. (Latch startup time) until the MC Unit becomes able to actually accept the latch signal after starting LATCH command.

  Note For details, see *1-7 Performance Calculation Method for the Counter Latch Startup Time* on page 20.

- As shown below, it takes the following time periods until the MC Unit becomes able to accept another LATCH command after completion of a LATCH command:
  - When Unit cycle: Communication cycle = 1 : 1 6 × Unit cycle
  - When Unit cycle: Communication cycle = 2 : 1 4 × Unit cycle
- Do not restart the MC Unit, or restore power only to the MC unit (including temporary power interruption) when the Unit is waiting for a latch signal after executing LATCH command in which the latch check position has been specified. When Latch check start/end positions are specified in LATCH command, the motor parameters [900A: Latch range (+) No.] and [900B: Latch range (–) No.] in the servo driver will be automatically updated. Restarting the MC Unit or restoring power only to the MC unit (including temporary power interruption) at this point will not bring back the parameter settings before being updated. In addition, executing an origin search, etc. using a latch signal under this condition may cause the axis to operate in an unexpected way since the latch signal input outside of the latch check range cannot be detected.

- Especially, be cautious of temporary power interruption since it is impossible to know when it happens. Should it happen on the MC unit, make sure to clear the latch check range by setting the servo driver so that its power is also restored when it happens, or by using the following programs when restarting the MC Unit:

1,2,3... 1. Execute the program that only clears the latch check range:

Execute LATCH command to clear the range (Example 1)

```
PROG Pxxx Qxxxxxxxx; Program started
LATCH [Jxx] #xxxxxx; Latch range cleared (Latch resource acquired)
END; Program completed (Latch resource released)
```

Execute PARAM command to clear the range (Example 2)

```
PROG Pxxx Qxxxxxxxx; Program started
PARAM [Jxx]820 = 0; Servo parameter positive latch possible range cleared
PARAM [Jxx]822 = 0; Servo parameter negative latch possible range cleared
END; Program completed
```

2. Add a command that intentionally clears the range before executing origin search, etc.:

Execute LATCH command to clear the range (Example 3)

```
LATCH [Jxx] #xxxxxx;  Latch range cleared (latch resource acquired)
LATCH [Jxx] #xxxxxx I0 J0; Latch resource released
DATUM [Jxx];  Origin search
```

Execute PARAM command to clear the range (Example 4)

```
PARAM [Jxx]820 = 0; Servo parameter positive latch possible range cleared
PARAM [Jxx]822 = 0; Servo parameter negative latch possible range cleared
DATUM [Jxx]; Origin search
```

Single Block Ignored (NSTOP)

In single block mode, the block specified with NSTOP command does not stop at the end of the block and proceeds to the next block.

Command type

Not executed as an independent command (no type).

Format

NSTOP_<other command>;

Ex: NSTOP_MOVE [J01]100.00 [J02]-300.00;

Operand

Nil

Description

- In single block mode, the block with NSTOP command at the beginning does not stop at the end of the block and proceeds to the next block.
- When the motion task control bit [Block stop] is turned ON, stopping the operation is prioritized and the block is stopped regardless of this command's influence.

6-3-5 Control Command

Program Start (PROG)

The Program Start (PROG) command declares axes to be used in the program.

Command type

Multiple execution command

Format

PROG_P<program number> {Q<axis declaration>};

Ex: PROG_P1000 Q0000000F;

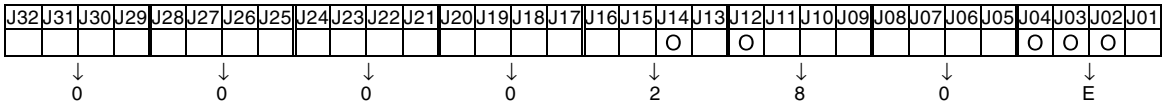
Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Program number	0 to 1999	No	No	No	No	No	No	No
Axis declaration	00000000 to FFFFFFFF [hex]	No	No	No	No	No	No	No

Description

- Program is started and axes to be used in the program are declared.
- If this command is omitted, programs cannot be loaded.
- Axis declaration describes the 32-bit string in hexadecimal corresponding to the physical axis numbers.

  Example: If physical axes J02, J03, J04, J12, and J14 are used, program [PROG P000 Q0000280E;].



- The commands to axes are valid only if they have been issued to the declared axes (no restriction on the commands using I/O variables).
- There is no restriction on referencing the axis in such case where an axis is used as a master axis in synchronization.
- If PROG command is not present at the beginning of a program, the program cannot be loaded.
- If the declared axis cannot be reserved due to the following reasons when motion main program is started, a warning will occur, and the motion program status bit: Start warning is turned ON.
  - Axis status bit: Command disabled/enabled is OFF.
  - Axis status bit: Axis not used/used is ON.
  - Axis status bit: Manual/Automatic mode is OFF.
- If the axis declared in a sub-program cannot be reserved when calling a motion sub-program (when the axis is used in the main program, or in the sub-program called by the same main program), the alarm [2007h: Axis reservation disable] will occur.
- The axis declared in a sub-program cannot be used for the main program that called the sub-program. The alarm [2007h: Axis reservation disable] will occur.

Program End (END)

The END command ends the main program.

Command type

Single execution command

Format

END;

Ex: END;

Operand

Nil

Description

- END command ends the main program.
- If END command is not present in the main program, the program cannot be loaded.

- END command cancels axis operation commands (MOVELINK/CAMBOX/CONNECT/ADDAX/SYNC/ SPEED/TORQUE) being executed.
- In execution of axis operation commands other than the above, END command execution will be completed after the axis status bits [Positioning completed] (x+32, bit06 for Axis 1) for all the axes operated with the program are turned ON (1).
- Modal data is initialized according to the default setting (motion task).
- All the axes reserved by axis declaration are released.
- End command execution will be completed when all the processing above is completed.

Sub-Program Call (GOSUB)

The specified sub-program is called.

Command type Single execution command

Format GOSUB_P<sub-program number>

Ex: GOSUB_P500;

Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Sub-program number	500 to 999 1500 to 1999	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No

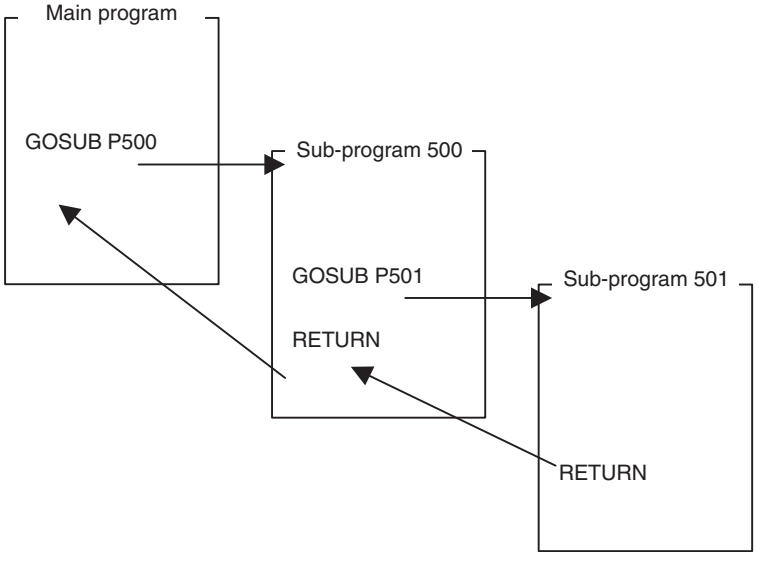
Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) Figures below the decimal point are to be omitted.

Description

- Sub-programs are executed.
- Sub-programs can be nested up to 5 levels.
- If the nesting limit is exceeded, the alarm [2002h: Sub-program nesting error] will occur.
- GOSUB command execution will be completed when the operation moves to the sub-program successfully.



Sub-Program End (RETURN)

Sub-program is ended.

Command type Single execution command

Format RETURN;

Ex: RETURN;

Operand Nil

Description

- Sub-program is ended and the operation returns to the program that called the sub-program.
- If RETURN command is not present in a sub-program, the program cannot be loaded.
- All the axes reserved by axis declaration are returned to the main program.
- RETURN command execution will be completed when the operation returns the program that called the sub-program.

Dwell Time (DWELL)

The operation waits for the specified time period.

Command type Single execution command

Format DWELL_T<dwell time>;

Ex: DWELL_T100;

Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Dwell time	0 to 60000	No	No	Yes (See note.)	Yes	No	Yes	No

Note Word data is extended to long word data with a sign in the MC Unit.

Description

- The operation waits for the time period specified in Dwell time. The unit is in [ms].
- During DWELL command execution, if the motion program is stopped (except for block stop), waiting will be cancelled. When the program is resumed with the motion task control bit: [Start Mode] = 1 (resume from where the operation was stopped), waiting will be resumed for the remaining time.
- DWELL command is not an axis movement command, however, it is the cancel object of STOPOP command. When it is cancelled, waiting will be immediately cancelled and the command execution is completed.
- DWELL command execution will be completed when the specified waiting time period elapses.

Wait for Condition to be Met (WAIT)

The next block will not be executed until the conditional expression is satisfied.

Command type Multiple execution command

Format WAIT_<conditional expression>

Ex: WAIT_#DW0001 == 1;

The formats of conditional expressions are shown in the following table. Immediate values and variables are the only comparison objects. If a different data type is used, an alarm will occur in pre-analysis.

Conditional Expression	Format
Equal to	(Immediate value or Variable)==(Immediate value or Variable)
Not equal to	(Immediate value or Variable)<>(Immediate value or Variable)
Greater than	(Immediate value or Variable)>(Immediate value or Variable)
Less than	(Immediate value or Variable)<(Immediate value or Variable)
Equal to or greater than	(Immediate value or Variable)>=(Immediate value or Variable)
Equal to or less than	(Immediate value or Variable)<=(Immediate value or Variable)

Operand

Nil

Description

- The next block will not be executed until Conditional expression is satisfied.
- If the motion program is stopped (except for block stop) during WAIT command execution, waiting for condition to be satisfied is cancelled and the command execution is completed. It means that waiting will not be resumed even if it is re-started with the motion task control bit: [Start Mode] = 1 (resume from where the operation was stopped).
- DWELL command is not an axis movement command, however, it is the cancel object of STOPOP command. When it is cancelled, waiting for condition to be satisfied will be immediately cancelled and the command execution is completed.
- WAIT command execution will be completed when the conditional expression is satisfied.

Optional End (STOPOP)

If the conditional expression is satisfied, execution of the next block will be interrupted and then the block after the interrupted block will be executed.

Command type

Single execution command

Format

STOPOP_<conditional expression>;

Ex: STOPOP_#DW0001 == 1;

The formats of conditional expressions are shown in the following table. Immediate values and variables are the only comparison objects. If a different data type is used, an alarm will occur in pre-analysis.

Conditional Expression	Format
Equal to	(Immediate value or Variable)==(Immediate value or Variable)
Not equal to	(Immediate value or Variable)<>(Immediate value or Variable)
Greater than	(Immediate value or Variable)>(Immediate value or Variable)
Less than	(Immediate value or Variable)<(Immediate value or Variable)
Equal to or greater than	(Immediate value or Variable)>=(Immediate value or Variable)
Equal to or less than	(Immediate value or Variable)<=(Immediate value or Variable)

Operand

Nil

Description

- If the conditional expression is satisfied, execution of the next block is interrupted.

- Checking the conditional expression will be completed when execution of [Block to end the operation midway] is completed.
- Commands that can be interrupted are all the axis movement commands, DWELL command, and WAIT command.
- STOPOP command execution will be completed when condition settings are completed inside the system.

  Ex:STOPOP_#DW0001 == 1;
  MOVE [J01] 10000; Axis travel command
  #DW0002 = 1;

  If #DW0001 becomes 1 during execution of MOVE, MOVE is interrupted, #DW0002 is set to 1 and then the next block is executed.

Conditional Branching (IF•••ELSE•••ENDIF)

If the conditional expression is satisfied, processing 1 will be executed.

If the conditional expression is not satisfied, processing 2 will be executed.

Command type

IF: Multiple execution command
ELSE: Multiple execution command
ENDIF: Multiple execution command

Format

IF_<conditional expression>;
<processing 1>
{ELSE;
<processing 2>}
ENDIF;

Ex: IF_#DW0001 == 1;
MOVE [J01]100.00 [J02]200.00;
ELSE;
MOVE [J03]-100.00 [J04]-10.00;
ENDIF;

The formats of conditional expressions are shown in the following table. Immediate values and variables are the only comparison objects. If a different data type is used, an alarm will occur in pre-analysis.

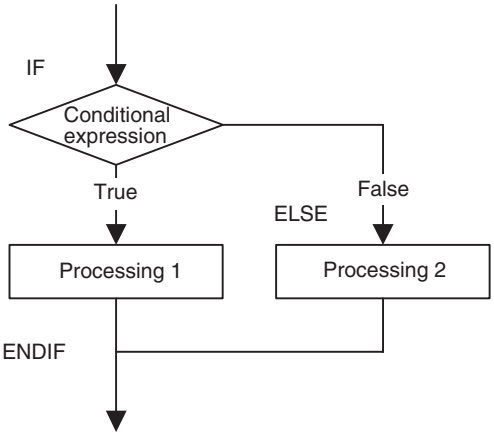
Conditional Expression	Format
Equal to	(Immediate value or Variable)==(Immediate value or Variable)
Not equal to	(Immediate value or Variable)<>(Immediate value or Variable)
Greater than	(Immediate value or Variable)>(Immediate value or Variable)
Less than	(Immediate value or Variable)<(Immediate value or Variable)
Equal to or greater than	(Immediate value or Variable)>=(Immediate value or Variable)
Equal to or less than	(Immediate value or Variable)<=(Immediate value or Variable)

Operand

Nil

Description

- If the conditional expression is satisfied, processing 1 will be executed. If the conditional expression is not satisfied, processing 2 will be executed.
- Processing 1 is described between IF and ELSE (can be described over multiple lines).
- Processing 2 is described between ELSE and ENDIF (can be described over multiple lines).
- ELSE and processing 2 can be omitted.



Repeat While (WHILE...WEND)

While the conditional expression is being satisfied, processing between WHILE and WEND is repeatedly executed.

Command type

WHILE: Multiple execution command
WEND: Multiple execution command

Format

WHILE_<conditional expression>;
<processing>
WEND;

Ex: WHILE_#DW0001 == 1;
INC MOVE [J01]100.00 [J02]200.00;
WEND;

The formats of conditional expressions are shown in the following table. Immediate values and variables are the only comparison objects. If a different data type is used, an alarm will occur in pre-analysis.

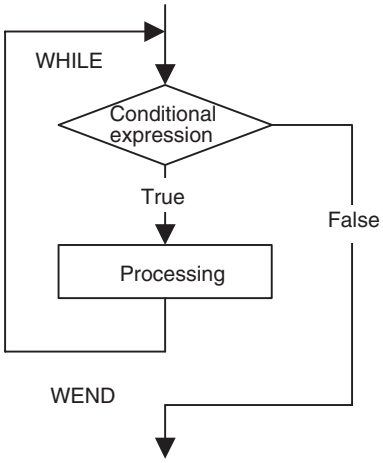
Conditional Expression	Format
Equal to	(Immediate value or Variable)==(Immediate value or Variable)
Not equal to	(Immediate value or Variable)<>(Immediate value or Variable)
Greater than	(Immediate value or Variable)>(Immediate value or Variable)
Less than	(Immediate value or Variable)<(Immediate value or Variable)
Equal to or greater than	(Immediate value or Variable)>=(Immediate value or Variable)
Equal to or less than	(Immediate value or Variable)<=(Immediate value or Variable)

Operand

Nil

Description

- As long as the conditional expression is being satisfied, processing between WHILE and WEND is repeatedly executed.
- Processing can be described over multiple lines.



Repeat FOR (FOR...NEXT)

Processing is repeated for the specified number of times.

Command type

FOR: Multiple execution command
NEXT: Multiple execution command

Format

<Default value setting> (← can be omitted)
FOR_W<work registers for repeat count> L<repeat end value> S<number of increment steps>;
<processing>
NEXT;

Ex: FOR_W#DL0002 L1000 S1;
INC MOVE [J01]100.00 [J02]200.00;
NEXT;

Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Work registers for repeat count	Variable	No	No	No	Yes	No	No	No
Repeat end value	1 to 2147483647	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No
Number of increment steps	–2147483648 to 2147483647	No	No	Yes (See note 1.)	Yes	Yes (See note 2.)	Yes	No

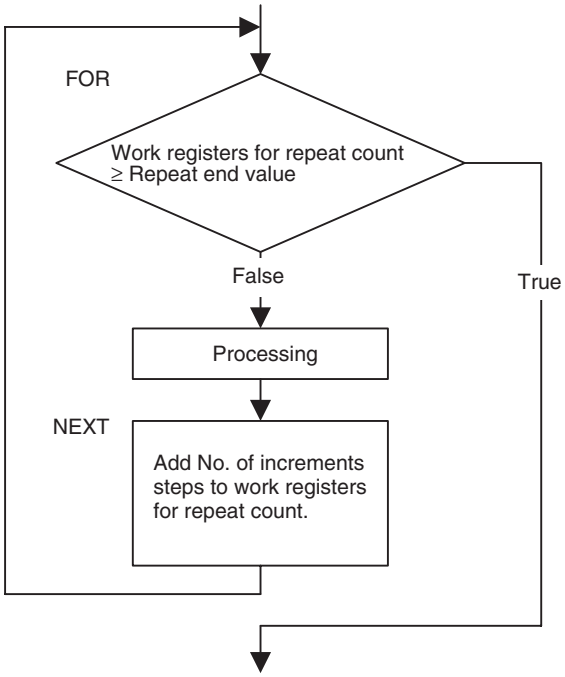
Note

(1) Word data is extended to long word data with a sign in the MC Unit.

(2) Figures below the decimal point are to be omitted.

Description

- Processing between FOR and NEXT will be repeatedly executed until Work resisters for repeat count becomes equal to or greater than Repeat end value.
- When decrementing (when No. of increment steps is signed "minus"), the condition will be until Repeat end value becomes equal to or greater than Work register for repeat count.
- Number of increment steps specifies the incrementing amount of Work resisters for repeat count. If negative value is set, it will be the decrementing amount.



Parallel Execution (PARALLEL...JOINT... JWAIT)

Processing is branched and executed in parallel.

Command type

PARALLEL: Single execution command
JOINT: Single execution command
JWAIT: Single execution command

Format

PARALLEL _N<number of branches>;
<processing 1>
{JOINT;
<processing 2>
JOINT;

<processing N>}
JWAIT;

Ex: PARALLEL_N2;
INC MOVE [J01]100.00 [J02]200.00;
JOINT;
ABL MOVE [J03]-100.00 [J04]-50.00;
JWAIT;

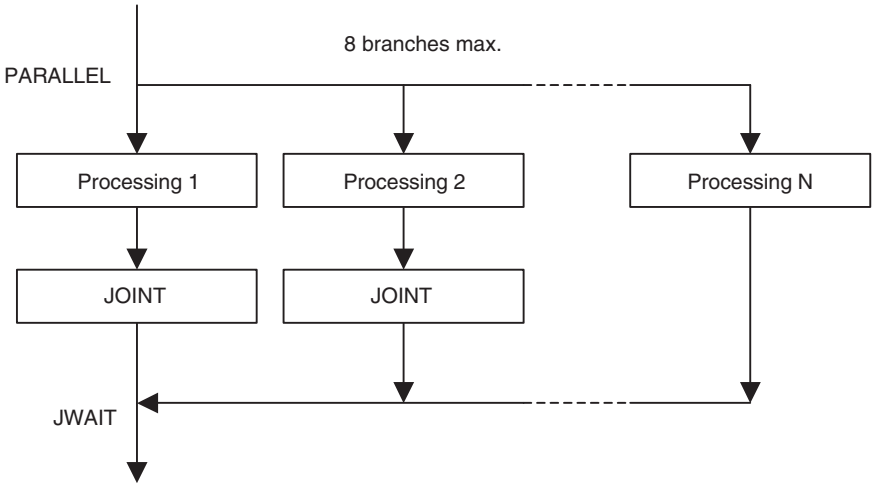
Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Number of branches	1 to 8	No	No	No	No	No	No	No

Description

- Processing for the number of branches specified in PARALLEL command is executed in parallel.
- The parallel branches queue at JWAIT command and parallel branching is completed.

- The number of parallel branches can be specified with Number of branches. The maximum number of branches for the Unit is specified in the parameter [P00002: Number of parallel branches].
  If Number of branches exceeds the parameter setting, the alarm [200Dh: Count specification error] will occur.
- PARALLEL command cannot be used in sub-programs. If used, the program cannot be loaded.
- END and PARALLEL commands cannot be used within processing 1, 2, and N (program end and parallel branch nesting cannot be executed inside parallel branching).
- Each of processing 1, 2, and N can be described over multiple lines.
- The following sequence is fixed when commands are executed in the order, processing 1, processing 2, and processing N.
- When using "PARALLEL_N1", JOINT command cannot be described.



Selective Execution (SWITCH...CASE...BREAK...SEND)

Processing is selected and executed depending on the value of the conditional variable.

Command type

SWITCH: Multiple execution command
CASE: Multiple execution command
BREAK: Multiple execution command
DEFAULT: Multiple execution command
SEND: Multiple execution command

Format

SWITCH_<conditional variable>;
{CASE_<conditional constant>;
<processing 1>
BREAK;
CASE_<conditional constant>;
<processing 2>
BREAK;
---}
{DEFAULT;}
<processing N>
SEND;

```
EX: SWITCH #DW0000;
    CASE 0;
    ABL MOVE [J03]-100.00 [J04]-50.00;
    BREAK;
    CASE 1;
    INC MOVE [J01]-200.00 [J02]50.00;
    BREAK;
    DEFAULT;
    INC MOVE [J01]0.00 [J02]0.00 [J03]0.00 [J04]0.00;
    SEND;
```

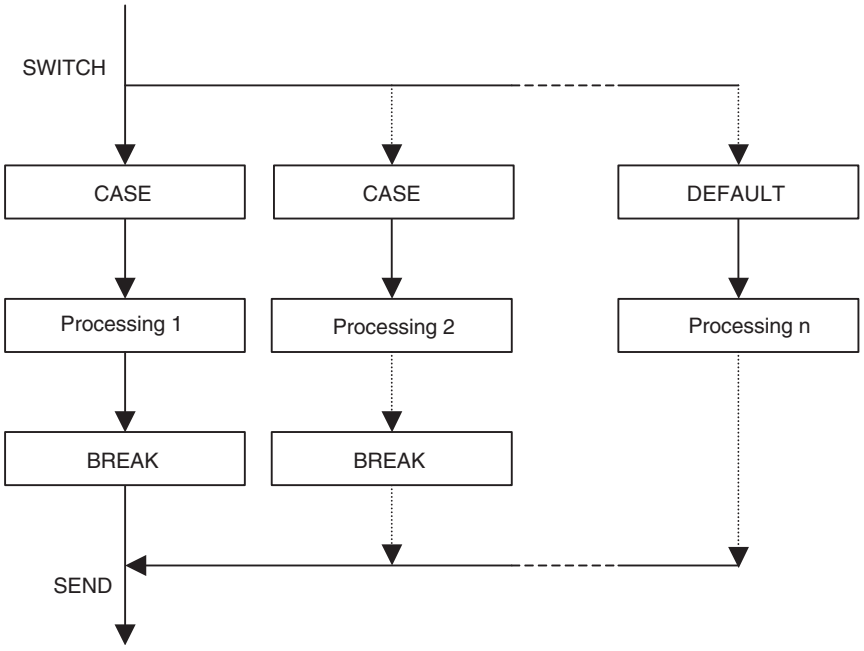
Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Conditional Variable	Variable	No	No	Yes (See note.)	Yes	No	No	No
Conditional constant	Operation numerical value range	Yes	No	Yes (See note.)	Yes	No	No	No

Note Word data is extended to long word data with a sign in the MC Unit.

Description

- If Conditional variable specified in SWITCH command matches Conditional constant specified in CASE command, only processing between CASE command with the matching constant and BREAK command will be executed.
- If Conditional variable does not match Conditional constant in any of CASE commands, processing between DEFAULT and SEND commands will be executed. If DEFAULT block is omitted, nothing will be executed.
- CASE command within processing 1, 2, and N is ignored, which means that the same processing can be executed under a different condition.
- There is no limit on the number of CASE commands (actually, the number of blocks per program limits it).
- SWITCH command cannot be used within processing 1, 2, and N (selective branches can not be nested).
- Processing 1, 2, and N can be described over multiple lines.



No Operation (Single) (NOPS)

No processing will occur.

Command type

Single execution command

Format

NOPS;

Ex: NOPS;

Operand

Nil

Description

- No processing will occur, however, NOPS command functions as a single execution command.
- NOPS command is used when motion program stepping has to be coordinated.

Example of Use

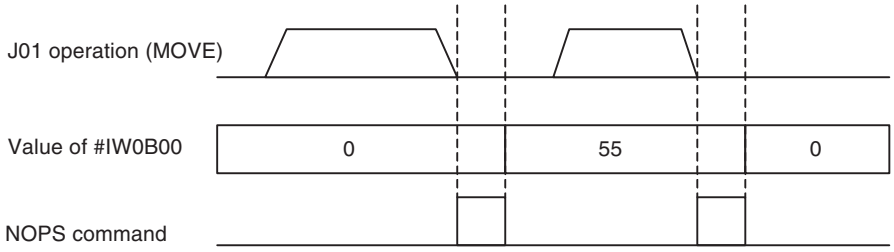
In positioning processes, NOPS is used when outputting data such as providing interlocking for external devices, etc. External devices indicate devices that are directly connected to the PLC or the general-purpose output of the MC unit.

The program example is shown below:

Program

```
PROG P0001 Q00000001; Program declared.
MOVE [J01]200000; J01 moved to the position 200000
NOPS; Block stopped till completion of single execution command MOVE
#IW0B00 = 0055; Value output in Unit Cycle of MC unit next to the one where
MOVE [J01]300000; single execution command NOPS was executed
NOPS; J01 moved to the position 300000
#IW0B00 = 0000; Block stopped till completion of single execution command
MOVE
END; Value output in Unit Cycle of MC unit next to the one where single exe-
cution command NOPS was executed.
```

Timing chart



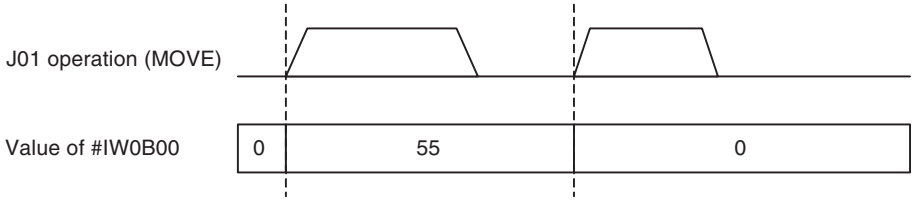
Note Without NOPS command, the value of #IW0B00 changes on the timing described below:

Program

PROG P0001 Q00000001; Program declared
MOVE [J01]200000; J01 moved to the position 200000
#IW0B00 = 0055; Value output in Unit Cycle of MC unit next to the one where MOVE [J01]300000; single execution command MOVE was executed. (See note.)
#IW0B00 = 0000; J01 moved to the position 300000
END; Value output in Unit Cycle of MC unit next to the one where
Single execution command MOVE was executed. (See note.)

Note Being a multiple execution command, they are output without waiting for completion of the single execution command MOVE.

Timing chart



No Operation (Multiple) (NOPM)

No processing will occur.

Command type Multiple execution command

Format NOPM;

Ex: NOPM;

Operand Nil

Description

- No processing will occur, however, NOPM command functions as a multiple execution command.
- NOPM command is used when motion program stepping has to be coordinated.

Example of Use

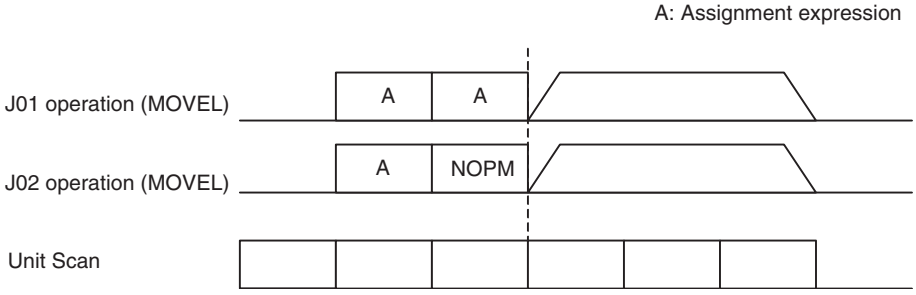
With parallel execution command, etc., NOPM command is used to match (or delayed) the timing as in starting operations of axes in the same Unit Scan, etc.

The program example is shown below:

Program

```
PROG P0001 Q00000001; Program declared
PARALLEL N2;
#PL0000 = #IL0B00 * 1000; Result of (IL0B00 x 1000) assigned to PL0000
#PL0001 = #IL0B02 * 500; Result of (IL0B02 x 500) assigned to PL0001
MOVEL [J01]#PL0000 F#PL0001; J01 moved to the position PL0000 at the
speed PL0001
JOINT;
#PL0002 = #IL0B02 * 1000; Result of (IL0B02 x 1000) assigned to PL0002
NOPM; Stepping Adjusted for simultaneous start of [J01], [J02]
MOVEL [J02]#PL0000 F#PL0002; J02 moved to the position PL0000 at the
speed PL0002
JWAIT;
END;
```

Timing chart

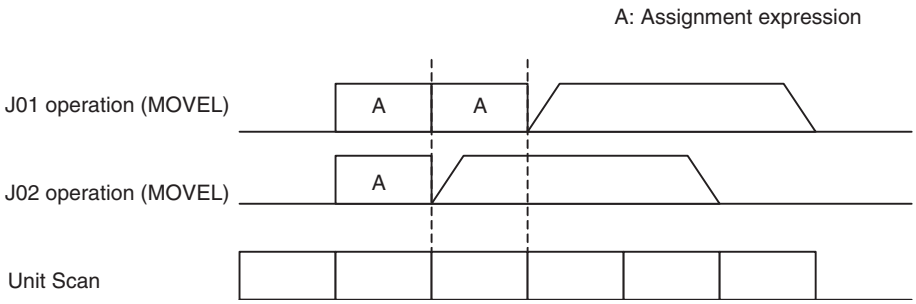


Note Without NOPM command, [J01] and [J02] are started on the timing described below:

Program

```
PROG P0001 Q00000001; Program declared
PARALLEL N2;
#PL0000 = #IL0B00 * 1000; Result of (IL0B00 x 1000) assigned to PL0000
#PL0001 = #IL0B02 * 500; Result of (IL0B02 x 500) assigned to PL0001
MOVEL [J01]#PL0000 F#PL0001; J01 moved to the position PL0000 at the
speed PL0001
JOINT;
#PL0002 = #IL0B02 * 1000; Result of (IL0B02 x 1000) assigned to PL0002
MOVEL [J02]#PL0000 F#PL0002; J02 moved to the position PL0000 at the
speed PL0002
JWAIT;
END;
```

Timing chart



6-3-6 Simple Arithmetic Operation

ASSIGN (=) Values are assigned for the specified variable.

Command type Multiple execution command

Format <First term> = <Second term>;
Ex: #MF1000 = 123.45;

Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
First term	Variable	No	Yes	Yes	Yes	Yes	No	No
Second term	Operation numerical value range (See note.)	Yes	Yes	Yes	Yes	Yes	Yes	No

Note Both immediate values and variables can use the values within the ranges defined for each type.

- Integer immediate value: –2147483648 to 2147483647
- Decimal immediate value: –2147483648. to 2147483647.
- Bit type: 0, 1
- Word type: –32768 to 32767
- Long word type: –2147483648 to 2147483647
- Real number type: ±(1.175E-38 to 3.402E+38), 0
- Indirect specification type: 0 to 10239

Description

- The value in the second term is assigned to the first term.
- If the types are different on both sides, the type on the right is converted to that of the left.
- If the value on the right side cannot be stored in the left side, the alarm [2005h: Operation overflow] will occur.

Precaution for Handling the Data Types

1,2,3...

1. Bit type
   - When the bit type is used, all the operands must be the bit type.
   - The integer immediate values 0 and 1 are treated as the bit type.
2. Types other than the bit type
   - Types other than the bit type are prioritized in the following order Real number type > Long word type > Word type
   - Operation is performed in the type of the highest priority, and the operation result will be stored after being converted to the type on the left.
   - The integer immediate value is treated as long word type, and the decimal immediate value is treated as real number type.

Simple Arithmetic Operations (+, –, *, /, %, ^)

This command executes the specified simple arithmetic operations.

Command type

+, –, *, /, %, and ^: Not executed as an independent command (no type).

Format

<First term> = <Second term> Operator <Third term>;

Ex: #MF1000 = #MF0010 + #MF0012;

Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
First term	Variable	No	No	Yes	Yes	Yes	No	No
Second term	Operation numerical value range (See note.)	Yes	No	Yes	Yes	Yes	Yes	No
Third term	Operation numerical value range (See note.)	Yes	No	Yes	Yes	Yes	Yes	No

Note Both immediate values and variables can use the values within the ranges defined for each type.

- Integer immediate value: –2147483648 to 2147483647
- Decimal immediate value: –2147483648. to 2147483647.
- Bit type: 0, 1
- Word type: –32768 to 32767
- Long word type: –2147483648 to 2147483647
- Real number type: ±(1.175E-38 to 3.402E+38), 0
- Indirect specification type: 0 to 10239

Description

- The following operators are used in operations.

Operator	Function	Description
+	Add	Adds the 2nd and 3rd terms, and assigns the result to the 1st term.
–	Subtract	Subtracts the 3rd term from the 2nd, and assigns the result to the 1st term.
*	Multiply	Multiplies the 2nd and 3rd terms, and assigns the result to the 1st term.
/	Divide	Divides the 2nd term by the 3rd, and assigns the result for the 1st term.
%	Reminder	Remainder from the division of the 2nd term by the 3rd is assigned to the 1st term.
^	Exponent	Raises the 2nd and the 3rd terms, and assigns the result for the 1st.

- If the types are different on both sides, the type on the right is converted to that of the left.
- If the value on the right side cannot be stored in the left side, the alarm [2005h: Operation overflow] will occur.

Precaution for Handling the Data Types

1,2,3... 1. Bit type
- When the bit type is used, all the operands must be the bit type.
- The integer immediate values 0 and 1 are treated as the bit type.

2. Types other than the bit type
- Types other than the bit type are prioritized in the following order Real number type > Long word type > Word type
- Operation is performed in the type of the highest priority, and the operation result will be stored after being converted to the type on the left.
- The integer immediate value is treated as long word type, and the decimal immediate value is treated as real number type.

6-3-7 Logic Operation

Logic Operations (|, &, ~) This specified logic operation is executed.

Command type |, &, and ~: Not executed as an independent command (no type).

Format <First term> = <Second term> Operator <Third term>;
Ex: #MW1000 = #MW0010 & #MW0011;

Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
First term	Variable	No	Yes (See note.)	Yes	Yes	No	No	No
Second term	–2147483648 to 2147483647	No	Yes (See note.)	Yes	Yes	No	Yes	No
Third term	–2147483648 to 2147483647	No	Yes (See note.)	Yes	Yes	No	Yes	No

Note For XOR (LOGICAL EXCLUSIVE OR) (~), the bit type cannot be used for variables.

Description
- The logic operation is executed with logic operators on each bit corresponding to the second and third terms. The result will be output to the bit corresponding to the first term.

Logic operator	Function	Description
|	OR (LOGICAL OR)	Assigns the LOGICAL OR (OR) of the 2nd and 3rd terms to the 1st term.
&	AND (LOGICAL AND)	Assigns the LOGICAL AND (AND) of the 2nd and 3rd terms to the 1st term.
~	XOR (LOGICAL EXCLUSIVE OR)	Assigns the LOGICAL EXCLUSIVE OR (XOR) of the 2nd and 3rd terms to the 1st term.

- If the types are different on both sides, the type on the right is converted to that of the left.
- If the value on the right side cannot be stored in the left side, the alarm [2005h: Operation overflow] will occur.

- The table below shows the result of logic operations.

Second term	Third term	Logical OR (OR)	Logical AND (AND)	Logical exclusive OR (XOR)
0	0	0	0	0
0	1	1	0	1
1	0	1	0	1
1	1	1	1	1

Precaution for Handling the Data Types

1,2,3... 1. Bit type
- When the bit type is used, all the operands must be the bit type.
- The integer immediate values 0 and 1 are treated as the bit type.

2. Types other than the bit type
- Types other than the bit type are prioritized in the following order Real number type > Long word type > Word type
- Operation is performed in the type of the highest priority, and the operation result will be stored after being converted to the type on the left.
- The integer immediate value is treated as long word type, and the decimal immediate value is treated as real number type.

Logic NOT (REVERSE) (!)

This command reverses bits.

Command type Not executed as an independent command (no type).

Format <First term> = ! <Second term>;
Ex: #MW1000 = !#MW0010;

Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
First term	Variable	No	Yes	Yes	Yes	No	No	No
Second term	–2147483648 to 2147483647	Yes (See note.)	Yes	Yes	Yes	No	Yes	No

Note Figures below the decimal point are to be omitted.

Description
- The reversed bits (NOT) on the right side are assigned to the left side.
- If the types are different on both sides, the type on the right is converted to that of the left.
- If the value on the right side cannot be stored in the left side, the alarm [2005h: Operation overflow] will occur.

Precaution for Handling the Data Types

1,2,3... 1. Bit type
- When the bit type is used, all the operands must be the bit type.
- The integer immediate values 0 and 1 are treated as the bit type.

2. Types other than the bit type
- Types other than the bit type are prioritized in the following order Real number type > Long word type > Word type

- Operation is performed in the type of the highest priority, and the operation result will be stored after being converted to the type on the left.
- The integer immediate value is treated as long word type, and the decimal immediate value is treated as real number type.

6-3-8 Function

Functions

The specified function operation is executed.

The following functions can be executed; ABSOLUTE VALUE (ABS), SINE (SIN), COSINE (COS), TANGENT (TAN), ARC SINE (ASIN), ARC COSINE (ACOS), ARC TANGENT (ATAN), SQUARE ROOT (SQR), EXPONENT (EXP), NATURAL LOGARITHM (LOG), DECIMAL (FRAC), and SIGN (SGN).

Command type

ABS: Not executed as an independent command (no type).
SIN: Not executed as an independent command (no type).
COS: Not executed as an independent command (no type).
TAN: Not executed as an independent command (no type).
ASIN: Not executed as an independent command (no type).
ACOS: Not executed as an independent command (no type).
ATAN: Not executed as an independent command (no type).
SQR: Not executed as an independent command (no type).
EXP: Not executed as an independent command (no type).
LOG: Not executed as an independent command (no type).
FRAC: Not executed as an independent command (no type).
SGN: Not executed as an independent command (no type).

Format

<First term> = Function <Second term>;

Ex: #MF1000 = SIN #MF0010;

Operand

ABS (Absolute Value), SGN (Sign)

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
First term	Variable	Yes	No	Yes	Yes	Yes	No	No
Second term	Operation numerical value range (See note.)	No	No	Yes	Yes	Yes	Yes	No

SIN (SINE), COS (COSINE), ATAN (ARC TANGENT), SQR (SQUARE ROOT), EXP (EXPONENT), LOG (NATURAL LOGARITHM)

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
First term	Variable	Yes	No	Yes	No	Yes	No	No
Second term	Operation numerical value range (See note.)	No	No	Yes	No	Yes	No	No

TAN (TANGENT), ASIN (ARC SINE), ACOS (ARC COSINE), FRAC (DECIMAL)

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
First term	Variable	Yes	No	No	No	Yes	No	No
Second term	Operation numerical value range (See note.)	No	No	No	No	Yes	No	No

Note Both immediate values and variables can use the values within the ranges defined for each type.

- Integer immediate value: –2147483648 to 2147483647
- Decimal immediate value: –2147483648. to 2147483647.
- Bit type: 0, 1
- Word type: –32768 to 32767
- Long word type: –2147483648 to 2147483647
- Real number type: ±(1.175E-38 to 3.402E+38), 0

  Note that the inputs of ASIN, ACOS, and ATAN commands must be 1 or less.
- Indirect specification type: 0 to 10239

Description

- The following functional operations are executed:

Notation	Function	Description
ABS	ABSOLUTE VALUE	Finds the absolute value of the specified data.
SIN	SINE	If the value on the right side is integer type: Input unit is [0.01deg]. The range of the specified data is -32768 to 32767 [0.01deg]. If input is outside the specified range, the alarm [200Fh: Other operand error] will occur. If the value on the right side is real number type: Input unit is [deg]. If the value on the left side is integer type: The value 10,000 times the actual result is output. If the value on the left side is real number type: The result is output as it is.
COS	COSINE	Finds the cosine of the specified data. If the value on the right side is integer type: Input unit is [0.01deg]. The range of the specified data is -32768 to 32767 [0.01deg]. If input is outside the specified range, the alarm [200Fh: Other operand error] will occur. If the value on the right side is real number type: Input unit is [deg]. If the value on the left side is integer type: The value 10,000 times the actual result is output. If the value on the left side is real number type: The result is output as it is.
TAN	TANGENT	Finds the tangent of the specified data. The specified data is real number type only.
ASIN	ARC SINE	Finds the arc sine of the specified data. (Unit: [deg]) The specified data is real number type only.

Notation	Function	Description
ACOS	ARC COSINE	Finds the arc cosine of the specified data. (Units: [deg]) The specified data is real number type only.
ATAN	ARC TANGENT	Finds the arc tangent of the specified data. (Units: [deg]) The specified data is real number type only.
SQR	SQUARE ROOT	Finds the square root of the specified data.
EXP	EXPONENT	Finds the exponent of the specified data.
LOG	NATURAL LOGARITHM	Finds the natural logarithm of the specified data. (Base: e)
FRAC	DECIMAL	Extracts the decimal portion of the specified data.
SGN	SIGN	Extracts the sign of the specified data. Value of specified data ≥ 0 → 1 Value of specified data < 0 → –1

- If the types are different on both sides, the type on the right is converted to that of the left.
- If the value on the right side cannot be stored in the left side, the alarm [2005h: Operation overflow] will occur.

Precaution for Handling the Data Types

1,2,3... 1. Bit type
- When the bit type is used, all the operands must be the bit type.
- The integer immediate values 0 and 1 are treated as the bit type.

2. Types other than the bit type
- Types other than the bit type are prioritized in the following order Real number type > Long word type > Word type
- Operation is performed in the type of the highest priority, and the operation result will be stored after being converted to the type on the left.
- The integer immediate value is treated as long word type, and the decimal immediate value is treated as real number type.

6-3-9 Bit Operation

Specified Bit ON/OFF (SET/RESET)

According to the result of logic operation expression, the SET/RST command turns ON or OFF the specified bit of the specified variable.

Command type

SET: Not executed as an independent command (no type).
RESET: Not executed as an independent command (no type).

Format

<First term> = SET <logic operation expression>;
<First term> = RESET <logic operation expression>;

Ex: #MB01000 = SET #MB01001 & #MB01002;

Operand)

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
First term	Variable	No	Yes	No	No	No	No	No

Description

- If the logic operation expression on the right side is true, SET command turns ON the bit specified on the left side.
- If the logic operation expression on the right side is true, RESET command turns OFF the bit specified on the left side.

- If the logic operation expression is false, SET or RESET command does not turn ON or OFF the specified bit.
- When the logic operation is executed on each corresponding bit with the logic operator on the right side and if there is any bit having the result of 1, it is considered to be true. On the other hand, if all the bits are 0, it is considered to be false.

Shift Right/Shift Left (SFTR/SFTL)

The Shift Right/ Shift left (SFTR/SFTL) command shifts variables.

Command type

SFTR: Multiple execution command
SHTL: Multiple execution command

Format

SFTR<shift object variable>_N<shift amount>;
SFTL<shift object variable>_N<shift amount>;
Ex: SFTR #MW1000 N2;

Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Shift object Variable	Variable	No	No	Yes	Yes	No	No	No
Shift amount	Word type (See note.):1 to 16 Long word type (See note.):1 to 32	No	No	Yes	No	No	No	No

Note Setting range varies depending on the type of the shift object.

Description

- SFTR command shifts Shift object variable to the right for the amount specified in Shift amount.
- SFTL command shifts Shift object variable to the left for the amount specified in Shift amount.
- SFTR and SFTL commands are executed only inside word or long word type variables.

6-3-10 Data Operation

BCD to BIN (BIN)

BCD data is converted into BIN data.

Command type

Not executed as an independent command (no type).

Format

<First term>= BIN<Second term>;
Ex: #MW1000 = BIN #MW1001;

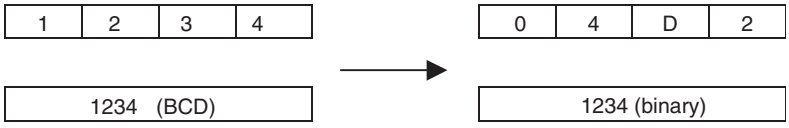
Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
First term	Variable	No	No	Yes	Yes	No	No	No
Second term	Word type: 0-9999 (See note.) Long type: 0-99999999	No	No	Yes	Yes	No	Yes	No

Note Setting range when viewed as BCD data.

Description

- BIN command converts the specified value (BCD data) into binary (BIN code).
- BIN command can be used only for integer data.



BIN to BCD (BCD)

The BCD command converts the BIN data into the BCD data.

Command type Not executed as an independent command (no type).

Format <Variable>= BCD<numerical value>;
Ex: #MW1000 = BCD #MW1001;

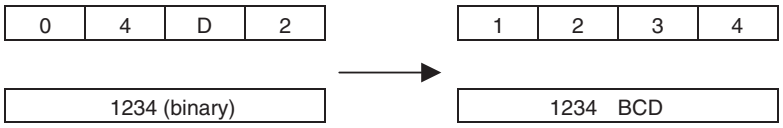
Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
First term	Variable	No	No	Yes	Yes	No	No	No
Second term	Word type: 0-9999 (See note.) Long type: 0-99999999	No	No	Yes	Yes	No	Yes	No

Note Setting range when viewed as BIN data.

Description

- BCD command converts the specified value (BIN data) to BCD code.
- BCD command can be used only for integer data.



Block Transfer (XFER)

Data is transferred as a block.

Command type Multiple execution command

Format XFER<transfer source first data>_<transfer destination first data>_N<number of transferred data>;
Ex: XFER #MW1000_#MW1100_N2;

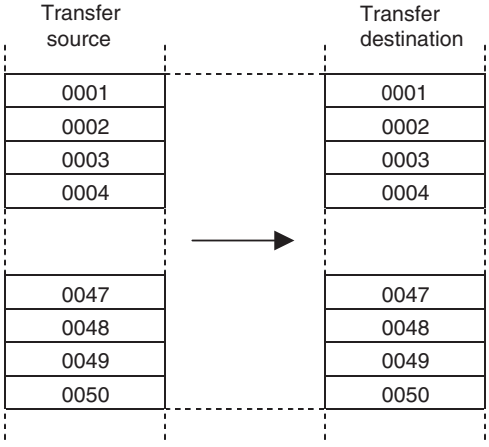
Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Transfer source first data	Variable	No	No	Yes	No	No	No	No

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
Transfer destination first data	Variable	No	No	Yes	No	No	No	No
Number of transferred data	System variable:1 to (2048 - address) Global general variable:1 to (8192 - address) Input variable:1 to (4096 - address) Output variable:1 to (4096 - address) Task variable:1 to (128 - address)	No	No	Yes	No	No	No	No

Description

- Data for the number of words specified in Number of transferred words is transferred from the address specified in Transfer source first data to the address specified in Transfer destination first data.
- If the transfer source and destination overlap with each other, the overlap is automatically processed and data is transferred so that it is not corrupted.
- 256 words can be transferred in one scan. If the size exceeds 256 words, it is transferred over several scans.



Clear (CLEAR)

The specified data is cleared to 0.

Command type

Multiple execution command

Format

CLEAR<first cleared data>_N<number of cleared data>;

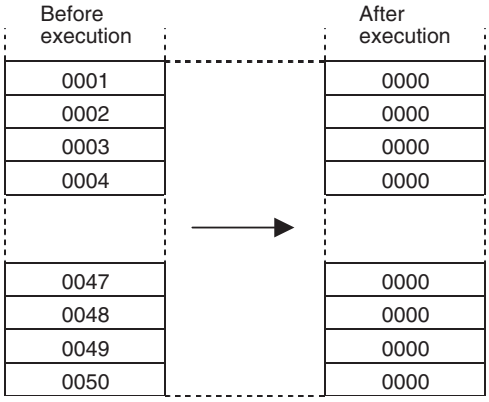
Ex: CLEAR #MW1000_N2;

Operand

Operand	Setting range	Decimal	Variable specification					INC/ABL influence
			Bit	Word	Long word	Real number	Indirect specification	
First cleared data	Variable	No	No	Yes	No	No	No	No
Number of cleared data	Global general variable:1 to (8192- address) Input variable:1 to (4096- address) Output variable:1 to (4096- address) Task variable: 1 to (128- address)	No	No	Yes	No	No	No	No

Description

- Data for the number of words specified in Number of cleared data is cleared to 0 from the address specified in First cleared data.
- 256 words can be transferred in one scan. If the size exceeds 256 words, it is transferred over several scans.



SECTION 7
PC Interface Area

This section describes the interface area in the CPU Unit used to control and monitor the CS1W-MCH71 Motion Control Unit.

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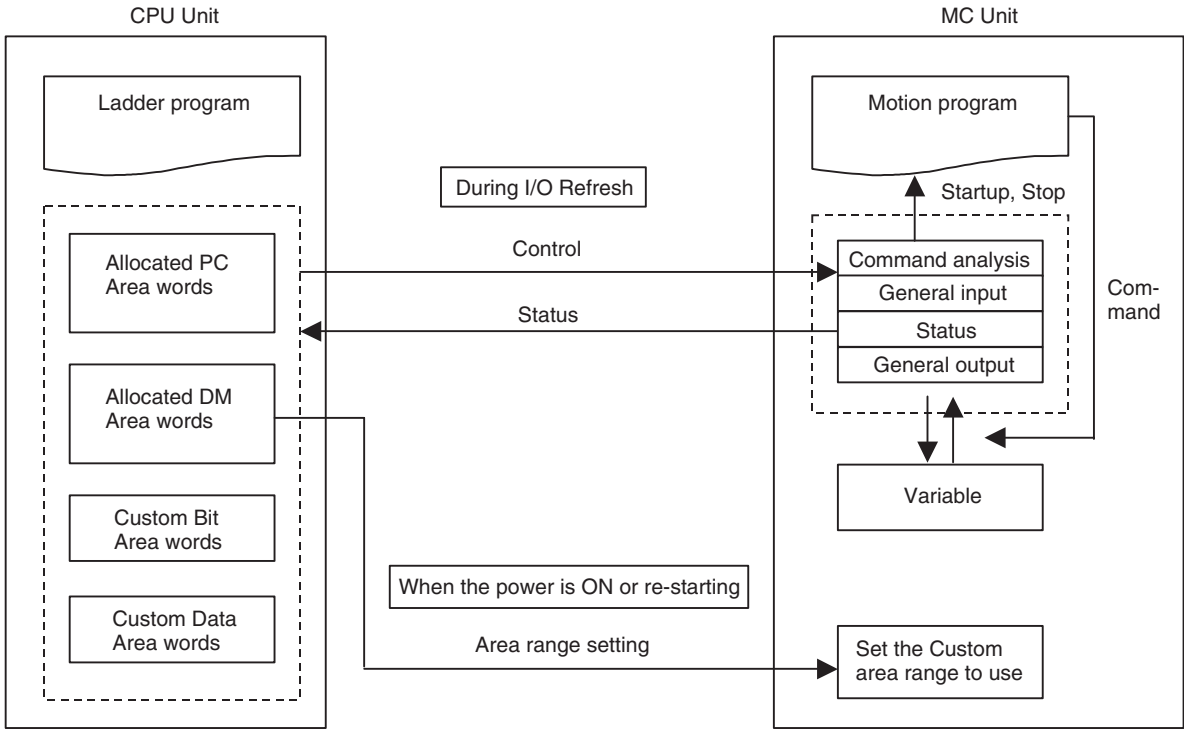
7-1 Overview

CPU Unit can control MC Unit with the following three different methods of data I/O.

1,2,3...

1. Data exchange with allocated PC area words.
2. Data exchange with allocated DM area words.
3. Data exchange with allocated Custom area words.

7-1-1 Data Exchange Area Overview



The following table shows the allocated PC interface area to be refreshed cyclically.

The number of motion tasks automatically sets the actual number of transferred words. In addition, [the area range setting] in the allocated DM area and [the physical axis setting] in axis allocation parameters determine the number of Custom area words.

Area	Brevity	Direction	Usage	Remark	No. of words min.	No. of words max.
Allocated PC AREA words (25 words)	n	Output	Control Bit	Unit and task control	5	12
		Input	Status Bit	Unit and task status	6	13
Allocated DM Area words (100 words)	m	Output	Area range setting (Initial setting)	Only first time	20	20
		Output	Control Data	Task control	4	18
		Input	Status Data	Unit and task status	8	36
Custom Bit Area	x	Output	Control Bit	Axis control	0	32
		Input	Status Bit	Axis status	0	32
Custom Data Area	d	Output	Control Data	Axis control	0	32
		Input	Status Data	Axis status	0	96

Area	Brev-ity	Direction	Usage	Remark	No. of words min.	No. of words max.
Custom I/O Area	a_A	Setting	General I/O A	General I/O	0	160
	a_B	Setting	General I/O B	General I/O	0	160
	a_C	Setting	General I/O C	General I/O	0	160
	a_D	Setting	General I/O D	General I/O	0	160
	a_E	Setting	General I/O E	General I/O	0	160
	a_F	Setting	General I/O F	General I/O	0	160
	a_G	Setting	General I/O G	General I/O	0	160
	a_H	Setting	General I/O H	General I/O	0	160
					23 (See note 1.)	1551 (See note 2.)

Note (1) The total number of words (in a normal operation) when No. of motion tasks = 1, No. of Axes = 1, and without custom area allocations

(2) The total number of words (in a normal operation) when No. of motion tasks = 8, No. of Axes = 32, and all of general I/O are allocated

7-1-2 About I/O Refresh

CPU and MC Units exchange various data mentioned above (allocated bits, allocated DM, custom bit area, etc.) with each other asynchronously. Therefore, the following behaviors may be encountered.

When the CPU Unit's Cycle Time is shorter than the MC Unit's Unit Cycle

Data will be notified to the MC Unit after the CPU Unit runs for several cycles. Therefore, it is required to prepare the ladder program to confirm that data has been notified from the CPU Unit to the MC Unit successfully.

Ex: Turn ON the origin search bit and then confirm that the busy flag of the axis is turned ON.

When the CPU Unit's Cycle Time is longer than the MC Unit's Unit Cycle

Data will be notified to the MC Unit after the CPU Unit runs for 1 cycle.

When the CPU Unit's Cycle Time and the MC Unit's Unit Cycle are exactly the same

There is a possibility that none of data is notified to the MC Unit. In this case, set a longer or shorter Cycle Time for the CPU Unit.

7-1-3 Allocated Area List

Word Allocation Based on the Unit Number

The bit area and the range of respective DM areas are allocated based on the unit number of the Unit.

Brevity codes	Addresses in the CPU unit	
n	CPU Bus Unit allocated bit area words	Word 1500 – 1899 n = 1500 + 25 × Unit Number
m	CPU Bus Unit allocated DM area words	D30000 – D31599 m = D30000 + 100 × Unit Number

CPU Bus Unit Allocated Bit Area Words

25 words are allocated for each Unit starting from the word 1500. The allocation will be as shown below:

Unit Number	Bit area	Unit Number	Bit area
0	Word 1500-1524	8	Word 1700-1724
1	Word 1525-1549	9	Word 1725-1749

Unit Number	Bit area	Unit Number	Bit area
2	Word 1550-1574	10	Word 1750-1774
3	Word 1575-1599	11	Word 1775-1799
4	Word 1600-1624	12	Word 1800-1824
5	Word 1625-1649	13	Word 1825-1849
6	Word 1650-1674	14	Word 1850-1874
7	Word 1675-1699	15	Word 1875-1899

CPU Bus Unit Allocated DM Area Words

100 words are allocated for each Unit starting from D30000. The allocation will be as show below:

Unit Number	DM area	Unit Number	DM area
0	D30000-30099	8	D30800-30899
1	D30100-30199	9	D30900-30999
2	D30200-30299	10	D31000-31099
3	D30300-30399	11	D31100-31199
4	D30400-30499	12	D31200-31299
5	D30500-30599	13	D31300-31399
6	D30600-30699	14	D31400-31499
7	D30700-30799	15	D31500-31599

CPU Bus Unit Restart Flag

When starting CPU Bus Unit, turn it OFF once, and then ON again. It will automatically turn OFF after restart processing is completed. The respective bits correspond to the unit numbers.

Word No.	Bit No.	Function
A501	00-15	CPU Bus Unit Restart Flag

Standby for Unit Startup

These bits turn ON when the CPU Bus Unit is in the initial processing.

The respective bits correspond to the unit numbers.

Word No.	Bit No.	Function
A302	00-15	CPU Bus Unit Initializing Flag

Custom Area Allocation

It is possible to allocate custom areas regardless of the unit numbers.

These areas are allocated through [Area range setting] in the allocated DM area words.

The area range setting is used when the power is turned ON for the first time. Therefore, if changed afterwards, it will be ignored. The change will be enabled at the next power ON.

Area	Brevity	CPU Unit's Addresses	
Custom bit Area	x	Depends on Unit area range setting (m+0, m+1)	CIO, WR
Custom data Area	d	Depends on Unit area range setting (m+2, m+3)	CIO, WR, DM, EM

Area	Brevity	CPU Unit's Addresses	
Custom I/O Area	a_A	Depends on General I/O area range setting (m+4, m+5)	CIO, WR, DM, EM
	a_B	Depends on General I/O area range setting (m+6, m+7)	CIO, WR, DM, EM
	a_C	Depends on General I/O area range setting (m+8, m+9)	CIO, WR, DM, EM
	a_D	Depends on General I/O area range setting (m+10, m+11)	CIO, WR, DM, EM
	a_E	Depends on General I/O area range setting (m+12, m+13)	CIO, WR, DM, EM
	a_F	Depends on General I/O area range setting (m+14, m+15)	CIO, WR, DM, EM
	a_G	Depends on General I/O area range setting (m+16, m+17)	CIO, WR, DM, EM
	a_H	Depends on General I/O area range setting (m+18, m+19)	CIO, WR, DM, EM

Allocation of Custom Bit Area and Custom Data Area

The Custom bit area (brevity code: x) and Custom data area (brevity code: d) are the areas for controls and statuses related to axes. With [Bit area type (m+0)] and [Data area type (m+2)] of [Unit area range setting] in the allocated DM area words, the area types on the CPU Unit are specified. With [Bit area first address (m+1)] and [Data area first address (m+3)], the first address of each area on the CPU Unit is specified.

Up to the words for the biggest axis number set to other than [0:Unused] in the axis allocation parameter [P1AA01: Physical axis setting] are allocated.

Name	Function
Bit area type	Area type specification on the CPU Unit 0: Not used (no transfer) 1: CIO 2: WR 3 and higher: Reserved for system
Bit area first address	First address specification on the CPU Unit ≅0000H-(Upper limit varies depending on bit area type.)
Data area type	Area type specification on the CPU Unit 0: Not used (no transfer) 1: CIO 2: WR 3: DM 4: EM (Fix banks at 0 in the EM area) 5: and above: Reserved for system.
Data area first address	First address specification on the CPU Unit ≅0000H-(Upper limit varies depending on data area type.)

No.	Name	Purpose
P1AA01	Physical axis setting	The greatest axis number that is going to be used determines the number of allocated.

Custom I/O Area Allocation

Custom I/O Area (brevity code a_A-H) is the area to exchange custom data between the CPU Unit and MC Unit. In the Custom I/O Area, there are eight general I/O areas A-H, and the size 1-160 words can be specified for each area.

In case of general I/O A, the number of transferred words is specified with [PORT_A No. of transferred words (bit 00-07 of m+4)] of [General I/O area range setting] in the allocated DM area. The area type on the CPU Unit is specified with [PORT_A Area type (bit 08-14 of m+4)]. In addition, transfer direction is specified with [PORT_A Direction]. The first address on the CPU Unit is specified with [PORT_A First address (m+5)].

On the MC Unit, the custom I/O area can be treated as I/O variables in the motion program.

When transfer direction is [MC Unit _ CPU]: Output variable

When transfer direction is [CPU_MC Unit]: Input variable

Area	Input variable	Output variable
General I/O A	IW0B00	OW0B00
General I/O B	IW0BA0	OW0BA0
General I/O C	IW0C40	OW0C40
General I/O D	IW0CE0	OW0CE0
General I/O E	IW0D80	OW0D80
General I/O F	IW0E20	OW0E20
General I/O G	IW0EC0	OW0EC0
General I/O H	IW0F60	OW0F60

Name	Function
Port_A Area type	CPU Unit area type for General I/O A: 0: Not used (no transfer). 1: CIO 2: WR 3: DM 4: EM (fixed at bank 0) 5 and higher: Reserved for system.
Port_A Direction	Transfer direction for General I/O A: 0: MC Unit to CPU Unit 1: CPU Unit to MC Unit
Port_A First Address	CPU Unit first address for general I/O A: 0000H-(Upper limit varies depending on Port_A Area type.)

- General I/O area allocation is performed using [PORT_* Number of transferred words], [PORT_* Area type], [PORT_* Direction], and [PORT_* First address].
- The destination of allocation in the MC Unit is:
  When [PORT_* Direction] is 0 (MC Unit to CPU): Output variable
  When [PORT_*Direction] is 1 (CPU to MC Unit): Input variable.
- The above data can be used only for PC21 Bus Initialization. It will be ignored if it is changed after the power is already ON.

Note (1) Make sure that values of the data are appropriate for operations.

(2) Make sure to confirm the safety of devices prior to changing the allocation areas.

7-1-4 CPU Unit's Influence

CPU Unit Operating Mode Change

CS-series CPU Units have the following three operating modes:

1,2,3... 1. RUN Mode
Programs can be executed normally.

2. MONITOR Mode
Programs can be executed normally. Data saved in the memory can be modified.

3. PROGRAM mode
Programs cannot be executed. Programming and debugging are possible.

The MC Unit operates as shown in the table below when the operating mode of the CPU Unit is changed:

CPU Unit operating mode change	MC Unit operation
RUN Mode or MONITOR Mode → PROGRAM Mode	All the axes decelerate and stop. *Note that, however, there will be no influence on the MC Unit operation when the MC Unit is in Tool Mode. (The CPU Unit does not control the MC Unit in Tool Mode.)
Other than the above	There is no influence on the MC Unit operation.

CPU Unit Status

The MC Unit operates as shown in the table below when the CPU Unit is in the following state:

CPU Unit status	MC Unit operation
CPU Unit fatal error: An error such as memory error occurred during operation and the operation cannot be continued.	• When "CPU stopping" is notified, Servo OFF (See note.) is executed. • This error is stored in the error log. • From this point on, no commands can be accepted from the CPU Unit. Note that, however, various operations can be received from the Support Tool. (Event communications can be used.)
Load rejection: Load is rejected from applications in debugging.	• When "Load rejection" is notified, the MC Unit interprets all the inputs from the CPU Unit as all "0". Due to this, the program operation, the JOG operation, and so on, decelerate and stop.
Bus error:	• When the Bus error is detected, Servo OFF (See note.) is executed. • The error is stored in the error log. • From this point on, no commands can be accepted.
CPU WDTUP:	• When "WDT UP" is detected, the same processing as for CPU Unit fatal error is executed.
Power interruption:	• When "Power interruption" is detected, Servo OFF (*1) is executed. • From this point on, no commands can be accepted.
CPU standby: (When CPU Unit is turned ON)	• This is ignored because there is no influence on execution of MC Unit functions.
Restarting CPU Bus Unit during operation • User turned ON AR • Routing table transfer (communication unit)	• When Restart is detected, Servo OFF is executed on all the tasks and axes. • After that, the same processing as for powering ON is executed.
Verification error: When CPU Unit is turned ON	• "Verification error" is notified. • The error is stored in the error log. • From this point on, no commands can be accepted.

Note Output signals will not change even when Servo OFF is executed.

7-2 Operating Mode

This section describes the functions that control the MC Unit in Manual Mode and the ladder program of the CPU Unit that controls the MC Unit in Automatic Mode.

7-2-1 Manual Mode/Automatic Mode

- There are two types of operating modes for MC Unit; one is Manual Mode and another is Automatic Mode.
- The bit [Manual/Automatic mode] in the allocated bit area switches the mode between Automatic and Manual.

- The mode can be set for each axis. ON (1) is Automatic Mode and OFF (0) is Manual Mode.
- In Manual Mode, operations of the MC Unit are controlled directly from the CPU Unit using the PC interface areas.
- In Automatic Mode, motion programs programmed with the motion language are executed.

Whether function can or cannot be executed in each operating mode

Function	Command method	Manual Mode	Automatic Mode
Axis Alarm Reset	Axis control bit	Yes	Yes
Deceleration Stop	Axis control bit	Yes	No
Servo Lock	Axis control bit	Yes	Yes
Servo Unlock	Axis control bit	Yes	Yes
JOG	Axis control bit	Yes	No
STEP	Axis control bit	Yes	No
Origin Search	Axis control bit	Yes	No
Machine Origin Return	Axis control bit	Yes	No
Error Counter Reset	Axis control bit	Yes	Yes
Forced Origin	Axis control bit	Yes	No
ABS Origin Setting	Axis control bit	Yes	No
Axis Override Enable	Axis control bit	Yes	Yes
JOG/STEP Direction	Axis control bit	Yes	No
Axis Machine Lock	Axis control bit	Yes	Yes
Manual/Automatic Mode	Axis control bit	Yes	Yes
Present Position Preset	IOWR instruction	Yes	No

Yes: Can be executed
No: Cannot be executed

7-2-2 Manual Mode

In Manual Mode, control for each axis is possible and the following functions can be executed.

Each function can be enabled and executed when the corresponding bit is turned ON. If 2 or more bits are turned ON (1) simultaneously, the processing will proceed following the priority shown below:

Priority	Name of bits	Specification
High	Servo Unlock	Cancels Servo lock status.
	Deceleration Stop	Decelerates to stop (JOG, STEP, Origin search, Machine origin return).
	Axis Alarm Reset	Clears the alarm occurring on the axis level and MLK slave alarm.
	Error Counter Reset	Resets the error counter (Position command value = present position).
	STEP	Starts STEP operation (PTP operation for debugging).
	JOG	Starts JOG operation.
	Machine Origin Return	Starts machine origin return (PTP).
	Origin Search	Starts origin search.
	Forced Origin	Defines the present position as the origin on the machine coordinate system.
	Present Position Preset (IOWR)	Change the present position to the specified value.
	ABS Origin Setting	Sets the origin of the ABS encoder.
Low	Servo Lock	Starts the servo lock status.

The following functions can be executed simultaneously with other functions:

Name of bits	Specification
Axis Override Enable	Enables the axis override value.
JOG/STEP Direction	Specifies the JOG, and STEP operation direction.
Axis Machine Lock	Starts axis machine lock.
Manual/Automatic Mode	Switches between Manual and Automatic modes.

Whether another function can or cannot be executed during execution of a function

The following table shows whether another function can or cannot be executed when a function listed vertically on the left are being executed:

Yes: Can be executed ≅No: Cannot be executed (Ignored)

Function currently being executed	Function to be executed along with the function currently being executed.											
	Servo Unlock	Deceleration Stop	Axis Alarm Reset	Error Counter Reset	STEP	JOG	Machine Origin Return	Origin Search	Forced Origin	Present Position Preset	ABS Origin Setting	Servo Lock
Servo Unlock	---	No	Yes	Yes	No	No	No	No	No	No	No	No
Deceleration Stop	Yes	---	Yes	Yes	No	No	No	No	No	No	No	No
Axis Alarm Reset	Yes	No	---	Yes	No	No	No	No	No	No	No	No
Error Counter Reset	Yes	Yes	Yes	---	No	No	No	No	No	No	No	No
STEP	Yes	Yes	Yes	Yes	---	No	No	No	No	No	No	No
JOG	Yes	Yes	Yes	Yes	No	---	No	No	No	No	No	No
Machine Origin Return	Yes	Yes	Yes	Yes	No	No	---	No	No	No	No	No
Origin Search	Yes	Yes	Yes	Yes	No	No	No	---	No	No	No	No
Forced Origin	Yes	No	Yes	Yes	No	No	No	No	---	No	No	No
Present Position Preset (IOWR)	Yes	No	Yes	Yes	No	No	No	No	No	---	No	No
ABS Origin Setting	Yes	No	Yes	Yes	No	No	No	No	No	No	---	No
Servo Lock	Yes	No	Yes	Yes	No	No	No	No	No	No	No	---

During execution of the following functions, the Busy flag will be turned ON. After execution of a function, turn the bit OFF, check if the BUSY flag is OFF, and then execute the other functions.

- Error counter reset, STEP, JOG, Machine origin return, Origin search, Forced origin, and ABS origin setting

The following table shows whether deceleration stop can be executed or not and whether the Busy flag turns ON or stays OFF when the functions listed vertically on the left are being executed. Additionally, whether the functions listed vertically on the left can be executed under various conditions or not is shown:

Function	Condition												
	Interruption by deceleration stop	BUSY ON/OFF	Restriction due to status: Yes: Can be executed No: Cannot be executed								Restriction due to communications Yes: Can be executed No: Cannot be executed		
			Automatic Mode ON	BUSY ON	Axis Operating ON	No Origin ON	Axis Alarm Occurring	Servo Unlock	Other stop request ON	Positioning Completed OFF	Virtual axis	Not a Servo axis	Command Disabled/Enabled OFF
Axis Alarm Reset	No	OFF	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deceleration Stop	---	OFF	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Servo Lock	No	OFF	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No
Servo Unlock	No	OFF	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
JOG	Yes	ON	No	No	Yes	Yes	No	No	No	Yes	Yes	No	No
STEP	Yes	ON	No	No	Yes	Yes	No	No	No	Yes	Yes	No	No
Origin Search	Yes	ON	No	No	Yes	Yes	No	No	No	Yes	Yes	No	No
Machine Origin Return	Yes	ON	No	No	Yes	No	No	No	No	Yes	Yes	No	No
Error Counter Reset	No	ON	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Forced Origin	No	ON	No	No	No	Yes	No	Yes	No	No	Yes	No	No
ABS Origin Setting	No	ON	No	No	No	Yes	No	Yes	No	No	No	No	No
Axis Override Enable	No	OFF	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	No	No
JOG/STEP Direction	No	OFF	No	No	Yes	Yes	No	No	No	Yes	Yes	No	No
Axis Machine Lock	No	OFF	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Manual/Automatic Mode	No	OFF	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present Position Preset (IOWR)	No	OFF	No	No	No	Yes	No	Yes	No	Yes	Yes	No	No

7-2-3 Automatic Mode

- In Automatic Mode, motion programs programmed with the motion language are executed.
- Follow the procedure below to execute the motion program in Automatic Mode.
- In this example, Axis 1 is operated with Motion task 1.

1,2,3... 1. Set the MC Unit to Automatic Mode.
To specify the axis to be used in the program, turn ON the axis control bit [Manual/Automatic mode (15 bits of word x+0).

2. Specify the program number to be executed.
   Set the program number to be executed in the motion task control data [Motion program number (word m+22)] of motion task control data.
3. Set the Start Mode for restarting the motion program interrupted in the middle of execution. (See note.)
   Set the mode in the axis control bit [Start Mode (01 and 02 bits of word n+4)].
4. Start the program.
   Turn ON the Motion task control bit [Motion program start (01 bit of word n+4)].

Note There are three different patterns to stop a motion program:

1,2,3...

1. Motion task control bit [Deceleration stop] (Interruption):
   Deceleration stop is executed regardless of the block (Stopped in the middle).
2. Motion task control bit [Block stop]:
   Operation is stopped at the end of the block currently being executed (Block stop).
3. END command is executed.
   The method of resuming the interrupted motion program can be selected in the Start Mode as show in the table below.

Start Mode	Operation
0,3	Reads the program number and execute the program from the beginning.
1	Program is executed from the block indicated by Executing Motion Block No. Operation varies depending on the command or stopping status. • Resuming motion program when executing MOVE/MOVEL/MOVEC/MOVEI/MOVET commands: The program is resumed from where it was stopped. • Resuming motion program when executing MOVETRAV/MOVELINK/CAMBOX (1 cycle) commands: When stopped midway, the program resumes for the remaining travel distance. In case of block stop, the program for the entire travel distance is executed again. • Resuming motion program when executing commands DATUM/CAM For both midway stop and block stop, the program for the entire travel distance Is executed again.
2	Resumes the program from the next block of the block indicated by Executing Motion Block No.

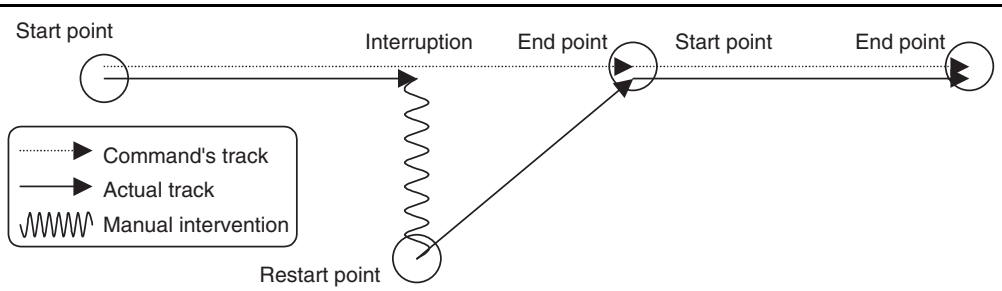
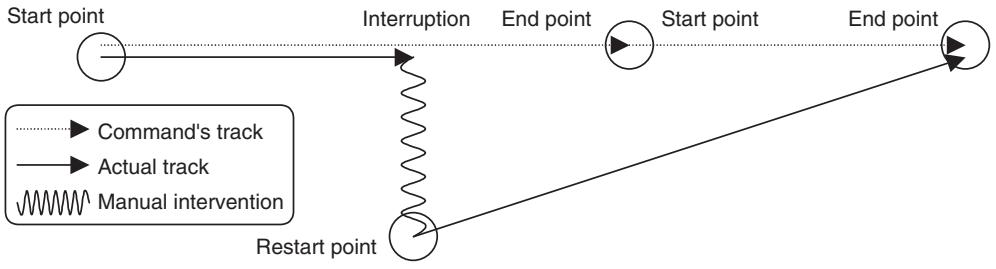
Details of resuming motion programs interrupted in midway of MOVE/MOVEL/MOVEC/MOVEI/MOVET command execution (in Start Mode 1 or 2) are explained in the following pages.

When a program is stopped in the middle of a block for a finite length axis

The Executing Motion Block No. indicates the block where the motion program was stopped.

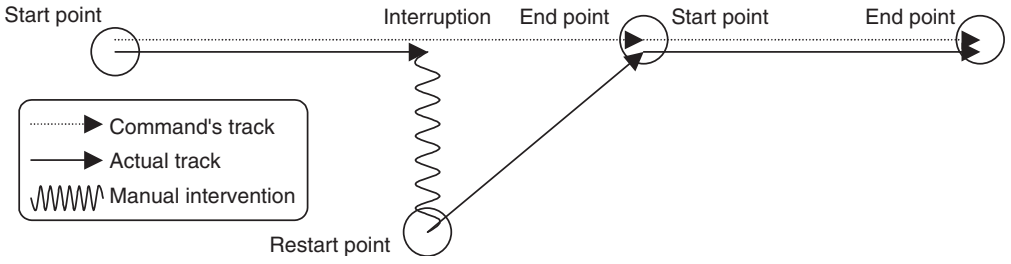
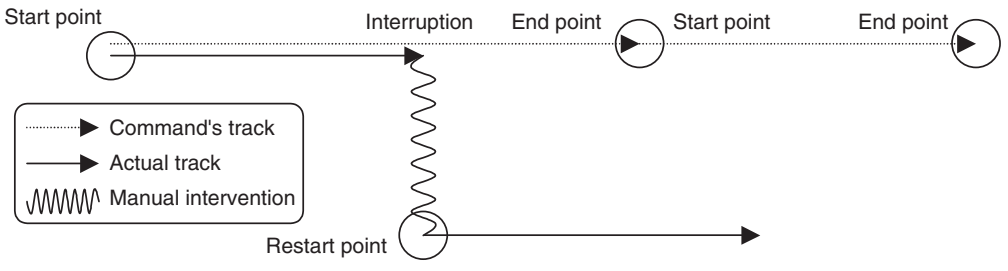
In case of ABL specification

```
...
ABL MOVE [J1] 2000 [J2] 0; _ When this block is interrupted
ABL MOVE [J1] 3000 [J2] 0;
...
```

Start Mode	Operation
1 Resumes program from midway of the block indicated by Executing Block Number.	
2 Resumes program from the next block of the one indicated by Executing Block Number.	

In case of INC specification

```
...
INC MOVE [J1] 2000 [J2] 0; _ When this block is interrupted
INC MOVE [J1] 1000 [J2] 0;
...
```

Start Mode	Operation
1 Resumes program from midway of the block indicated by Executing Block Number.	
2 Resumes program from the next block of the one indicated by Executing Block Number.	

When a program is stopped in the middle of a block for an infinite length axis

The Executing Motion Block No. indicates the block where the motion program was stopped. Operation will be as described below when operation is continued in the middle of a block in start mode 1.

MC Units manufactured before 2 February 2004 (Lot No. 040202xxxx)

- Axis 1 is set to a turntable.
- Axis 1 is set as an infinite length axis.
- The command value for axis 1 is set between 0° and 359°.
- The following command is executed.
  MOVE [J01]500
- This command means to turn axis 1 once (360°) and then to position to 140° in the second turn.
- Assume that the above command is executed, but a deceleration stop is executed at 120° in the first turn.
- If operation is continued in start mode 1 after decelerating to a stop, axis 1 will be positioned to 140° in the same turn (i.e., in the first turn in this example).

MC Units manufactured 2 February 2004 (Lot No. 040202xxxx) or later

The above operating modes can be combined with the MOVE, MOVEL, and MOVET commands with P00004 bit 06 (continuous operation using infinite length axis for multiple rotations) set to 1 to enable positioning to the final target position, as follows.

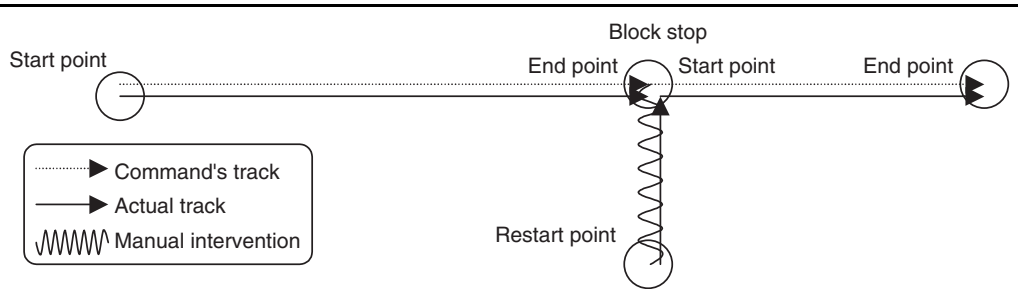
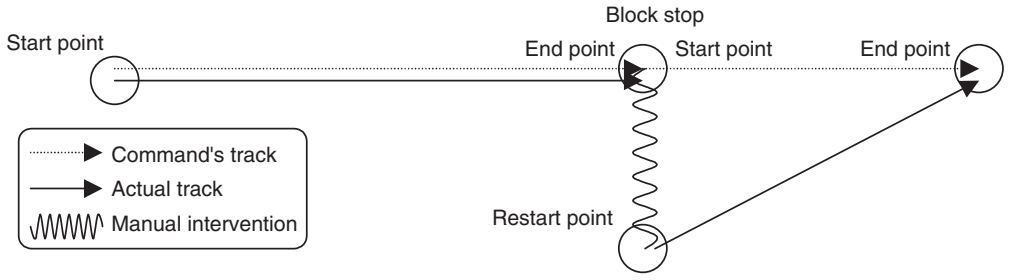
- Axis 1 is set to a turntable.
- Axis 1 is set as an infinite length axis.
- The command value for axis 1 is set between 0° and 359°.
- The following command is executed.
  MOVE [J01]500
- This command means to turn axis 1 once (360°) and then to position to 140° in the second turn.
- Assume that the above command is executed, but a deceleration stop is executed at 120° in the first turn.
- If operation is continued in start mode 1 after decelerating to a stop, axis 1 will be positioned to the final target position (i.e., to 140° in the second turn in this example).

When a program is stopped at the end of a block

The Executing Motion Block No. indicates the block number where the motion program was stopped.

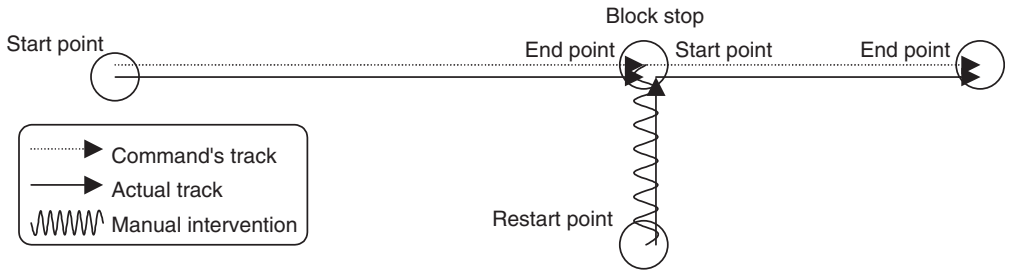
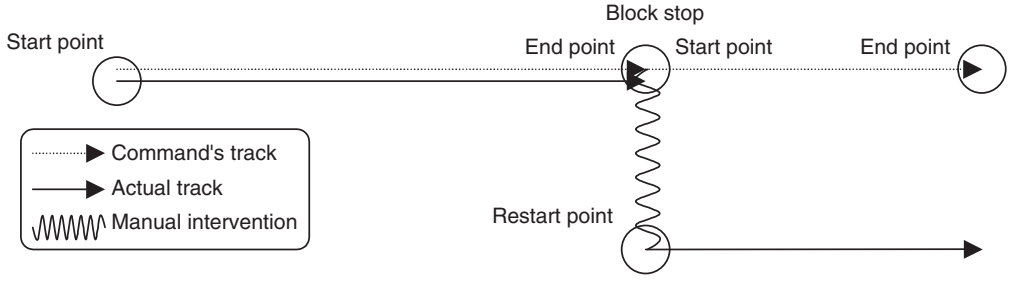
In case of ABL specification

...
ABL MOVE [J1] 2000 [J2] 0; _ When this block is interrupted
ABL MOVE [J1] 3000 [J2] 0;
...

Start Mode	Operation
1 Resumes program from midway of the block indicated by Executing Block Number.	
2 Resumes program from the next block of the one indicated by Executing Block Number.	

In case of INC specification

...
INC MOVE [J1] 2000 [J2] 0; _ When this block is interrupted
INC MOVE [J1] 1000 [J2] 0;
...

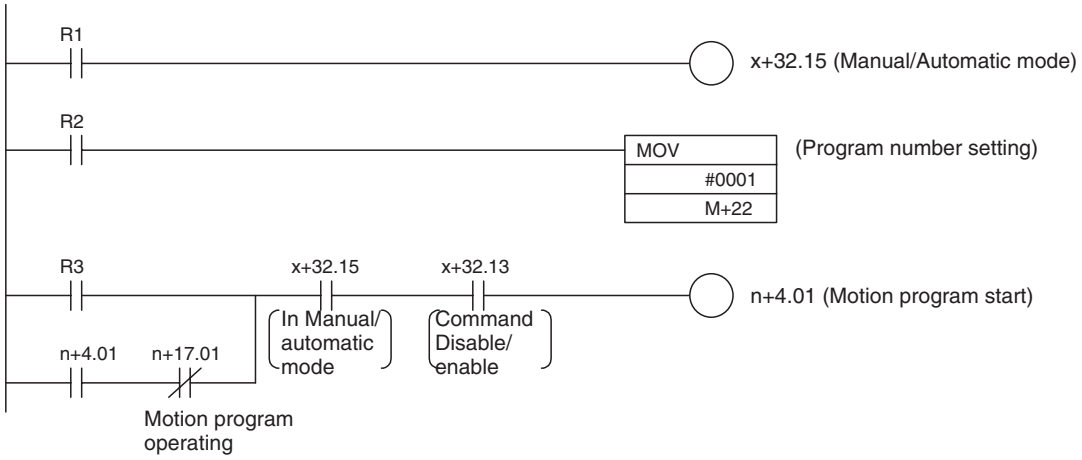
Start Mode	Operation
1 Resumes program from midway of the block indicated by Executing Block Number.	
2 Resumes program from the next block of the one indicated by Executing Block Number.	

Ladder program example to execute motion programs

The procedure to execute the motion program is described as a ladder program below.

Note that, however, the following ladder program contains the circuits of only the minimum requirements to execute a motion program. Therefore, it is necessary to add circuits depending on the actual requirement for actual operations.

Ladder Program



For R1 to R3, use work bits.

In this program, the program [P0001] is executed in motion task 1.

For actual operation, change the axis on which the motion program is to be executed, motion task, and program number as needed.

Turn ON R1 in order to specify Automatic Mode.

Turn ON R2 for the following conditions:

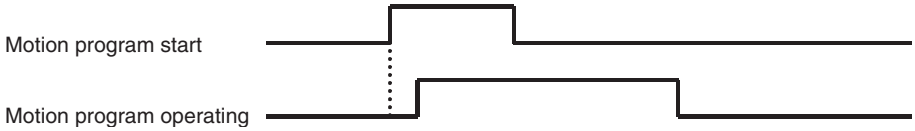
1,2,3...

1. Executing a program for the first time after the power is turned ON
2. Executing a program from the first block
3. When the program number was changed

Turning ON R3 will start the execution.

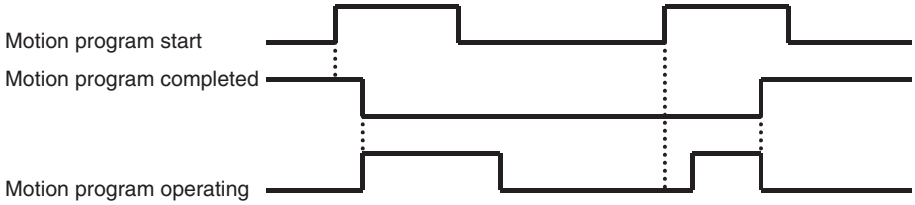
Motion Program Operating Bit

The Motion program operating bit turns ON during program execution, and turns OFF when program execution is completed or stopped.



Motion Program Completed Bit

When a motion program is completed, the motion program completed bit turns ON (turns ON when the END command execution is completed). Even if the motion program start is ON, the motion program operating bit turns OFF simultaneously when the motion program completed bit is turned ON.



Related PC Interface Area List

The list below is for the motion task 1. the list for motion tasks 2-8 is the same as motion task 1.

Classification	Word	Variable	bit	Name	Specifications
Motion task 1 Control bit	n+4	IW0340	01	Motion program start	0: Nil 1: Nil ↑: Starts motion program operation following the specified Start Mode. ↓: Nil
			02-03	Start Mode	0,3: Reads the program number and executes the program from the beginning. 1: Executes the program from the block indicated by Executing Motion Block Number. Operation at resuming interrupted programs varies depending on the command used or stopping status. For details, see *7-4-3 Motion Task Control Bits* (page 404). 2: Executes the program continuously from the next block of the block indicated by Executing Motion Block Number.
Motion task 1 Control data	m+22	IW0360	00-15	Motion task 1 Program number	Specifies the program number to be executed in motion tasks. 0-499
Axis 1 Control bit	x+0	IW0440	15	Manual/Automatic mode	0: Manual mode 1: Automatic mode ↑: Decelerates to stop manual operation currently being executed. ↓: Decelerates to stop automatic operation currently being executed.
Motion task 1 Status bit	n+17	OW0340	01	Motion program operating	0: Motion task is not executing a program operation. 1: Motion task is executing a program operation. (Turned OFF after deceleration stop/block stop completion)
			02	Motion program completed	0: When program operation is started. 1: END command was executed.
			03	Block being stopped	0: Block not being stopped 1: Block being stopped
			05	Start warning	0: Motion program started operating successfully. 1: Motion program could not start operating. (Axis declaration, Axis mode)
Axis 1 Status bit	x+32	OW0440	15	In Manual/Automatic mode	0: In Manual mode 1: In Automatic mode

Explanation of the table

0: Indicates that the bit is OFF.

1: Indicates that the bit is ON.

↑: Indicates turning ON from 0 to 1.

↓: Indicates turning OFF from 1 to 0.

Decimal system is applied to the other values using multiple bits.

When controlling with the rise (or fall) of the bits from the CPU Unit to the MC Unit, the change of bits is processed in the MC Unit, not in the CPU Unit. Therefore, if instructions like DIFU/DIFD are used, the change of bits may not be reflected.

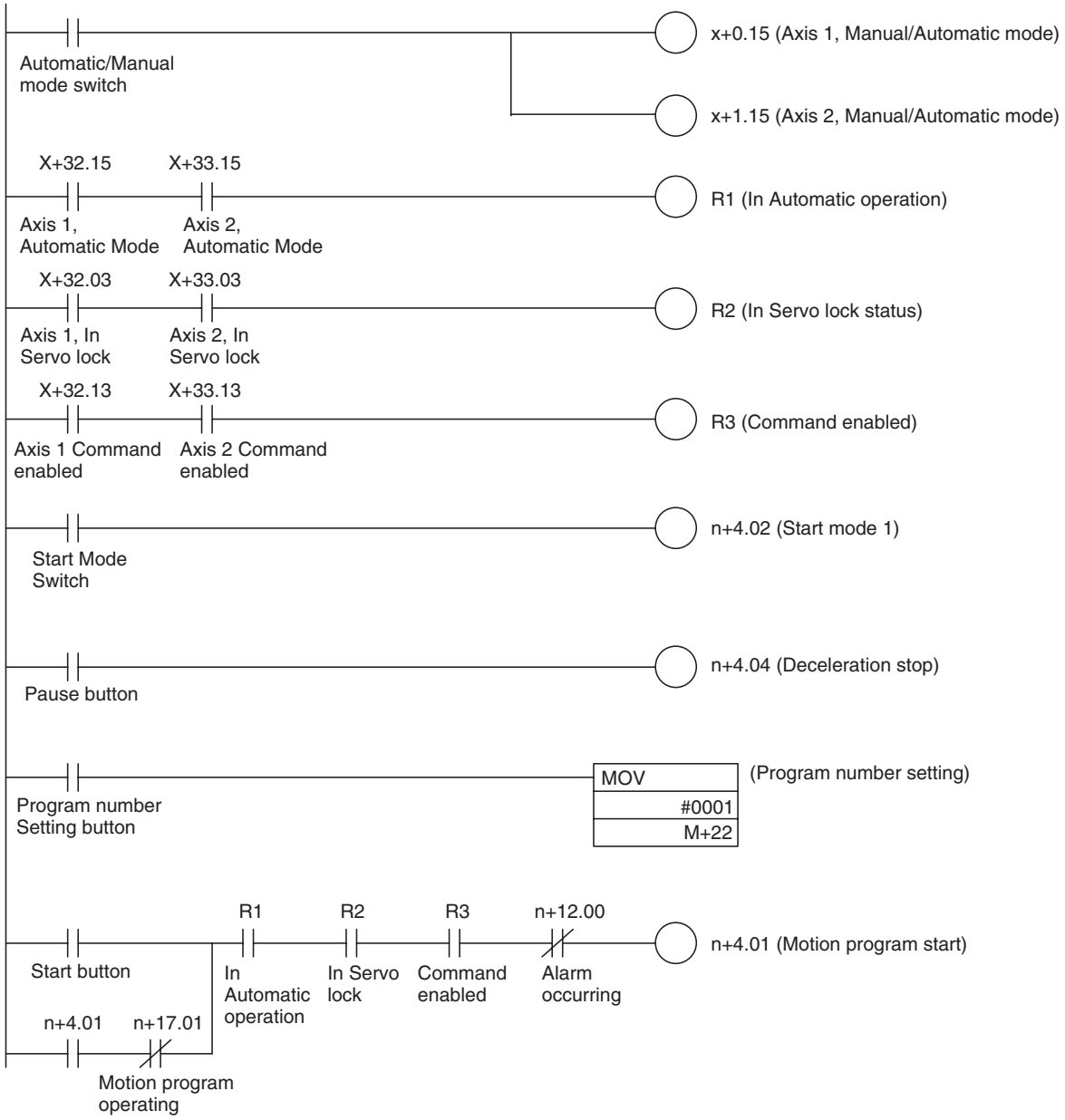
Ladder Program Example and Timing Chart

Ladder program example and timing chart for the program operation with axis movement (including deceleration stop) are shown below.

In this example, Axes 1 and 2 are operated with motion task 1 and the Motion task 1 Control bit [Deceleration stop] is used for stopping.

In the timing chart, Axes 1 and 2 are operated and they are stopped with deceleration stop in midway. After that, the operation is resumed in Start Mode 1 (Program execution is executed continuously from midway of the block indicated by the Executing Motion Block Number).

Ladder program



Note When executing axis movement commands in a motion program, it is required to execute Servo lock for all the applicable axes (the bit [In Servo Lock] is ON), and to set the operating mode to Automatic Mode (the bit [In Manual/Automatic mode] is ON). Therefore, make sure to insert the conditions R1 and R2 of the above ladder program.

Word Allocation Example

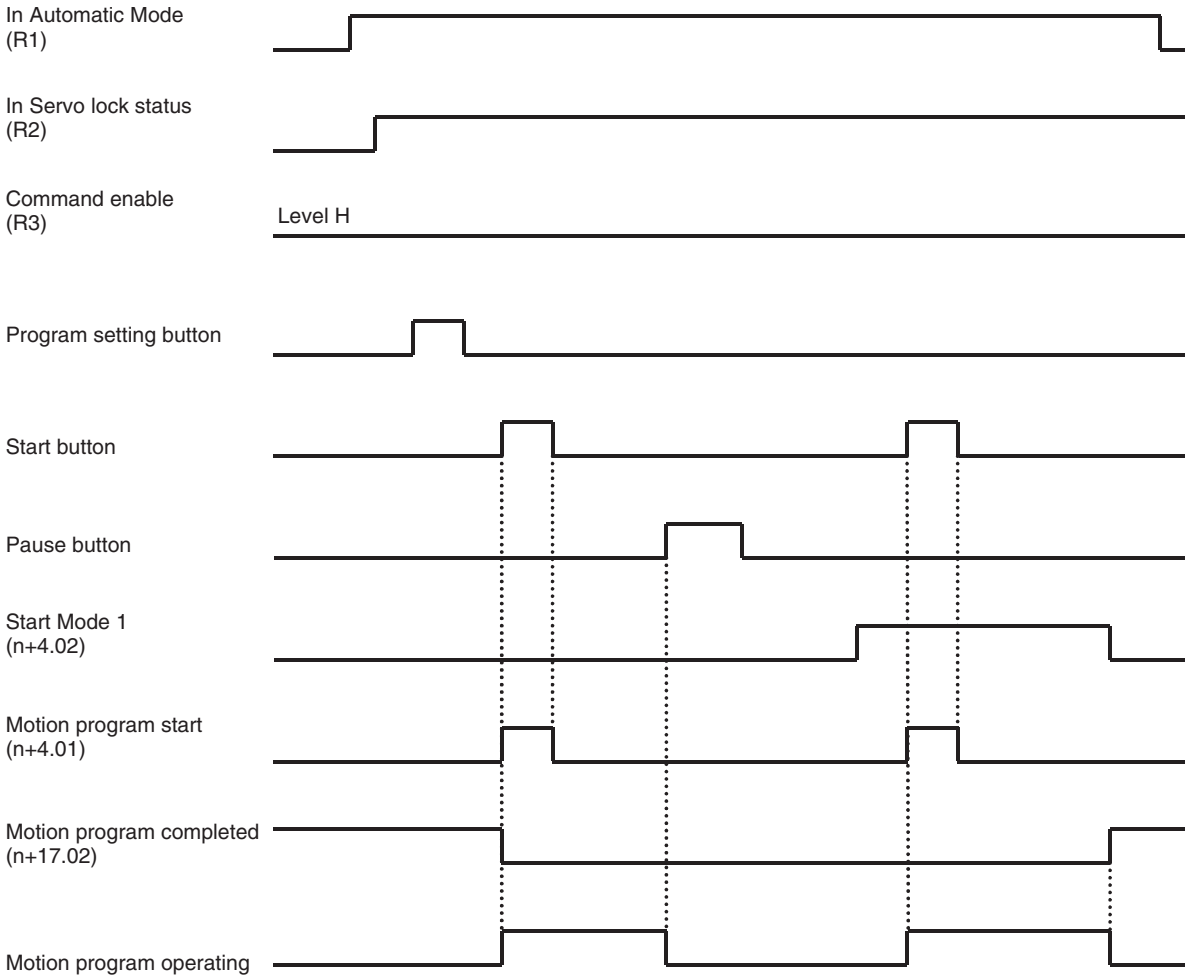
The word allocation for the ladder program above is shown below (Unit number: 0):

Description in ladder program	Axis 1	Axis 2
R1 to R3 (Work bit)	W50001 to W50003	
x+0.15, x+1.15 (Manual/Automatic Mode)	W20015 (See note.)	W20115 (See note.)
n+4.02 (Start Mode 1)	150402	
n+4.04 (Deceleration Stop)	150404	
n+4.01 (Motion Program Start)	150401	
m+22 (Program Number Setting)	DM30022	
x+32.15, x+33.15 (Automatic Mode)	W23215 (See note.)	W23315 See note.)
x+32.03, x+33.03 (In Servo Lock)	W23203 (See note.)	W23303 (See note.)
x+32.13, x+33.13 (Command Enabled)	W23205 (See note.)	W23305 (See note.)
n+17.01 (Motion Program Operating)	151701	
n+12.00 (Alarm Occurring)	151200	
Automatic/Manual Mode Switch	000100	
Start Button	000101	
Program Number Setting Button	000102	
Pause Button	000103	
Start Mode Switch	000104	

Note When setting the custom bit area from WR200, the area range for the Unit is set as shown below:

m+0 Area type specification on the CPU 0002h (WR)
m+1 Bit area first address 00C8h (200)

Timing Chart



MC Unit and CPU Unit Process Cycle

- **Do NOT set the same Cycle Time as the Unit Cycle of the MC Unit or the Cycle Time of [1/ integer] multiple when using the Minimum Cycle Time setting.**
  - The CPU Unit and MC Unit exchange data in the asynchronous Bus system via shared memory. When the timings of both Units for accessing the shared memory overlap, the Unit that accessed later will not be able to exchange data in that processing cycle.
  - If he CPU Unit accessed later than the MC Unit, the CPU Unit will be able to access the memory in the next cycle. On the other hand, if the MC Unit accessed later than the CPU Unit and the access timings overlap between them in the next cycle, the MC Unit will not be able to access the memory in the next cycle.
  - MC Unit executes internal processing in a constant Unit Cycle 1ms, 2ms, 3 ms, 4ms, 6 ms, or 8ms depending on the settings such as the number of axes, number of tasks, and number of parallel branches.
  - When using the Minimum Cycle Time setting, the timings of the Units to access the shared memory will overlap in every cycle, which may cause the case where the MC Unit cannot exchange data at all.

- **If the output time of the signal output from either Unit (CPU or MC) is shorter than the processing cycle of the other Unit to which the signal is input, the latter Unit may not be able to detect the change of the signal.**
  - To notify the change of the signal steadily, which is required when starting the motion program of the MC Unit from the CPU Unit, or in similar cases, it is necessary to make the start signal ON output time longer than the Unit Cycle of the MC Unit. To do so, handshake processing, such as that the start signal will be turned OFF observing the status of the bit [Motion program operating] output from the MC Unit, has to be executed. Note that, however, the status bit [Motion program operating] will be turned OFF when execution of the motion program is completed. Therefore, make sure that the Unit Cycle of the MC Unit is longer than the Cycle Time of the CPU Unit even when the number of commands in a program is small. Dwell Time (DWELL) command can be used in that case, for example.

7-3 Allocations for the CPU Unit

7-3-1 Allocations for the CPU Unit

CIO Output Area for the Unit (CPU→MC Unit, 12 words)

The symbols in the following tables indicate as below:

0: The bit is OFF.

1: The bit is ON.

↑: Rising from 0 to 1.

↓: Falling from 1 to 0.

Decimal system is applied to the other values using multiple bits.

When controlling with the rise (or fall) of the bits from the CPU Unit to the MC Unit, the change of bits is processed in the MC Unit, not in the CPU Unit. Therefore, if instructions like DIFU/DIFD are used, the change of bits may not be reflected.

Classification	Word	Variable	bit	Name	Specifications
Unit control bit	n+0	IW0300	00	Unit Alarm Reset	0: Nil 1: Does not turn ON the bit [Unit Alarm] ↑: Clears the alarm occurring on Unit level ↓: Nil
			01	System Parameter Save	0: Nil 1: Nil ↑: Saves system parameters to the Flash ROM ↓: Nil
			02	Position Data Save	0: Nil 1: Nil ↑: Saves position data to the Flash ROM ↓: Nil
			03	Teaching Condition Setting	0: Nil 1: Nil ↑: Specifies axes for teaching, reads the teaching address ↓: Nil
			04	Teaching Type	0: Feedback present position 1: Command present position ↑: Nil ↓: Nil
			05	Teaching Execution	0: Nil 1: Nil ↑: Writes present position specified with teaching type to position data ↓: Nil
			06	Servo Parameter Save	0: Nil 1: Nil ↑: Saves servo parameters into Flash ROM/ EEPROM in the Servo ↓: Nil
			07-11	Reserved	Reserved
			12-15	Present Value Monitor Select	Selects data to be output to the present value monitor. 0: Zero output 1: Feedback position (coordinate system currently being selected) 2: Feedback position (machine coordinate system) 3: Command position (coordinate system currently being selected) 4: Command position (machine coordinate system) 5: Feedback speed 1 (command unit/min) 6: Feedback speed 2 (depend on the parameter) 7: Command speed 1 (command unit/min) 8: Command speed 2 (depends on the parameter) 9: Error 10: Torque command 11-15: Reserved for system

Classification	Word	Variable	bit	Name	Specifications
	n+1	IW0301	00-15	Teaching Axis Setting 1-16	0: Nil 1: Specifies axis as teaching object ↑: Nil ↓: Nil
	n+2	IW0302	00-15	Teaching Axis Setting 17-32	0: Nil 1: Specifies axis as teaching object ↑: Nil ↓: Nil
Reserved	n+3	IW0320	00	Reserved	Reserved
			01	Reserved	Reserved
			02	Reserved	Reserved
			03-15	Reserved	Reserved
Motion task 1 Control bit	n+4	IW0340	00	Motion Task Alarm Reset	0: Nil 1: Does not turn ON the bit [Motion Task Alarm] ↑: Clears the alarm occurring on motion task level ↓: Nil
			01	Motion Program Start	0: Nil 1: Nil ↑: Starts the motion program operation following the specified Start Mode? ↓: Nil
			02-03	Start Mode	0, 3: Reads the program number and executes it from top. 1: Executes the program from the block indicated by Executing Motion Block Number. Operation at resuming interrupted programs varies depending on the command used or stopping status. For details, see *7-4-3 Motion Task Control Bits* (page 404). 2: Executes program continuously from the next block of the one indicated by Executing Motion Block Number.
			04	Deceleration Stop	0: Nil 1: Prohibits motion program start ↑: Executes deceleration stop regardless of block ↓: Nil
			05	Block Stop	0: Nil 1: Prohibits motion program start? ↑: Executes deceleration stop at the end of the block currently being executed ↓: Nil
			06	Single-block Operation Mode	0: Single-block operation mode OFF 1: Single-block operation mode ON ↑: Nil ↓: Nil
			07	Task Override Enable	0: Disables task override value (override 100% is used) 1: Enables task override value ↑: Nil ↓: Nil
			08-15	Reserved	Reserved
Motion task 2 Control bit	n+5	IW0341	00-15	Same as for Motion Task 1	Same as for Motion Task 1

Classification	Word	Variable	bit	Name	Specifications
Motion task 3 Control bit	n+6	IW0342	00-15	Same as for Motion Task 1	Same as for Motion Task 1
Motion task 4 Control bit	n+7	IW0343	00-15	Same as for Motion Task 1	Same as for Motion Task 1
Motion task 5 Control bit	n+8	IW0344	00-15	Same as for Motion Task 1	Same as for Motion Task 1
Motion task 6 Control bit	n+9	IW0345	00-15	Same as for Motion Task 1	Same as for Motion Task 1
Motion task 7 Control bit	n+10	IW0346	00-15	Same as for Motion Task 1	Same as for Motion Task 1
Motion task 8 Control bit	n+11	IW0347	00-15	Same as for Motion Task 1	Same as for Motion Task 1

CIO Input Area Words for the Unit (MC Unit → CPU, 13 words)

Classification	Word	Variable	bit	Name	Specifications
Alarm identification	n+12	OW0300	00	Alarm Occurring	0: No alarm 1: Alarm occurring in MC Unit (linked to LED [ERC] indicator)
			01	Unit Alarm Occurring	0: No alarm occurring on Unit level 1: Alarm occurring on Unit level
			02	Reserved	Reserved
			03-10	Motion Task Alarm Occurring 1-8	0: No alarm occurring on motion task level 1: Alarm occurring on motion task level
			11-15	Reserved	Reserved
	n+13	OW0301	00-15	Axis Alarm Occurring 1-16	0: No alarm occurring on axis 1: Alarm occurring on axis
	n+14	OW0302	00-15	Axis Alarm Occurring 17-32	0: No alarm occurring on axis 1: Alarm occurring on axis

Classification	Word	Variable	bit	Name	Specifications
Unit status bit	n+15	OW0303	00	Unit Ready	0: Unit is not ready for accepting commands 1: Unit is ready for accepting commands
			01	Unit Alarm	0: No alarm occurring on Unit level or Unit Alarm Reset is ON 1: Alarm occurring on Unit level
			02	Flash Save Completed	0: Neither parameter nor position data save is completed 1: Parameter or position data save completed (including error completion)
			03	Teaching Warning	0: Teaching condition setting, execution completed successfully 1: Condition error, Command disabled, No origin, Address overflow
			04	Teaching Condition Setting Completed	0: When Teaching condition setting bit is OFF 1: Teaching condition setting completed (including error completion)
			05	Teaching Execution Completed	0: Teaching execution is OFF 1: Teaching execution completed (including error completion)
			06	Reserved	Reserved
			07	External Forced Stop Request	0: There is no forced stop request from anything other than input variables 1: There is forced stop request from something other than input variables
			08	External Forced Stop Status	0: No forced stop request, or processing for stop 1: Stop by external forced stop request completed
			9-11	Reserved	Reserved
			12-15	Present Value Monitor Status	Indicates the present value monitoring output status 0: Zero output 1: Feedback position (coordinate system currently being selected) 2: Feedback position (machine coordinate system) 3: Command position (coordinate system currently being selected) 4: Command position (machine coordinate system) 5: Feedback speed 1 (command unit/min) 6: Feedback speed 2 (depends on the parameter) 7: Command speed 1 (command unit/min) 8: Command speed 2 (depends on the parameter) 9: Error 10: Torque command 11-15: Reserved for system
Reserved	n+16	OW0320	00	Reserved	Reserved
			01	Reserved	Reserved
			02-15	Reserved	Reserved

Classification	Word	Variable	bit	Name	Specifications
Motion task 1 Status bit	n+17	OW0340	00	Motion Task Alarm	0: No alarm occurring on motion task level or Motion Task Alarm Reset is ON 1: Alarm occurring on motion task level
			01	Motion Program Operating	0: Motion task is not executing program operation 1: Motion task is executing program operation (turned OFF after deceleration/block stop is completed)
			02	Motion Program Operation completed	0: When program operation is started 1: END command was executed
			03	In Block Stop	0: Not in Block Stop 1: In Block Stop
			04	Speed Clamp Warning	0: Speed not being clamped 1: Speed clamped by maximum speed limit
			05	Start Warning	0: Motion program started operating successfully 1: Motion program could not start operating (Axis declaration, Axis mode)
			06-15	Reserved	Reserved
Motion task 2 Status bit	n+18	OW0341	00-15	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
Motion task 3 Status bit	n+19	OW0342	00-15	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
Motion task 4 Status bit	n+20	OW0343	00-15	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
Motion task 5 Status bit	n+21	OW0344	00-15	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
Motion task 6 Status bit	n+22	OW0345	00-15	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
Motion task 7 Status bit	n+23	OW0346	00-15	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status
Motion task 8 Status bit	n+24	OW0347	00-15	Same as for Motion Task 1 Status	Same as for Motion Task 1 Status

7-3-2 DM Area Words for Unit (20 Words, CPU Unit_MC Unit)

Default Setting Area **DM Output Area for the Unit (CPU→ MC Unit, 20 Words)**

Classification	Word	Variable	bit	Name	Specifications
Unit area range settings (First time only)	m	---	00-15	Bit Area Type	Specifies area type on CPU Unit 0: Not used (no transfer) 1: CIO 2: WR 3 and above: Reserved for system
	m+1	---	00-15	Bit Area First Address	Specifies the first address on CPU Unit (Allocation for the axis number 1) 0000H-(Upper limit varies depending on bit area type.) **Note** The transfer size is maximum effective axis number x 2 words
	m+2	---	00-15	Data Area Type	Specifies area type on CPU Unit 0: Not used (no transfer) 1: CIO 2: WR 3: DM 4: EM (fixed at Bank 0) 5 and above: Reserved for system
	m+3	---	00-15	Data Area First Address	Specifies the first address on CPU Unit (Allocation of the axis number 1) 0000H-(Upper limit varies depending on bit area type.) **Note** The transfer size is maximum effective axis number x 4 words)
General I/O A area range settings (First time only)	m+4	---	00-07	PORT_A Number of Transferred Words	General I/O A Number of Transferred Words 1-160 words
			08-14	PORT_A Area Type	Specifies area type on CPU Unit 0: Not used (no transfer) 1: CIO 2: WR 3: DM 4: EM (fixed at Bank 0) 5 and above: Reserved for system
			15	PORT_A Direction	General I/O A Transfer Direction 0: MC Unit _ CPU 1: CPU _ MC Unit
	m+5	---	0-15	PORT_A First Address	CPU Unit First Address for General I/O A 0000H-(Upper limit varies depending on PORT_A area type.)
General I/O B area range settings	m+6 m+7	---	Same as for General I/O A area range settings		
General I/O C area range settings	m+8 m+9	---	Same as for General I/O A area range settings		
General I/O D area range settings	m+10 m+11	---	Same as for General I/O A area range settings		
General I/O E area range settings	m+12 m+13	---	Same as for General I/O A area range settings		

Classification	Word	Variable	bit	Name	Specifications
General I/O F area range settings	m+14 m+15	---	Same as for General I/O A area range settings		
General I/O G area range settings	m+16 m+17	---	Same as for General I/O A area range settings		
General I/O H area range settings	m+18 m+19	---	Same as for General I/O A area range settings		

Default Setting Area Details of setting data for default setting area are explained here.

Custom Bit Area Settings

Word	Name	Timing for enabling the setting
m	Bit Area Type	When the power is turned ON, or when MC Unit is restarted
m+1	Bit Area First Address	

Data configuration

	15	00
m	Area type	
m+1	First address (Hex)	

Setting range

0000 to 0002 Hex

0000 to XXXX Hex (XXXX varies depending on the bit area type.)

Explanation

- Area type specification (word m)

  Specifies the memory area of PLC to which the custom bit area is allocated.

  00: Does not use the custom bit area

  01: CIO area
  Specifies CIO area of PLC starting from the specified first address (m+1)

  02: WR area
  Specifies WR area of PLC starting from the specified first address (m+1)

Note When mounting several MC Units on the same PLC, make sure that the operation data areas of the MC Units do not overlap. Since MC Units do not detect the error even if custom bit areas of different Units are overlapping in PLC, a malfunction may result.

- First address (word m+1)

  When either CIO (0001) or WR (0002) area is specified for the custom bit area in the area type specification (word m), the first address is to be specified.

  Set the first address in hexadecimal (Hex). The setting ranges are as follows:

  CIO area: 0000 to 17BB Hex (0 to 6075)

  WR area: 0000 to 01BB Hex (0 to 443)

  When “Does not use the custom bit area (0000)” is specified in area type specification (word m), this setting is not necessary.

Setting example

Ex1:

m	0001
m+1	0064

The custom bit area is allocated, as shown below, starting from word 0064Hex (100) of CIO area in PLC.

	Control bit	Status bit
Axis 01	100	132
Axis 02	101	133
.	.	.
.	.	.
.	.	.
Axis 31	130	162
Axis 32	131	163

Ex2:

m	0002
m+1	00C8

The custom bit area is allocated, as shown below, starting from word 00C8Hex (200) of CIO area in PLC.

	Control bit	Status bit
Axis 01	200	232
Axis 02	201	233
.	.	.
.	.	.
.	.	.
Axis 31	230	262
Axis 32	231	263

Note Custom bit area is allocated for 32 axes starting from the specified first address regardless of the setting of the axis parameter [P1AA01: Physical axis setting].
However, in the addresses corresponding to the axes that are set to “Not used” in the axis parameter [P1AA01: Physical axis setting], data is not transferred between CPU Unit and MC Unit.

Custom Data Area Settings

Word	Name	Timing for enabling the setting
m+2	Data Area Type	When the power is turned ON, or when MC Unit is restarted
m+3	Data Area First Address	

Data configuration

	15 to 00
m+2	Area type specification
m+3	First address (Hex)

Setting range

0000 to 0004 Hex

0000 to XXXX Hex (XXXX varies depending on the data area type.)

Explanation

- Area type specification (word m+2)

  Specifies the memory area of PLC to which the custom data area is allocated.

  00: Does not use the custom data area

  01: CIO area
  Specifies CIO area of PLC starting from the specified first address (m+3).

  02: WR area
  Specifies WR area of PLC starting from the specified first address (m+3).

03: DM area (custom address)
Specifies DM area of PLC starting from the specified first address (m+3).

04: EM area (custom word)
Specifies EM area of PLC starting from the specified first address (m+3).

When EM area (04) is specified for the operation data area in area type specification (word m+2), EM area is fixed at Bank No.0.

Note Do not set the bank No. of the file memory on PLC. Specifying EM area of the file memory bank No. causes the alarm [0044h: CPU memory error].
When mounting several MC Units on the same PLC, make sure that operation data areas do not overlap. Since MC Units do not detect the error even if custom data areas of different Units are overlapping in PLC, a malfunction may result.
For details of bank and file memory of EM area, refer to "SYSMAC CS Series CS1G/H-CPU__-EV1, CS1G/H-CPU__H Programmable Controllers Operation Manual (Cat. No. W339-E1-□□)".

- First address (word m+3)

  When CIO (0001), WR (0002), DM (0003), or EM area (0004) is specified for the operation data area in the area type specification (word m+2), the first address is to be specified.

  Set the first address in hexadecimal (Hex). The setting ranges are as follows:

  CIO area: 0000 to 177F Hex (0 to 6015)

  WR area: 0000 to 017F Hex (0 to 383)

  DM area: 0000 to 7F7F Hex (0 to 32639)

  EM area: 0000 to 7F7F Hex (0 to 32639)

  When "Does not use the custom data area (0000)" is specified in the area type specification (word m+2), this setting is not necessary.

Setting example

m+2	0003
m+3	7530

The custom data area is allocated, as shown below, starting from word 7530Hex (30000) of DM area in PLC.

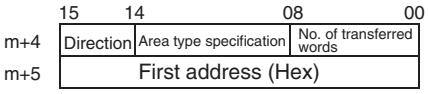
	Control data	Status data
Axis 01	30000	30032 to 30034
Axis 02	30001	30035 to 30037
.	.	.
.	.	.
.	.	.
Axis 31	30030	30122 to 30124
Axis 32	30031	30125 to 30127

Note Custom data area is allocated for 32 axes starting from the specified first address regardless of the setting of the axis parameter [P1AA01: Physical axis setting].
However, in the addresses corresponding to the axes that are set to "Not used" in the axis parameter [P1AA01: Physical axis setting], data is not transferred between CPU Unit and MC Unit.

General I/O Area Settings (with PORT_A)

Word	Name	Timing for enabling the setting
m+4	PORT Area Type, No. of Transferred Words, Direction Specification	When the power is turned ON, or when MC Unit is restarted
m+5	PORT Area First Address	

Data configuration



Setting range

0000 to XYZZ Hex (X = 0 or 8, Y = 0 to 4, ZZ = 00 to A0)

0000 to XXXX Hex (XXXX varies depending on the data area type.)

Explanation

- No. of transferred words (word m+4 bit00 to 07)

  Specifies the No, of words transferred between CPU Unit and MC Unit.

  The No. of words specified here starting from the first address specified in (word m+5) is transferred.

- Area type specification (word m+4 bit08 to 14)

  Specifies the memory area of PLC to which the general I/O area is allocated.

  00: Does not use the general I/O area

  01: CIO area
  Specifies CIO area of PLC starting from the specified first address (m+5).

  02: WR area
  Specifies WR area of PLC starting from the specified first address (m+5).

  03: DM area (custom address)
  Specifies DM area of PLC starting from the specified first address (m+5).

  04: EM area (custom word)
  Specifies EM area of PLC starting from the specified first address (m+5).

- PORT direction (word m+4 bit15)

  Specifies the direction of transferring general I/O.

  0: MC Unit _ CPU Unit
  Output variables of MC unit (with PORT_A: from OW0B00 on) for the specified No. of transferred words (word m+4 bit00 to 07) are transferred to the memory area of PLC specified with the area type specification (word m+4 bit08 to 14) and the first address (word m+5).

  1: CPU Unit _ MC Unit
  The specified No. of words (word m+4 bit00 to 07) is transferred from the memory area of PLC specified in the area type specification (word m+4 bit08 to 14) and the first address (word m+5) to input variables of MC Unit (with PORT_A: from IW0B00 on).

  When EM area (04) is specified for the operation data area in the area type specification (word m+4 bit08 to 14), EM area is fixed at Bank No.0.

Note Do not set the bank No. of the file memory on PLC. Specifying EM area of the file memory bank No. causes the alarm [0044h: CPU memory error].
When mounting several MC Units on the same PLC, make sure that operation data areas do not overlap. Since MC Units do not detect the error even if general I/O areas of different Units are overlapping in PLC, a malfunction may result.

For details of bank and file memory of EM area, refer to “SYSMAC CS Series CS1G/H-CPU__-EV1, CS1G/H-CPU__H Programmable Controllers Operation Manual (Cat. No. W339-E1-□□)”.

- First address (word m+5)

  When CIO (0001), WR (0002), DM (0003), or EM area (0004) is specified for the operation data area in the area type specification (word m+4 bit08 to 14), the first address is to be specified.

  Set the first address in hexadecimal (Hex). The setting range varies depending on the setting of the No. of transferred words (word m+4 bit00 to 07).

  When setting the No. of transferred words to its maximum “A0 Hex (160)”, the setting ranges are as follows:

  CIO area: 0000 to 175F Hex (0 to 5983)

  WR area: 0000 to 015F Hex (0 to 351)

  DM area: 0000 to 7F5F Hex (0 to 32607)

  EM area: 0000 to 7F5F Hex (0 to 32607)

  When “Does not use the general I/O area (00)” is specified in the area type specification (word m+4 bit 08 to 14), this setting is not necessary.

Setting example

Ex1:

General I/O A	m+4	840A
(PORT_A)	m+5	4E20

0Ahex (10) words of the custom I/O area starting from word 4E20Hex (20000) in EM area of PLC are transferred to input variables of MC Unit (IW0B00~).

	On PLC	Direction	On MC Unit
PORT_A	EM 20000 to 20009	→	IW 0B00 to 0B09

Ex2:

General I/O A	m+4	010A
(PORT_A)	m+5	0000
General I/O B	m+6	8164
(PORT_B)	m+7	1388
General I/O C	m+8	8205
(PORT_C)	m+9	00C8
General I/O D	m+10	84A0
(PORT_D)	m+11	2710
General I/O E	m+12	0000
(PORT_E)	m+13	0000
General I/O F	m+14	810A
(PORT_F)	m+15	000A
General I/O G	m+16	03A0
(PORT_G)	+17m	7D00
General I/O H	m+18	0328
(PORT_H)	m+19	7DA0

The custom I/O area is allocated to the memory area of PLC as shown below:

	On PLC	Direction	On MC Unit
PORT_A	CIO 0000 to 0009	←	OW 0B00 to 0B09
PORT_B	CIO 5000 to 5099	→	IW 0BA0 to 0C03
PORT_C	WR 200 to 204	→	IW 0C40 to 0C43

	On PLC	Direction	On MC Unit
PORT_D	EM 10000 to 10159	→	IW 0CE0 to 0D7F
PORT_E	Not used-	---	---
PORT_F	CIO 0010 to 0019	→	IW 0E20 to 0E29
PORT_G	DM 32000 to 32159	←	OW 0EC0 to 0F5F
PORT_H	DM 32160 to 32199	←	OW 0F60 to 0F87

Data Area **DM Output Area Words for the Unit (CPU Unit → MC Unit, 18 words)**

Classification	Word	Variable	bit	Name	Specifications
Unit control data	m+20	IW0310	00-15	Teaching Address	Specifies teaching start address 0-10239
Reserved	m+21	IW0330	00-15	Reserved	Reserved
Motion task 1 Control data	m+22	IW0360	00-15	Motion Task 1 Program No.	Specifies program No. to be executed with motion task 0-499
	m+23	IW0361	00-15	Motion Task 1 Override	Sets override value to be used in motion program 0.00 to 327.67[%], 0.01% unit
Motion task 2 Control data	m+24	IW0362	00-15	Same as for Motion Task 1	Same as for Motion Task 1
	m+25	IW0363			
Motion task 3 Control data	m+26	IW0364	00-15	Same as for Motion Task 1	Same as for Motion Task 1
	m+27	IW0365			
Motion task 4 Control data	m+28	IW0366	00-15	Same as for Motion Task 1	Same as for Motion Task 1
	m+29	IW0367			
Motion task 5 Control data	m+30	IW0368	00-15	Same as for Motion Task 1	Same as for Motion Task 1
	m+31	IW0369			
Motion task 6 Control data	m+32	IW036A	00-15	Same as for Motion Task 1	Same as for Motion Task 1
	m+33	IW036B			
Motion task 7 Control data	m+34	IW036C	00-15	Same as for Motion Task 1	Same as for Motion Task 1
	m+35	IW036D			
Motion task 8 Control data	m+36	IW036E	00-15	Same as for Motion Task 1	Same as for Motion Task 1
	m+37	IW036F			

DM Input Area Words for the Unit (MC Unit → CPU Unit, 36 words)

Classification	Word	Variable	bit	Name	Specifications
Unit Status data	m+38	OW0310	00-15	Unit Alarm Code	Outputs the code of the alarm occurring on Unit level.
	m+39	OW0311	00-15	Teaching Address Monitor	Outputs address currently being object of teaching
Reserved	m+40	OW0330	00-15	Reserved	Reserved
	m+41	OW0331	00-15	Reserved	Reserved

Classification	Word	Variable	bit	Name	Specifications
Motion task 1 Status data	m+42	OW0360	00-15	Motion Task Alarm Code	Outputs the code of the alarm occurring on motion task level.
	m+43	OW0361	00-15	Executing Motion Program No.	Outputs the program No. of the program currently being executed by a motion task or temporarily being stopped.
	m+44	OW0362	00-15	Executing Motion Block No. (Single execution command)	Outputs the block No. of the single execution command currently being executed by a motion task or temporarily being stopped. During execution of parallel branching, the block number of the leftmost block is output.
	m+45	OW0363	00-15	Executing Motion Block No. (Multiple execution command)	Outputs the block number of the multiple execution command currently being executed by a motion task or temporarily being stopped is output. During execution of parallel branching, the block number of the leftmost block is output.
Motion task 2 Status data	m+46	OW0364	00-15	Same as Motion Task 1 Status data	Same as Motion Task 1 Status data
	m+47	OW0365	00-15		
	m+48	OW0366	00-15		
	m+49	OW0367	00-15		
Motion task 3 Status data	m+50	OW0368	00-15	Same as Motion Task 1 Status data	Same as Motion Task 1 Status data
	m+51	OW0369	00-15		
	m+52	OW036A	00-15		
	m+53	OW036B	00-15		
Motion task 4 Status data	m+54	OW036C	00-15	Same as Motion Task 1 Status data	Same as Motion Task 1 Status data
	m+55	OW036D	00-15		
	m+56	OW036E	00-15		
	m+57	OW036F	00-15		
Motion task 5 Status data	m+58	OW0370	00-15	Same as Motion Task 1 Status data	Same as Motion Task 1 Status data
	m+59	OW0371	00-15		
	m+60	OW0372	00-15		
	m+61	OW0373	00-15		
Motion task 6 Status data	m+62	OW0374	00-15	Same as Motion Task 1 Status data	Same as Motion Task 1 Status data
	m+63	OW0375	00-15		
	m+64	OW0376	00-15		
	m+65	OW0377	00-15		
Motion task 7 Status data	m+66	OW0378	00-15	Same as Motion Task 1 Status data	Same as Motion Task 1 Status data
	m+67	OW0379	00-15		
	m+68	OW037A	00-15		
	m+69	OW037B	00-15		
Motion task 8 Status data	m+70	OW037C	00-15	Same as Motion Task 1 Status data	Same as Motion Task 1 Status data
	m+71	OW037D	00-15		
	m+72	OW037E	00-15		
	m+73	OW037F	00-15		

7-3-3 Custom Bit Area

Custom Bit Area (CPU→ MC Unit, 32 words)

Classification	Word	Variable	bit	Name	Specifications
Axis 1 Control bits	x+0	IW0440	00	Axis Alarm Reset	0: Nil 1: Does not turn ON the bit [Axis Alarm] ↑: Clears the alarm occurring on axis level and MLK slave alarm ↓: Nil
			01	Deceleration Stop	0: Nil 1: Prohibits JOG, STEP, Origin Search, Machine Origin Return in manual mode ↑: Deceleration stop (JOG, STEP, Origin Search, Machine Origin Return) ↓: Nil
			02	Servo Lock	0: Nil 1: Nil ↑: Starts Servo lock ↓: Nil
			03	Servo Unlock	0: Nil 1: Prohibits Servo lock ↑: Cancels Servo lock state ↓: Nil
			04	JOG	0: Nil 1: Continues JOG operation ↑: Starts JOG operation ↓: Stops JOG operation
			05	STEP	0:Nil 1: Continues STEP operation ↑: Starts STEP operation ↓: Stops STEP operation
			06	Origin Search	0:Nil 1: Continues Origin Search ↑: Starts Origin Search ↓: Stops Origin Search
			07	Machine Origin Return	0: Nil 1: Continues Machine Origin Return (PTP) ↑: Starts Machine Origin Return (PTP) ↓: Stops Machine Origin Return (PTP)
			08	Error Counter Reset	0: Nil 1: Nil ↑: Resets error counter (Command position = Present position) ↓: Interrupts error counter reset
			09	Forced Origin	0: Nil 1: Nil ↑: Defines the present position as the origin on the machine coordinate system (invalid when the axis is moving) ↓: Nil

Classification	Word	Variable	bit	Name	Specifications
Axis 1 Control bits	x+0	IW0440	10	ABS Origin Setting	0: Nil 1: Nil ↑: Sets the absolute encoder origin ↓: Nil
			11	Axis Override Enable	0: Disables axis override value (override 100% is used) 1: Enables axis override value ↑: Nil ↓: Nil
			12	JOG/STEP Direction	0: Sets the JOG and STEP operation direction to positive 1: Sets the JOG and STEP operation direction to negative ↑: Nil ↓: Nil
			13	Axis Machine Lock	0: Not using Axis machine lock mode 1: Using Axis machine lock mode ↑: Nil ↓: Nil
			14	Reserved	Reserved
			15	Manual/Automatic Mode	0: Manual Mode 1: Automatic Mode ↑: Decelerates to stop the manual operation being executed ↓: Decelerates to stop the automatic operation being executed
Axis 2 control bits	x+1	IW0441	00-15	Same as for Axis 1	Same as for Axis 1
Axis 3 control bits	x+2	IW0442	00-15	Same as for Axis 1	Same as for Axis 1
Axis 4 control bits	x+3	IW0443	00-15	Same as for Axis 1	Same as for Axis 1
Axis 5 control bits	x+4	IW0444	00-15	Same as for Axis 1	Same as for Axis 1
Axis 6 control bits	x+5	IW0445	00-15	Same as for Axis 1	Same as for Axis 1
Axis 7 control bits	x+6	IW0446	00-15	Same as for Axis 1	Same as for Axis 1
Axis 8 control bits	x+7	IW0447	00-15	Same as for Axis 1	Same as for Axis 1
Axis 9 control bits	x+8	IW0448	00-15	Same as for Axis 1	Same as for Axis 1
Axis 10 control bits	x+9	IW0449	00-15	Same as for Axis 1	Same as for Axis 1
Axis 11 control bits	x+10	IW044A	00-15	Same as for Axis 1	Same as for Axis 1
Axis 12 control bits	x+11	IW044B	00-15	Same as for Axis 1	Same as for Axis 1
Axis 13 control bits	x+12	IW044C	00-15	Same as for Axis 1	Same as for Axis 1
Axis 14 control bits	x+13	IW044D	00-15	Same as for Axis 1	Same as for Axis 1
Axis 15 control bits	x+14	IW044E	00-15	Same as for Axis 1	Same as for Axis 1
Axis 16 control bits	x+15	IW044F	00-15	Same as for Axis 1	Same as for Axis 1
Axis 17 control bits	x+16	IW0450	00-15	Same as for Axis 1	Same as for Axis 1
Axis 18 control bits	x+17	IW0451	00-15	Same as for Axis 1	Same as for Axis 1
Axis 19 control bits	x+18	IW0452	00-15	Same as for Axis 1	Same as for Axis 1
Axis 20 control bits	x+19	IW0453	00-15	Same as for Axis 1	Same as for Axis 1
Axis 21 control bits	x+20	IW0454	00-15	Same as for Axis 1	Same as for Axis 1
Axis 22 control bits	x+21	IW0455	00-15	Same as for Axis 1	Same as for Axis 1
Axis 23 control bits	x+22	IW0456	00-15	Same as for Axis 1	Same as for Axis 1
Axis 24 control bits	x+23	IW0457	00-15	Same as for Axis 1	Same as for Axis 1
Axis 25 control bits	x+24	IW0458	00-15	Same as for Axis 1	Same as for Axis 1

Classification	Word	Variable	bit	Name	Specifications
Axis 26 control bits	x+25	IW0459	00-15	Same as for Axis 1	Same as for Axis 1
Axis 27 control bits	x+26	IW045A	00-15	Same as for Axis 1	Same as for Axis 1
Axis 28 control bits	x+27	IW045B	00-15	Same as for Axis 1	Same as for Axis 1
Axis 29 control bits	x+28	IW045C	00-15	Same as for Axis 1	Same as for Axis 1
Axis 30 control bits	x+29	IW045D	00-15	Same as for Axis 1	Same as for Axis 1
Axis 31 control bits	x+30	IW045E	00-15	Same as for Axis 1	Same as for Axis 1
Axis 32 control bits	x+31	IW045F	00-15	Same as for Axis 1	Same as for Axis 1

Custom Bit Area (MC Unit → CPU, 32 words)

Classification	Word	Variable	bit	Name	Specifications
Axis 1 Status bits	x+32	OW0440	00	Axis Alarm	0: No alarm occurring on axis or MLK slave or Axis Alarm Reset is ON. 1: Alarm occurring on axis or MLK slave
			01	Machine Origin	0: Machine coordinate system FB position is outside of the origin in-position range 1: Machine coordinate system FB position is within the origin in-position range.
			02	Busy	0: Not executing functions listed below. 1: Executing the functions listed below or Command is ON JOG, STEP, Origin Search, Machine Origin Return, Error Counter Reset, Forced Origin, and ABS Origin Setting
			03	In Servo Lock	0: In Servo Unlock 1: In Servo Lock
			04	No Origin	0: Origin on machine coordinate system is defined 1: Origin on machine coordinate system is not defined (Always OFF for virtual axis and ABS encoder axis whose origin has been already set.)
			05	Axis Operating	0: No axis operating command being output 1: Axis operating command being output
			06	Positioning Completed	0: Outputting positioning command, or axis is outside of in-position range 1: Not outputting positioning command and axis is within in-position range.
			07	Positioning Completed (No.2)	0: Outputting positioning command, or axis is outside of No.2 in-position range. 1: Not outputting positioning command, and axis is within No.2 in-position range.
			08	Error Counter Warning	0: Error amount is within error counter warning range 1: Error amount exceeded the error counter warning value
			09	Axis Machine Lock Status	0: Not in Axis machine lock mode 1: In Axis machine lock mode
			10	Counter Latch Completed	0: Counter latch not completed 1: Counter latch completed
			11	MECHATROLINK Warning	0: Warning is not detected on MECHATROLINK-II device 1: Warning is detected on MECHATROLINK-II device
			12	Reserved	Reserved
			13	Command Disabled/Enabled	0: Not allocated or not implemented 1: Allocated and implemented (1 for virtual axis unconditionally)
			14	Axis Not Used/Used	0: Axis is not used 1: Axis is used (In Manual Mode: JOG, etc. being executed, In Automatic Mode: Axis declared in the program that is operating)
			15	In Manual/Automatic Mode	0: In Manual Mode 1: In Automatic Mode
Axis 2 Status bits	x+33	OW0441	00-15	Same as for Axis 1	Same as for Axis 1

Classification	Word	Variable	bit	Name	Specifications
Axis 3 Status bits	x+34	OW0442	00-15	Same as for Axis 1	Same as for Axis 1
Axis 4 Status bits	x+35	OW0443	00-15	Same as for Axis 1	Same as for Axis 1
Axis 5 Status bits	x+36	OW0444	00-15	Same as for Axis 1	Same as for Axis 1
Axis 6 Status bits	x+37	OW0445	00-15	Same as for Axis 1	Same as for Axis 1
Axis 7 Status bits	x+38	OW0446	00-15	Same as for Axis 1	Same as for Axis 1
Axis 8 Status bits	x+39	OW0447	00-15	Same as for Axis 1	Same as for Axis 1
Axis 9 Status bits	x+40	OW0448	00-15	Same as for Axis 1	Same as for Axis 1
Axis 10 Status bits	x+41	OW0449	00-15	Same as for Axis 1	Same as for Axis 1
Axis 11 Status bits	x+42	OW044A	00-15	Same as for Axis 1	Same as for Axis 1
Axis 12 Status bits	x+43	OW044B	00-15	Same as for Axis 1	Same as for Axis 1
Axis 13 status bits	x+44	OW044C	00-15	Same as for Axis 1	Same as for Axis 1
Axis 14 Status bits	x+45	OW044D	00-15	Same as for Axis 1	Same as for Axis 1
Axis 15 Status bits	x+46	OW044E	00-15	Same as for Axis 1	Same as for Axis 1
Axis 16 Status bits	x+47	OW044F	00-15	Same as for Axis 1	Same as for Axis 1
Axis 17 Status bits	x+48	OW0450	00-15	Same as for Axis 1	Same as for Axis 1
Axis 18 Status bits	x+49	OW0451	00-15	Same as for Axis 1	Same as for Axis 1
Axis 19 Status bits	x+50	OW0452	00-15	Same as for Axis 1	Same as for Axis 1
Axis 20 Status bits	x+51	OW0453	00-15	Same as for Axis 1	Same as for Axis 1
Axis 21 Status bits	x+52	OW0454	00-15	Same as for Axis 1	Same as for Axis 1
Axis 22 Status bits	x+53	OW0455	00-15	Same as for Axis 1	Same as for Axis 1
Axis 23 Status bits	x+54	OW0456	00-15	Same as for Axis 1	Same as for Axis 1
Axis 24 Status bits	x+55	OW0457	00-15	Same as for Axis 1	Same as for Axis 1
Axis 25 Status bits	x+56	OW0458	00-15	Same as for Axis 1	Same as for Axis 1
Axis 26 Status bits	x+57	OW0459	00-15	Same as for Axis 1	Same as for Axis 1
Axis 27 Status bits	x+58	OW045A	00-15	Same as for Axis 1	Same as for Axis 1
Axis 28 Status bits	x+59	OW045B	00-15	Same as for Axis 1	Same as for Axis 1
Axis 29 Status bits	x+60	OW045C	00-15	Same as for Axis 1	Same as for Axis 1
Axis 30 Status bits	x+61	OW045D	00-15	Same as for Axis 1	Same as for Axis 1
Axis 31 Status bits	x+62	OW045E	00-15	Same as for Axis 1	Same as for Axis 1
Axis 32 Status bits	x+63	OW045F	00-15	Same as for Axis 1	Same as for Axis 1

7-3-4 Custom Data Area

Custom Data Area (CPU →MC Unit, 32 words)

Classification	Word	Variable	bit	Name	Specifications
Axis 1 Control data	d+0	IW0480	00-15	Axis 1 Override	Sets the override value to be used for the axis. 0.00 to 327.67 [%], 0.01% unit
Axis 2 Control data	d+1	IW0481	00-15	Axis 2 Override	Same as for Axis 1 Control data
Axis 3 Control data	d+2	IW0482	00-15	Axis 3 Override	Same as for Axis 1 Control data
Axis 4 Control data	d+3	IW0483	00-15	Axis 4 Override	Same as for Axis 1 Control data
Axis 5 Control data	d+4	IW0484	00-15	Axis 5 Override	Same as for Axis 1 Control data
Axis 6 Control data	d+5	IW0485	00-15	Axis 6 Override	Same as for Axis 1 Control data
Axis 7 Control data	d+6	IW0486	00-15	Axis 7 Override	Same as for Axis 1 Control data
Axis 8 Control data	d+7	IW0487	00-15	Axis 8 Override	Same as for Axis 1 Control data
Axis 9 Control data	d+8	IW0488	00-15	Axis 9 Override	Same as for Axis 1 Control data
Axis 10 Control data	d+9	IW0489	00-15	Axis 10 Override	Same as for Axis 1 Control data
Axis 11 Control data	d+10	IW048A	00-15	Axis 11 Override	Same as for Axis 1 Control data
Axis 12 Control data	d+11	IW048B	00-15	Axis 12 Override	Same as for Axis 1 Control data
Axis 13 Control data	d+12	IW048C	00-15	Axis 13 Override	Same as for Axis 1 Control data

Classification	Word	Variable	bit	Name	Specifications
Axis 14 Control data	d+13	IW048D	00-15	Axis 14 Override	Same as for Axis 1 Control data
Axis 15 Control data	d+14	IW048E	00-15	Axis 15 Override	Same as for Axis 1 Control data
Axis 16 Control data	d+15	IW048F	00-15	Axis 16 Override	Same as for Axis 1 Control data
Axis 17 Control data	d+16	IW0490	00-15	Axis 17 Override	Same as for Axis 1 Control data
Axis 18 Control data	d+17	IW0491	00-15	Axis 18 Override	Same as for Axis 1 Control data
Axis 19 Control data	d+18	IW0492	00-15	Axis 19 Override	Same as for Axis 1 Control data
Axis 20 Control data	d+19	IW0493	00-15	Axis 20 Override	Same as for Axis 1 Control data
Axis 21 Control data	d+20	IW0494	00-15	Axis 21 Override	Same as for Axis 1 Control data
Axis 22 Control data	d+21	IW0495	00-15	Axis 22 Override	Same as for Axis 1 Control data
Axis 23 Control data	d+22	IW0496	00-15	Axis 23 Override	Same as for Axis 1 Control data
Axis 24 Control data	d+23	IW0497	00-15	Axis 24 Override	Same as for Axis 1 Control data
Axis 25 Control data	d+24	IW0498	00-15	Axis 25 Override	Same as for Axis 1 Control data
Axis 26 Control data	d+25	IW0499	00-15	Axis 26 Override	Same as for Axis 1 Control data
Axis 27 Control data	d+26	IW049A	00-15	Axis 27 Override	Same as for Axis 1 Control data
Axis 28 Control data	d+27	IW049B	00-15	Axis 28 Override	Same as for Axis 1 Control data
Axis 29 Control data	d+28	IW049C	00-15	Axis 29 Override	Same as for Axis 1 Control data
Axis 30 Control data	d+29	IW049D	00-15	Axis 30 Override	Same as for Axis 1 Control data
Axis 31 Control data	d+30	IW049E	00-15	Axis 31 Override	Same as for Axis 1 Control data
Axis 32 Control data	d+31	IW049F	00-15	Axis 32 Override	Same as for Axis 1 Control data

Custom Data Area (MC Unit → CPU, 96 words)

Classification	Word	Variable	bit	Name	Specifications	
Axis 1 Status data	d+32	OW0480	00-15	Axis Alarm Code	Outputs the code of the alarm occurring on axis or MECHATROLINK-II slave.	
	d+33	OW0481	00-15	Present Value Monitor	Selects from the following ten items to output.	Corresponds to the following system variables.
	d+34	OW0482	00-15		• Feedback position (coordinate system currently being selected)	SL0200
					• Feedback position (machine coordinate system)	SL0202
					• Command position (coordinate system currently being selected)	SL0204
					• Command position (machine coordinate system)	SL0206
					• Feedback speed 1	SL020A
					• Feedback speed 2	SL020C
					• Command speed 1	SL020E
					• Command speed 2	SL0210
					• Error	SL0212
					• Torque command	SL0214
					Note that however, when [I/O axis] is specified in the parameter [P1AA02: MECHATROLINK-II device type], 0 will be always output regardless of the settings of [SL0200, SL0202].	
Axis 2 Status data	d+35	OW0483	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data	
	d+36	OW0484				
	d+37	OW0485				

Classification	Word	Variable	bit	Name	Specifications
Axis 3 Status data	d+38	OW0486	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+39	OW0487			
	d+40	OW0488			
Axis 4 Status data	d+41	OW0489	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+42	OW048A			
	d+43	OW048B			
Axis 5 Status data	d+44	OW048C	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+45	OW048D			
	d+46	OW048E			
Axis 6 Status data	d+47	OW048F	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+48	OW0490			
	d+49	OW0491			
Axis 7 Status data	d+50	OW0492	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+51	OW0493			
	d+52	OW0494			
Axis 8 Status data	d+53	OW0495	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+54	OW0496			
	d+55	OW0497			
Axis 9 Status data	d+56	OW0498	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+57	OW0499			
	d+58	OW049A			
Axis 10 Status data	d+59	OW049B	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+60	OW049C			
	d+61	OW049D			
Axis 11 Status data	d+62	OW049E	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+63	OW049F			
	d+64	OW04A0			
Axis 12 Status data	d+65	OW04A1	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+66	OW04A2			
	d+67	OW04A3			
Axis 13 Status data	d+68	OW04A4	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+69	OW04A5			
	d+70	OW04A6			
Axis 14 Status data	d+71	OW04A7	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+72	OW04A8			
	d+73	OW04A9			
Axis 15 Status data	d+74	OW04AA	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+75	OW04AB			
	d+76	OW04AC			
Axis 16 Status data	d+77	OW04AD	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+78	OW04AE			
	d+79	OW04AF			
Axis 17 Status data	d+80	OW04B0	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+81	OW04B1			
	d+82	OW04B2			
Axis 18 Status data	d+83	OW04B3	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+84	OW04B4			
	d+85	OW04B5			

Classification	Word	Variable	bit	Name	Specifications
Axis 19 Status data	d+86	OW04B6	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+87	OW04B7			
	d+88	OW04B8			
Axis 20 Status data	d+89	OW04B9	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+90	OW04BA			
	d+91	OW04BB			
Axis 21 Status data	d+92	OW04BC	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+93	OW04BD			
	d+94	OW04BE			
Axis 22 Status data	d+95	OW04BF	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+96	OW04C0			
	d+97	OW04C1			
Axis 23 Status data	d+98	OW04C2	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+99	OW04C3			
	d+100	OW04C4			
Axis 24 Status data	d+101	OW04C5	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+102	OW04C6			
	d+103	OW04C7			
Axis 25 Status data	d+104	OW04C8	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+105	OW04C9			
	d+106	OW04CA			
Axis 26 Status data	d+107	OW04CB	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+108	OW04CC			
	d+109	OW04CD			
Axis 27 Status data	d+110	OW04CE	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+111	OW04CF			
	d+112	OW04D0			
Axis 28 Status data	d+113	OW04D1	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+114	OW04D2			
	d+115	OW04D3			
Axis 29 Status data	d+116	OW04D4	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+117	OW04D5			
	d+118	OW04D6			
Axis 30 Status data	d+119	OW04D7	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+120	OW04D8			
	d+121	OW04D9			
Axis 31 Status data	d+122	OW04DA	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+123	OW04DB			
	d+124	OW04DC			
Axis 32 Status data	d+125	OW04DD	00-15	Same as for Axis 1 Status data	Same as for Axis 1 Status data
	d+126	OW04DE			
	d+127	OW04DF			

Custom Area (CPU ← → MC Unit, 8 Areas × 160 words)

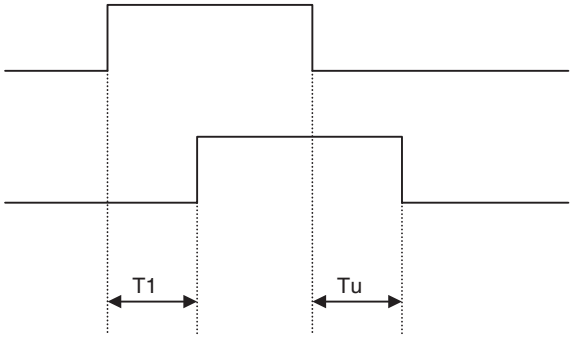
Classification	Word	Variable	bit	Name	Specifications
General I/O A	a_A	IW0B00 - IW0B9F or OW0B00 - OW0B9F	00-15	General I/O A Word 1-160	Reflects the data from general output A (CPU_MC Unit), or sets the data to be output to general input A (MC Unit_CPU)
General I/O B	a_B	IW0BA0 - IW0C3F or OW0BA0 - OW0C3F	00-15	General I/O B Word 1-160	Same as for General I/O A
General I/O C	a_C	IW0C40 - IW0CDF or OW0C40 - OW0CDF	00-15	General I/O C Word 1-160	Same as for General I/O A
General I/O D	a_D	IW0CE0 - IW0D7F or OW0CE0 - OW0D7F	00-15	General I/O D Word 1-160	Same as for General I/O A
General I/O E	a_E	IW0D80 - IW0E1F or OW0D80 - OW0E1F	00-15	General I/O E Word 1-160	Same as for General I/O A
General I/O F	a_F	IW0E20 - IW0EBF or OW0E20 - OW0EBF	00-15	General I/O F Word 1-160	Same as for General I/O A
General I/O G	a_G	IW0EC0 - IW0F5F or OW0EC0 - OW0F5F	00-15	General I/O G Word 1-160	Same as for General I/O A
General I/O H	a_H	IW0F60 - IW0FFF or OW0F60 - OW0FFF	00-15	General I/O H Word 1-160	Same as for General I/O A

7-4 Interface Specifics

This section provides detailed information on each bit in the PC IF Area and the functions of data in allocated DM Area.

Response Time

For each bit, description of 'Timing Chart' is provided. [T1] indicates the Unit Scan while [Tu] indicates being not fixed.



Note The MC Unit supports processing of great amounts of data and varieties of peripheral devices to realize multi-axis applications. Due to the fact, it takes the MC Unit a certain period of time (8 seconds min.) to get ready for operation.
To make the MC Unit receive commands from the PLC without fail, the bit [Unit Ready] is provided. When sending commands from the PLC to the MC Unit, make sure to check the bit [Unit Ready].
For details of the bit [Unit Ready], see page 401.

7-4-1 Unit Control Bits

Word	Variable	Bit	Name	I/O
n+0	IW0300	00	Unit Alarm Reset	Output

Function

- If an error that requires stopping internal operation of the Unit occurs, it will be detected as an alarm.
- Using Unit Alarm Reset after having removed the cause of the error can clear the alarm.

Command and Operation

Name	Specifications
Unit Alarm Reset	0: Nil 1: Does not turn ON the bit [Unit Alarm] ↑: Clears the alarm occurring on Unit level ↓: Nil

The alarm on Unit level will be cleared when the bit [Unit Alarm Reset] is turned ON.

Status Condition

Name	Specifications
Alarm Occurring	0: No alarm occurring 1: Alarm occurring on MC Unit (linked to ERC indicator)
Unit Alarm Occurring	0: No alarm occurring on Unit level 1: Alarm occurring on Unit level

Name	Specifications
Unit Alarm	0: No Alarm occurring on Unit level or the bit [Unit Alarm Reset] is ON 1: Alarm occurring on unit level
Unit Alarm Code	Output the code of the alarm occurring on Unit level

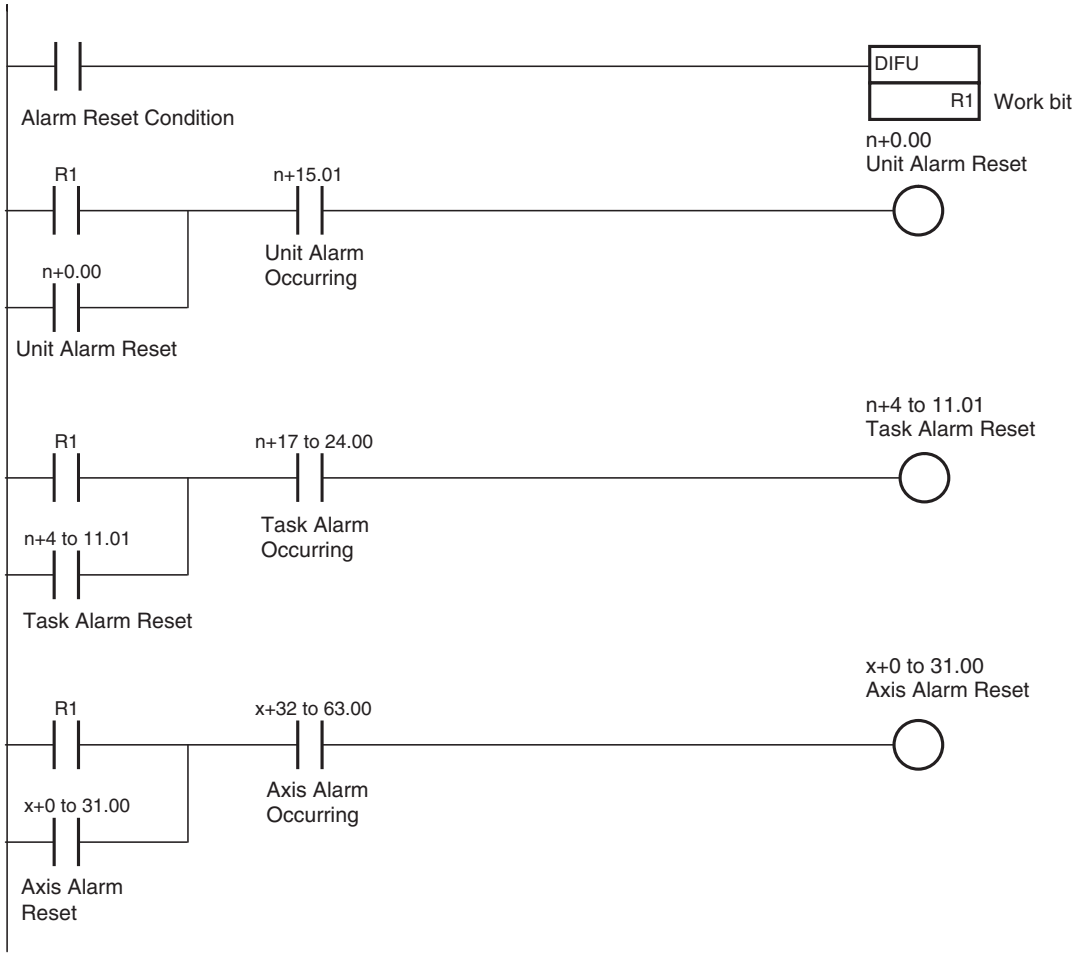
- When an alarm occurs on the Unit level, the bits [Alarm Occurring], [Unit Alarm Occurring], and [Unit Alarm] turn ON and the alarm code will be stored in the Unit status data [Unit Alarm Code].
- If several alarms occur, only the code of the first alarm will be stored in [Unit Alarm Code].

Effect of Other Functions Nil

Effect on Other Functions When an alarm occurs, it affects other functions (operation failure, operation interruption, etc.)

System Parameter Nil

Program Example



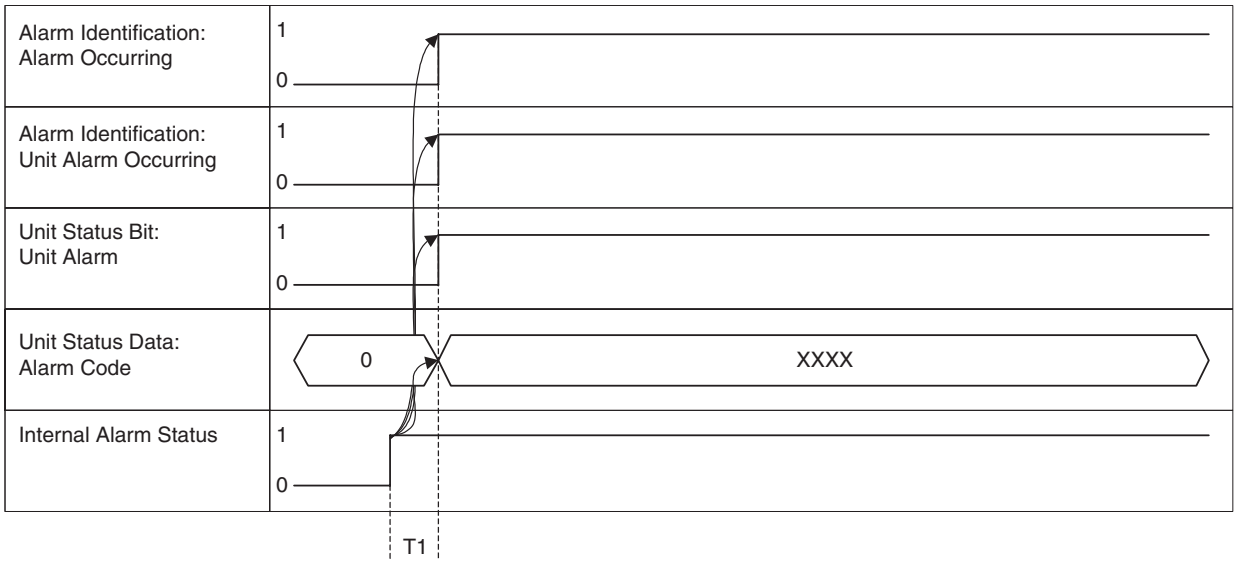
On MC Unit, there are three types of alarms:

- Unit alarm
- Task alarm
- Axis alarm

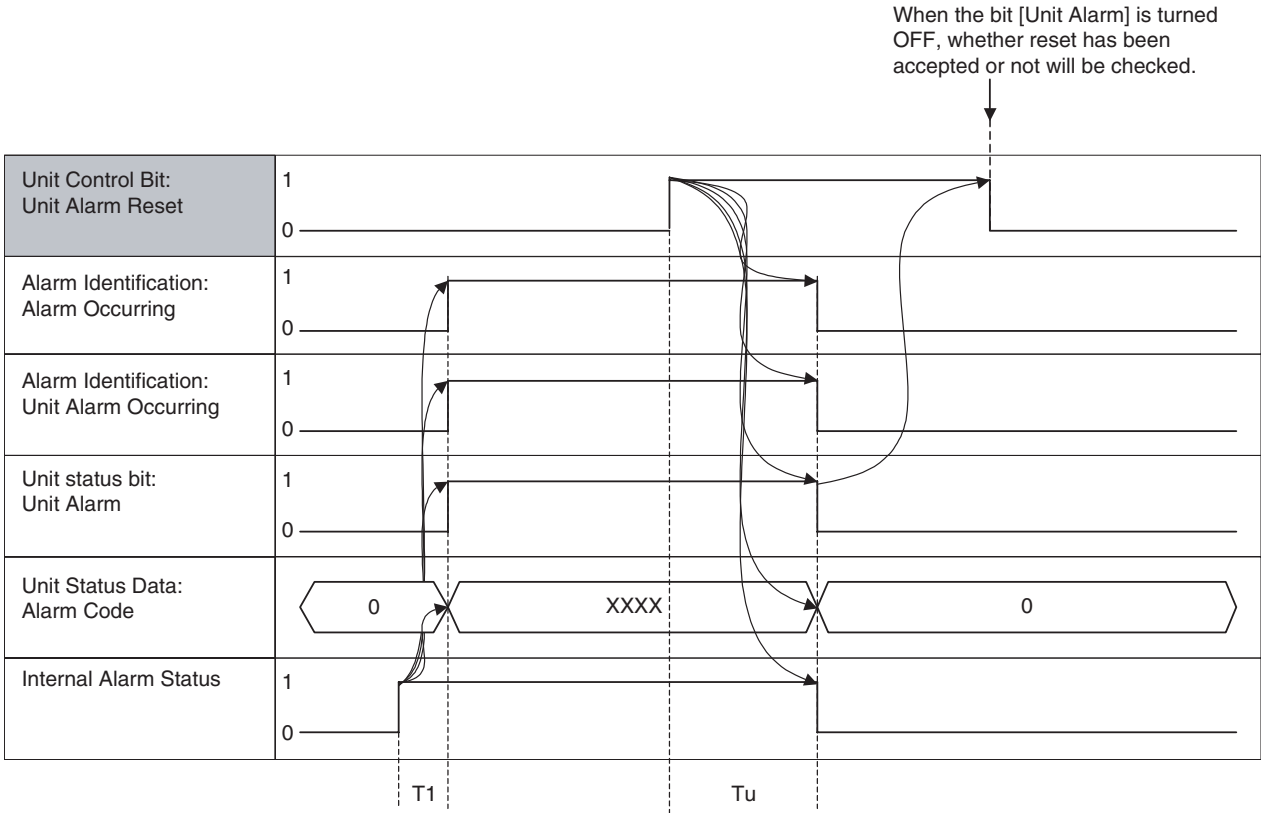
Alarms are reset on the basis of each type. Therefore, execute the alarm reset over the Unit, Task, and Axis to clear an alarm occurring on the MC Unit without fail.

Timing Chart

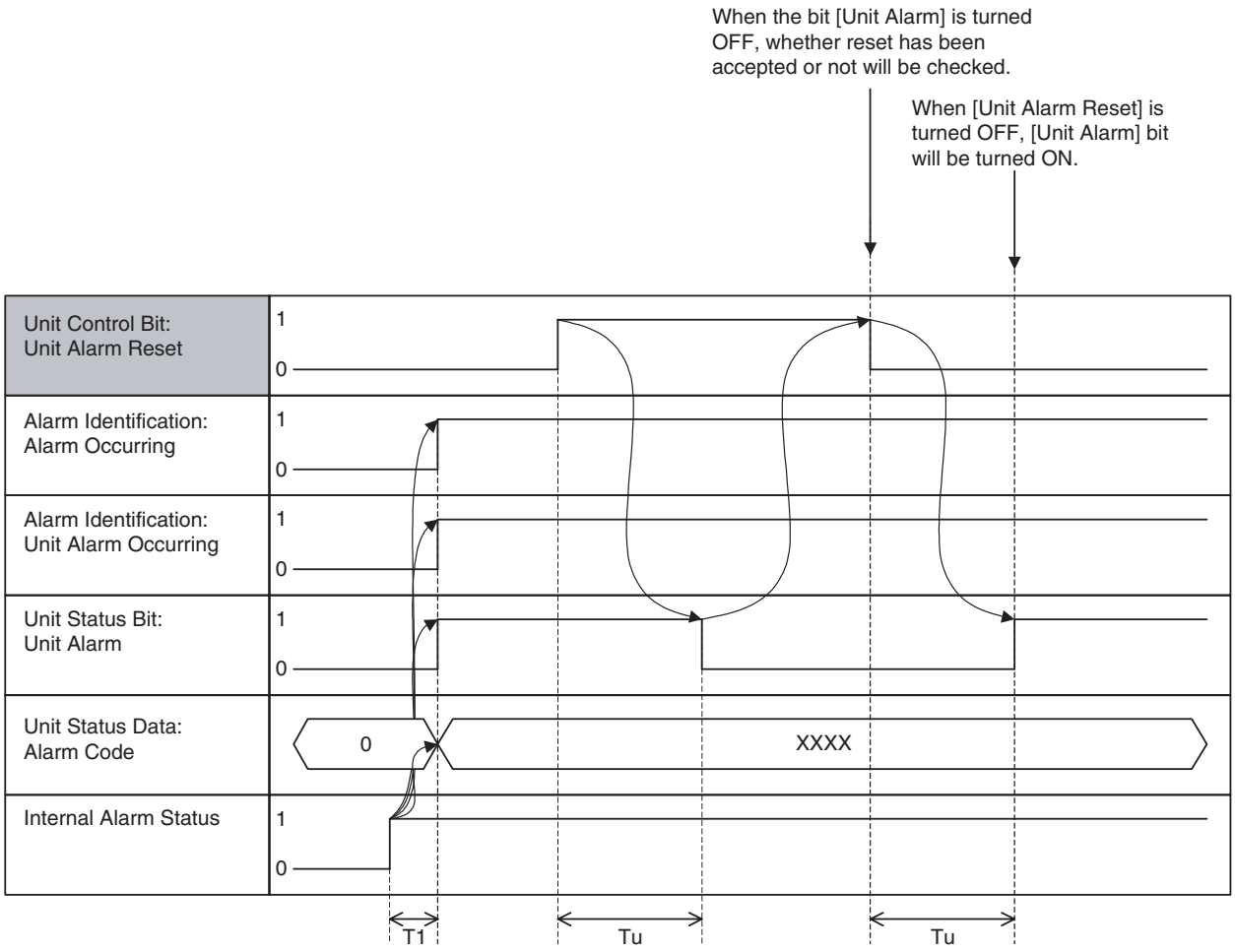
Basic operation (Alarm Occurring):



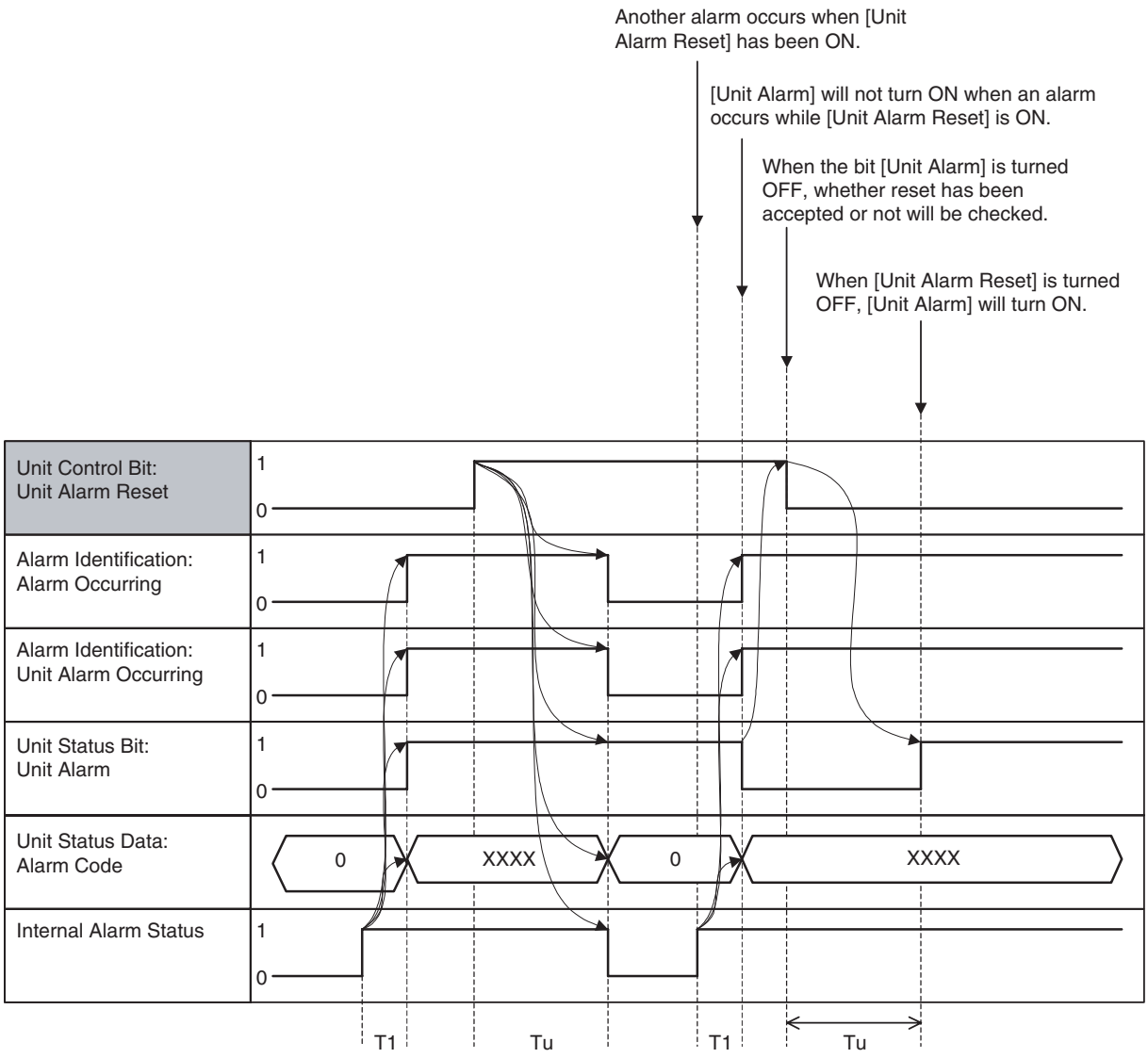
Basic operation (Alarm Reset):



Alarm that cannot be reset occurs:



Alarm occurs when [Unit Alarm Reset] has been ON:



Word	Variable	Bit	Name	I/O
n+0	IW0300	01	System Parameter Save	Output

Function

With this function, system parameters that have been changed using IOWR instruction in the ladder program can be saved into the Flash ROM of the MC Unit.

Command and Operation

Name	Specifications
System Parameter Save	0: Nil 1: Nil ↑: Saves system parameters in the Flash ROM. ↓: Nil

- System parameters will be saved when the bit [System Parameter Save] is turned ON.
- Turning OFF the bit [System Parameter Save] after the command reception will not interrupt the processing.

Status Condition

Name	Specifications
Flash Save Completed	0: Neither parameter nor position data save is completed 1: Parameter or position data save is completed (including error completion)

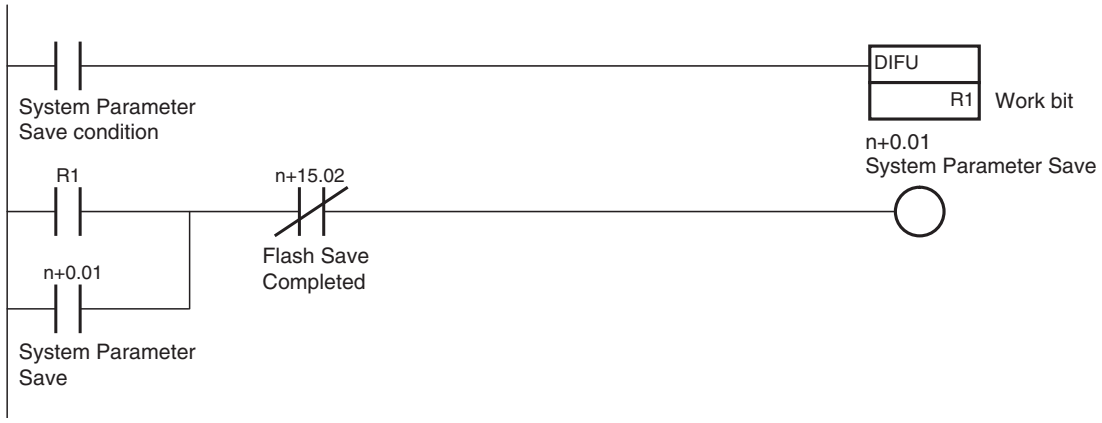
- When saving is completed (normal completion or error completion), the bit [Flash Save Completed] will turn ON.
- The same status bit is used for saving position data. Therefore, it is not recommended to save system parameters simultaneously with position data.

Effect of Other Functions Nil

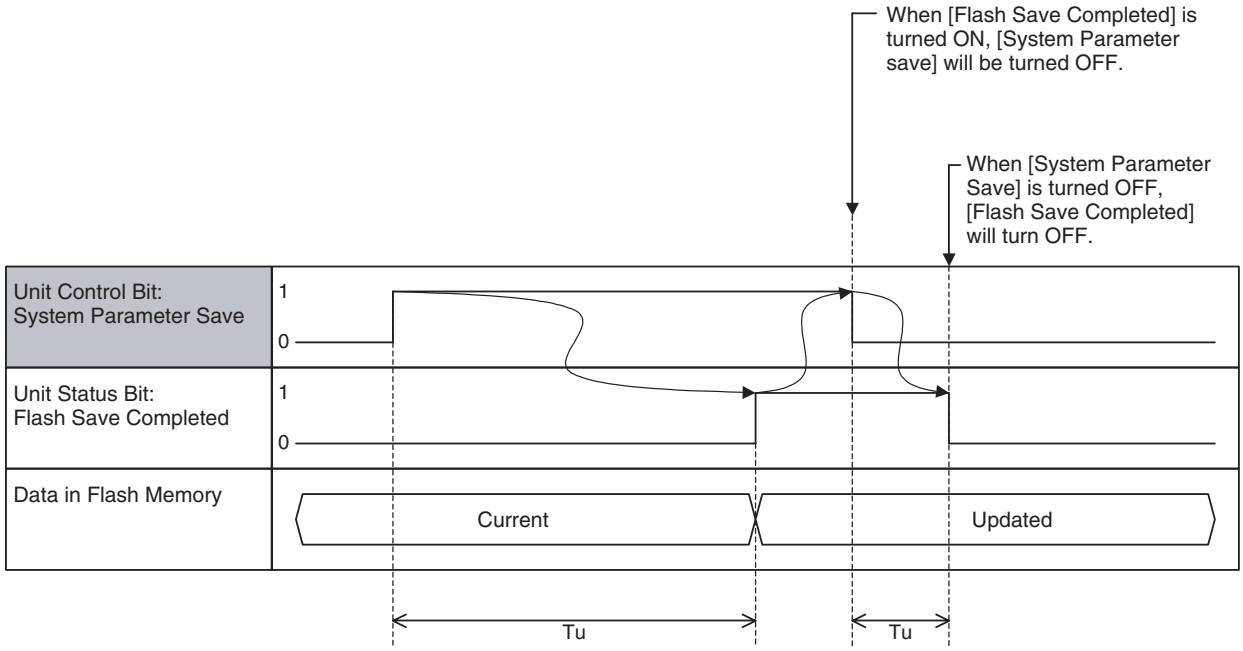
Effect on Other Functions Nil

System Parameter Nil

Program Example

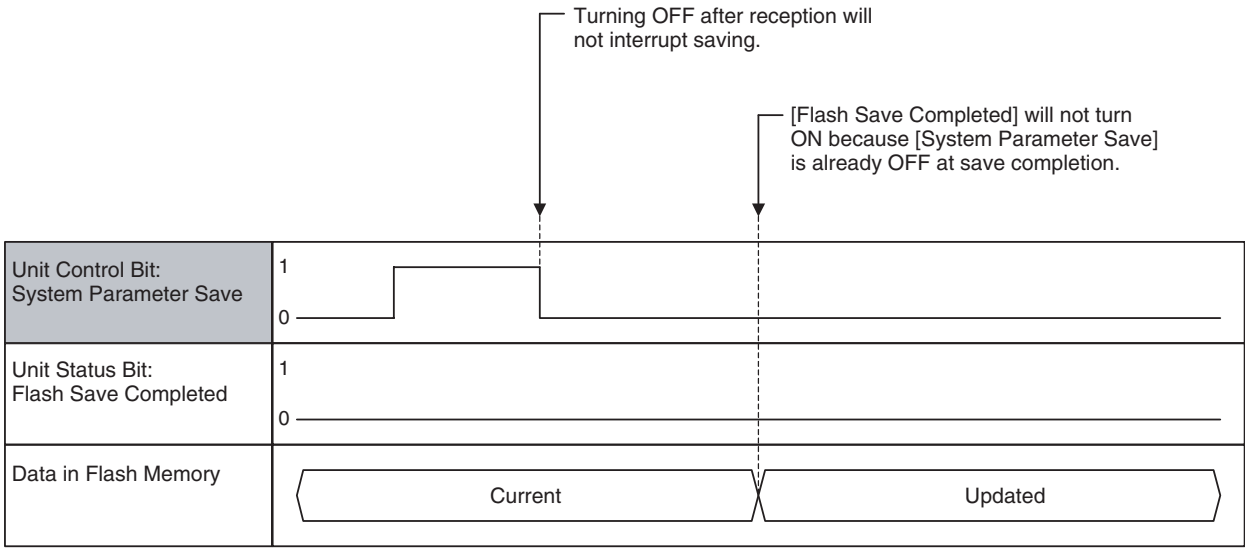


Timing Chart **Basic operation:**



The timing chart will be the same as the above even at error completions. Use the bit [Unit Alarm] to confirm normal completion or error completion. (Confirm with the alarm as it seldom happens.)

If [System Parameter Save] is turned OFF before completion:



Word	Variable	Bit	Name	I/O
n+0	IW0300	02	Position Data Save	Output

Function

With this function, the position data that has been changed using IOWR instruction or teaching function from ladder program is saved into the Flash ROM of the MC Unit.

Command and Operation

Name	Specifications
Position Data Save	0: Nil 1: Nil ↑: Saves position data in the Flash ROM ↓: Nil

- Position data will be saved when the bit [Position Data Save] is turned ON.
- Turning OFF the bit [Position Data Save] after the command reception will not interrupt the processing.

Status Condition

Name	Specifications
Flash Save Completed	0: Neither parameter nor position data save is completed 1: Parameter or position data save is completed (including error completion)

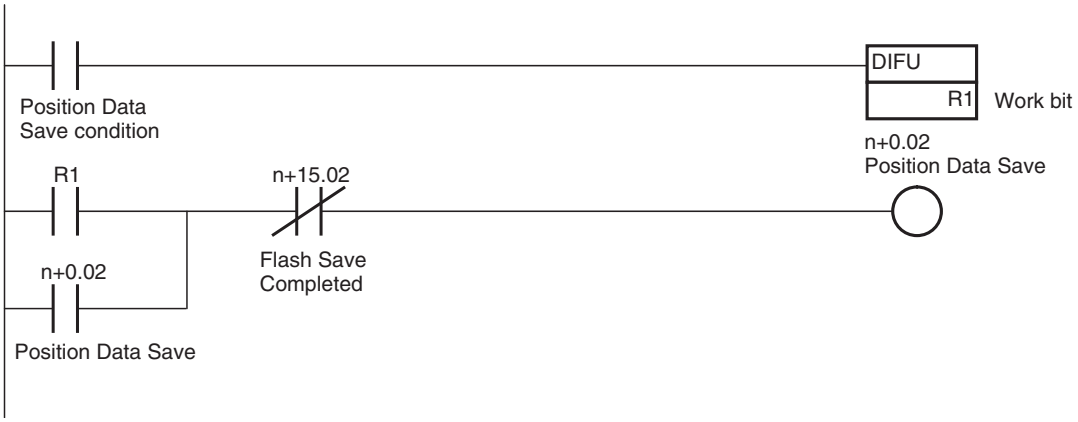
- When saving is completed (normal completion or error completion), the bit [Flash Save Completed] will turn ON.
- The same status bit is used for saving system parameters. Therefore, it is not recommended to save position data simultaneously with system parameters.

Effect of Other Functions Nil

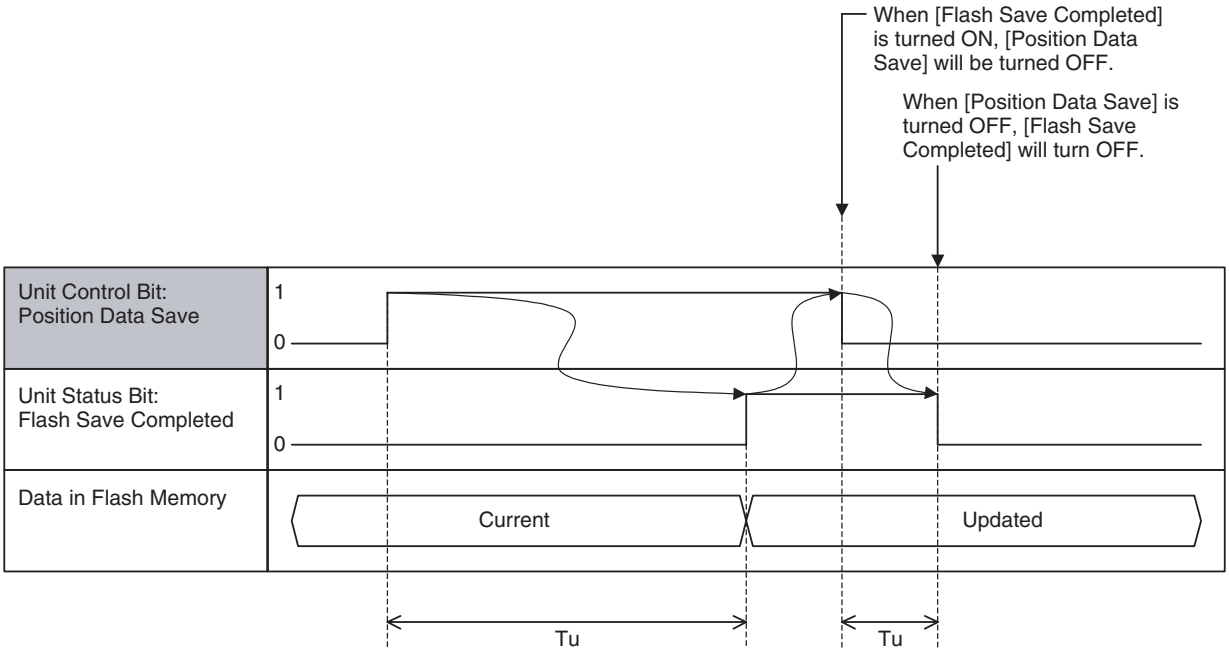
Effect on Other Functions Nil

System Parameter Nil

Program Example



Timing Chart **Basic Operation:**



The timing chart will be the same as the above even at error completions. Use the bit [Unit Alarm] to confirm normal completion or error completion. (Confirm with the alarm as it seldom happens.)

Words	Variables	Bits	Name	I/O
n+0	IW0300	03	Teaching Condition Setting	Output
n+0	IW0300	04	Teaching Type	Output
n+0	IW0300	05	Teaching Execution	Output
n+1	IW0301	00-15	Teaching Axis Setting 1-16	Output
n+2	IW0302	00-15	Teaching Axis Setting 17-32	Output

Function

- To use the actual positions on an application in motion programs as position data, the present positions are stored in position data.
- Generally, there are following 2 operations:
  - Teaching Condition Setting:
    The axis and address of teaching object will be specified when the bit [Teaching Condition Setting] is turned ON.
  - Teaching Execution:
    The present position will be stored in position data when the bit [Teaching Execution] is turned ON.

Command and Operation

Name	Specifications
Teaching Condition Setting	0: Nil 1: Nil ↑: Specifies the Teaching axis, reads the Teaching address. ↓: Nil
Teaching Type	0: Feedback present position 1: Command present position ↑: Nil ↓: Nil
Teaching Execution	0:Nil 1:Nil ↑: Writes present position specified with Teaching type into position data ↓: Nil
Teaching Axis Setting 1-16	0: Nil 1: Specifies the axis as a teaching axis ↑: Nil ↓: Nil
Teaching Axis Setting 17-32	0: Nil 1: Specifies the axis as a teaching axis ↑: Nil ↓: Nil
Teaching Address	Specifies the teaching start address 0-10239

- [Teaching Axis Setting 1-16], [Teaching Axis Setting 17-32], and [Teaching Address] will be read when the bit [Teaching Condition Setting] is turned ON, and then, teaching will be ready to be started.
- When the bit [Teaching Execution] is turned ON, the data specified with [Teaching Type] of the axes specified with the bits [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32] will be stored in position data.
- The bit [Teaching Type] will be referenced when the bit [Teaching Execution] is turned ON and it cannot be changed during execution of teaching.
- If [Teaching Condition Setting] is omitted after teaching execution, the address of teaching object will be incremented for the number of axes specified with the bits [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32].
- Condition setting and execution can be performed simultaneously by turning ON the bits [Teaching Condition Setting] and [Teaching Execution] simultaneously. However, when an error occurred, there is no way to know which operation caused the error. Therefore, it is not recommended.

- The bit [Teaching Address] will return to zero if the address after increment in teaching execution exceeds 10239 (27FFh).

Status Condition

Name	Specifications
Teaching Warning	0: Teaching condition setting, execution completed successfully 1: Condition error, Command disabled, No origin, or Address overflow
Teaching Condition Setting Completed	0: When the bit [Teaching Condition Setting] is OFF 1: Teaching condition setting completed (including error completion)
Teaching Execution Completed	0: When the bit [Teaching Execution] is OFF 1: Teaching execution completed (including error completion)
Teaching Address Monitor	Output the address of current teaching object

- The bit [Teaching Warning] indicates the error status of teaching condition setting and teaching execution. It turns ON simultaneously with either of the bits [Teaching Condition Setting Completed] or [Teaching Execution Completed] under the following conditions respectively:

  When Teaching condition setting is executed:

  - When [Teaching Axis Setting 1-16] = [Teaching Axis Setting 17-32] = 0
  - When there are any non-allocated axes among the axes specified with the bits [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32]
  - [Teaching Address] is outside of position data range
  - When the addition of [Teaching Address] and the addresses for the number of axes specified with the bits [Teaching Axis Setting1-16] and [Teaching Axis Setting 17-32] exceeds the position data range

  When Teaching is executed:

  - When [Teaching Execution] was turned ON without teaching condition setting
  - When the bits [Command Disabled/Enabled] for the axes specified with [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32] are OFF, or when the bits [No Origin] for any of the axes are ON.
  - When the addition of [Teaching Address Monitor] and the addresses for the number of teaching-object axes exceeds the position data range
- The bit [Teaching Condition Setting Completed] indicates the completion status (normal or error) of teaching condition setting and it will be turned OFF when the bit [Teaching Condition Setting] is turned OFF.
- The bit [Teaching Execution Completed] indicates the completion status (normal or error) of teaching execution and it will be turned OFF when the bit [Teaching Execution] is turned OFF.
- The bit [Teaching Address Monitor] indicates the address of the teaching object. It will be incremented for the number of axes specified with [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32] when teaching execution is completed normally.

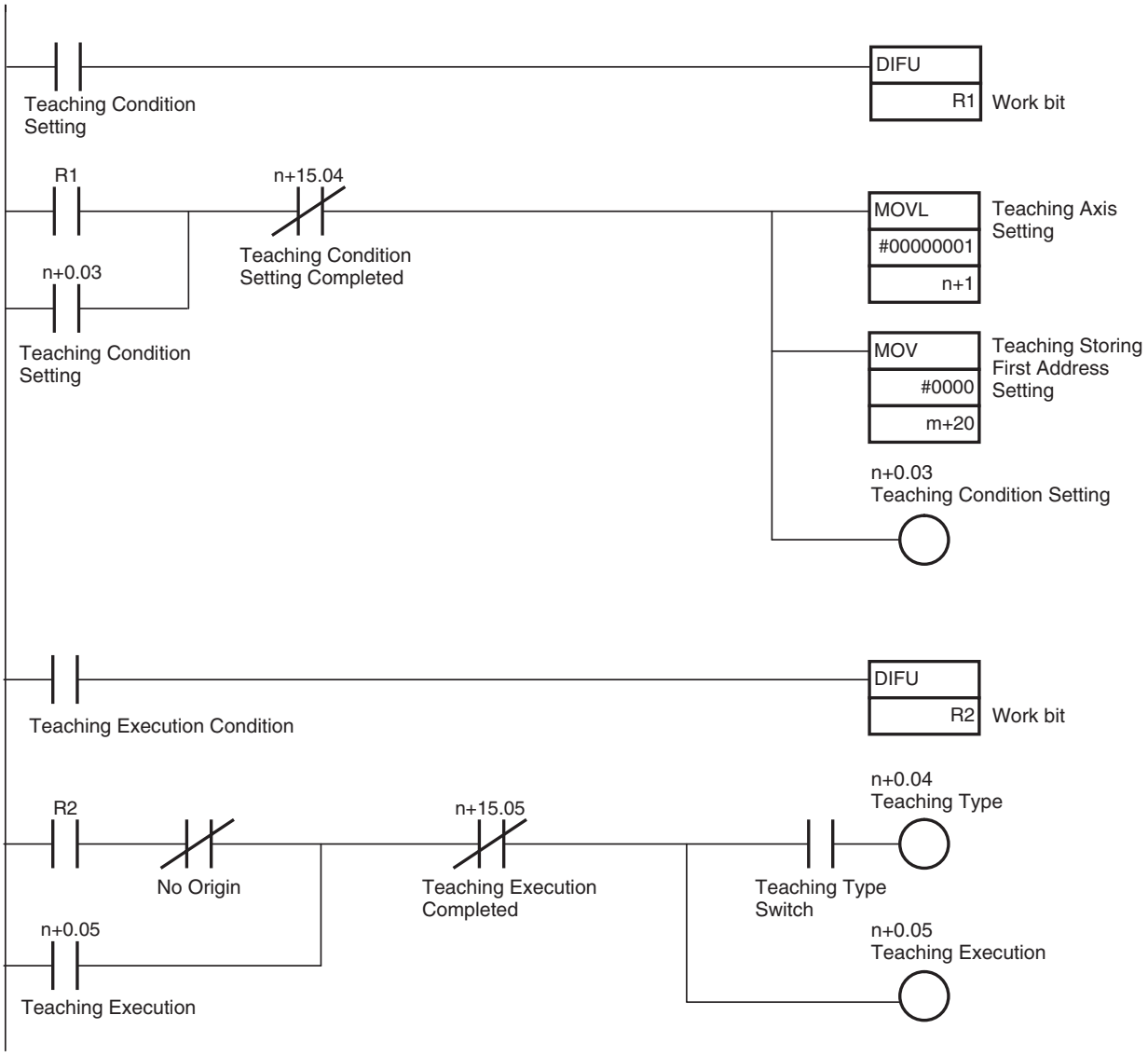
Effect of Other Functions

Classification	Items	Effect
Physical status	Servo axis	No effect
	Virtual axis	No effect
	I/O axis	No effect
	Counter axis	No effect
Control status	In Position control	No effect
	In Speed control	No effect
	In Torque control	No effect
Status bits	Busy	No effect
	In Servo Lock	No effect
	No Origin	Cannot execute Teaching if it is turned ON.
	Axis Operating	No effect
	Positioning Completed	No effect
	Positioning Completed (No.2)	No effect
	Axis Machine Lock Status	No effect
	Command Disabled/Enabled	Cannot execute Teaching if it is turned OFF.
	Axis Not Used/Used	No effect
	In Manual/Automatic Mode	No effect

Effect on Other Functions Nil

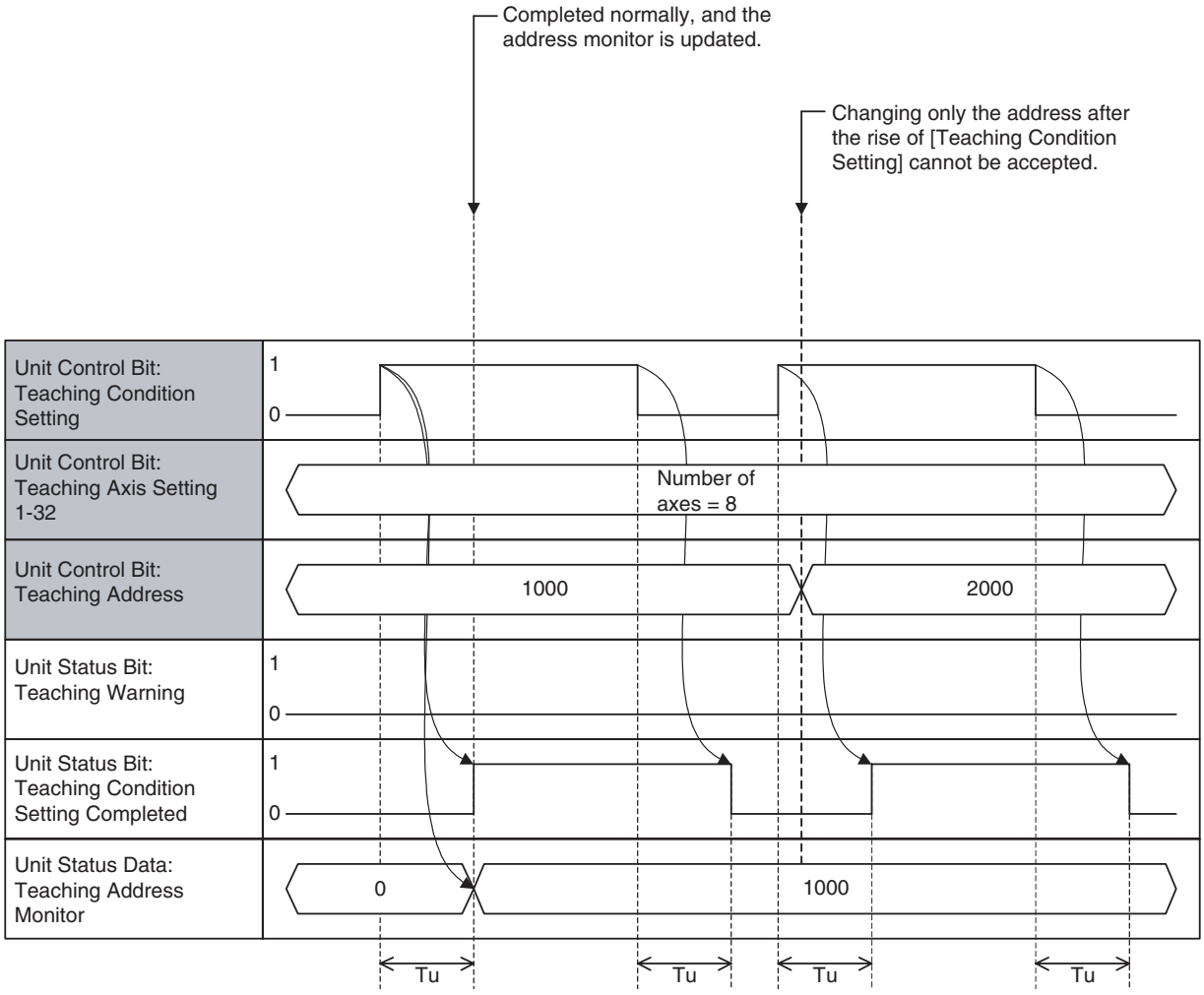
System Parameter Nil

Program Example

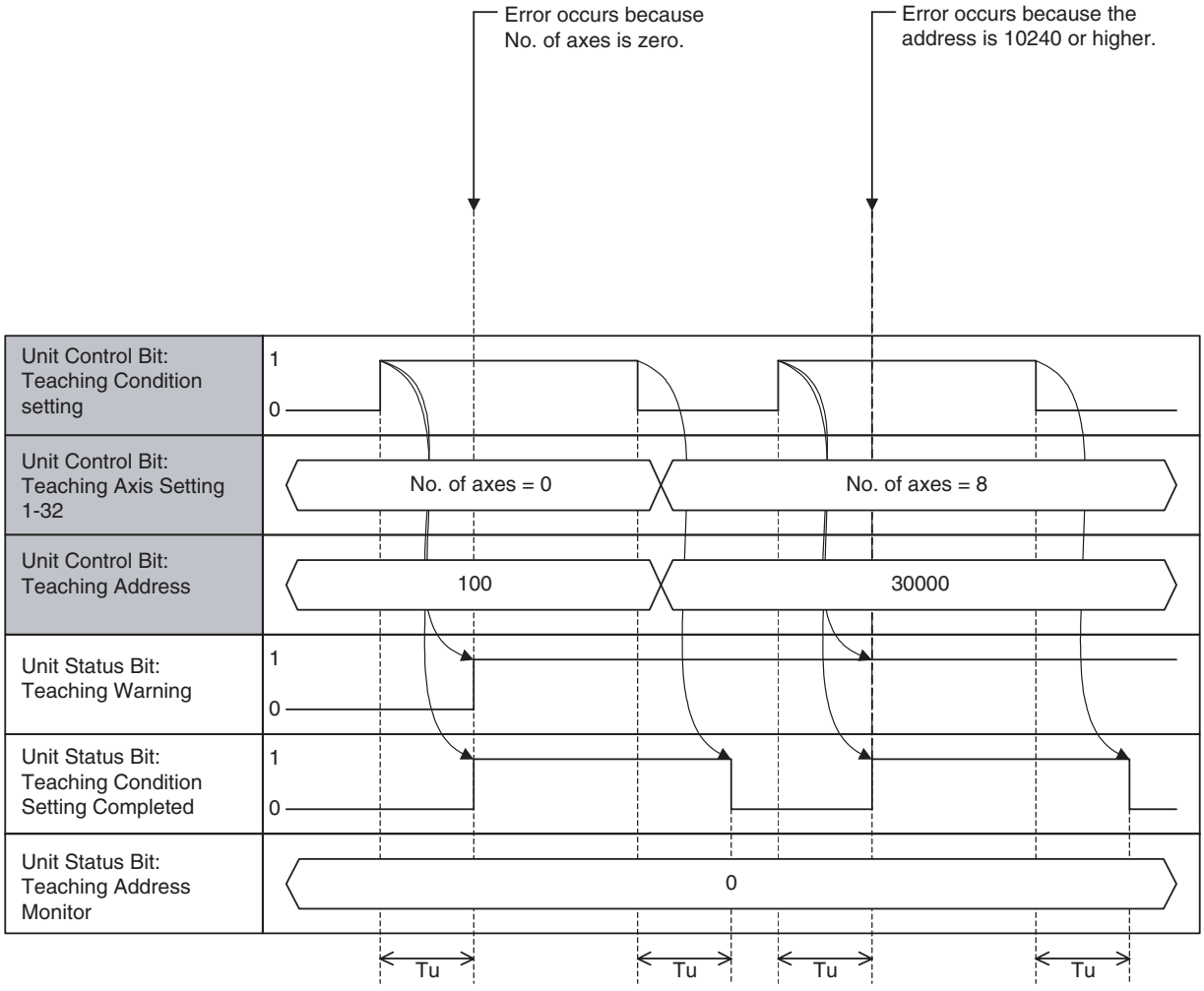


Timing Chart

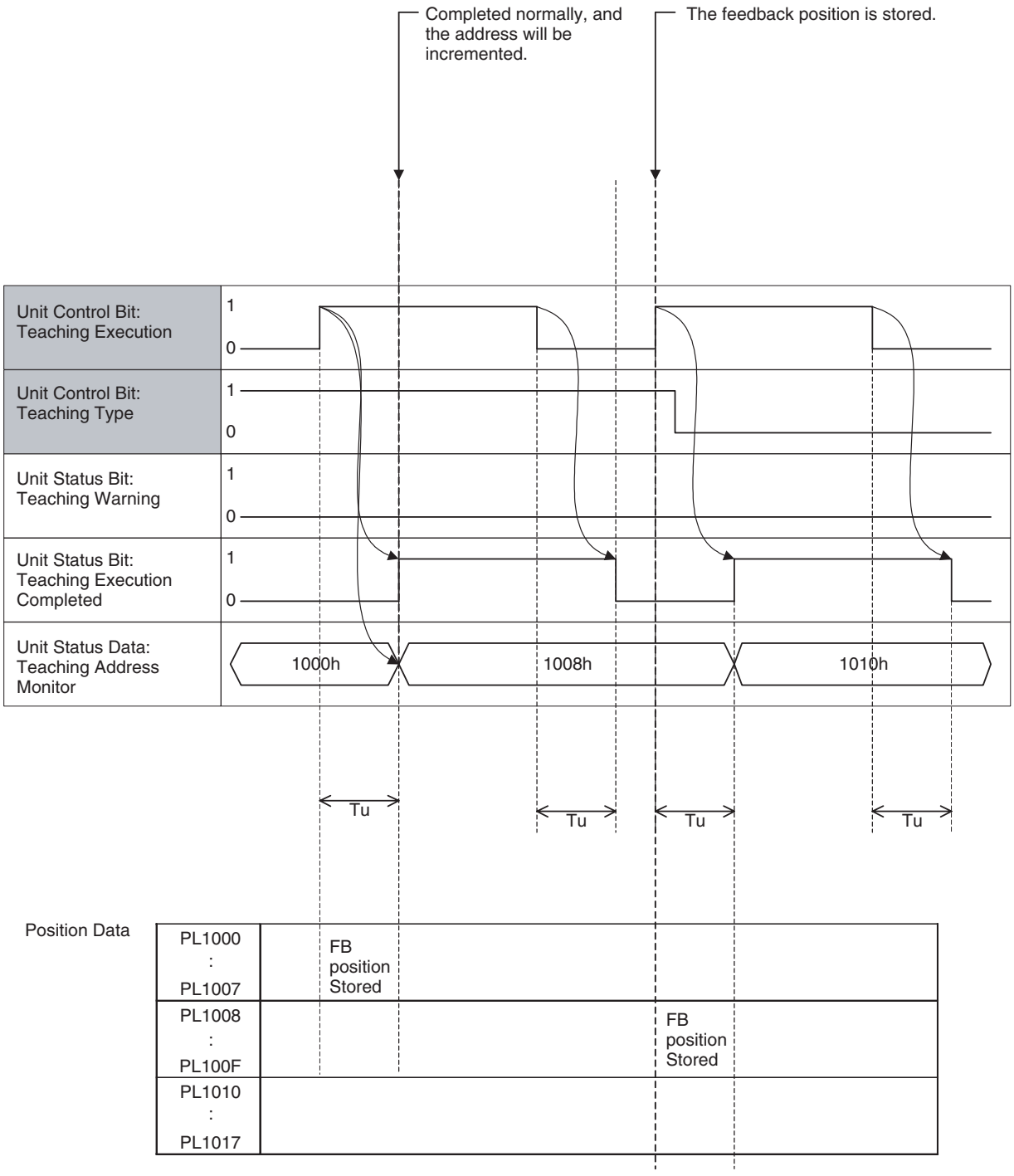
Teaching Condition Setting (Normal completion):



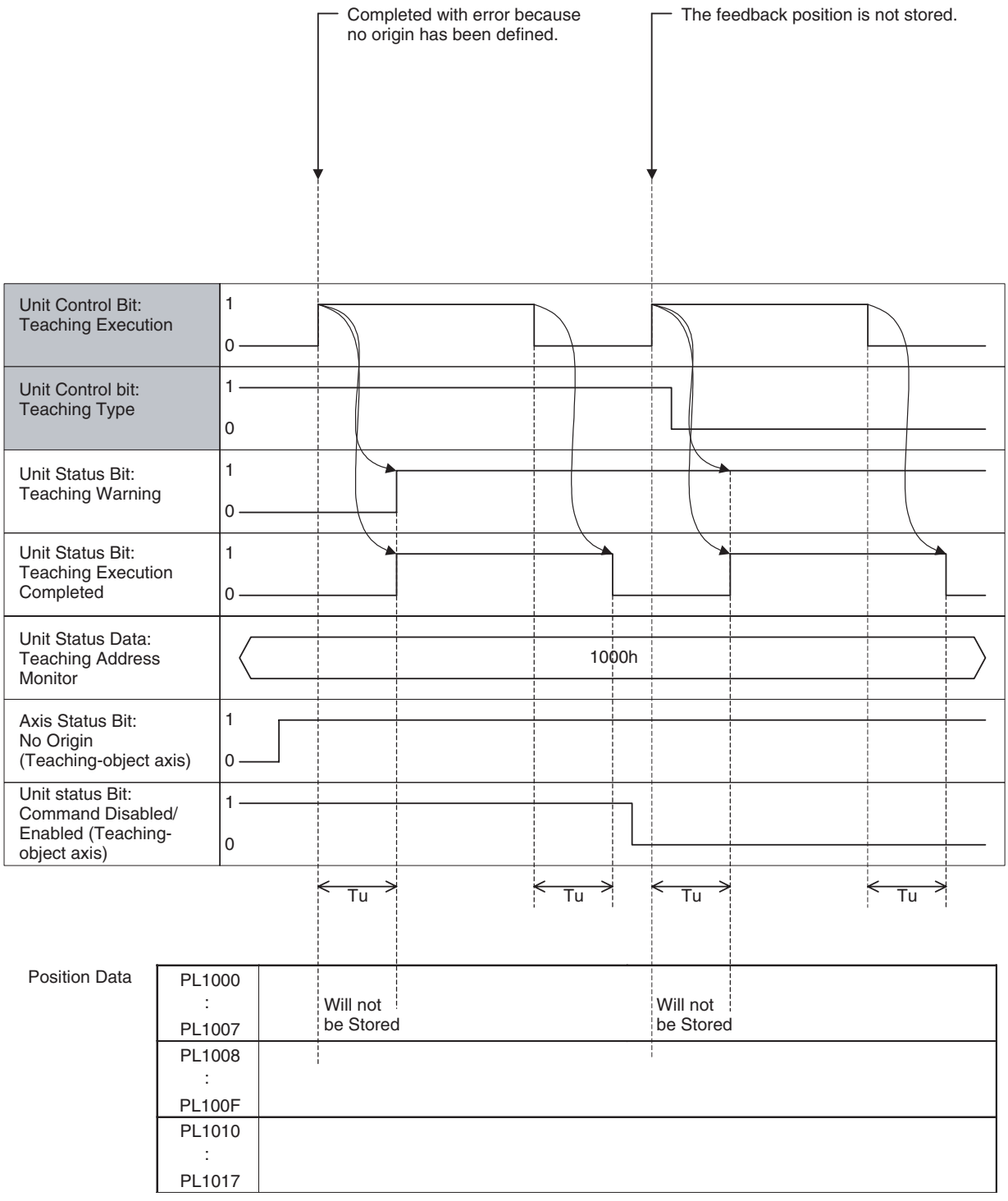
Teaching Condition Setting (Error Completion):



Teaching Execution (Normal completion):



Teaching Execution (Error completion):



Word	Variable	Bit	Name	I/O
n+0	IW0300	06	Servo Parameter Save	Output

Function

With this function, the servo parameters that have been changed using IOWR instruction in the ladder program are saved into both the Flash ROM of the MC Unit and the EEPROM of the Servo.

Command and Operation

Name	Specifications
Servo Parameter Save	0: Nil 1: Nil ↑: Saves servo parameters in the Flash ROM and EEPROM. ↓: Nil

- Servo parameters will be saved when the bit [Servo Parameter Save] is turned ON.
- Turning OFF the bit [Servo Parameter Save] after the command reception will not interrupt the processing.

Status Condition

Name	Specifications
Flash Save Completed	0: Neither parameter nor position data save is completed 1: Parameter or position data save is completed (including error completion)

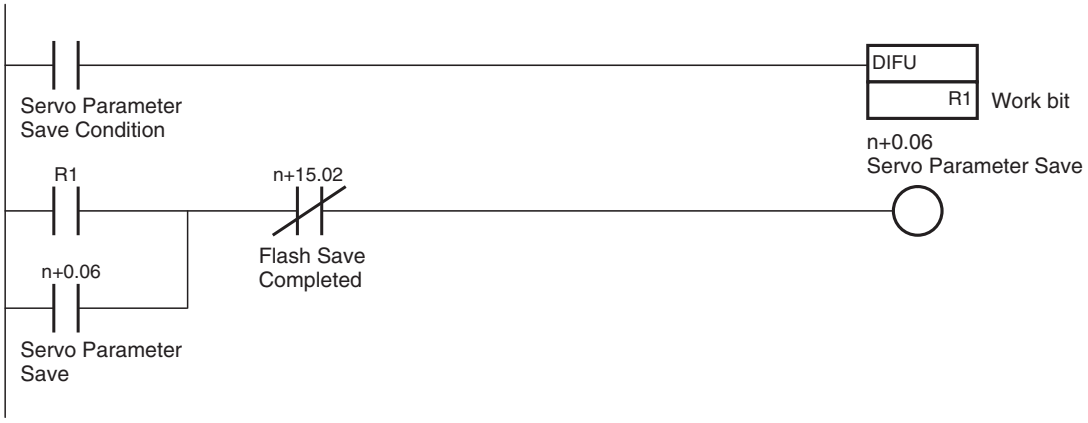
- When saving is completed (normal completion or error completion), the bit [Flash Save Completed] will turn ON.
- The same status bit is used for saving position data. Therefore, it is not recommended to save servo parameters simultaneously with position data.

Effect of Other Functions Nil

Effect on Other Functions Nil

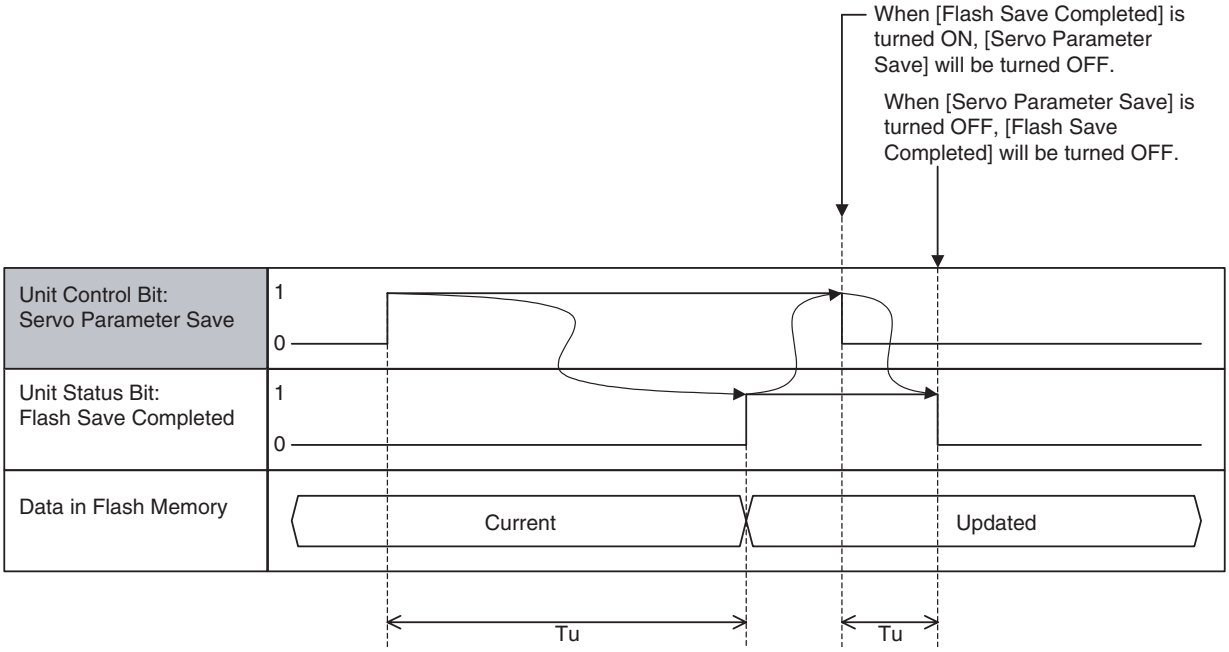
System Parameter Nil

Program Example



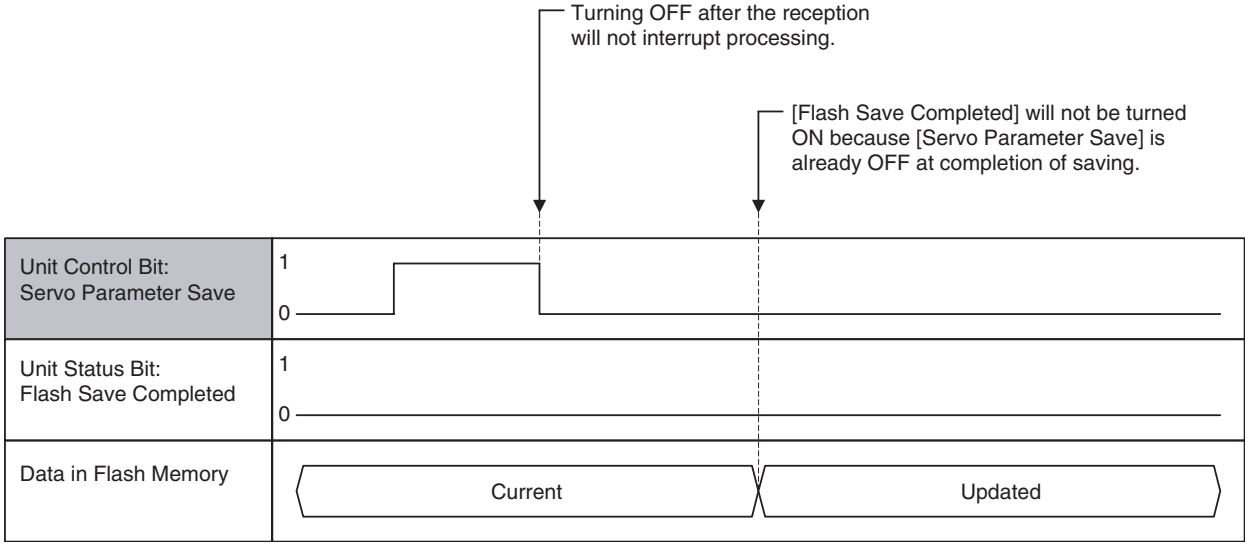
Timing Chart

Basic Operation:



The timing chart will be the same as the above even at error completions. Use the bit [Unit Alarm] to confirm normal completion or error completion. (Confirm with the alarm as it seldom happens.)

If [Servo Parameter Save] is turned OFF before completion:



Word	Variable	Bit	Name	I/O
n+0	IW0300	12-15	Present Value Monitor Select	Output

Function

- The present value of the operation data such as positions, speed, etc. unique to each axis is output as monitor data.
- Though data unique to each axis is handled, selection is made for the Unit. (Monitor data cannot be selected for each axis.)

Command and Operation

Name	Function
Present Value Monitor Select	Selects data to be output to present value monitor.
	0: Zero output Outputs 0.
	1: Feedback position (coordinate system currently being selected) Outputs feedback position on the selected coordinate system.
	2: Feedback position (machine coordinate system) Outputs feedback position on the machine coordinate system.
	3: Command position (coordinate system currently being selected) Outputs command position on the selected coordinate system.
	4: Command position (machine coordinate system) Outputs command position on the machine coordinate system.
	5: Feedback speed 1 Outputs feedback speed (command unit/min) About the precision, refer to page 90.
	6: Feedback speed 2 Outputs feedback speed (% or r/min). About the precision, refer to page 90.
	7: Command speed 1 Outputs command speed (command unit/min).
	8: Command speed 2 Outputs command speed (% or r/min).
	9: Error Outputs error.
	10: Torque Outputs Torque command value.
	11 and above: Reserved for system Outputs 0.

Status Condition

Name	Function
Present Value Monitor Status	Indicates the output status of present value monitor.
	0: Zero output
	1: Feedback position (coordinate system currently being selected)
	2: Feedback position (machine coordinate system)
	3: Command position (coordinate system currently being selected)
	4: Command position (machine coordinate system)
	5: Feedback speed 1
	6: Feedback speed 2
	7: Command speed 1
	8: Command speed 2
	9: Error
	10: Torque
	11 and above: Reserved for system.

Name	Function		
	Servo Axis	**Virtual Axis**	**I/O axis, Counter axis**
Present Value Monitor	Selects from the following 11 to output		Always zero
	0: Zero Value range: 0, Unit: Nil	←	
	1: Feedback position (selected coordinate system) Value range: –2147483648 to 2147483647, Unit: Command unit	Same value as for 3	
	2: Feedback position (machine coordinate system) Value range: –2147483648 to 2147483647, Unit: Command unit	Same value as for 4.	
	3: Command position (selected coordinate system) Value range: –2147483648 to 2147483647, Unit: Command unit	←	
	4: Command position (machine coordinate system) Value range: –2147483648 to 2147483647, Unit: Command unit	←	
	5: Feedback speed 1 Value range: –, Unit: Command unit/min	Same value as for 7.	
	6: Feedback speed 2 Value range: –, Unit: 0.01% (motor rated speed) or 0.01 r/min	Same value as for 8.	
	7: Command speed 1 Value range: –, Unit: Command unit/min	←	
	8: Command speed 2 Value range: –, Unit: 0.01% (motor rated speed) or 0.01 r/min	Always zero	
	9: Error Value range: –, Unit: pulse	Always zero	
	10: Torque Value range: –, Unit: 0.01% (In Position/Speed control: motor rated torque) 0.01%(In Torque control: motor maximum torque)	Always zero	

- Output status of [Present Value Monitor] is reflected in the bit [Present Value Monitor Status].
- The operation data such as axis position and speed is output to [Present Value Monitor].
- When [Present Value Monitor Select] is set to “0” or “11” and above, 0 will be output to [Present Value Monitor Status] and [Present Value Monitor].
- When the unit status bit [Command Disabled/Enabled] is OFF, 0 will be output to [Present Value Monitor].

Effect of Other Functions

Classification	Item	Effects
Physical Status	Servo axis	Refer to the table [Present value monitor] above.
	Virtual axis	Refer to the table [Present value monitor] above.
	I/O axis	Refer to the table [Present value monitor] above.
	Counter axis	Refer to the table [Present value monitor] above.
Control Status	In Position control	No effect
	In Speed control	No effect
	In Torque control	No effect

Classification	Item	Effects
Status Bits	Busy	No effect
	In Servo Lock	No effect
	No Origin	No effect
	Axis Operating	No effect
	Positioning Completed	No effect
	Positioning Completed (No.2)	No effect
	Axis Machine Lock Status	No effect
	Command Disabled/Enabled	When OFF: [Present Value Monitor] = 0 When ON: No effect
	Axis Not Used/Used	No effect
	In Manual/Automatic Mode	No effect

Effect on Other Functions Nil

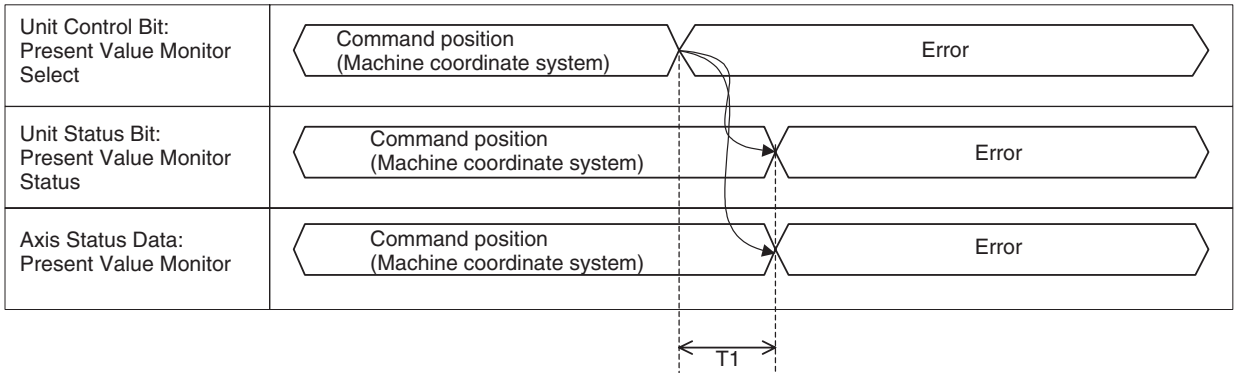
System Parameter

No.	Name	Purpose
P00004	Unit Function Select	Determining the unit for the feedback speed 2

Program Example



Timing Chart **Basic operation:**



7-4-2 Unit Status Bits

Word	Variable	Bit	Name	I/O
n+15	OW0303	00	Unit Ready	Input

Function This bit indicates the status of operation preparation in the Unit.

Status Condition

Words	bit	Name	Specifications
n+15	00	Unit Ready	0: The Unit is not ready to accept commands. 1: The Unit is ready to accept commands.

- The bit [Unit Ready] will be turned ON after the power is turned ON, the initial processing is completed, and the motion task becomes ready to receive commands.
- During normal operations, the bit [Unit Ready] will be turned OFF when an alarm that requires the system stop occurs.

Effect on Other Functions

- When the bit [Unit Ready] is OFF, all the commands from the cyclic area will be ignored.
- Whether the motion program can be actually executed or not depends on the bit [Command Disabled/Enabled] of the axis declared by PROG command.

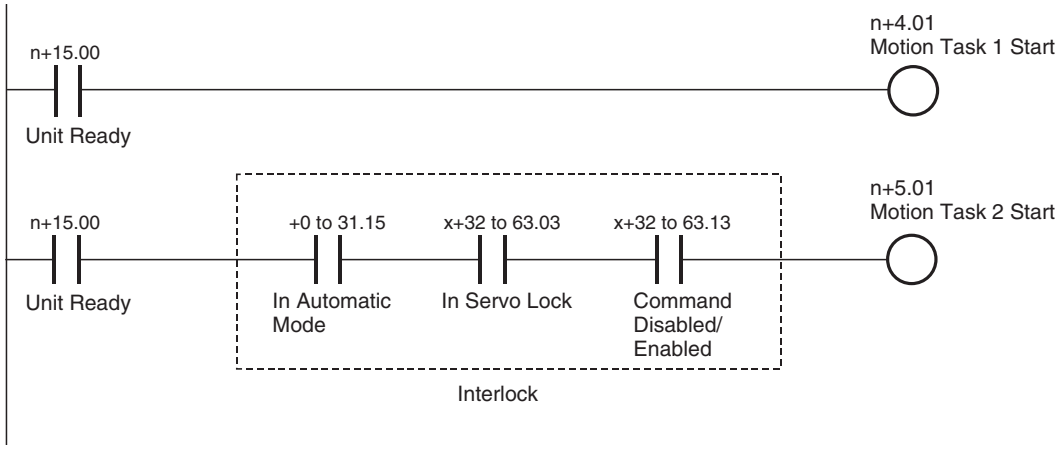
System Parameters Nil

Program Example

The MC Unit supports processing of great amounts of data and varieties of peripheral devices to realize multi-axis applications. Due to the fact, it takes the MC Unit a certain period of time (8 seconds min.) to get ready for operation.

Additionally, the MC Unit and CPU Unit establish communications asynchronously. To make the MC Unit receive instructions from PLC without fail, make sure to send instructions from the CPU Unit to the MC Unit when the bit [Unit Ready] is ON.

<Example of always using Task 1 and 2 as start tasks>



Note Programs (for arithmetic operation, etc.) that do not use axes may start motion tasks with the bit [Unit Ready], however, programs that use axes require interlock for the used axes as shown above.

Timing Chart Nil

Word	Variable	Bit	Name	I/O
n+15	OW0303	07	External Forced Stop Request	Input
		08	External Forced Stop Status	Input

Function

The bit [External Forced Stop Request] indicates the occurrence of a forced stop request from something other than the input variable. The bit [External Forced Stop Status] indicates the status of the stop caused by a forced stop request.

Status Condition

Name	Specifications
External Forced Stop Request	0: No forced stop request from something (FINS, etc.) other than input variable 1: There is a forced stop request from something (FINS, etc.) other than input variable.
External Forced Stop Status	0: No forced stop request, or processing for the stop 1: Stopped with a forced stop request

The bit [External Forced Stop Request] is turned ON on the timing starting the stop for all the slaves after receiving [Task Control Setting (axis, task stop)] successfully while it will be turned OFF when it receives [Task Control Setting (axis, task stop cancel)] successfully.

The bit [External Forced Stop Request] will be turned ON when the operating mode of the CPU Unit is switched to Program Mode. After confirming that all the axes and tasks have been stopped, the bit [External Forced Stop Request] will be turned OFF.

The bit [External Forced Stop Status] will be turned ON when processing for each stopping operation is completed after the rise of the bit [External Forced Stop Request].

Details of the above status are stored in the system variables shown below:

Address	Name	Description
SW0004	Forced stop request from tool: Details of the request	Indicates the forced stop request from tool Bit00: Axis, task stop Bit01: Axis, task stop cancel Bit06: CAM data buffer copy Bit07: Program buffer copy
SW0005	Forced stop request from tool: Object 1	Indicates the forced stop request from tool Bit00-07: 0: There is no forced stop request for Motion task 1-8 1: There is a forced stop request for Motion task 1-8 Bit08: 0/1 Reserved
SW0006 SW0007	Forced stop request from tool: Object 2	Indicates the forced stop request from tool Bit00-31: 0: There is no forced stop request for Axis 1-32 1: There is a forced stop request for Axis 1-32
SW0008	Reserved	Reserved
SW0009	Forced stop status from tool: Object 1	Indicates the forced stop status from tool Bit00-07: 0: Motion task 1-8 being executed 1: Motion task 1-8 being stopped Bit08: 0/1 Reserved
SW000A SW000B	Forced stop status from tool: Object 2	Indicates the forced stop status from tool Bit00-31: 0: Axis 1-32 being operated 1: Axis 1-32 being stopped

Effect on Other Functions While the bit [External Forced Stop Request] is ON, all the commands except for FINS commands are ignored.

System Parameter Nil

Timing Chart Nil

7-4-3 Motion Task Control Bits

Words	Variables	Bits	Name	I/O
n+4 - n+11	IW0340 - IW0347	01	Motion Program Start (Task 1) - Motion Program Start (Task 8)	Output
		02-03	Start Mode (Task 1) - Start Mode (Task 8)	

Function

Specifying a program number and starting the motion task can execute the motion program that was stored in the MC Unit.

Command and Operation

Name	Specifications
Motion Program Start	0: Nil 1: Nil ↑: Starts the motion program operation following the specified Start Mode. ↓: Nil
Start Mode	0,3: Reads program number and executes the program from top. 1: Executes the program from the block indicated by Executing Motion Block Number. Operation at resuming interrupted programs varies depending on the command used or stopping status. 2: Executes the program from the next block of the block indicated by Executing Motion Block Number.
Motion Program Number	Specifies program number to be executed in motion task. 0-499

- Motion program execution can be started or resumed by turning ON the bit [Motion Program Start].
- Turning ON the bit [Motion Program Start] when a motion program is being executed is ignored.
- If there is an interrupted program ([Executing Motion Block Number] is not 0), the bit [Start Mode] will be referenced to determine the operation at resuming when the bit [Motion Program Start] is turned ON.
- If there is no interrupted program ([Executing Motion Program Number] is 0), the bit [Start Mode] does not have any function, i.e. a program number is read to start the program from the begging.
- After a program was interrupted, if one of the following conditions is met, the bit [Start Mode] will be disabled, i.e. a program number is read to start the program from the beginning:
  The program number has been changed.
  he program has been changed, deleted, or transferred.
  The CAM data has been changed, deleted, or transferred.
  (Note that all the programs and CAM data other than the ones being executed are also the objects.)
- If the bit [Start Mode] is 0 or equivalent to 0, [Motion Program Number] will be referenced when [Motion Program Start] is turned ON.

- In [Start Mode] = 1, the operation at resuming an interrupted program varies depending on the command being executed as shown below:

Command	Operation
MOVE/MOVEL/MOVEC/ MOVEI/MOVET	See *7-2-3 Automatic Mode* (page 348).
MOVETRAV/MOVELINK/ CAMBOX (1 cycle)	When interrupted midway of a block, resumes to finish the remaining travel distance. When interrupted at the end of a block, the entire program will be executed from the beginning again.
DATUM/CAM	The entire program is executed again from the beginning regardless of whether it was interrupted midway or at the end.

Status Condition

Name	Specifications
Motion Program Operating	0: Motion task is not executing program operation. 1: Motion task is executing program operation (turned OFF after deceleration or block stop completion).
Motion Program Operation Completed	0: When program operation is started 1: END command was executed
Executing Motion Program Number	Outputs the program number of the program currently being executed with motion task or temporarily being stopped.
Executing Motion Block Number (Single execution command)	• Outputs the block number of the single execution command currently being executed with motion task, or temporarily being stopped. • During execution of parallel branching, the block number of the leftmost block is output.
Executing Motion Block Number (Multiple execution command)	• Outputs the block number of the multiple execution command currently being executed with motion task, or temporarily being stopped. • During execution of parallel branching, the block number of the leftmost block is output.

- The bit [Motion Program Operating] indicates the execution status of the motion program. It will be turned ON during program execution, and OFF when deceleration stop or block stop is completed, or when the operation is completed with END command execution.
- The bit [Motion Program Operation Completed] indicates the status of whether the program has been executed to the end or not. It will be turned ON when the operation is completed with END command execution, and it will be turned OFF when the next program operation is started.
- [Executing Program Number] indicates the program number of the program being executed. It will be updated when a new program execution is started. If program operation is interrupted or completed, the value immediately before will be held.
- [Executing Motion Block Number (Single execution command)] indicates the block number of the single execution command currently being executed. It will be updated only when a command execution is started. If program operation is interrupted or completed, the value immediately before will be held, and updated when execution of the next block is started in Pass Mode section.

Note 1-shot output may occur. In that case, depending on the Scan Time of the ladder program and the Unit Scan Time of the MC Unit, the output may not be reflected in the ladder program.

- [Executing Motion Block Number (Multiple execution command)] indicates the block number of the multiple execution command currently being executed. It will be updated only when a command execution is started. If program operation is interrupted or completed, the value immediately before will be held.

Note When several multiple execution commands are executed in one Unit Scan, regardless of the Scan Time of the ladder program or the Unit Scan Time of the MC Unit, complete execution status cannot be reflected in the ladder program.

Effect of Other Functions

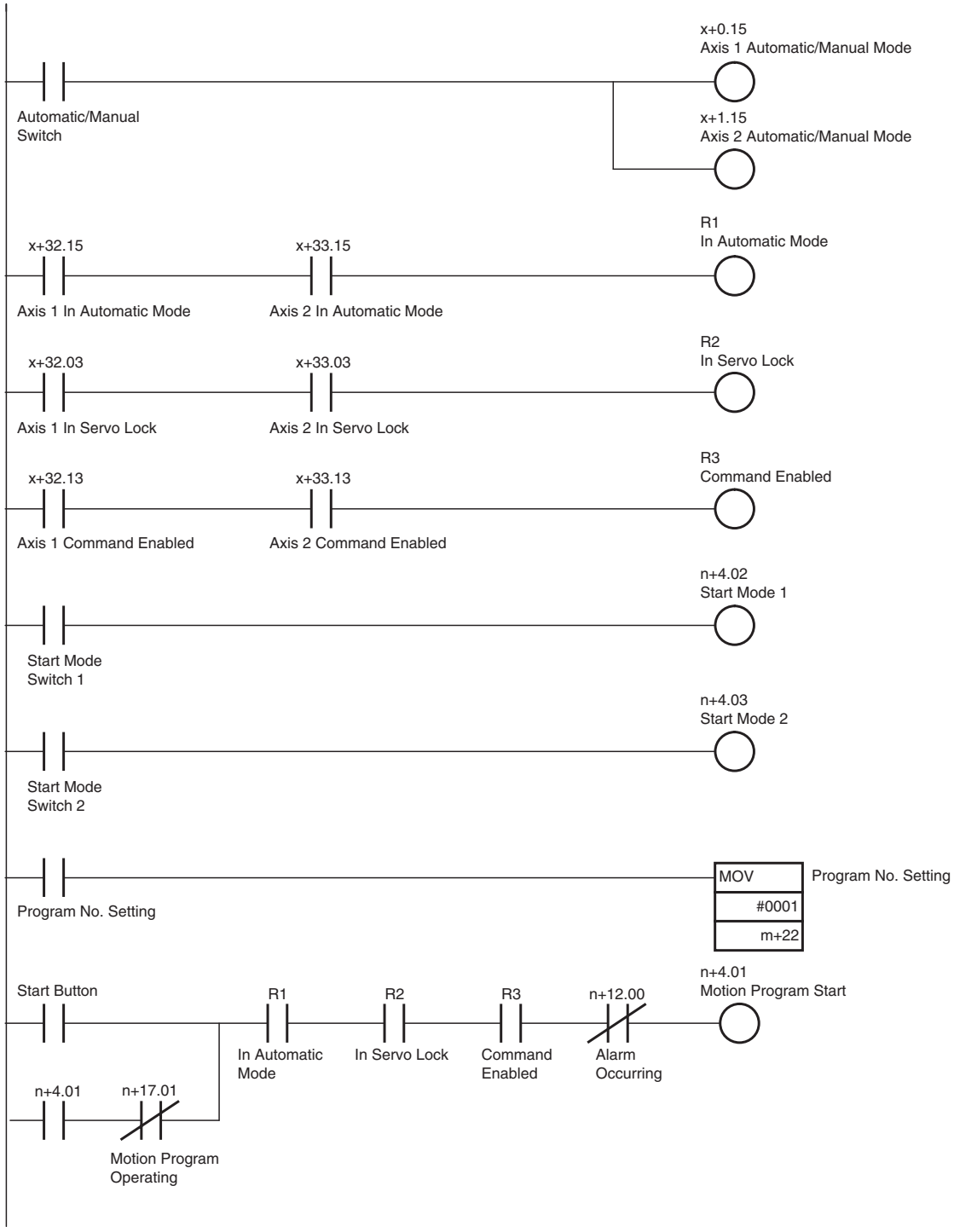
- When the bits [Deceleration Stop] and [Block Stop] are turned ON, motion program execution cannot be started by turning ON the bit [Motion Program Start].
- The axes declared with PROG command of the program to be executed are influenced as shown below. When they could not be started, the bit [Start Warning] is turned ON.

Classification	Items	Effect
Physical Status	Servo axis	No effect
	Virtual axis	No effect
	I/O axis	If declared, the alarm [201Ah: Axis declaration error] will occur.
	Counter axis	If declared, the alarm [201Ah: Axis declaration error] will occur.
Status Bits	Busy	No effect
	In Servo Lock	No effect
	No Origin	No effect
	Axis Operating	No effect
	Positioning Completed	No effect
	Positioning Completed (No.2)	No effect
	Axis Machine Lock Status	No effect
	Command Disabled/Enabled	Cannot be executed when OFF
	Axis Not Used/Used	Cannot be executed when ON
	In Manual/Automatic Mode	Cannot be executed when OFF

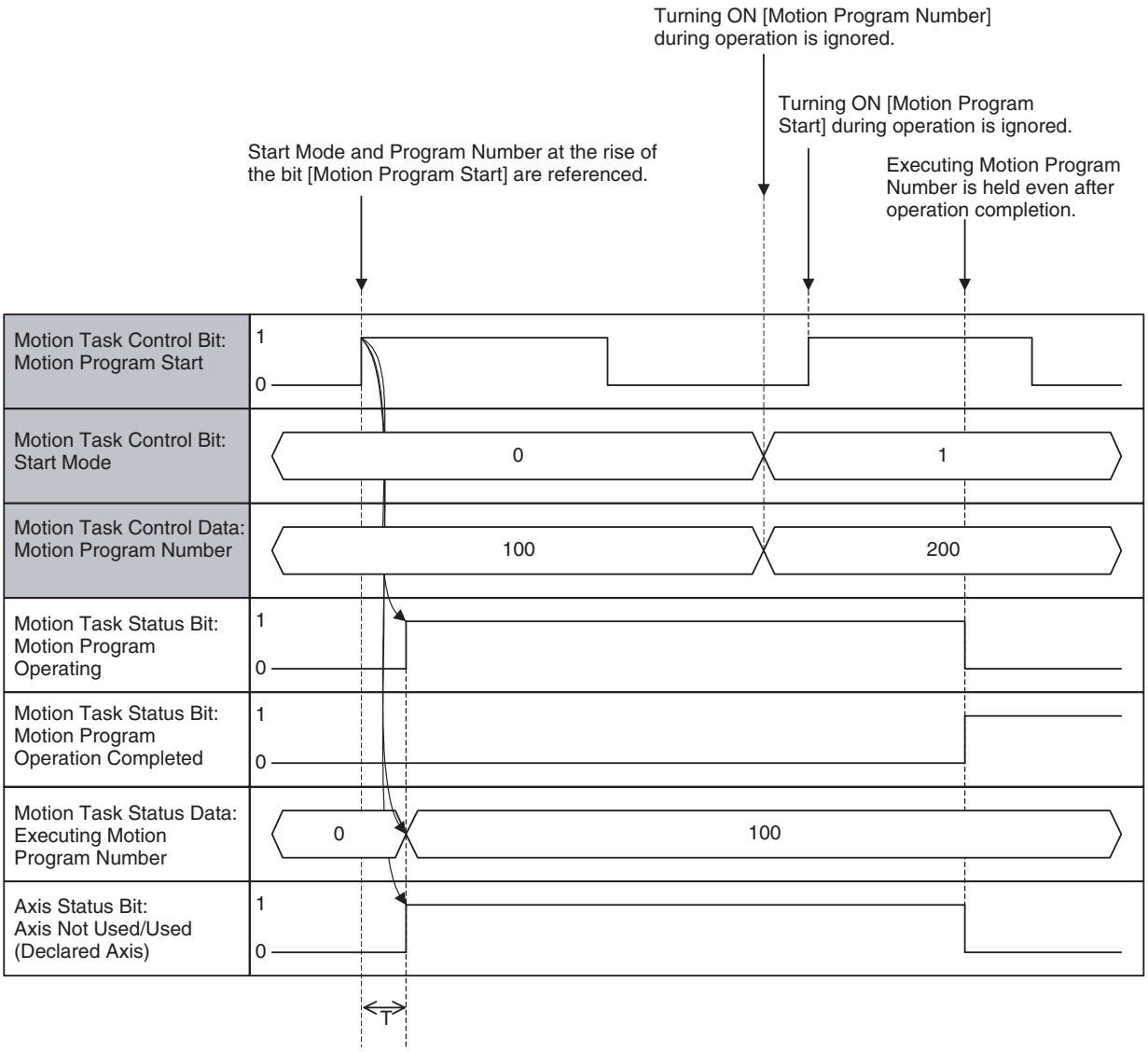
Effect on Other Function Nil

System Parameter Nil

Program Example **<Example of starting the program (program No. 1) using Axes 1 and 2 with motion task 1>**



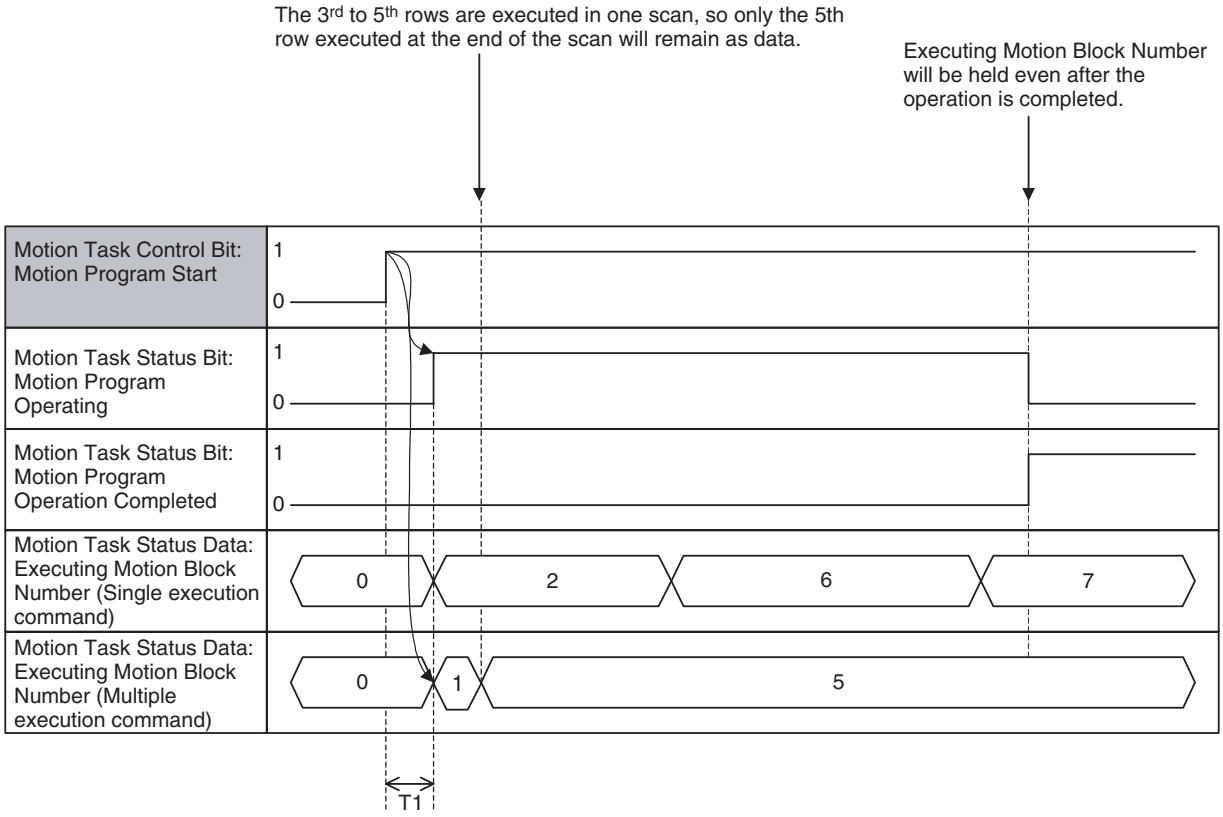
Timing Chart



Transition of Executing Motion Block Number:

Programs to be executed

Row No.	
1	PROG P100 Q00000003;
2	ABL MOVE [J01]1000 [J02]1000;
3	#MW1000 = 1000;
4	#MW1000 = 2000;
5	#MW1000 = 3000;
6	ABLMOVE [J01]#MW1000 [J02]#MW1000;
7	END;



Note This is the case where 4 commands can be executed simultaneously in 1 scan.

Word	Variable	Bit	Name	I/O
n+4 - n+11	IW0340 - IW0347	04	Deceleration Stop (Task 1) - Deceleration Stop (Task 8)	Output

Function Turn On the bit [Deceleration Stop] to stop the motion program being executed regardless of end of blocks.

Command and Operation

Name	Specifications
Motion Program Start	0: Nil 1: Nil ↑: Starts the motion program following the specified Start Mode. ↓: No
Start Mode	0,3: Reads program number and executes the program from top. 1: Executes the program from the block indicated by Executing Motion Block Number. Operation at resuming the interrupted program varies depending on the command used or stopping status. 2: Executes the program continuously from the next block of the block indicated by Executing Motion Block Number.
Deceleration Stop	0: No 1: Prohibits motion program start. ↑: Executes deceleration stop regardless of the blocks. ↓: No

- The motion program currently being executed will be stopped with deceleration regardless of the ends of blocks when the bit [Deceleration Stop] is turned ON.
- The motion program execution cannot be started when the bit [Deceleration Stop] is ON.
- Turning OFF the bit [Deceleration Stop] after turning it ON once will not interrupt the deceleration.
- Following operations will occur for commands without movement:
  - Single execution commands other than Axis movement, Axis operation start, and Axis operation end:
    The operation will not be interrupted and stop at the end of the block.
  - Multiple execution commands:
    The operation will stop at the end of the block without waiting for deceleration stop of movement command.
- If the bit [Deceleration Stop] is turned ON after axis operation start command has been executed, operations shown in the table below will occur.

Command	Operation
MOVELINK: Link Operation	Before synchronization condition is satisfied: Cancels standing by for synchronization and stops. After synchronization condition is satisfied: Cancels synchronization and executes deceleration stop.
CAMBOX: Electronic Cam, Synchronous	Before synchronization condition is satisfied: Cancels standing by for synchronization and stops. After synchronization condition is satisfied: Cancels synchronization and executes deceleration stop.
CONNECT: Electronic Shaft	Cancels synchronization and executes deceleration stop.
SYNC: Trailing Synchronization	Before synchronization condition is satisfied: Cancels standing by for synchronization and stops. After synchronization condition is satisfied: Cancels synchronization and executes deceleration stop.
ADDAX: Travel Distance Superimpose	Cancels synchronization and executes deceleration stop.

Command	Operation
SPEED: Speed Control	Decelerates to zero speed, and switches to Position Control Mode. After position loop is formed, the operation will be stopped.
TORQUE: Torque Control	Reduce torque to zero, and switches to Position Control Mode. After position loop is formed, the operation will be stopped.

The resuming operation is determined by [Start Mode]. For details, see *Start Mode* on page 404.

Status Condition

Name	Specifications
Motion Program Operating	0: Motion task is not executing program operation. 1: Motion task is executing program operation (turned OFF after deceleration or block stop is completed).
Motion program Operation Completed	0: When starting program operation 1: END command was executed.
Motion Program Number	Specifies the program number to be executed in motion task. 0-499
Executing Motion Program Number	Outputs the program number of the program currently being executed in motion task or temporarily being stopped.
Executing Motion Block Number (Single execution command)	• Outputs the block number of the single execution command currently being executed with motion task, or temporarily being stopped. • During execution of parallel branching, the block number of the leftmost block is output.
Executing Motion Block Number (Multiple execution command)	• Outputs the block number of the multiple execution command currently being executed with motion task, or temporarily being stopped. • During execution of parallel branching, the block number of the leftmost block is output.

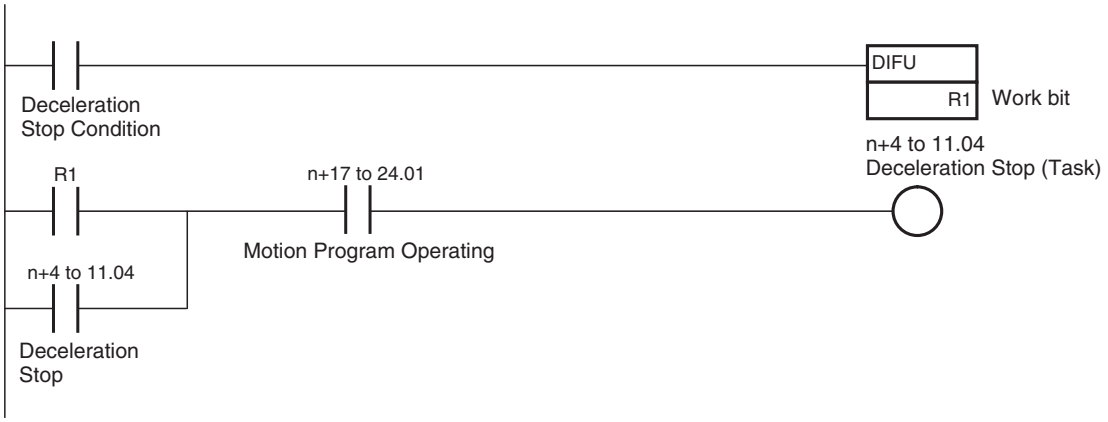
For details, see *Motion Program Start* and *Start Mode* on page 404.

Effect of Other Functions Nil

Effect on Other Functions When the bit [Deceleration Stop] is turned ON, turning ON the bit [Motion Program Start] will not start the motion program execution.

System Parameter Nil

Program Example



Timing Chart

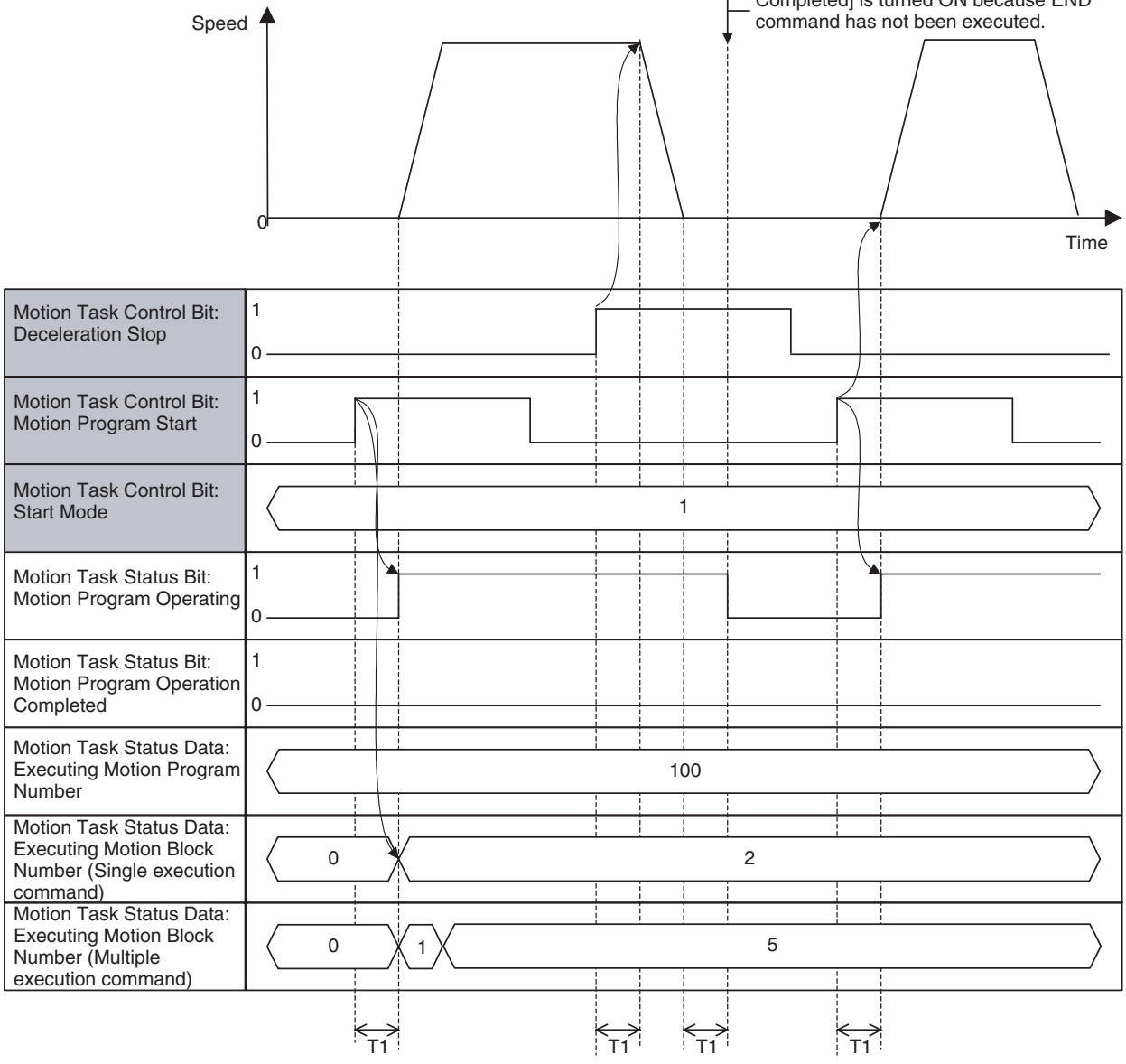
Programs to be executed

Row No.	
1	PROG P100 Q00000003;
2	ABL MOVEL [J01]1000 [J02]1000;
3	#MW1000 = 1000;
4	#MW1000 = 2000;
5	#MW1000 = 3000;
6	ABL MOVEL [J01]#MW1000 [J02]#MW1000;
7	END;

The bit [Deceleration Stop] is turned ON during execution of this block.

After deceleration stop is completed, Executing Motion Program Number and Executing Motion Block Number will be held.

The bit [Motion Program Operation Completed] is turned ON because END command has not been executed.

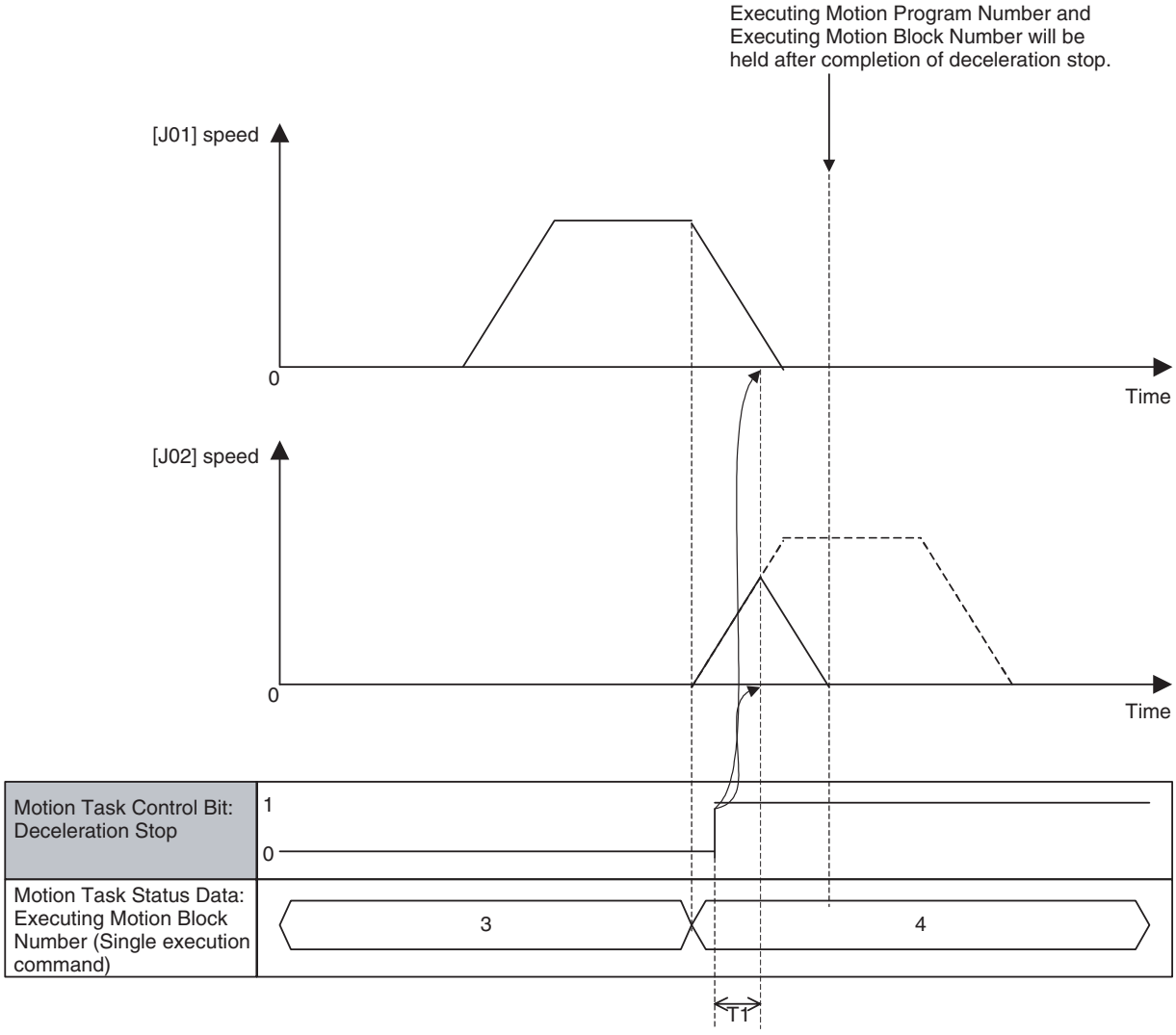


Stop in Pass Mode:

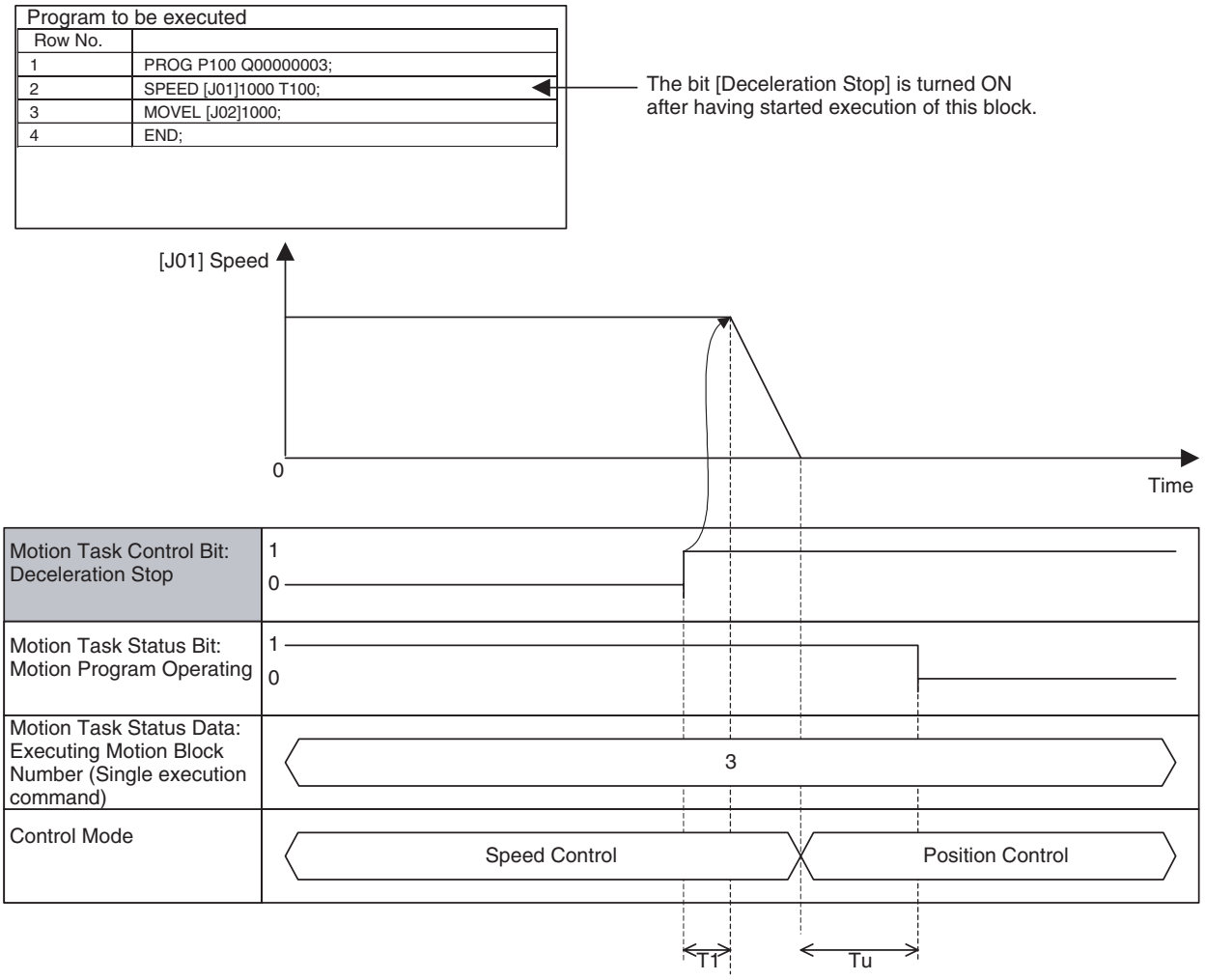
Programs to be executed

Row No.	
1	PROG P100 Q00000003;
2	PASSMODE;
3	MOVEL [J01]1000;
4	MOVEL [J02]1000;
5	END;

The bit [Deceleration Stop] is turned ON after having stated the execution of this block.



Stop in Speed or Torque Control:



Word	Variable	Bit	Name	I/O
n+4 - n+11	IW0340 - IW0347	05	Block Stop (Task 1) - Block Stop (Task 8)	Output

Function

With this function, the motion program is stopped at the end of the block currently being executed.

Command and Operation

Name	Specifications
Motion Program Start	0: Nil 1: Nil ↑: Starts motion program operation following the specified Start Mode. ↓: No

Name	Specifications
Start Mode	0,3: Reads program number and executes the program from top. 1: Executes the program from the block indicated by Executing Motion Block Number. Operation at resuming interrupted programs varies depending on the command used or stopping status. 2: Executes the program from the next block of the block indicated by Executing Motion Block Number.
Block Stop	0: Nil 1: Prohibits motion program start. ↑: Executes deceleration stop at the end of the block currently being executed. ↓: Nil

- The motion program currently being executed is stopped at the end of the block by turning ON the bit [Block Stop].
- Motion program execution cannot be started while the bit [Block Stop] is ON.
- Turning OFF the bit [Deceleration Stop] after it has been turned ON will not interrupt the block stop operation.
- When the bit [Block Stop] is turned ON after an axis operation start command has been executed, operations described in the table below will occur:

Command	Operation
MOVELINK: Link Operation	Before synchronization condition is satisfied: Cancels standing by for synchronization and stops. After synchronization condition is satisfied: Cancels synchronization and executes deceleration stop.
CAMBOX: Electronic Cam, Synchronous	Before synchronization condition is satisfied: Cancels standing by for synchronization and stops. After synchronization condition is satisfied: Cancels synchronization and executes deceleration stop.
CONNECT: Electronic Shaft	Cancels synchronization and executes deceleration stop.
SYNC: Trailing Synchronization	Before synchronization condition is satisfied: Cancels standing by for synchronization and stops. After synchronization condition is satisfied: Cancels synchronization and executes deceleration stop.
ADDAX: Travel Distance Superimpose	Cancels synchronization and executes deceleration stop.
SPEED: Speed Control	Decelerates to zero speed, and switches to Position Control Mode. After position loop is formed, the operation will be stopped.
TORQUE: Torque Control	Reduce torque to zero, and switches to Position Control Mode. After position loop is formed, the operation will be stopped.

Status Condition

Name	Specifications
Motion Program Operating	0: Motion task is not executing program operation. 1: Motion task is executing program operation (turned OFF after completion of deceleration or block stop)
Motion Program Operation Completed	0: When starting program operation 1: END command was executed.
In Block Stop	0: Not in Block Stop 1: In Block Stop
Motion Program Number	Specifies program number to be executed in motion task. 0-499
Executing Motion Program Number	Outputs the program number of the program currently being executed in motion task or temporarily being stopped.
Executing Motion Block Number (Single execution command)	• Outputs the block number of the single execution command currently being executed with motion task, or temporarily being stopped. • During execution of parallel branching, the block number of the leftmost block is output.
Executing Motion Block Number (Multiple execution command)	• Outputs the block number of the multiple execution command currently being executed with motion task, or temporarily being stopped. • During execution of parallel branching, the block number of the leftmost block is output.

For details, see *Motion Program Start* and *Start Mode* on page 404.

Effect of Other Functions

Block Stop is executed even for blocks with [NSTOP command: Single block ignored] specification (stopping is prioritized).

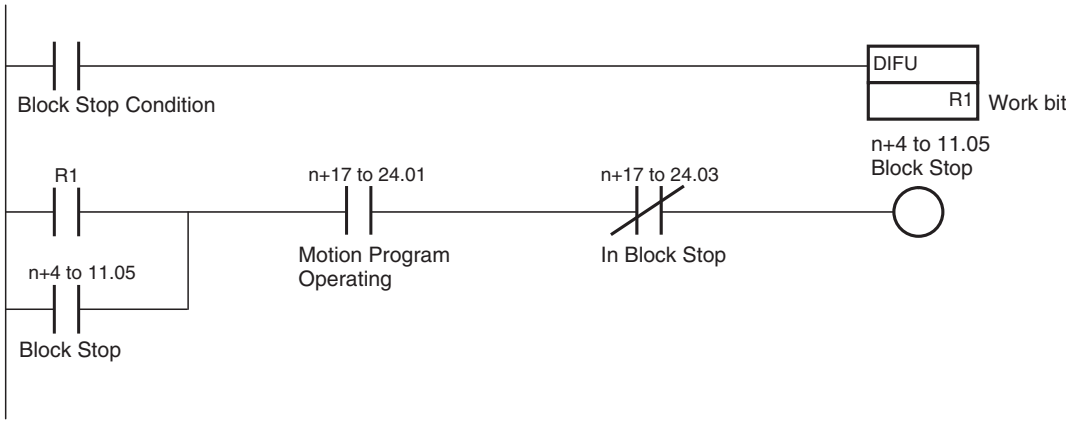
Effect on Other Functions

Turning ON the bit [Motion Program Start] will not start motion program execution while the bit [Block Stop] is turned ON.

System Parameter

Nil

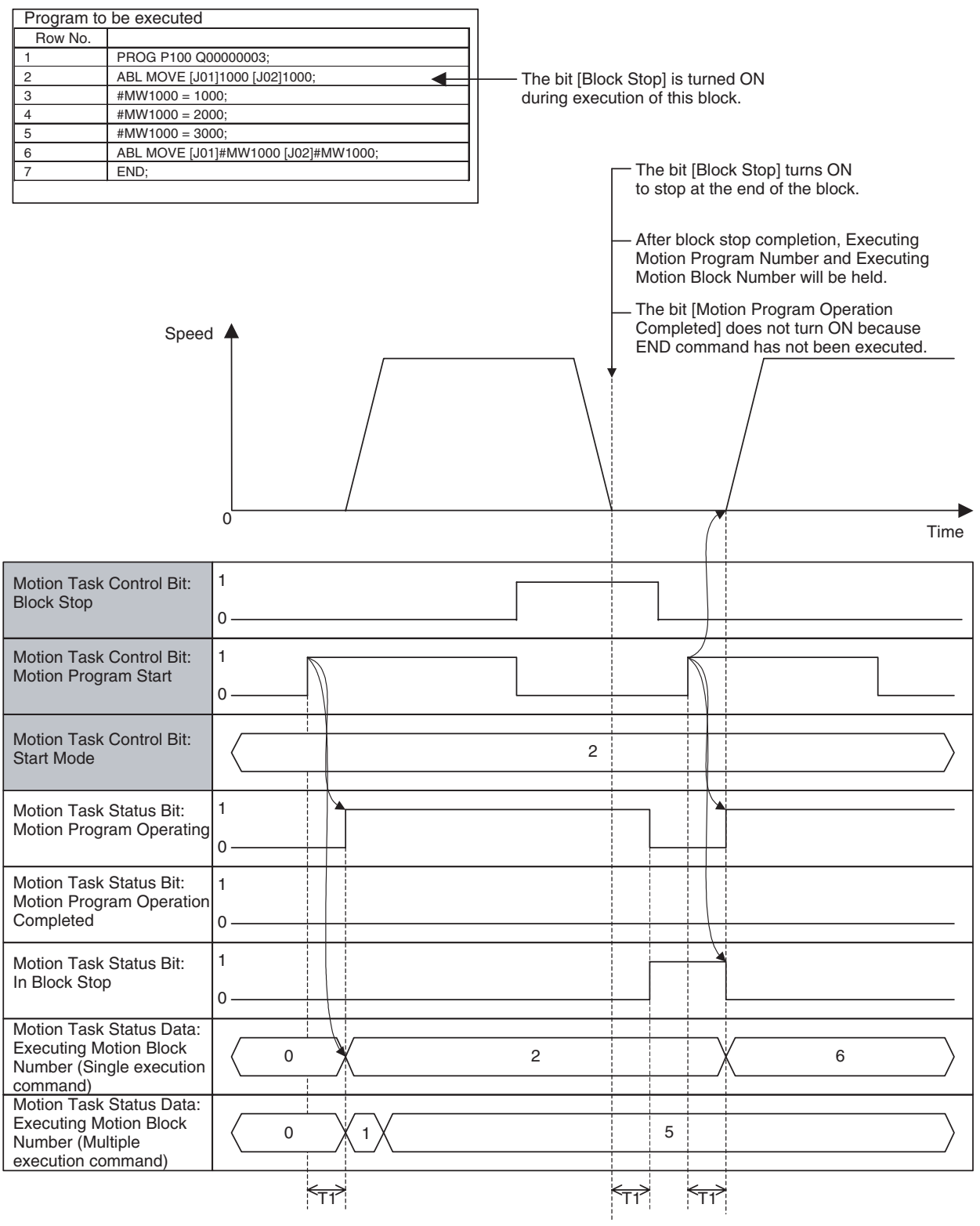
Program Example



Timing Chart **Basic Operation:**

Program to be executed

Row No.	
1	PROG P100 Q00000003;
2	ABL MOVE [J01]1000 [J02]1000;
3	#MW1000 = 1000;
4	#MW1000 = 2000;
5	#MW1000 = 3000;
6	ABL MOVE [J01]#MW1000 [J02]#MW1000;
7	END;

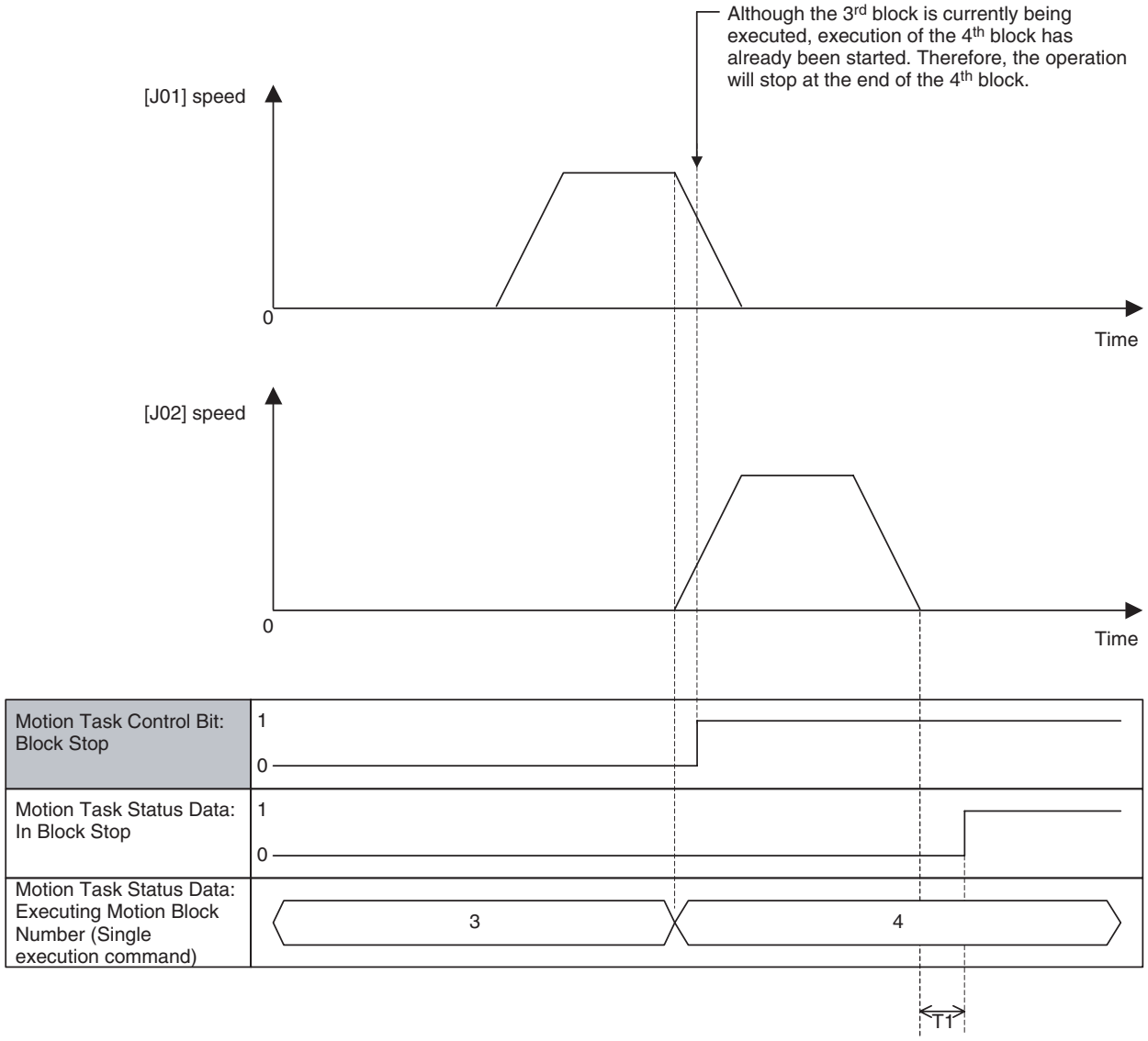


Stop in Pass Mode:

Program to be executed

Row No.	
1	PROG P100 Q00000003;
2	PASSMODE;
3	MOVEL [J01]1000;
4	MOVEL [J02]1000;
5	END;

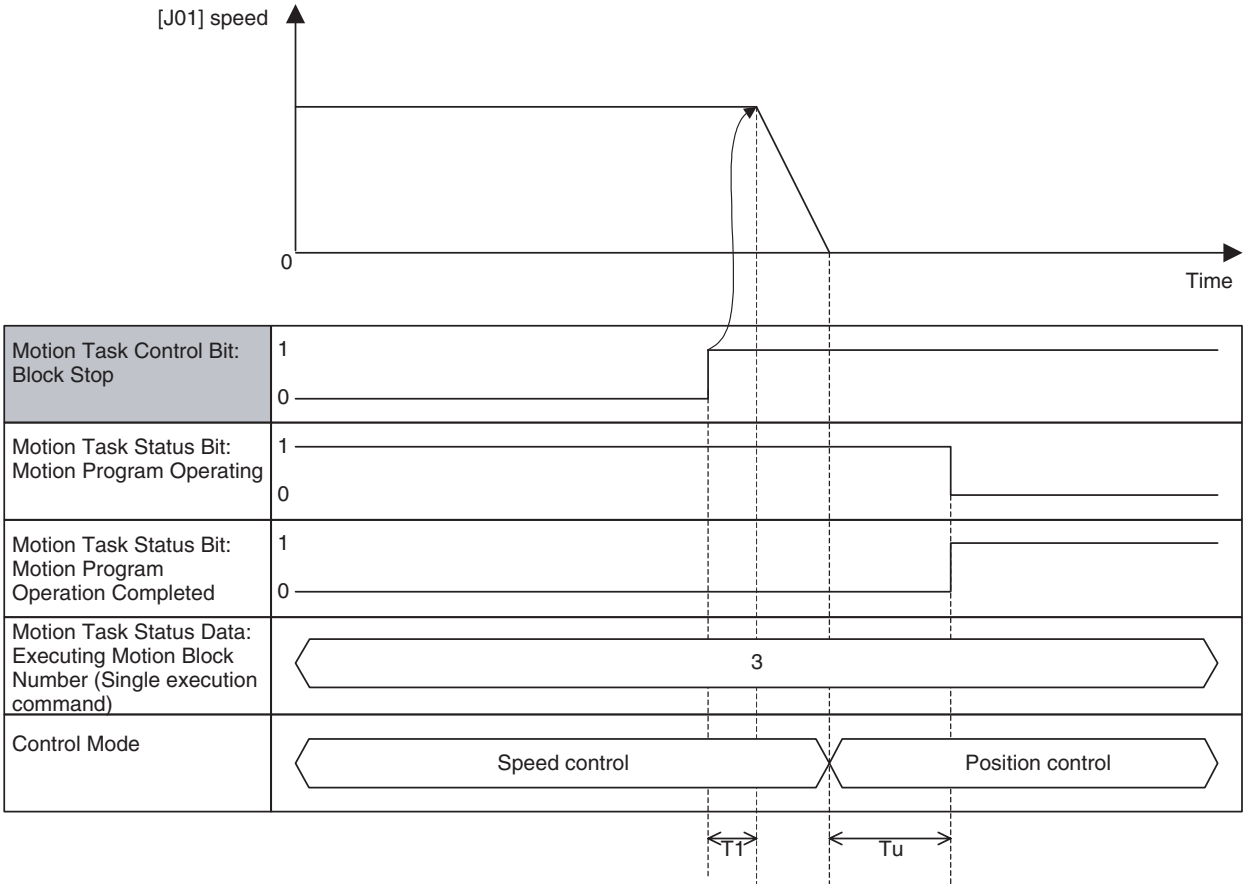
The bit [Block Stop] is turned ON after starting execution of this block.



Stop in Speed or Torque control mode:

Program to be executed	
Row No.	
1	PROG P100 Q00000003;
2	SPEED [J01]1000 T100;
3	MOVEL [J02]1000;
4	END;

The bit [Deceleration Stop] is turned ON after starting execution of this block.



Word	Variable	Bit	Name	I/O
n+4 - n+11	IW0340 - IW0347	06	Single Block Operation Mode (Task 1) - Single Block Operation Mode (Task 8)	Output

Function

- Single block operation mode is used for debugging purpose, etc. to execute the motion program block by block.
- [Block Stop] and [Single Block Operation Mode] are similar from the viewpoint that the operation is stopped at the end of the block, however, following differences can be observed between them:

Item	Block Stop	Single Block Operation
Purpose	Used to stop the motion program.	Used to debug the motion program.
Influence when starting execution	Motion program execution cannot be started while the bit [Block Stop] is ON.	Motion program execution can be started while the bit [Single Block Operation Mode] is ON.
Detection	Edge detection	Level detection
NSTOP command	Operation stops not being affected by NSTOP.	Operation does not stop being affected by NSTOP.

Command and Operation

Name	Specifications
Motion Program Start	0: Nil 1: Nil ↑: Starts motion program operation following the specified Start Mode ↓: No
Start Mode	0,3: Reads program number and executes the program from top. 1: Executes the program from the block indicated by Executing Motion Block Number. Operation at resuming interrupted programs varies depending on the command used or stopping status. 2: Executes the program continuously from the next block of the block indicated by Executing Motion Block Number.
Single Block Operation Mode	0: Single Block Operation Mode OFF 1: Single Block Operation Mode ON ↑: Nil ↓: Nil

- If motion program execution is started while the bit [Single Block Operation Mode] is ON, only one block will be executed and the operation will be stopped with Block Stop.
- If [Single Block Operation Mode] is turned ON during motion program operation, the same operation as for that of [Block Stop] will occur.
- Different from the bit [Block Stop], the motion program can be executed even when the bit [Single Block Operation Mode] is ON.
- Different from the bit [Block Stop], the bit [Single Block Operation Mode] is checked only at the end of the block. Therefore, the operation will not stop at the end of the block if the bit is turned OFF before program execution reaches the end of the block.
- Turn on the bit [Motion Program Start] to resume the motion program in Block Stop state.
- When the bit [Motion Program Start] is turned ON, the bit [Start Mode] will be checked. The relations between actual debugging operation and Start Mode are described below:

Debugging Operation	Start Mode
To proceed to the next block	Start Mode = 2
To start over from the top	Start Mode = 0, 3
To execute the same block that has just been executed again	Start Mode = 1

Status Condition

Name	Specifications
Motion Program Operating	0: Motion task is not executing program operation. 1: Motion task is executing program operation (turned OFF after completion of deceleration or block stop)
Motion Program Operation Completed	0: When starting program operation 1: END command was executed.
In Block Stop	0: Not in Block Stop 1: In Block Stop
Motion Program Number	Specifies program number to be executed in motion task. 0-499

Name	Specifications
Executing Motion Program Number	Outputs the program number of the program currently being executed in motion task or temporarily being stopped.
Executing Motion Block Number (Single execution command)	• Outputs the block number of the single execution command currently being executed with motion task, or temporarily being stopped. • During execution of parallel branching, the block number of the leftmost block is output.
Executed Motion Block Number (Multiple execution command)	• Outputs the block number of the multiple execution command currently being executed with motion task, or temporarily being stopped. • During execution of parallel branching, the block number of the leftmost block is output.

For details, see *Motion Program Start* and *Start Mode* on page 404.

Effect of Other Functions Operation does not stop at the end of the block with [NSTOP command: Single block ignored] specification.

Effect on Other Functions Nil

System Parameter Nil

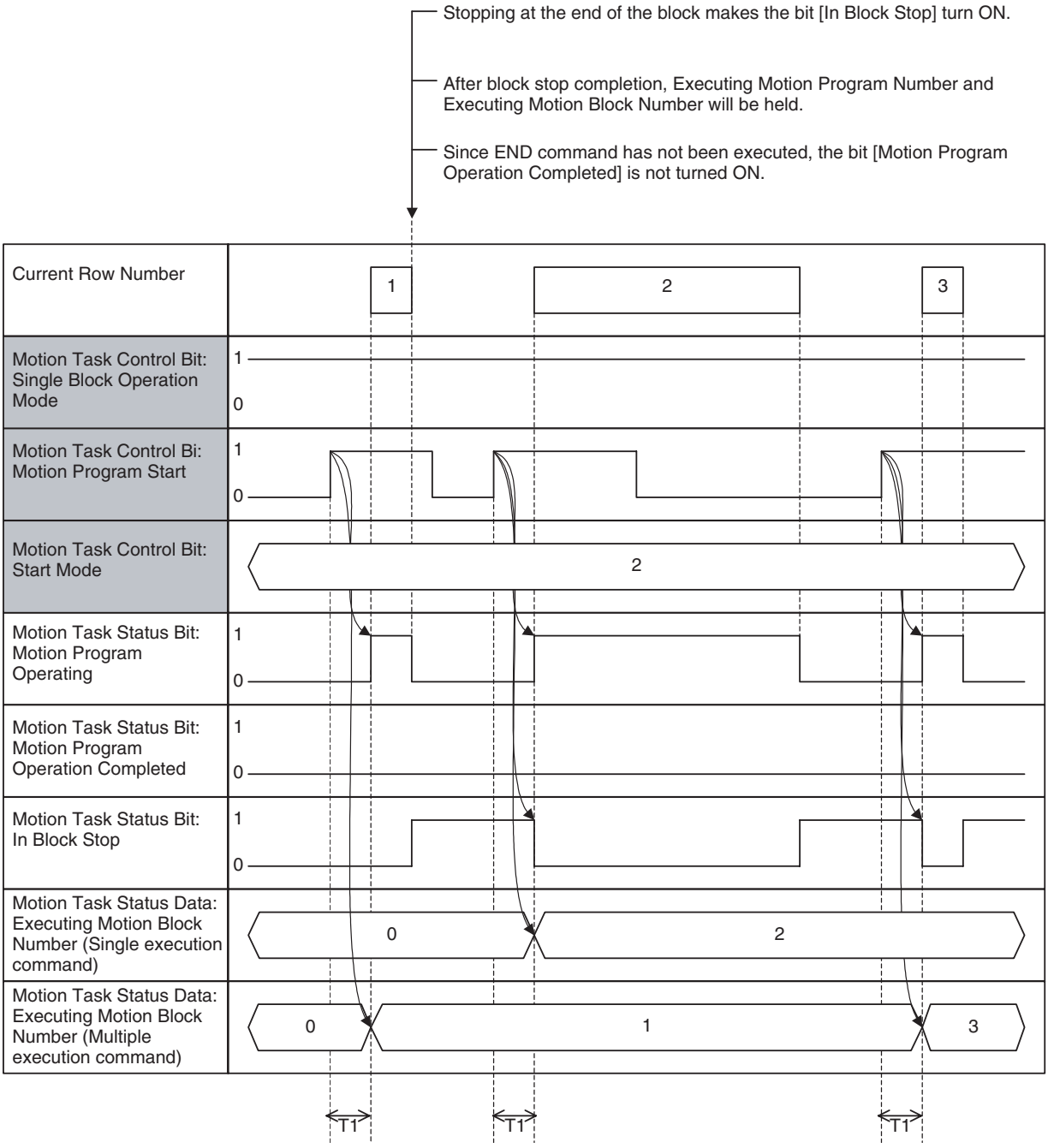
Program Example



Timing Chart **Basic Operation:**

Program to be executed

Row No.	
1	PROG P100 Q00000003;
2	ABL MOVE [J01]1000 [J02]1000;
3	#MW1000 = 1000;
4	#MW1000 = 2000;
5	#MW1000 = 3000;
6	ABL MOVE [J01]#MW1000 [J02]#MW1000;
7	END;



Word	Variable	Bit	Name	I/O
n+4 - n+11	IW0340 - IW0347	07	Task Override Enable (Task 1) - Task Override Enable (Task 8)	Output

Function

- Override is the function to change the feed rate specified in the motion program or parameter to the user-specified speed with % specification.
- There are two types of override functions, [Task Override] and [Axis Override]. One of them is used in motion program execution depending on the speed.
- The task override can be applied to the speed specified by operand F in the motion program.

The relations between each command and override are shown in the table below:

Classification	Function/Name	Command	Override	Remark
Axis Movement	Positioning	MOVE	Axis Override	
	Linear Interpolation	MOVEL	Task Override	
	Circular Interpolation	MOVEC	Task Override	
	Origin Search	DATUM	Axis Override	Applicable only for origin search feed rate
	Interrupt Feeding	MOVEI	Axis Override	
	Time-specified Positioning	MOVET	Axis Override	Specified time period will not be kept.
	Traverse	MOVETRAV	Task Override	
	Electronic Cam, Single Axis	CAM	Disable	
Axis Operation	Link Operation	MOVELINK	Disable	
	Electronic Cam, Synchronous	CAMBOX	Disable	
	Electronic Shaft	CONNECT	Disable	
	Trailing Synchronization	SYNC	Disable	
	Travel Distance Superimpose	ADDAX	Disable	
	Speed Control	SPEED	Disable	
	Torque Control	TORQUE	Disable	
Axis Operation Cancel	Trailing Synchronous Cancel	SYNCR	Disable	
	Travel Distance Superimpose Cancel	ADDAXR	Disable	
	Speed Control Cancel	SPEEDR	Disable	
	Torque Control Cancel	TORQUER	Disable	

Command and Operation

Name	Specifications
Task Override Enable	0: Disables axis override value (override 100% is used.) 1: Enables axis override value ↑: Nil ↓: Nil
Task Override	0 to 32767 [0.01%] 0.00% if value out of range is input.

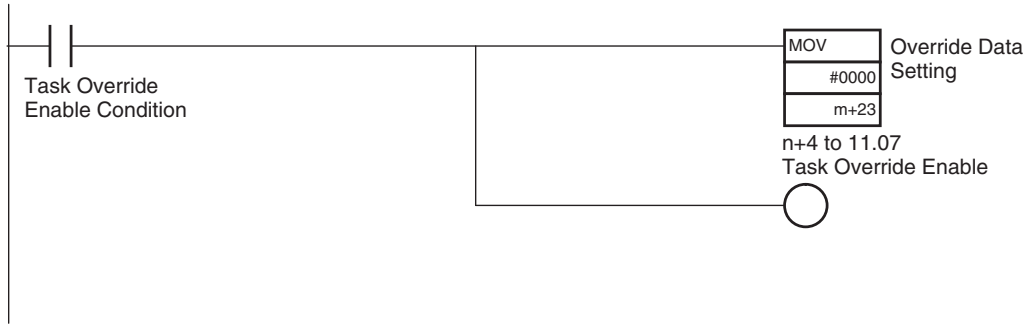
- The value in [Task Override] is enabled only while the bit [Task Override Enable] is turned ON. When the bit is OFF, override 100.00% is used.
- The bit [Task Override Enable] and data [Task Override] are always referenced.

Status Condition Nil

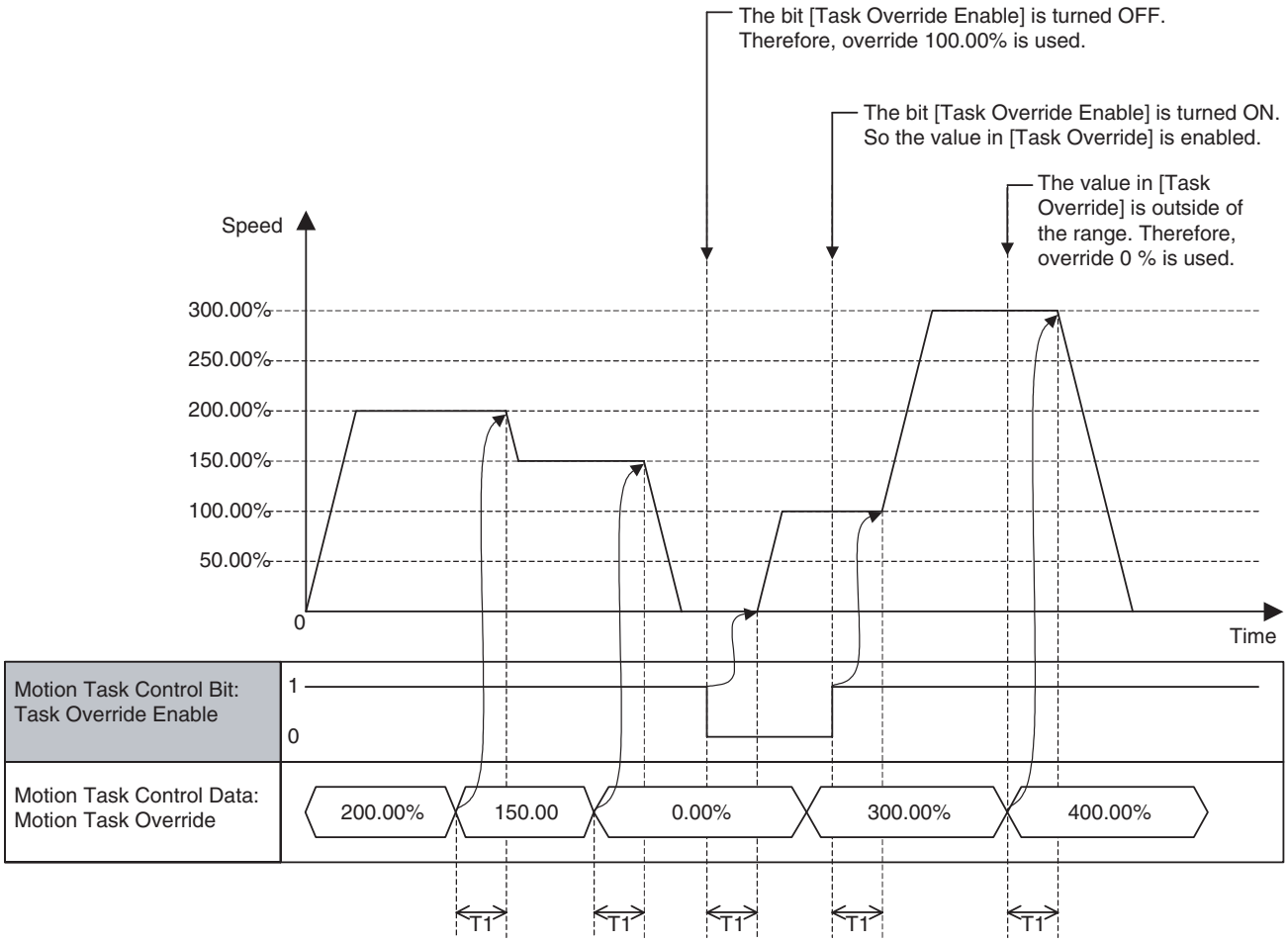
Effect of Other Functions Nil

Effect on Other Functions Speed of the functions with axis movement is affected.

Program Example



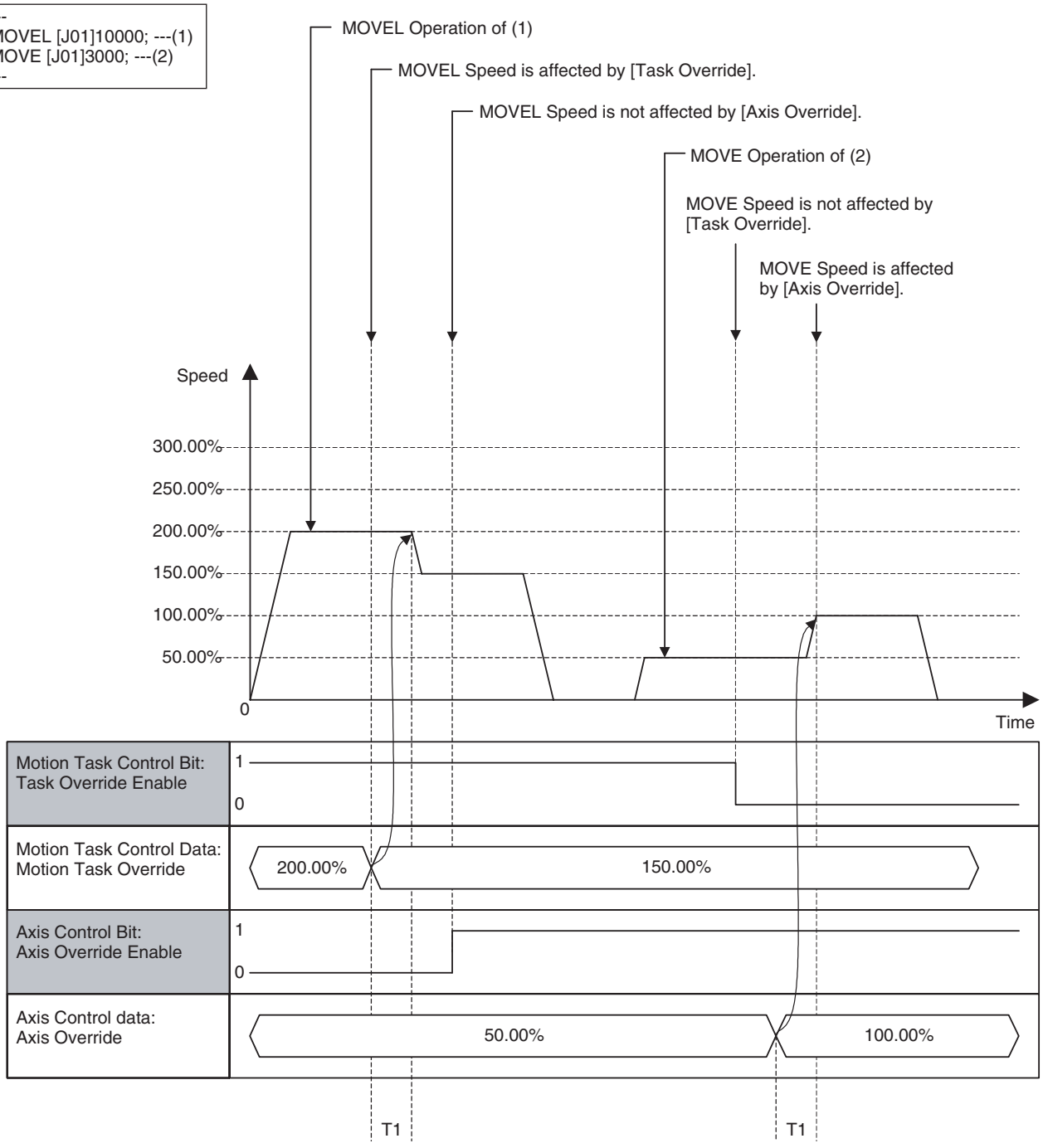
Timing Chart **Basic Operation:**



Relation between Task Override and Axis Override:

Program Example

```
---
MOVEL [J01]10000; ---(1)
MOVE [J01]3000; ---(2)
---
```



Word	Variable	Bit	Name	I/O
n+4 - n+11	IW0340 - IW0347	00	Motion Task Alarm Reset (Task1) - Motion Task Alarm Reset (Task8)	Output

Function

When an error that requires stopping operation occurs in the MC Unit, it is detected as an alarm.

Removing the cause and executing alarm reset can clear the alarms that occurred, except for some alarms.

Command and Operation

Name	Specifications
Motion Task Alarm Reset	0: Nil 1: Does not turn ON the bit [Motion Task Alarm]. ↑: Clears the alarm occurring in motion task. ↓: Nil

Turning ON the bit [Motion Task Alarm Reset] can reset alarms on the motion task level.

Status Condition

Name	Specifications
Alarm Occurring	0: No alarm 1: Alarm occurring in MC Unit (linked to ERC indicator)
Motion Task Alarm Occurring 1-8	0: No alarm occurring in motion task. 1: Alarm occurring in motion task.
Motion Task Alarm	0: No alarm in motion task, or on the axis level. Otherwise, the bit [Motion Task Alarm Reset] is ON. 1: Alarm occurring in motion task, or on the axis level.
Motion Task Alarm Code	Outputs the code of the alarm occurring in motion task.

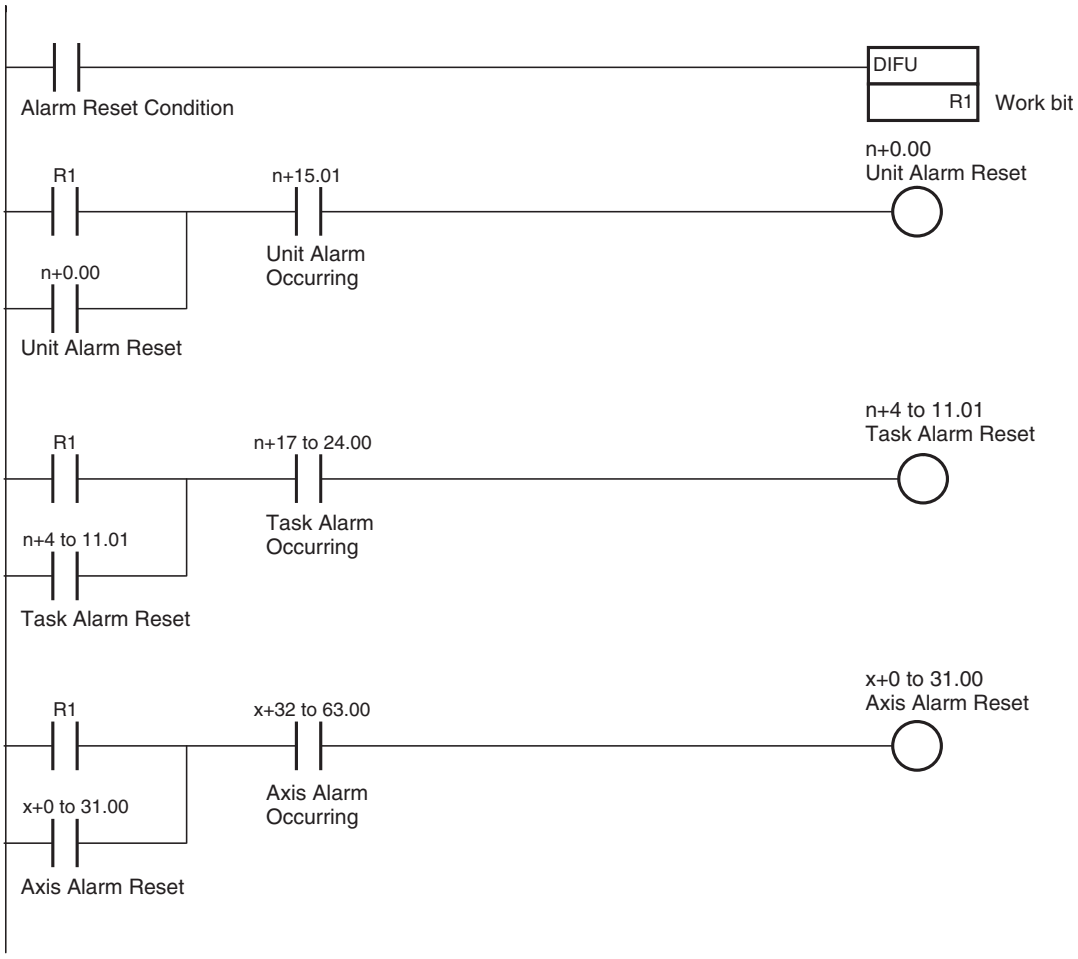
- When an alarm occurs on the motion task level, the bits [Alarm Occurring], [Motion Task Alarm Occurring 1-8] and [Motion Task Alarm] will be turned ON, and then the alarm code will be stored in [Motion Task Alarm Code].
- If several alarms occur, the alarm code detected first will be stored in Motion Task Alarm Code.

Effect of Other Functions Nil

Effect on Other Functions When an alarm occurs, it affects other functions (operation failure, operation interruption, etc.)

System Parameter Nil

Program Example



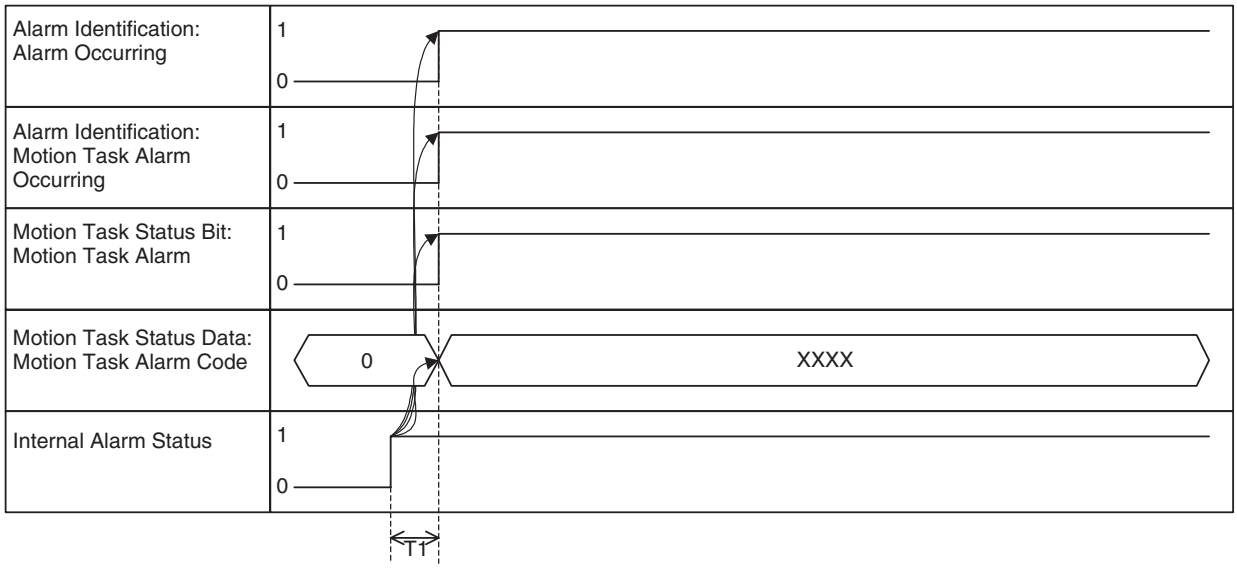
On MC Unit, there are three types of alarms:

- Unit alarm
- Task alarm
- Axis alarm

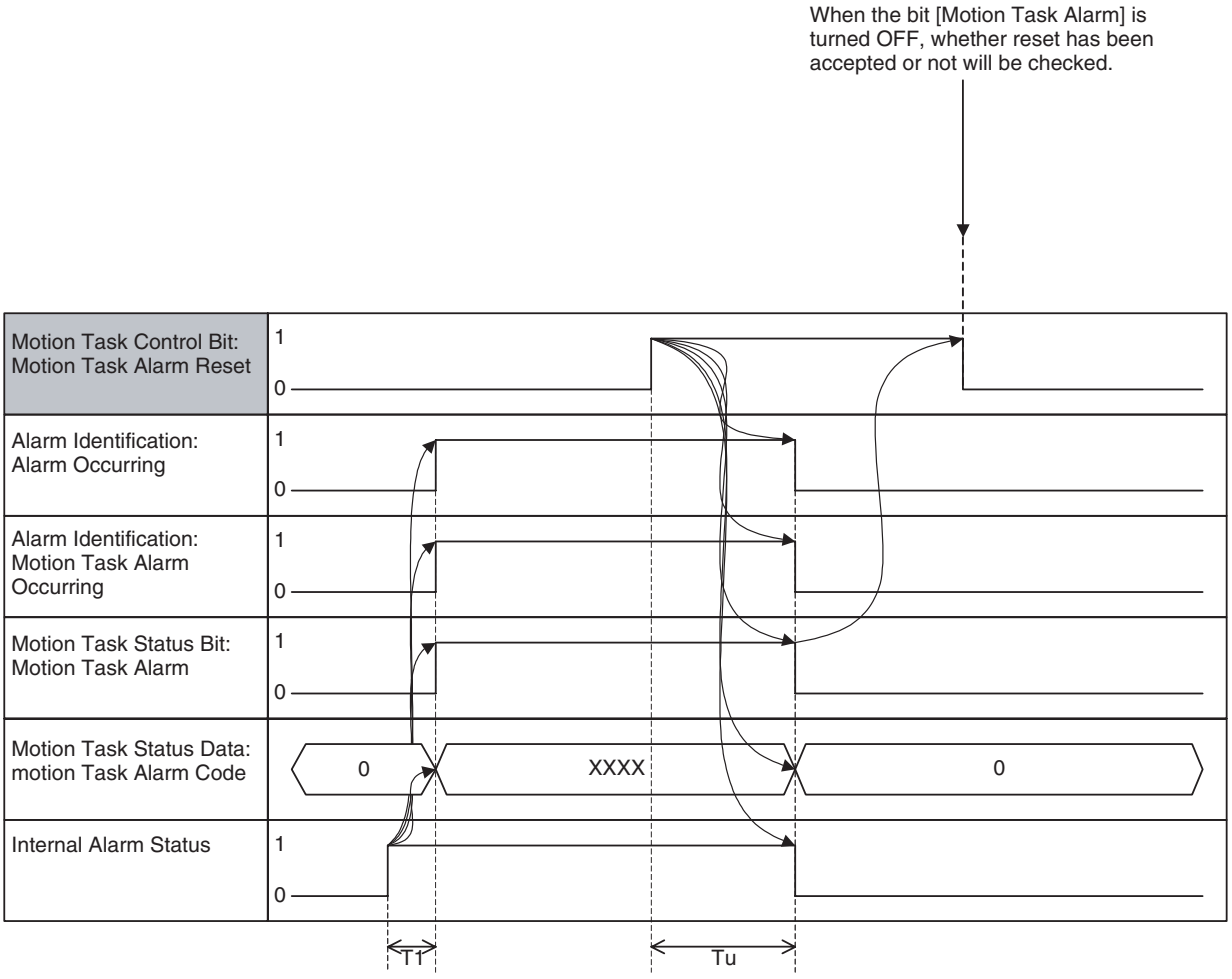
Alarms are reset on the basis of each type. Therefore, execute the alarm reset over the Unit, Task, and Axis to clear an alarm occurring on the MC Unit without fail.

Timing chart

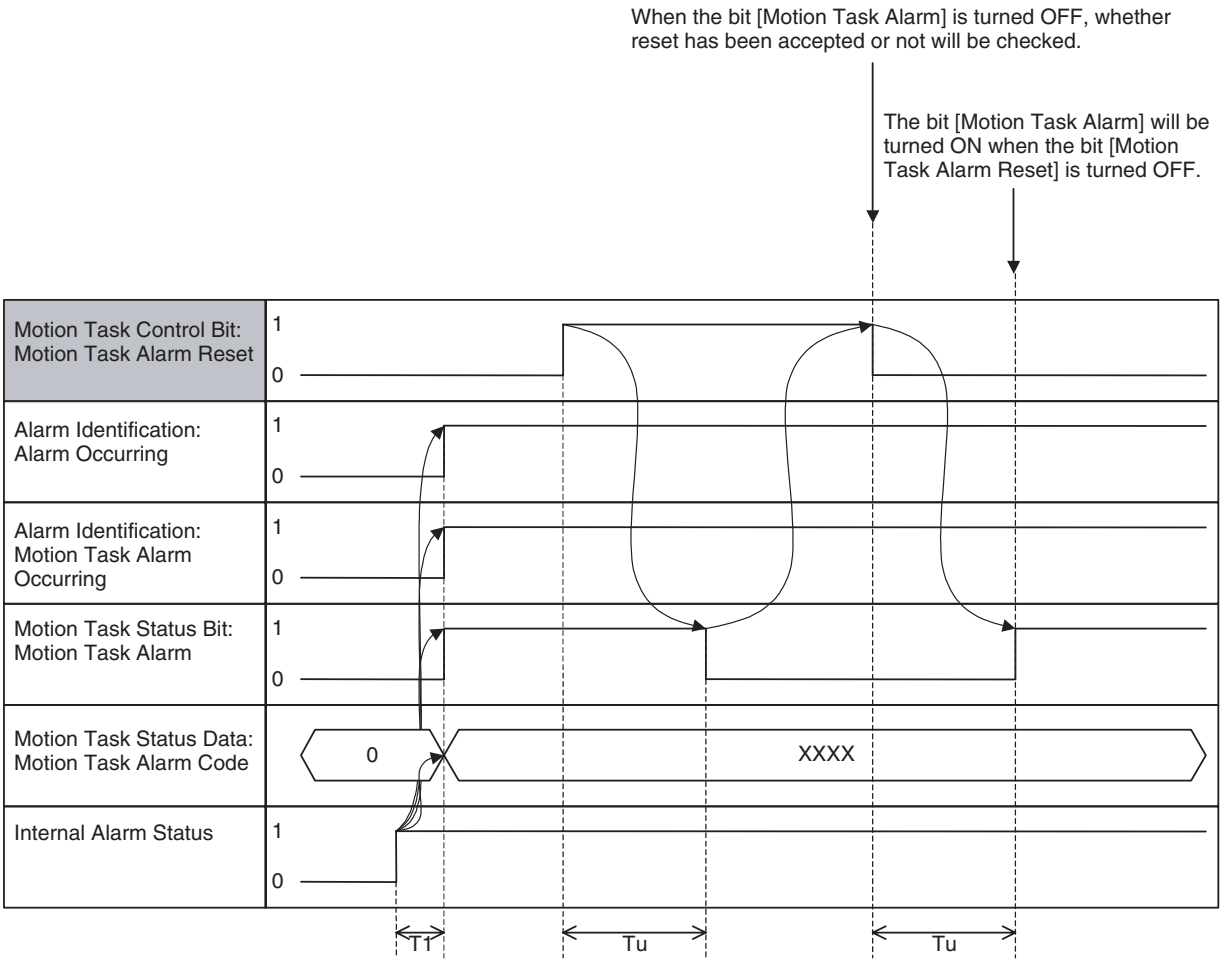
Basic Operation (Alarm Occurring):

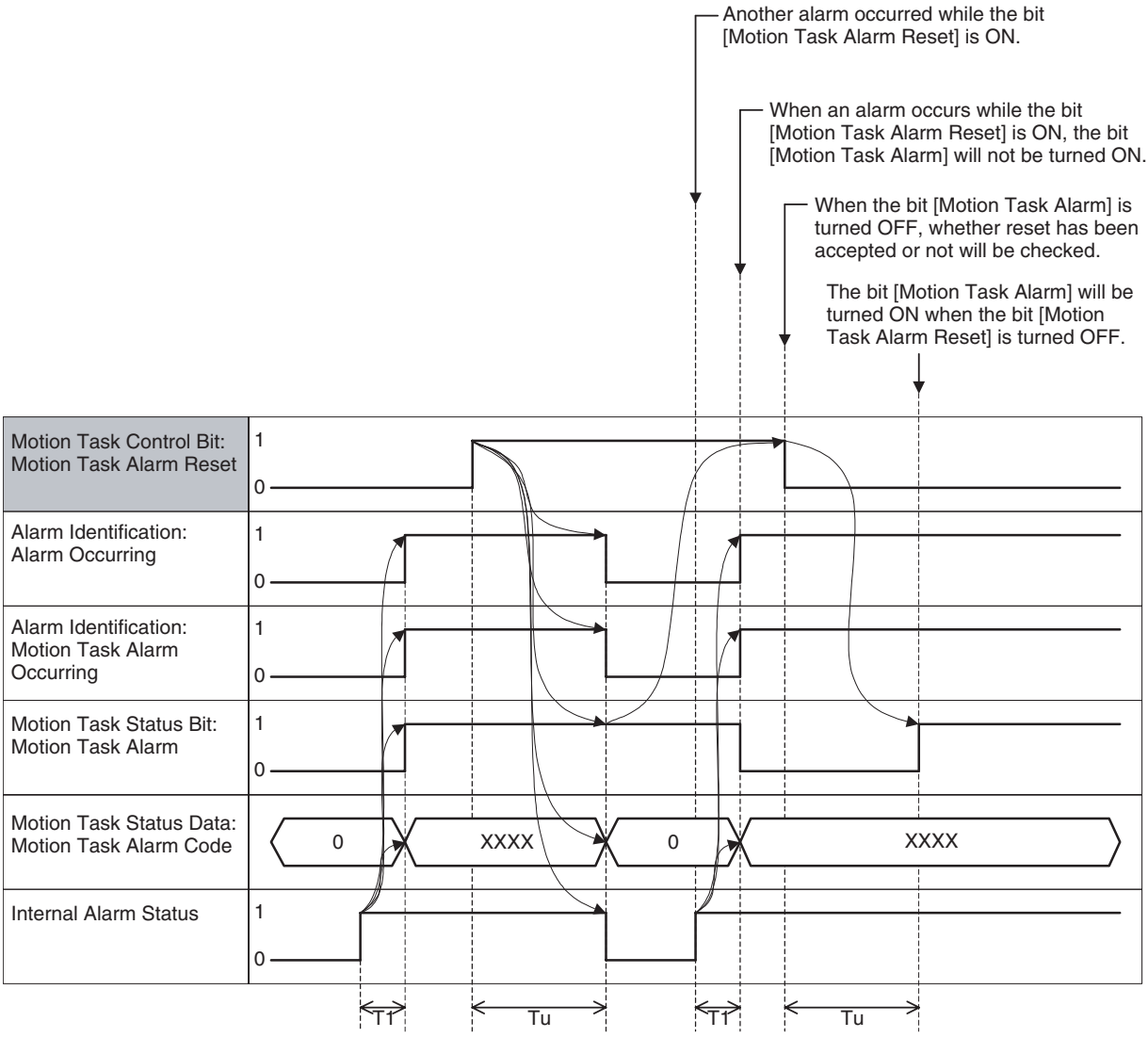


Basic Operation (Alarm Reset):



When an alarm that cannot be reset occurs:





Word	Variable	Bit	Name	I/O
n+17 - n+24	OW0340 - OW0347	04	Speed Clamp Warning (Task 1) - Speed Clamp Warning (Task 8)	Input

Function

The bit [Speed Clamp Warning] indicates the status that the speed specified in the motion program and multiplied by an override value was limited and could not be output.

Status Condition

Name	Specifications
Speed Clamp Warning	0: Speed not limited 1: Speed limited by the maximum speed setting
Start Warning	0: Started motion program operation successfully 1: Could not start motion program operation (Axis declaration, Axis mode)

1-shot output may occur. In that case, depending on the Scan Time of the ladder program and the Unit Scan Time of the MC Unit, the output may not be reflected in the ladder program.

Effect of Other Functions Nil

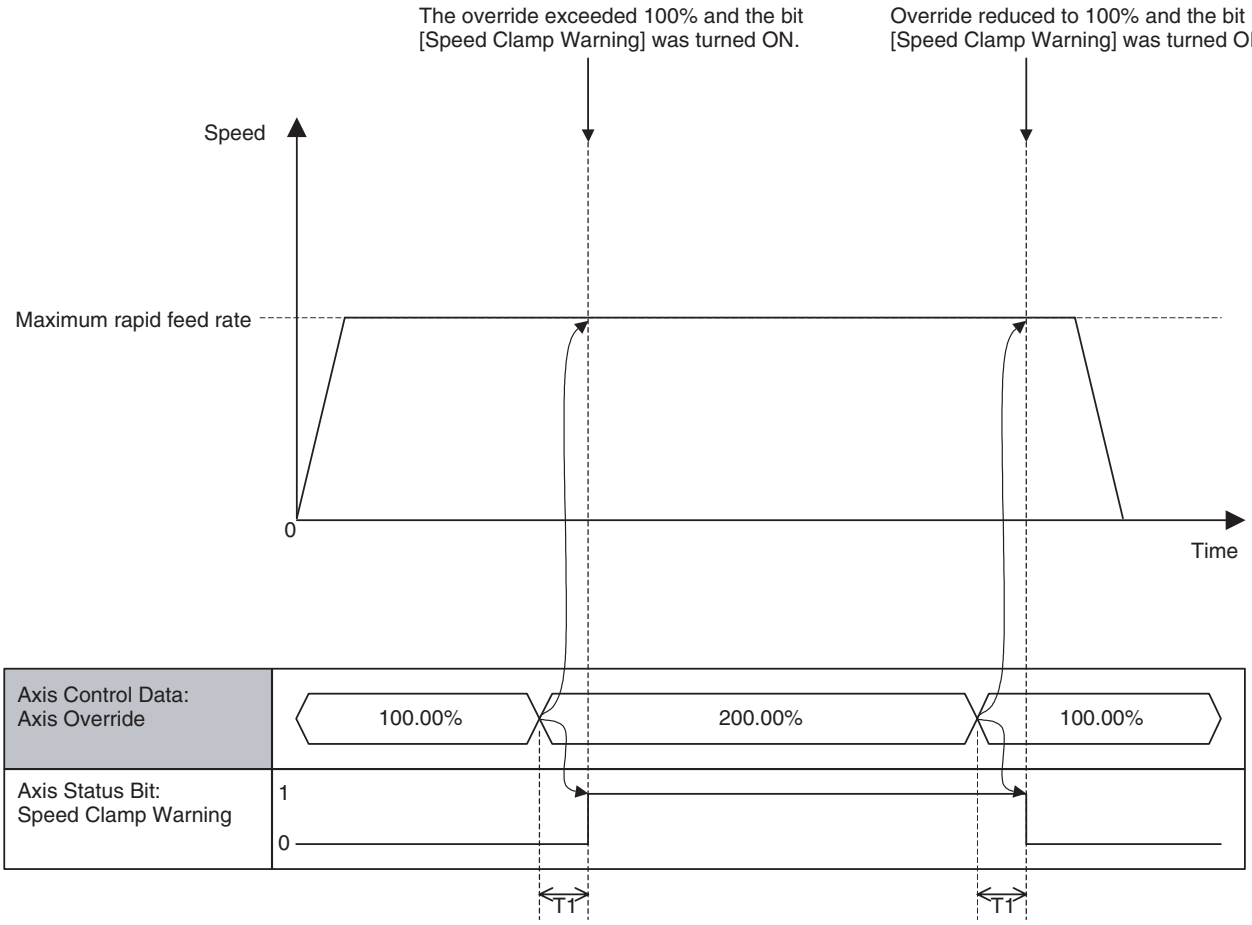
Effect on Other Functions Nil

System Parameter ON/OFF of the bit [Speed Clamp Warning] is determined by the following system parameters:

Parameter No.	Name
P00M01	Maximum interpolation feed rate
P2AA01	Maximum rapid feed rate

Timing Chart

Basic Operation:



Word	Variable	Bit	Name	I/O
n+17 - n+24	OW0340 - OW0347	05	Start Warning (Task 1) - Start Warning (Task 8)	Input

Function The bit [Start Warning] indicates the status that the execution start condition was not satisfied when starting motion program execution.

Status Condition

Name	Specifications
Start Warning	0: Started motion program operation successfully. 1: Could not start motion program operation (Axis declaration, Axis mode)

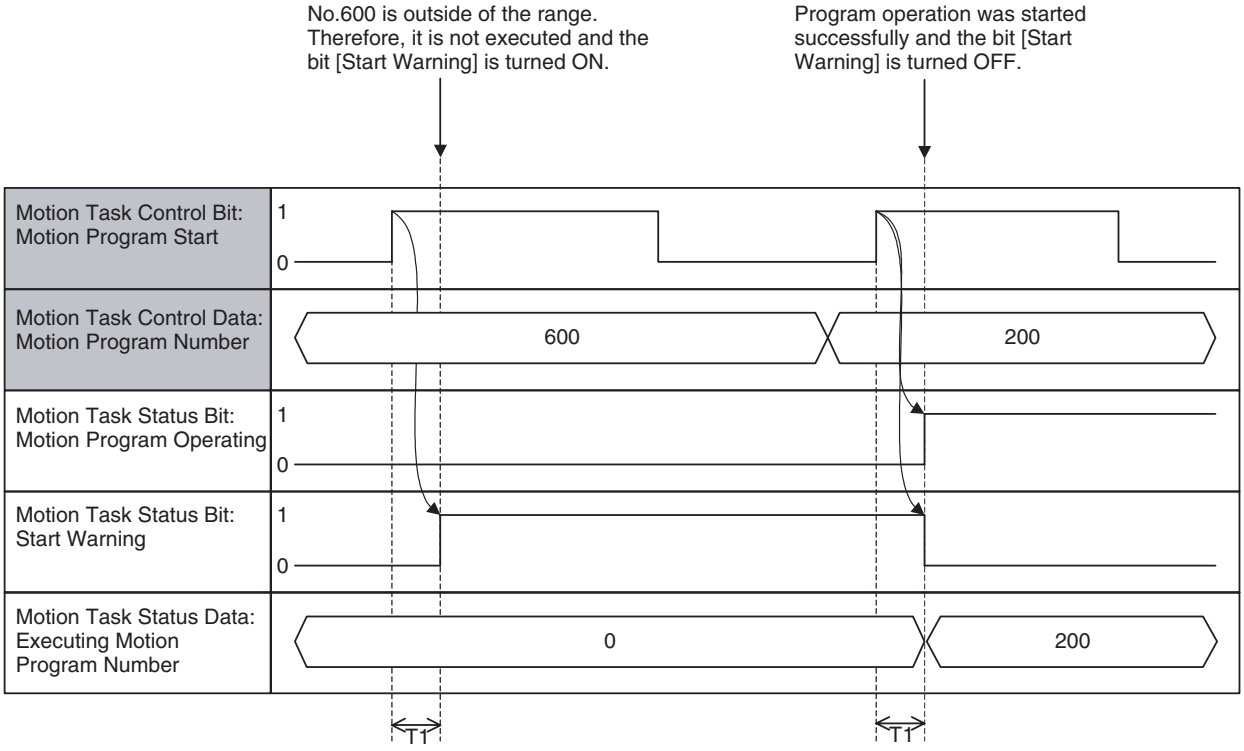
- The bit [Start Warning] is turned ON in the following cases and it will be turned OFF when motion program operation is started successfully.

- The bit [Deceleration Stop] or [Block Stop] is ON.
- [Motion Program Number] is not between 0-499.
- The motion program specified by [Motion Program Number] does not exist (It has not been loaded).
- The bit [Command Disable/Enable] of the axis specified by PROG command is OFF.
- The bit [Axis Not Used/Used] of the axis specified by PROG command is ON.
- The bit [Manual/Automatic Mode] of the axis specified by PROG command is OFF.
- A unit alarm, motion task alarm, or an alarm of the axis specified by PROG command is occurring, or the bit [External Forced Stop Request] is ON.

Effect on Other Functions Nil

System Parameter Nil

Timing Chart



7-4-4 Axis Control Bits, Axis Status Bits

Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	01	Deceleration Stop (Axis 1) - Deceleration Stop (Axis 32)	Output

Function The function is used for each function on the axis level as the interlock by interruption with a deceleration stop or ON state of the bit.

Command and Operation

Name	Specifications
Deceleration Stop	0: Nil 1: Prohibits JOG, STEP, and Origin Search in Manual Mode. ↑: Deceleration stop (JOG, STEP, and Origin Search) ↓: Nil

- When the bit [Deceleration Stop] is turned ON, the operation of each function in the table below will be stopped with deceleration.
- When the bit [Deceleration Stop] is ON, execution of each function in the table below will be prohibited.

Operation	At rising edge	ON
Axis Control Bit: JOG	Decelerated to stop	Execution prohibited
Axis Control Bit: STEP	Decelerated to stop	Execution prohibited
Axis Control Bit: Origin Search	Decelerated to stop	Execution prohibited
Axis Control Bit: Machine Origin Return	Decelerated to stop	Execution prohibited
Axis Control Bit: Forced Origin	Not influenced	Execution prohibited
Axis Control Bit: ABS Origin Setting	Not influenced	Execution prohibited
IOWR: Present Position Preset	Not influenced	Execution prohibited

- Turning ON the bit [Deceleration Stop] after having started deceleration stop operation will not interrupt deceleration stop operation.

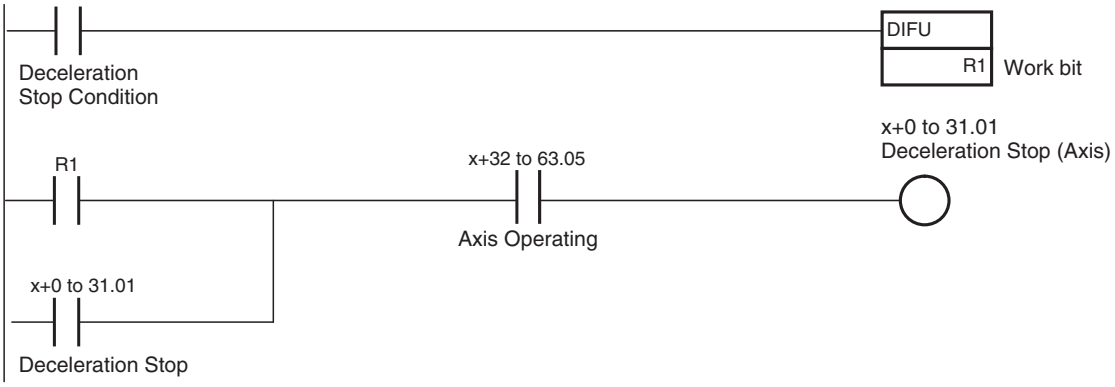
Status Condition Nil

Effect of Other Functions Nil

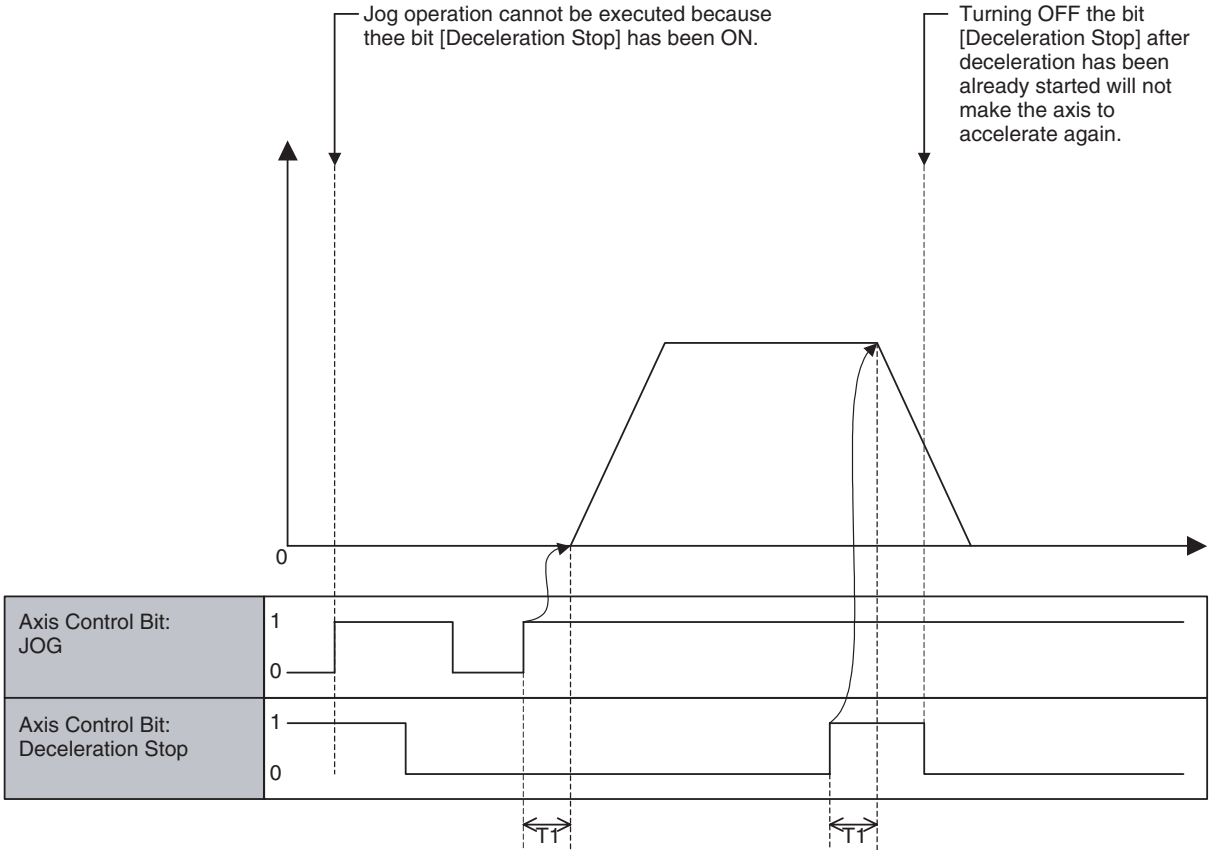
Effect on Other Functions Nil

System parameter Nil

Program Example



Timing Chart



Word	Variables	Bits	Name	I/O
x+0 - x+31	IW0440 - IW045F	02	Servo Lock (Axis 1) - Servo Lock (Axis 32)	Output
		03	Servo Unlock (Axis 1) - Servo Unlock (Axis 32)	Output

Function

This is the function to lock (Servo ON) or unlock (Servo OFF) the servo.

Command and Operation

Name	Specifications
Servo Lock	0: Nil 1: Nil ↑: Starts Servo Lock ↓: Nil
Servo Unlock	0: Nil 1: Prohibits Servo Lock ↓: Cancels Servo Lock state ↓: Nil

- Servo is locked when the bit [Servo Lock] is turned ON, and Servo is unlocked when the bit [Servo Unlock] is turned ON.
- While the bit [Servo Unlock] is ON, the bit [Servo Lock] is ignored.
- Turning ON the bit [Servo Unlock] after the bit [Servo Lock] has been already turned ON will interrupt the Servo Lock operation to unlock Servo.

- Once the bit [Servo Lock] is turned ON, the processing will not be interrupted (i.e. the bit [In Servo Lock] will turn ON) even if the bit [Servo Lock] is turned OFF before the rise of the bit [In Servo Lock].
- Similarly, once the bit [Servo Unlock] is turned ON, the processing will not be interrupted (i.e. the bit [In Servo Lock] will turn OFF) even if the bit [Servo Unlock] is turned OFF before the rise of the bit [In Servo Lock].

Status Condition

Bit	Name	Specifications
03	In Servo Lock	0: In Servo Unlock state 1: In Servo Lock state

Servo Lock status (ON/OFF status) is output to the bit [In Servo Lock].

Effect of Other Functions

Classification	Item	Effect
Physical Status	Servo Axis	No effect
	Virtual Axis	No effect
	I/O Axis	Ignored
	Counter Axis	Ignored
Status Bits	Busy	No effect
	Servo Lock	No effect
	No Origin	No effect
	Axis Operating	No effect
	Positioning Completed	No effect
	Positioning Completed (No.2)	No effect
	Axis Machine Lock Status	No effect
	Command Disable/Enable	Servo Lock/Unlock cannot be executed when OFF.
	Axis Not Used/Used	No effect
	In Manual/Automatic Mode	No effect

Effect on Other Functions

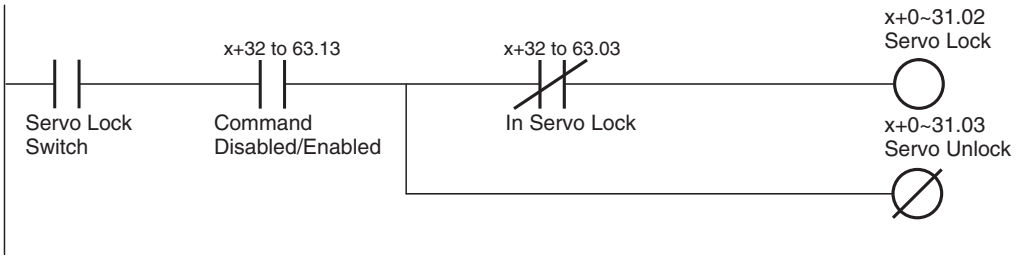
The functions in the following table cannot be executed when the bit [In Servo Lock] is OFF.

Function
Axis Control Bit: JOG
Axis Control Bit: STEP
Axis Control Bit: Origin Search
Axis Control Bit: Machine Origin Return
Other commands with axis movement

System Parameter

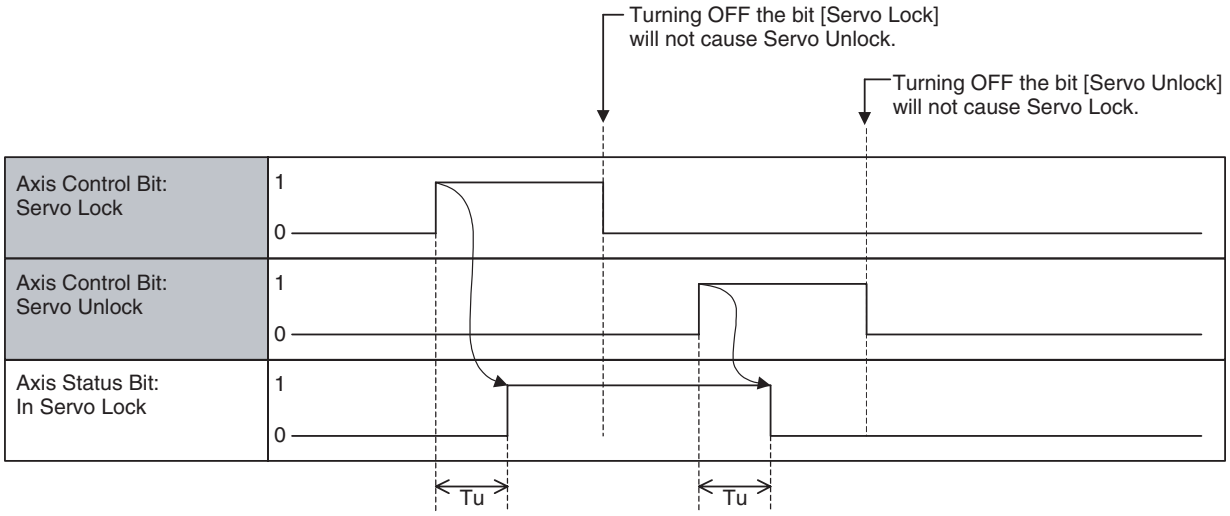
Nil

Program Example

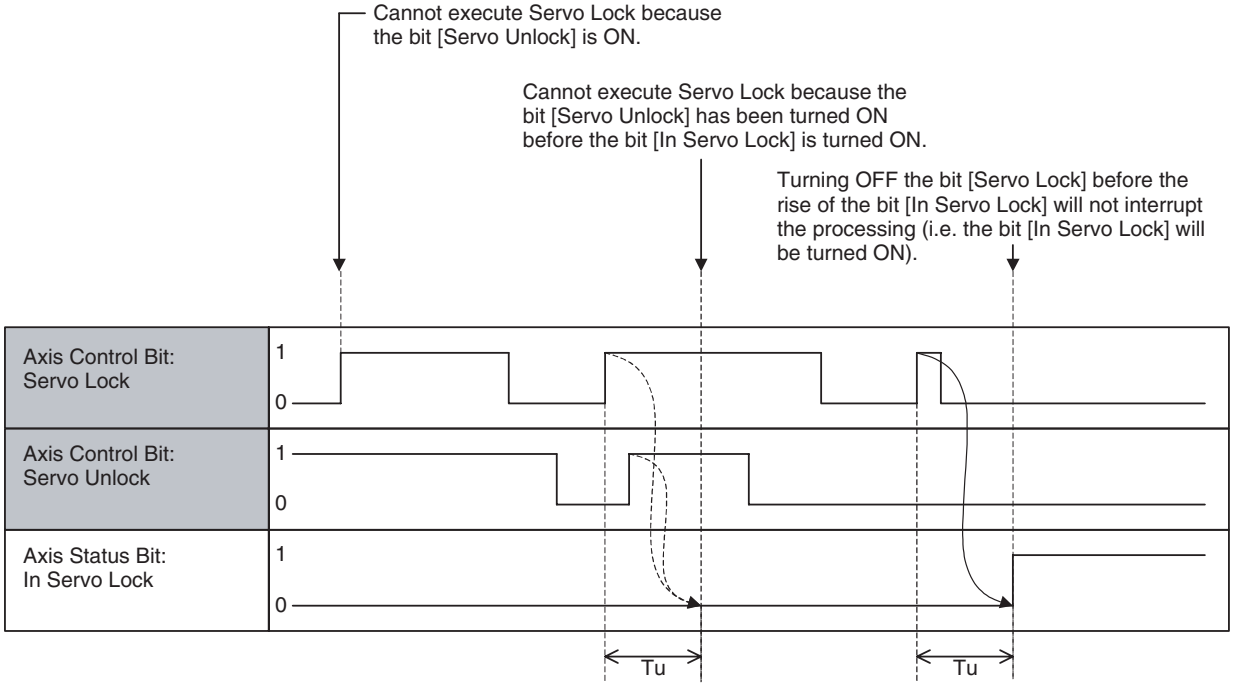


Timing Chart

Basic Operation:



Servo Unlock:



Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	04	JOG Operation (Axis 1) - JOG Operation (Axis 32)	Output

Function

- The axis is moved while the bit [JOG Operation] stays ON.
- [Axis Override] is applied to the speed. For details of timing, etc., see “Relation between Task Override and Axis Override” (page 423).

Command and Operation

Name	Specifications
JOG	0: Nil 1: Continues JOG operation ↑: Starts JOG operation ↓: Stops JOG operation
JOG/STEP Direction	0: Sets the direction of JOG and STEP operation to positive direction 1: Sets the direction of JOG and STEP operation to negative direction ↑: Nil ↓: Nil

- Acceleration will be started when the bit [JOG Operation] is turned ON, and deceleration will be started when the bit [JOG Operation] is turned OFF.

Operation Direction

- Pre-Ver. 2.0 MC Units:
  The bit [JOG/STEP direction] determines the operation direction when the bit [JOG Operation] is turned ON. The direction cannot be changed during operation.
- MC Units with Ver. 2.0 or Later:
  The operation direction is changed using the method set in system parameter P00004, bit 05 (unit function selections, direction switching method for JOG operation). Refer to page 59 for details.

Status Condition

Name	Specifications
Busy	0: Not executing any of the functions listed below. 1: Executing one of the functions listed below, or the command bit is ON. JOG, STEP, Origin Search, Machine Origin Return, Error Counter Reset, Forced Origin, and ABS Origin Setting
Axis Operating	0: No axis operating command 1: Axis operating command being output.
Positioning Completed	0: Outputting positioning command, or axis is outside of in-position range. 1: Not outputting positioning command, and axis is within in-position range.
Axis Not Used/Used	0: Axis is not being used. 1: Axis is being used. (In Manual Mode: Axis is used for JOG etc., In Automatic Mode: Axis is declared in the operating program)

Effect of Other Functions

Classification	Item	Effect
Physical Status	Servo Axis	No effect
	Virtual Axis	No effect
	I/O Axis	Ignored
	Counter Axis	Ignored

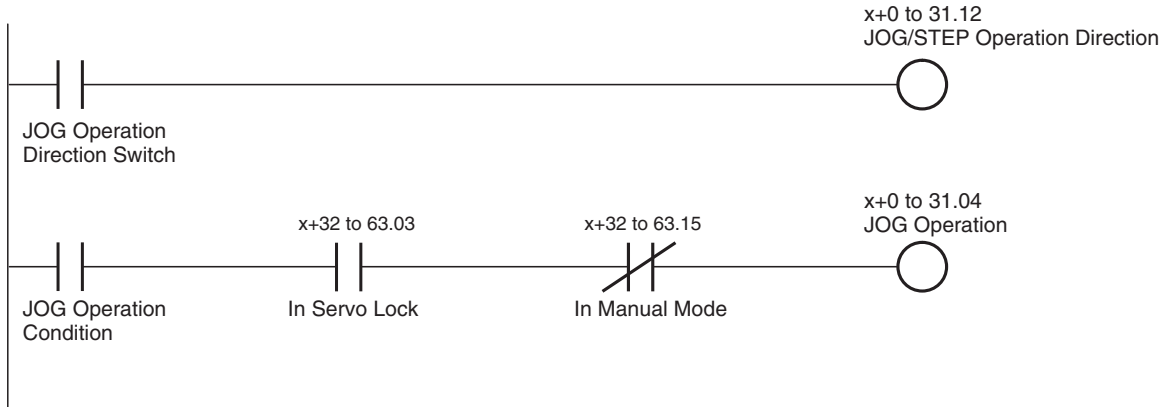
Classification	Item	Effect
Status Bits	Busy	JOG cannot be executed when ON.
	In Servo Lock	JOG cannot be executed when OFF.
	No Origin	No effect
	Axis Operating	JOG cannot be executed when ON.
	Positioning Completed	No effect
	Positioning Completed (No.2)	No effect
	Axis Machine Lock Status	No effect
	Command Disabled/Enabled	JOG cannot be executed when OFF.
	Axis Not Used/Used	JOG cannot be executed when ON.
	In Manual/Automatic Mode	JOG cannot be executed when ON.

Effect on Other Functions Nil

System Parameter The settings of the following parameters determines the speed pattern:

Parameter No.	Name
P2AA02	Maximum manual feed rate
P2AA04	Manual feed rate
P2AA07	Manual feed acceleration time
P2AA08	Manual feed deceleration time
P2AA10	Manual feed acceleration/deceleration type
P2AA12	Manual feed S-curve time constant

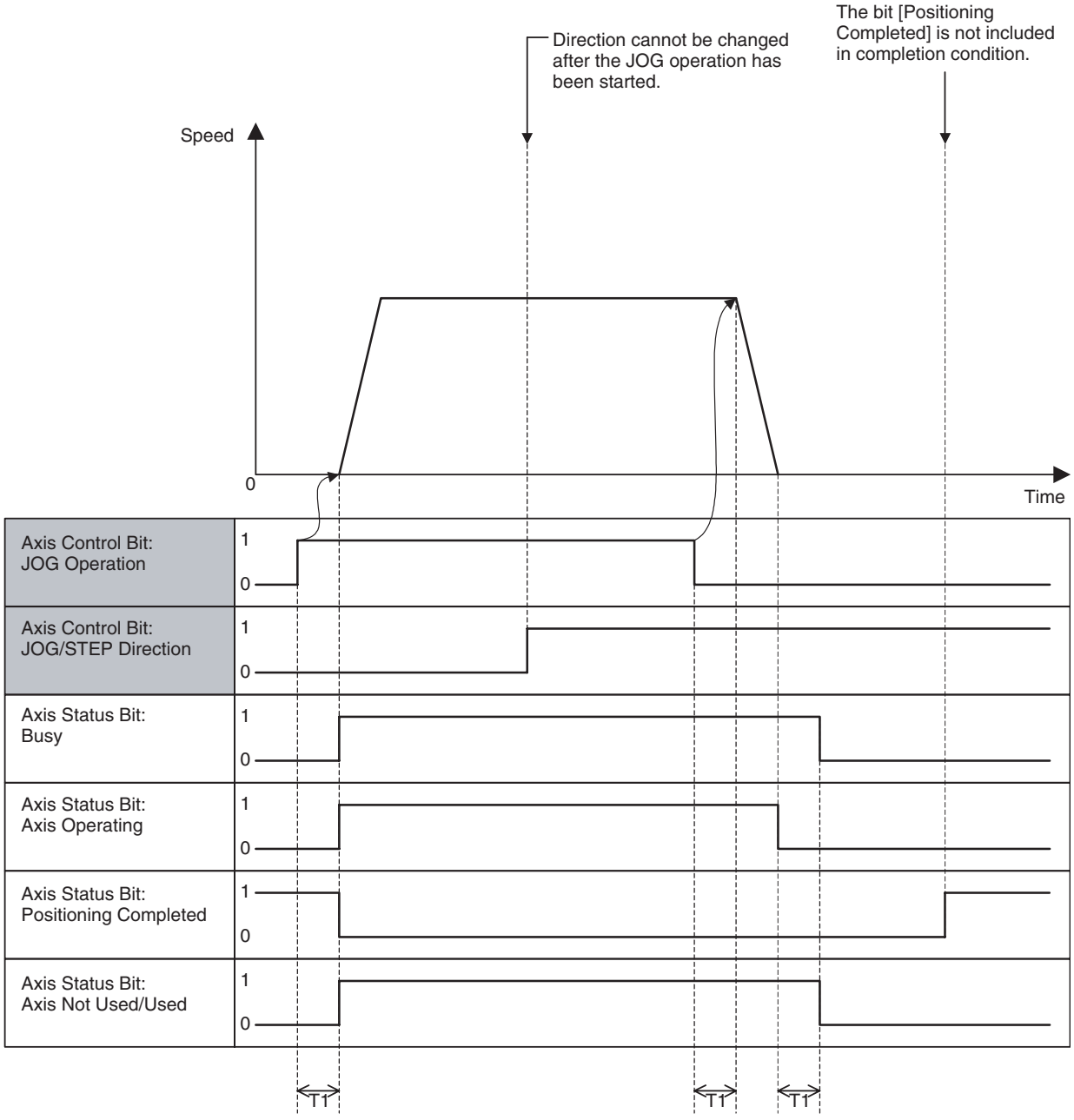
Program Example



Timing Chart

■ Pre-Ver. 2.0 MC Units, or MC Units with Ver. 2.0 or Later with P00004 bit 05 set to 0

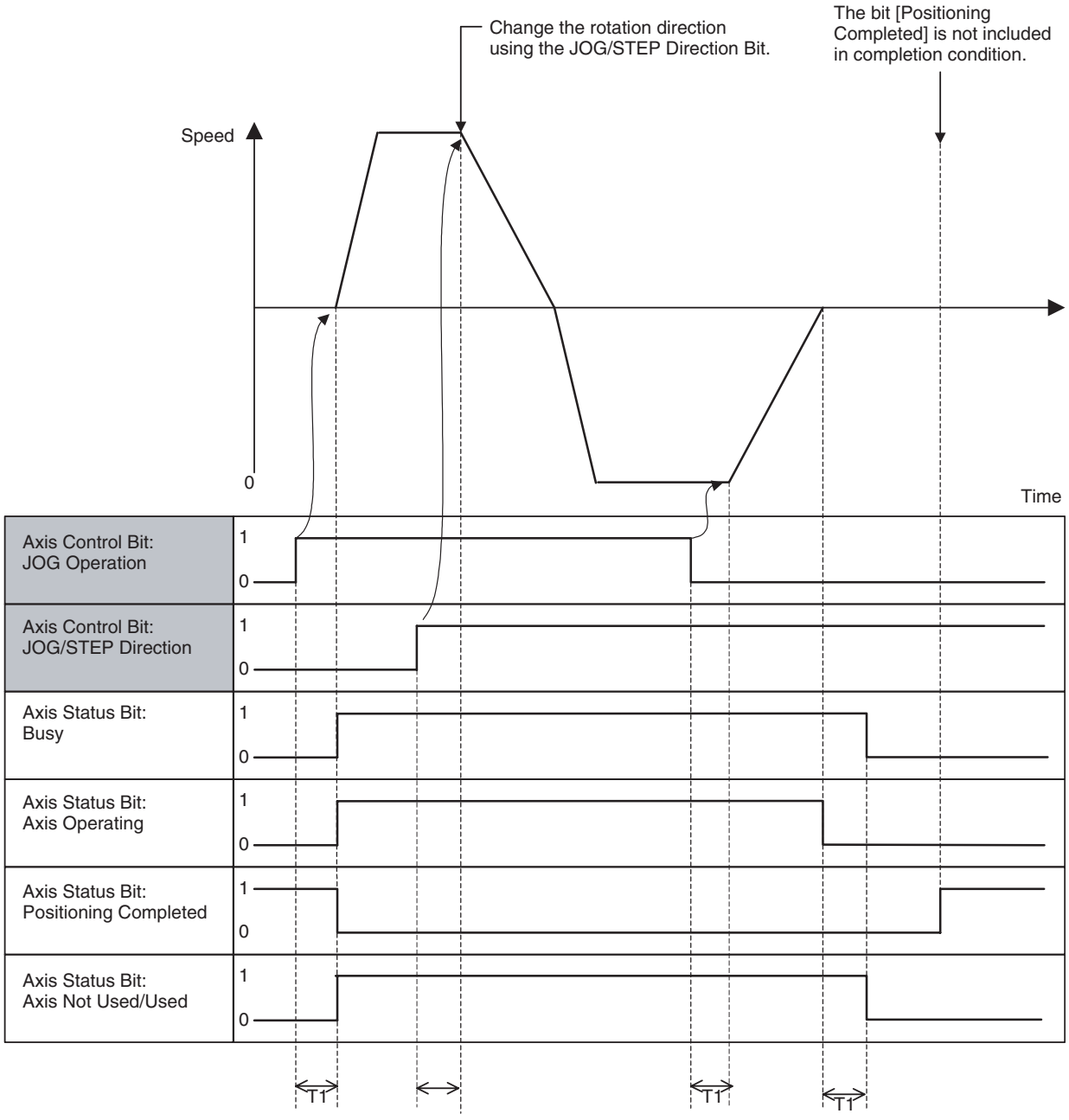
Basic Operation:



Timing Chart

■ MC Units with Ver. 2.0 or Later with P0004 bit 05 set to 1

Basic Operation:



Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	05	STEP Operation (Axis 1) - STEP Operation (Axis 32)	Output

Function

- The axis will be moved for the specified travel distance when the bit [STEP Operation] is turned ON.

- When the axis completes to move for the specified travel distance, it automatically decelerates to stop.
  (The travel distance for the deceleration stop is included in the specified travel distance.)
- [Axis Override] is applied to the speed. For details of timing, etc., see "Relation between Task Override and Axis Override" (page 423).

Command and Operation

Name	Specifications
STEP	0: Nil 1: Continues STEP operation ↑: Starts STEP operation ↓: Stops STEP operation
JOG/STEP Direction	0: Sets the direction of JOG and STEP operation to positive direction. 1: Sets the direction of JOG and STEP operation to negative direction. ↑: Nil ↓: Nil

- Acceleration will be started when the bit [STEP Operation] is turned ON. Even if the axis has not moved for the specified travel distance, it decelerates to stop when the bit [STEP Operation] is turned OFF.
- The bit [JOG/STEP Direction] determines the operation direction when the bit [STEP Operation] is turned ON. The operation direction cannot be changed during operation.

Status Condition

Name	Specifications
Busy	0: Not executing any of the functions listed below. 1: Executing one of the functions listed below, or the command bit is ON. JOG, STEP, Origin Search, Machine Origin Return, Error Counter Reset, Forced Origin, and ABS Origin Setting
Axis Operating	0: No axis operating command 1: Axis operating command being output.
Positioning Completed	0: Outputting positioning command, or axis is outside of in-position range. 1: Not outputting positioning command, and axis is within in-position range.
Axis Not Used/Used	0: Axis is not being used. 1: Axis is being used. (In Manual Mode: Axis is used for JOG etc., In Automatic Mode: Axis is declared in the operating program)

Effect of Other Functions

Classification	Item	Effect
Physical Status	Servo Axis	No effect
	Virtual Axis	No effect
	I/O Axis	Ignored
	Counter Axis	Ignored

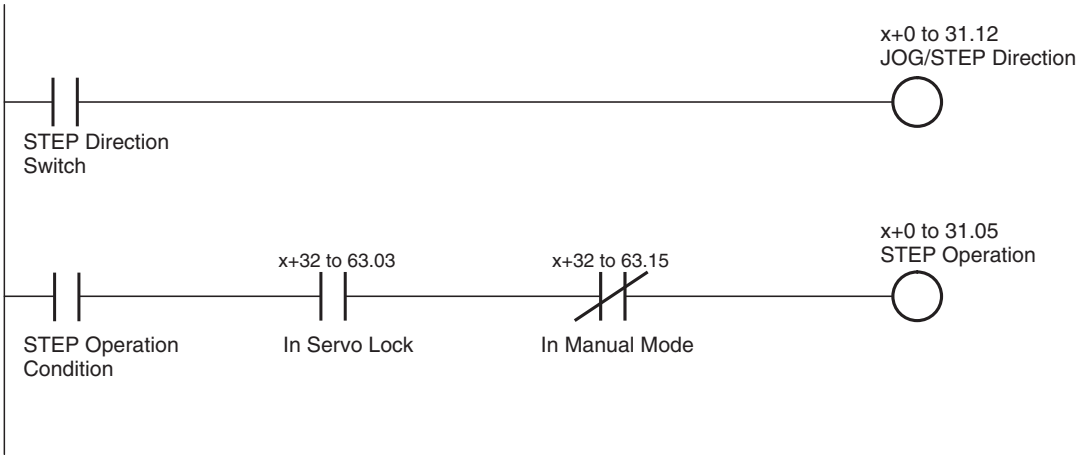
Classification	Item	Effect
Status Bits	Busy	STEP cannot be executed when ON.
	In Servo Lock	STEP cannot be executed when OFF.
	No Origin	No effect
	Axis Operating	STEP cannot be executed when ON.
	Positioning Completed	No effect
	Positioning Completed (No.2)	No effect
	Axis Machine Lock Status	No effect
	Command Disabled/Enabled	STEP cannot be executed when OFF.
	Axis Not Used/Used	STEP cannot be executed when ON.
	In Manual/Automatic Mode	STEP cannot be executed when ON.

Effect on Other Functions Nil

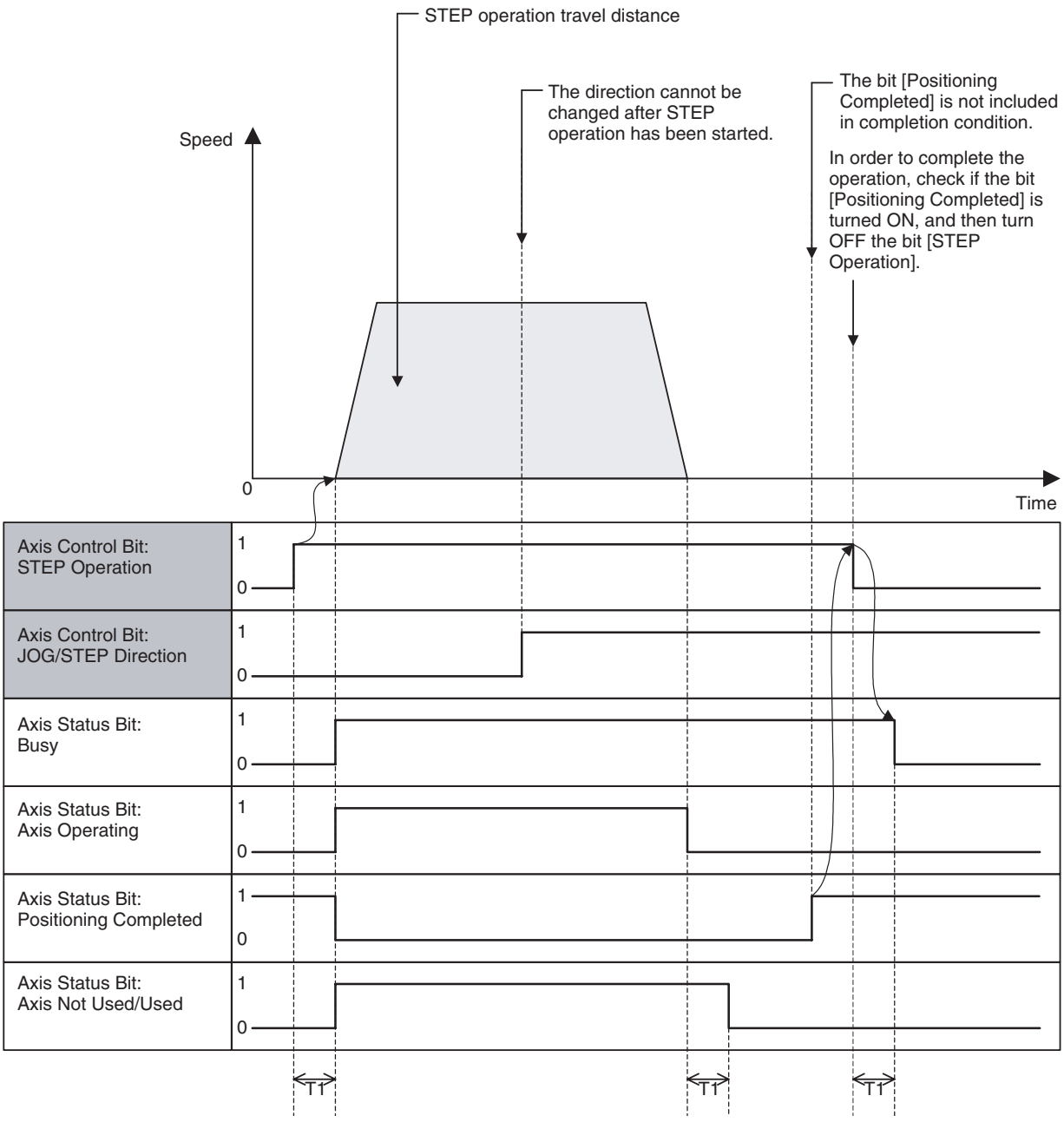
System Parameter The settings of the following system parameters determine the speed pattern and STEP operation travel distance:

Parameter No.	Name
P2AA02	Maximum manual feed rate
P2AA04	Manual feed rate
P2AA07	Manual feed acceleration time
P2AA08	Manual feed deceleration time
P2AA10	Manual feed acceleration/deceleration type
P2AA12	Manual feed S-curve time constant
P3AA01	STEP operation travel distance

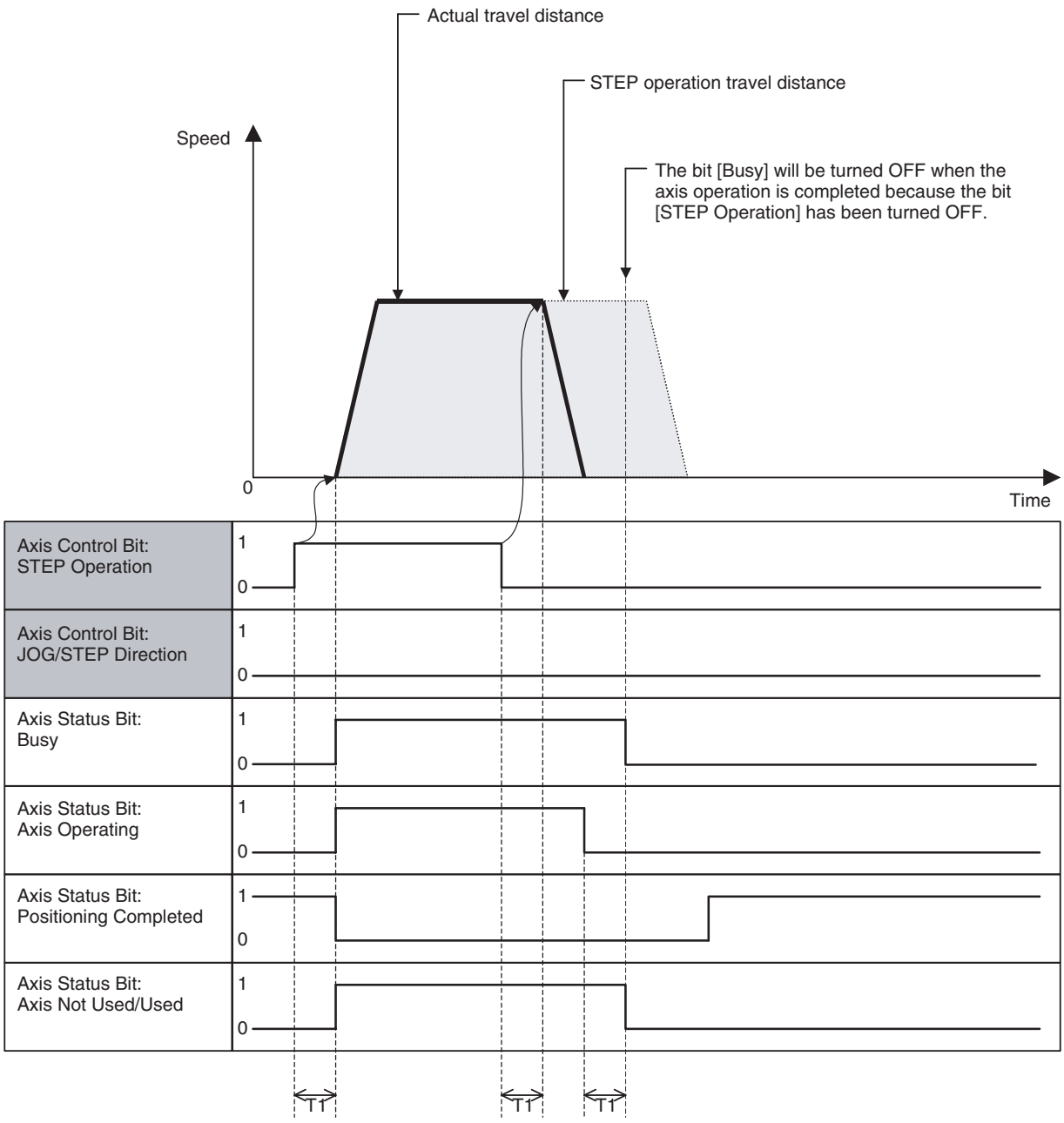
Program Example



Timing Chart **Basic Operation:**



Premature completion:



Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	06	Origin Search (Axis 1) - Origin Search (Axis 32)	Output

Function

- With this function, the axis searches for the machine origin using the specified external signal or phase-Z.
- When the machine origin is detected, the axis will automatically decelerate to stop. [Axis Override] is applied to the origin search feed rate. For details about timing, etc., see “Relation between Task Override and Axis Override” (page 423).
- Override cannot be used for Origin search approach speed and Origin search creep speed.

Command and Operation

Name	Specifications
Origin Search	0: Nil 1: Continues Origin search ↑: Starts Origin search ↓: Stops Origin search

Origin search operation will be started when the bit [Origin Search] is turned ON. Even if the machine origin is not detected, the axis decelerates to stop when the bit is turned OFF.

Status Condition

Name	Specifications
Machine Origin	0: Machine coordinate system FB position is outside of origin in-position range. 1: Machine coordinate system FB position is within origin in-position range.
Busy	0: Not executing any of the functions listed below. 1: Executing one of the functions listed below, or the command bit is ON. JOG, STEP, Origin Search, Machine Origin Return, Error Counter Reset, Forced Origin, and ABS Origin Setting
No Origin	0: Origin on machine coordinate system is defined. 1: Origin on machine coordinate system is not defined.
Axis Operating	0: No axis operating command 1: Axis operating command being output.
Positioning Completed	0: Outputting positioning command, or axis is outside of in-position range. 1: Not outputting positioning command, and axis is within in-position range.
Axis Not Used/Used	0: Axis is not being used. 1: Axis is being used. (In Manual Mode: Axis is used for JOG etc., In Automatic Mode: Axis is declared in the operating program)

Effect of Other Functions

Classification	Item	Effect
Physical Status	Servo Axis	No effect
	Virtual Axis	Performs the same operation as [Machine Origin Return]
	I/O Axis	Ignored
	Counter Axis	Ignored

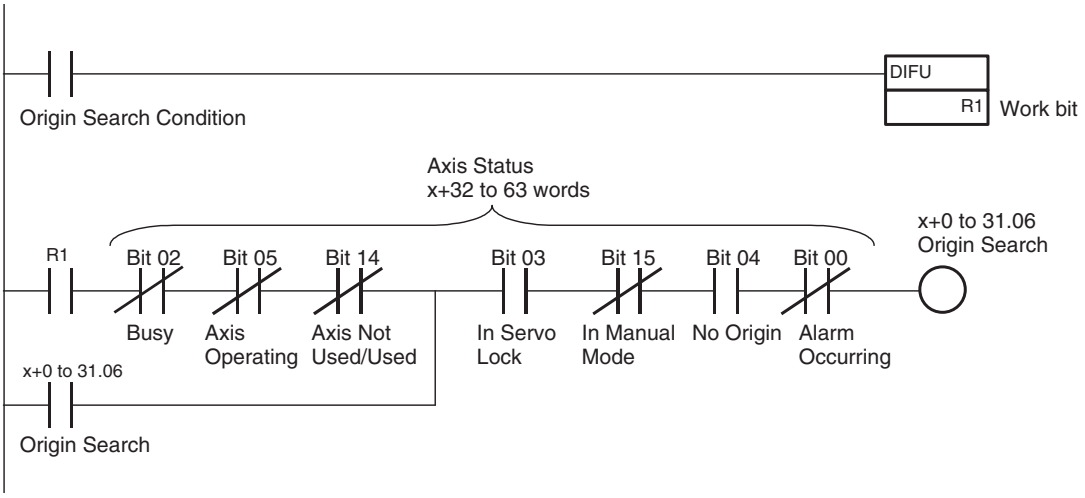
Classification	Item	Effect
Status Bits	Busy	Origin search cannot be executed when ON.
	In Servo Lock	Origin search cannot be executed when OFF.
	No Origin	No effect
	Axis Operating	Origin search cannot be executed when ON.
	Positioning Completed	Being ON is included in the completion condition
	Positioning Completed (No.2)	No effect
	Axis Machine Lock Status	Immediately completes origin search
	Command Disabled/Enabled	Origin search cannot be executed when OFF.
	Axis Not Used/Used	Origin search cannot be executed when ON.
	In Manual/Automatic Mode	Origin search cannot be executed when ON.

Effect on Other Functions When an origin search operation is started, the bit [No Origin] will be turned ON.

System Parameter The following system parameters determine the operation pattern and speed:

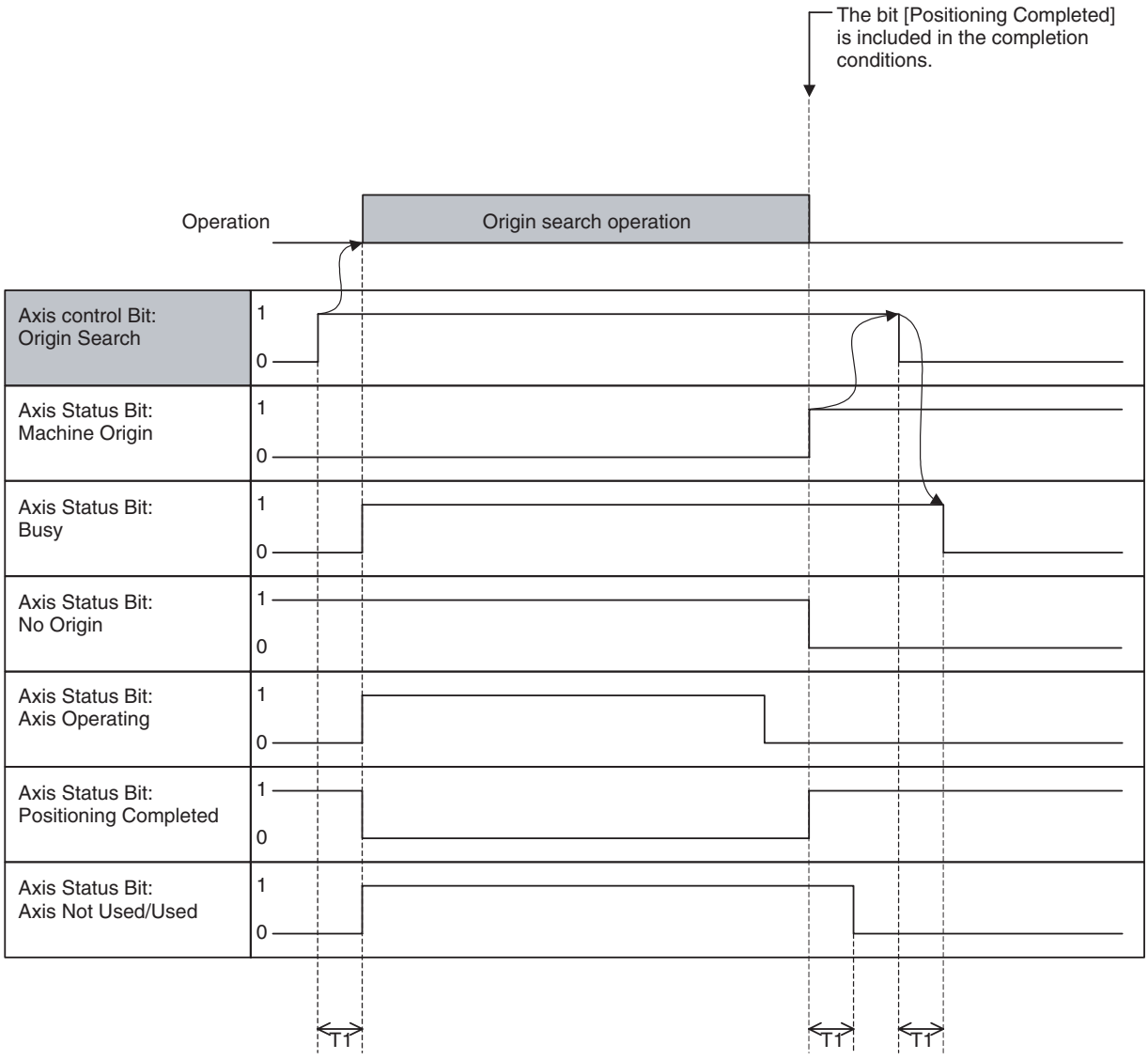
Parameter No.	Name	Remark
P2AA02	Maximum manual feed rate	For determining acceleration/deceleration
P2AA07	Manual feed acceleration time	For determining acceleration/deceleration
P2AA08	Manual feed deceleration time	For determining acceleration/deceleration
P2AA10	Manual feed acceleration/deceleration type	For determining acceleration/deceleration pattern
P4AA01	Origin search method	For determining origin search pattern
P4AA02	Origin search start direction	For determining origin search pattern
P4AA03	Phase-Z (phase-C) detection direction	For determining origin search pattern
P4AA04	Origin deceleration method	For determining origin search pattern
P4AA06	Origin determine signal	For determining origin search pattern
P4AA07	Origin search feed rate	For determining origin search pattern
P4AA08	Origin search approach speed	For determining origin search pattern
P4AA09	Origin search creep speed	For determining origin search pattern
P4AA10	Reference (machine) origin offset	The position after Forced Origin execution will be the one that is specified in this parameter.
P4AA11	Origin search final travel distance	For determining origin search pattern

Program Example

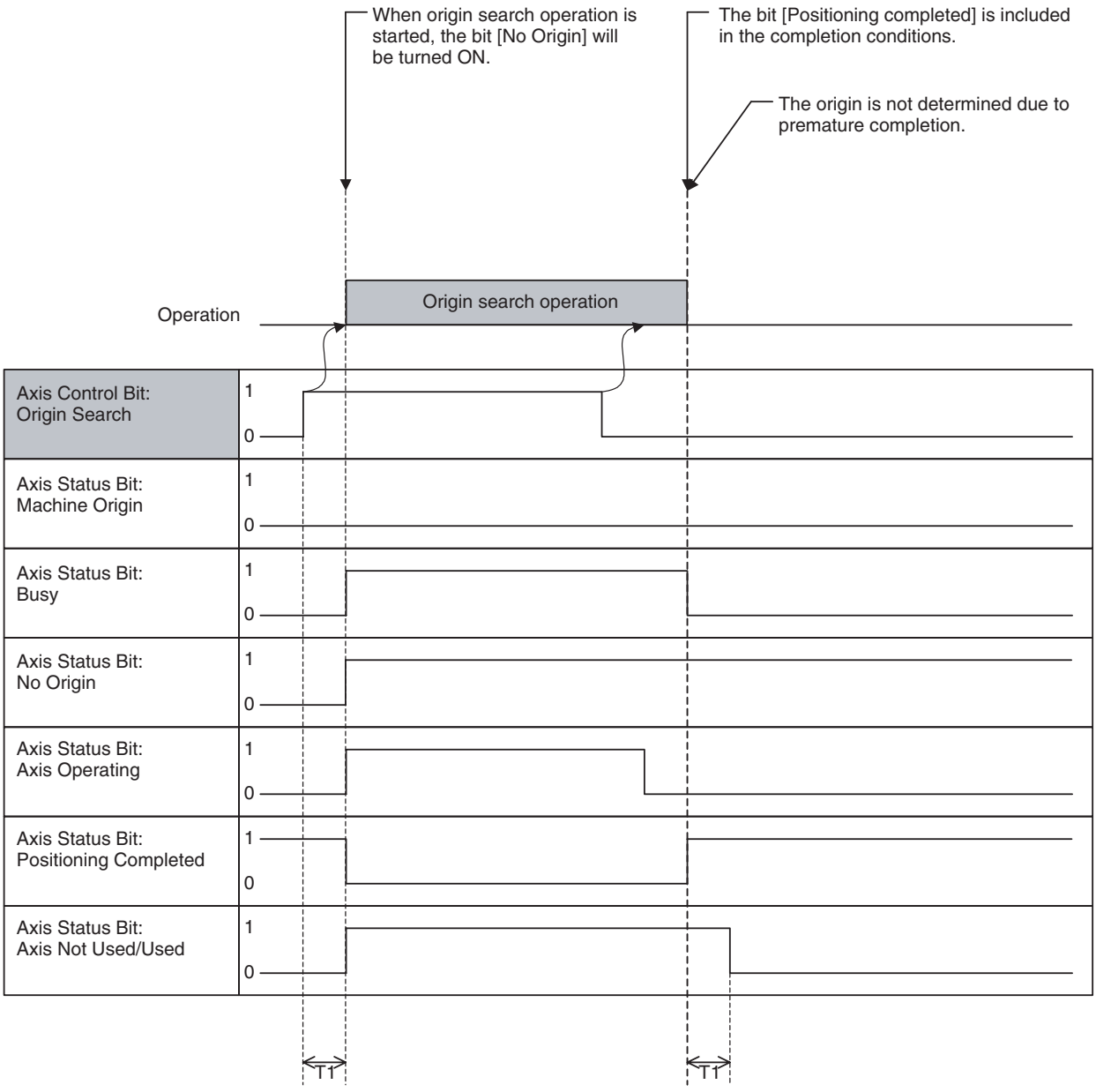


Timing Chart

Basic Operation:



Premature completion:



Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	07	Machine Origin Return (Axis 1) - Machine Origin Return (Axis 32)	Output

Function

- With the bit [Machine Origin Return], positioning to the machine origin that has been determined is executed.
- The axis Automatically will decelerate to stop when the bit [Machine Origin] is detected.
- [Axis Override] is applied to the speed. For details on timing, etc., see “Relation between Task Override and Axis Override” (page 423).

Command and Operation

Name	Specifications
Machine Origin Return	0: Nil 1: Continues Machine origin return (PTP) ↑: Starts Machine origin return (PTP) ↓: Stops Machine origin return (PTP)

The machine origin return operation will be started when the bit [Machine Origin Return] is turned ON. Even if the axis has not reached the machine origin, it decelerates to stop when the bit is turned OFF.

Status Condition

Name	Specifications
Machine Origin	0: Machine coordinate system FB position is outside of origin in-position range. 1: Machine coordinate system FB position is within origin in-position range.
Busy	0: Not executing any of the functions listed below. 1: Executing one of the functions listed below, or the command bit is ON. JOG, STEP, Origin Search, Machine Origin Return, Error Counter Reset, Forced Origin, and ABS Origin Setting
No Origin	0: Origin on machine coordinate system is defined. 1: Origin on machine coordinate system is not defined.
Axis Operating	0: No axis operating command 1: Axis operating command being output.
Positioning Completed	0: Outputting positioning command, or axis is outside of in-position range. 1: Not outputting positioning command, and axis is within in-position range.
Axis Not Used/Used	0: Axis is not being used. 1: Axis is being used. (In Manual Mode: Axis is used for JOG etc., In Automatic Mode: Axis is declared in the operating program)

Effect of Other Functions

Classification	Item	Effect
Physical Status	Servo Axis	No effect
	Virtual Axis	No effect
	I/O Axis	Ignored
	Counter Axis	Ignored

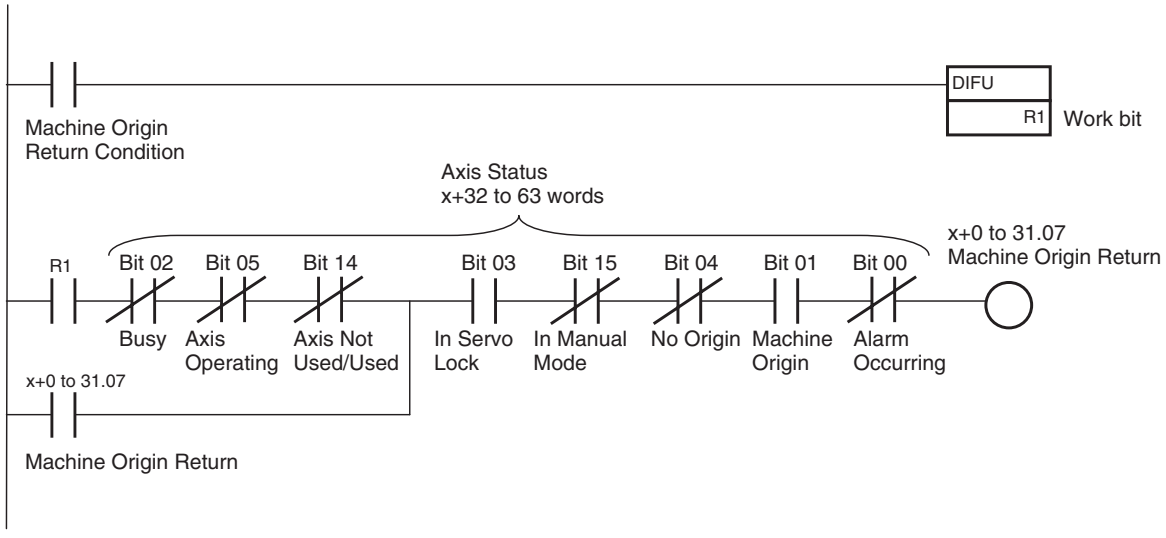
Classification	Item	Effect
Status Bits	Busy	Machine origin return cannot be executed when ON.
	In Servo Lock	Machine origin return cannot be executed when OFF.
	No Origin	Machine origin return cannot be executed when ON.
	Axis Operating	Machine origin return cannot be executed when ON.
	Positioning Completed	Being ON is included in the completion conditions.
	Positioning Completed (No.2)	No effect
	Axis Machine Lock Status	No effect
	Command Disabled/Enabled	Machine origin return cannot be executed when OFF.
	Axis Not Used/Used	Machine origin return cannot be executed when ON.
	In Manual/Automatic Mode	Machine origin return cannot be executed when ON.

Effect on Other Functions Nil

System Parameter The following system parameters determine the speed pattern:

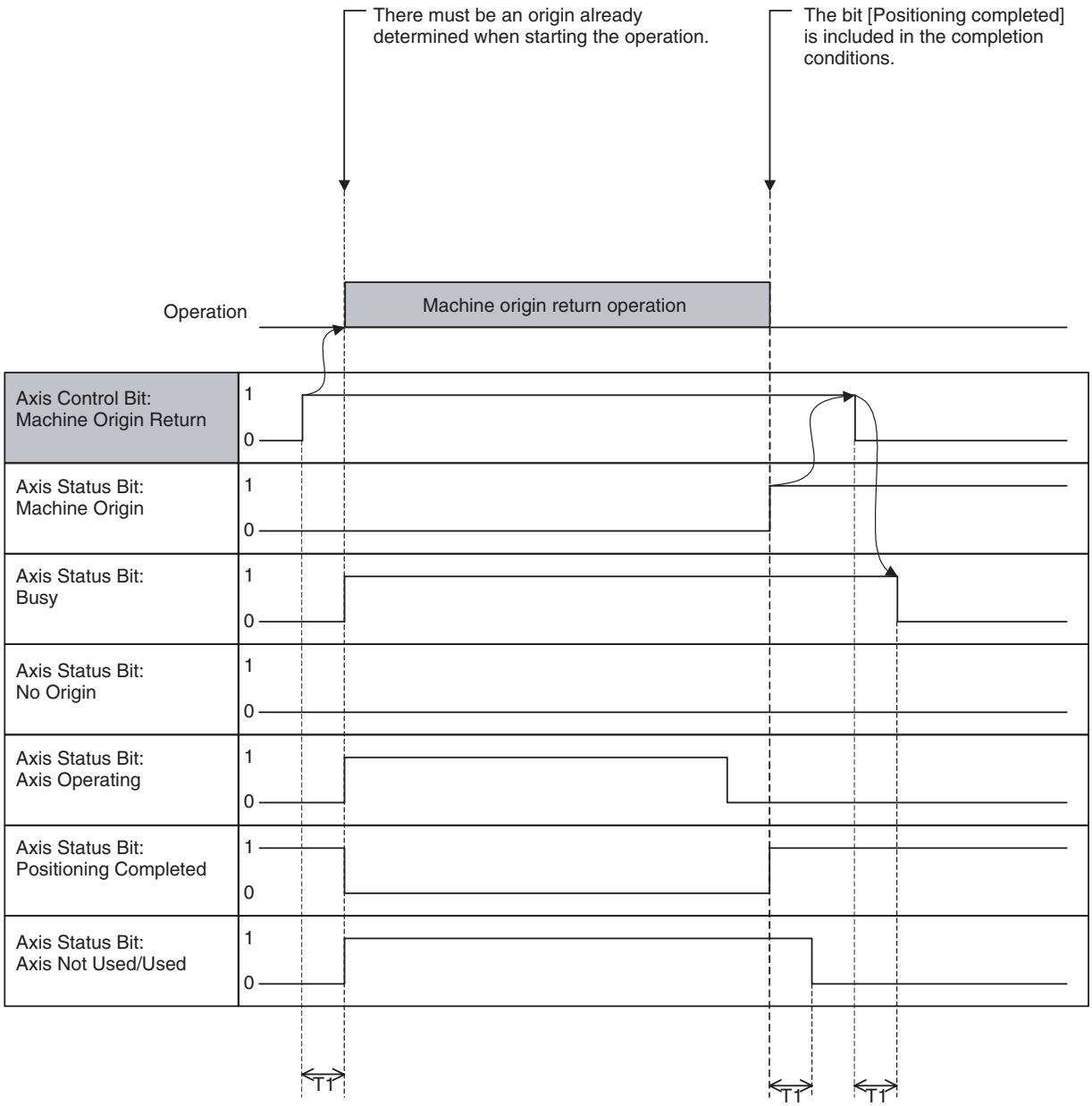
Parameter No.	Name
P2AA02	Maximum manual feed rate
P2AA04	Manual feed rate
P2AA07	Manual feed acceleration time
P2AA08	Manual feed deceleration time

Program Example

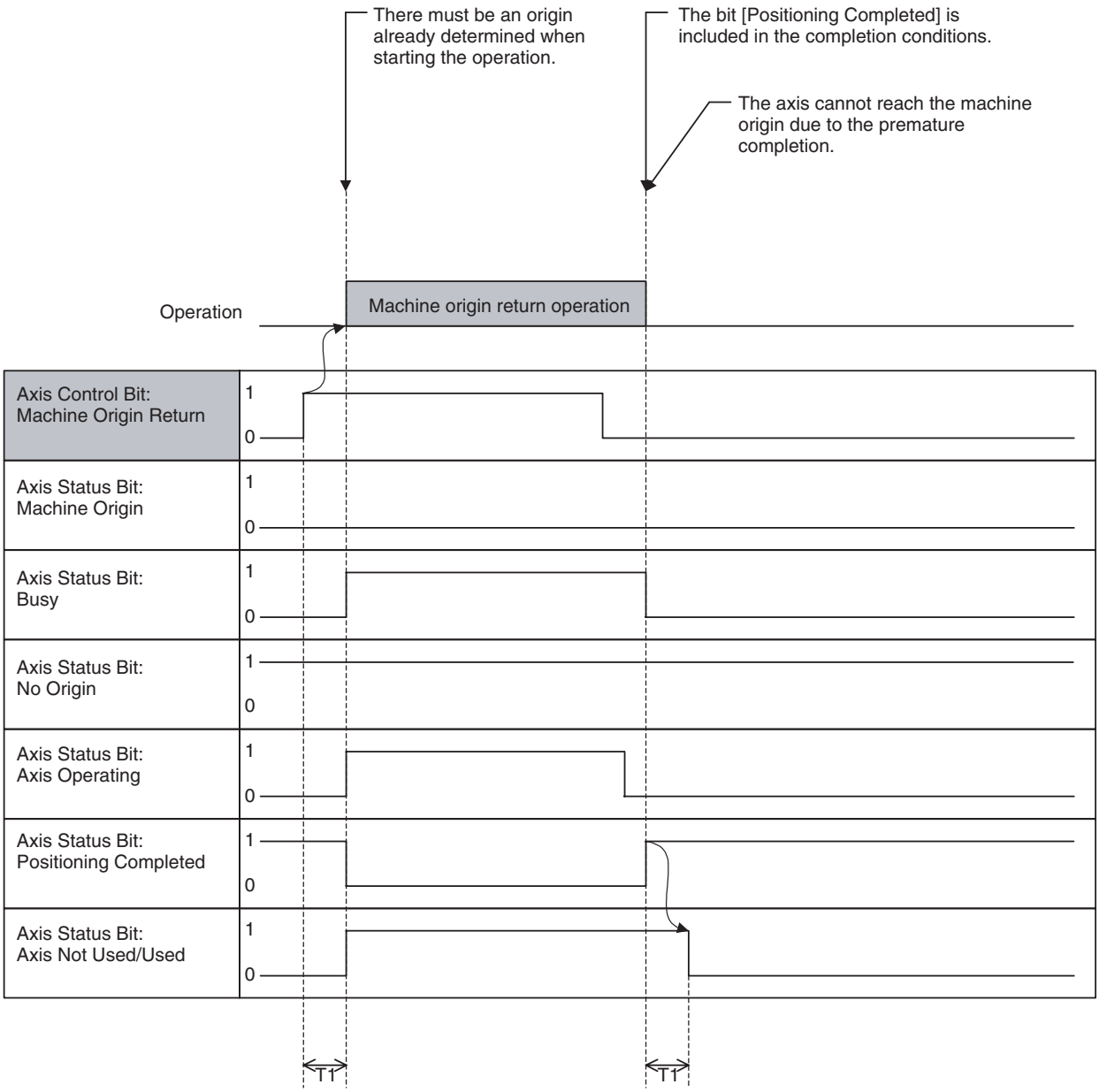


Timing Chart

Basic operation:



Premature completion:



Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	08	Error Counter Reset (Axis 1) - Error Counter Reset (Axis 32)	Output

Function

The error counter pulses that accumulated in a pressing operation, etc. using position control and torque control are forcibly cleared to put the axis into the positioning completed state.

Command and Operation

Name	Specifications
Error Counter Reset	0: Nil 1: Nil ↑: Resets error counter ↓: Interrupts Error counter reset

• When the bit [In Servo Lock] is OFF:

The error counter reset processing will be executed when the bit [Error Counter Reset] is turned ON.

Note Actually, Errors are not generated.

When the bit [Axis Operating] is OFF:

• The error counter reset processing will be executed when the bit [Error Counter Reset] is turned ON.

• When the bit [Axis Operating] is ON:

When the bit [Axis Operating] is turned OFF after the rising edge of the bit [Error Counter Reset], the error counter reset processing will be executed. If the bit [Error Counter Reset] has been turned OFF before the bit [Axis Operating] is turned OFF, the error counter reset processing will not be executed.

Note If the MC Unit and MECHATROLINK-II Servo are used together, the position loop is managed on the MECHATROLINK-II Servo. Therefore, depending on error amount, the error counter reset processing may not be executed at once, but may be executed being divided into several communication scans. In this case, the processing to output a position command that resets the error counter to the MECHATROLINK-II Servo is called the “Error counter reset”.

Status Condition

Name	Specifications
Busy	0: Not executing any of the functions listed below. 1: Executing one of the functions listed below, or the command bit is ON. JOG, STEP, Origin Search, Machine Origin Return, Error Counter Reset, Forced Origin, and ABS Origin Setting

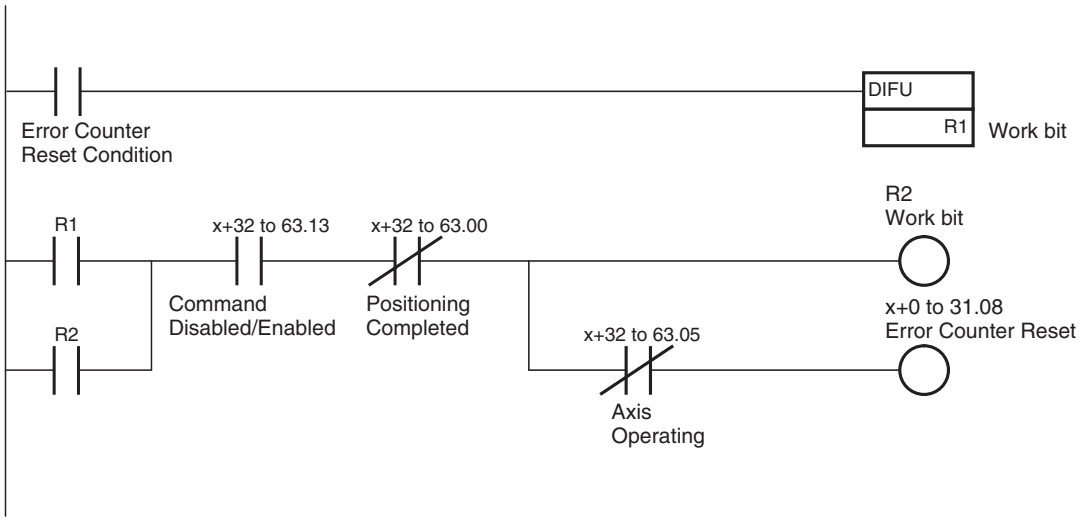
Effect of Other Functions Error counter reset cannot be executed while the bit [Axis Operating] is ON.

Effect on Other Functions

Classification	Item	Effect
Physical Status	Servo Axis	No effect
	Virtual Axis	No effect (Errors are not generated.)
	I/O Axis	Ignored
	Counter Axis	Ignored
Status Bits	Busy	No effect
	In Servo Lock	No effect
	No Origin	No effect
	Axis Operating	Error counter reset cannot be executed when ON (wait until turned OFF).
	Positioning Completed	No effect
	Positioning Completed (No. 2)	No effect
	Axis Machine Lock Status	No effect
	Command Disabled/Enabled	Error counter reset cannot be executed when OFF.
	Axis Not Used/Used	No effect
	In Manual/Automatic Mode	No effect

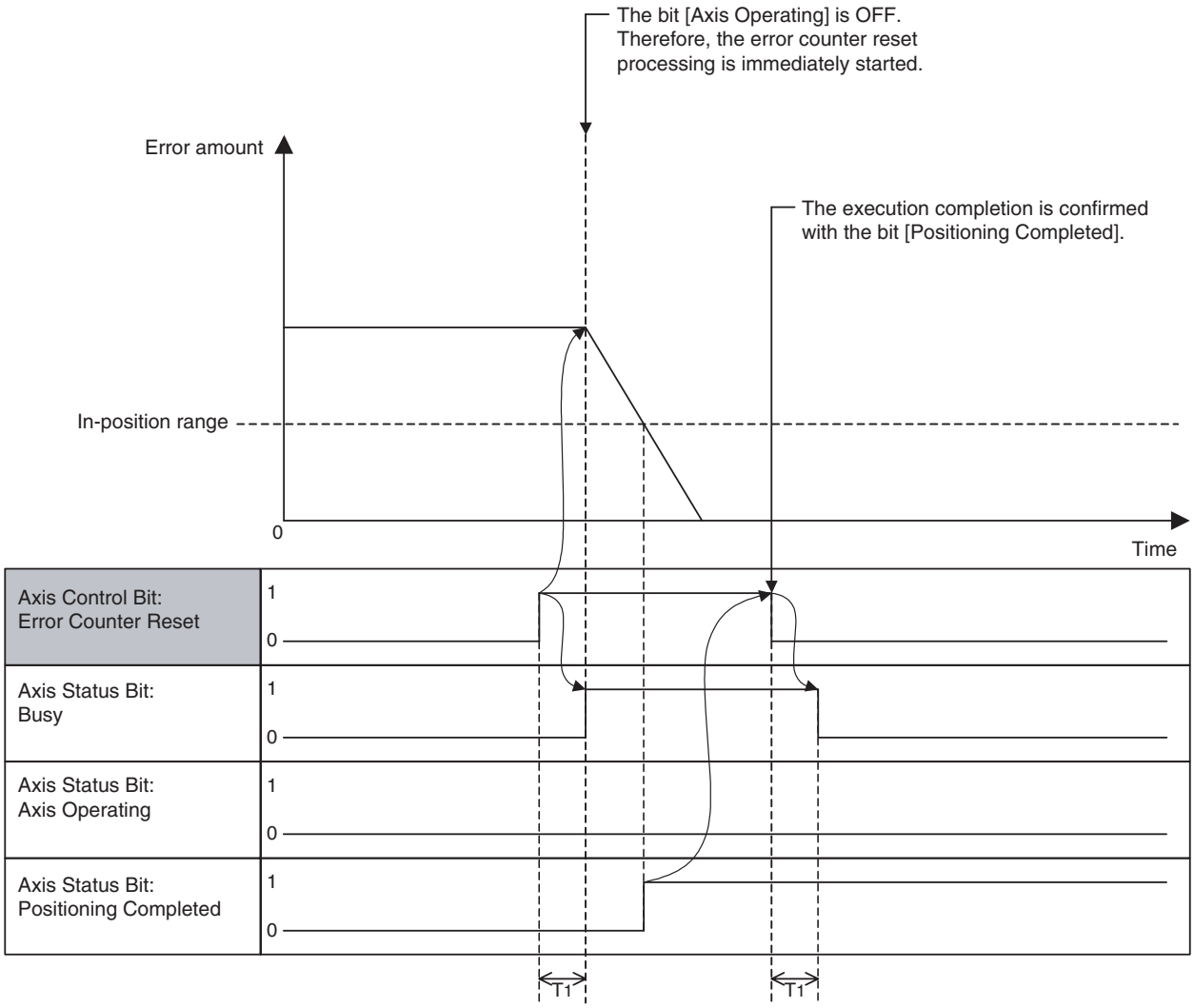
System Parameter Nil

Program Example

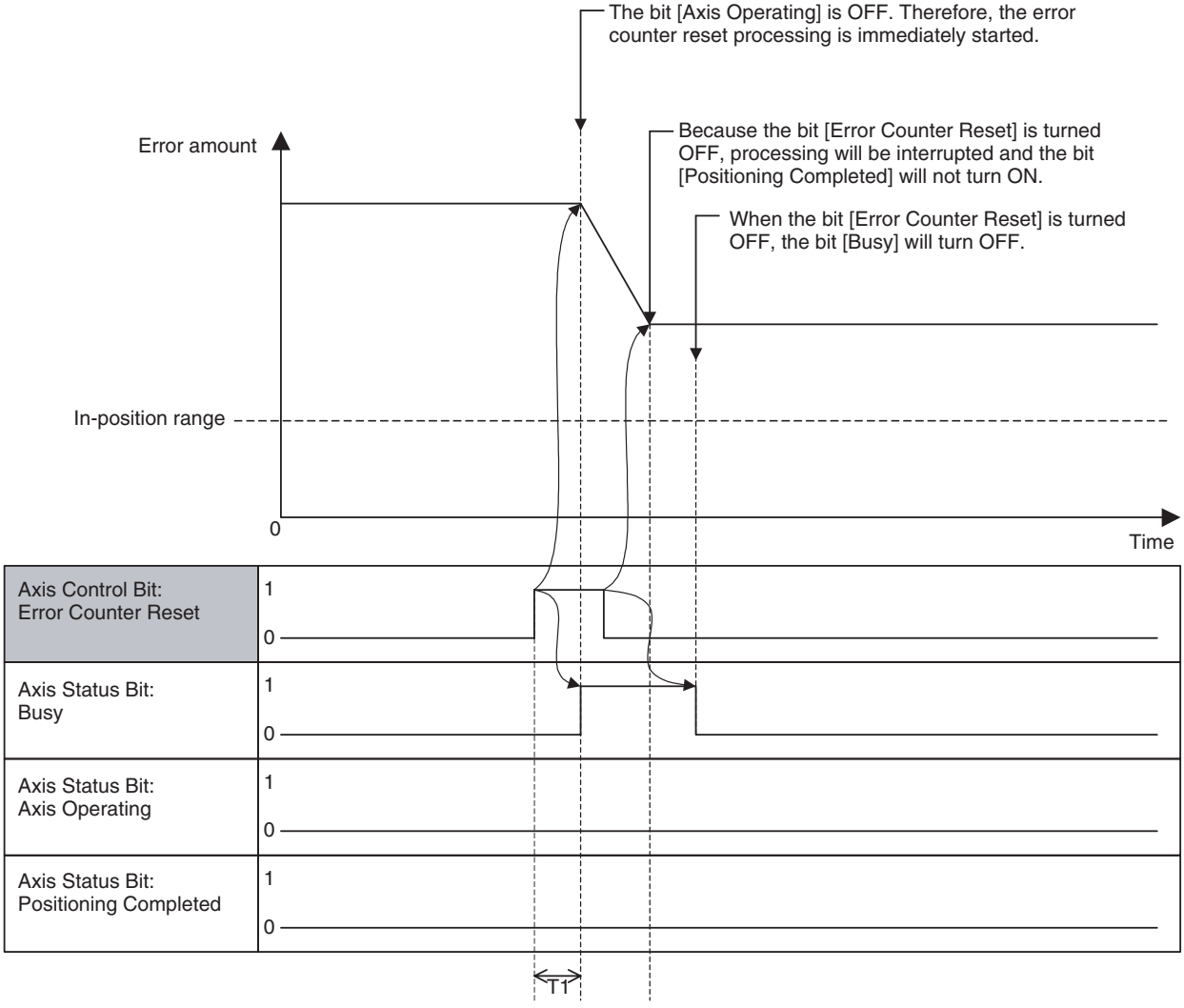


Timing Chart

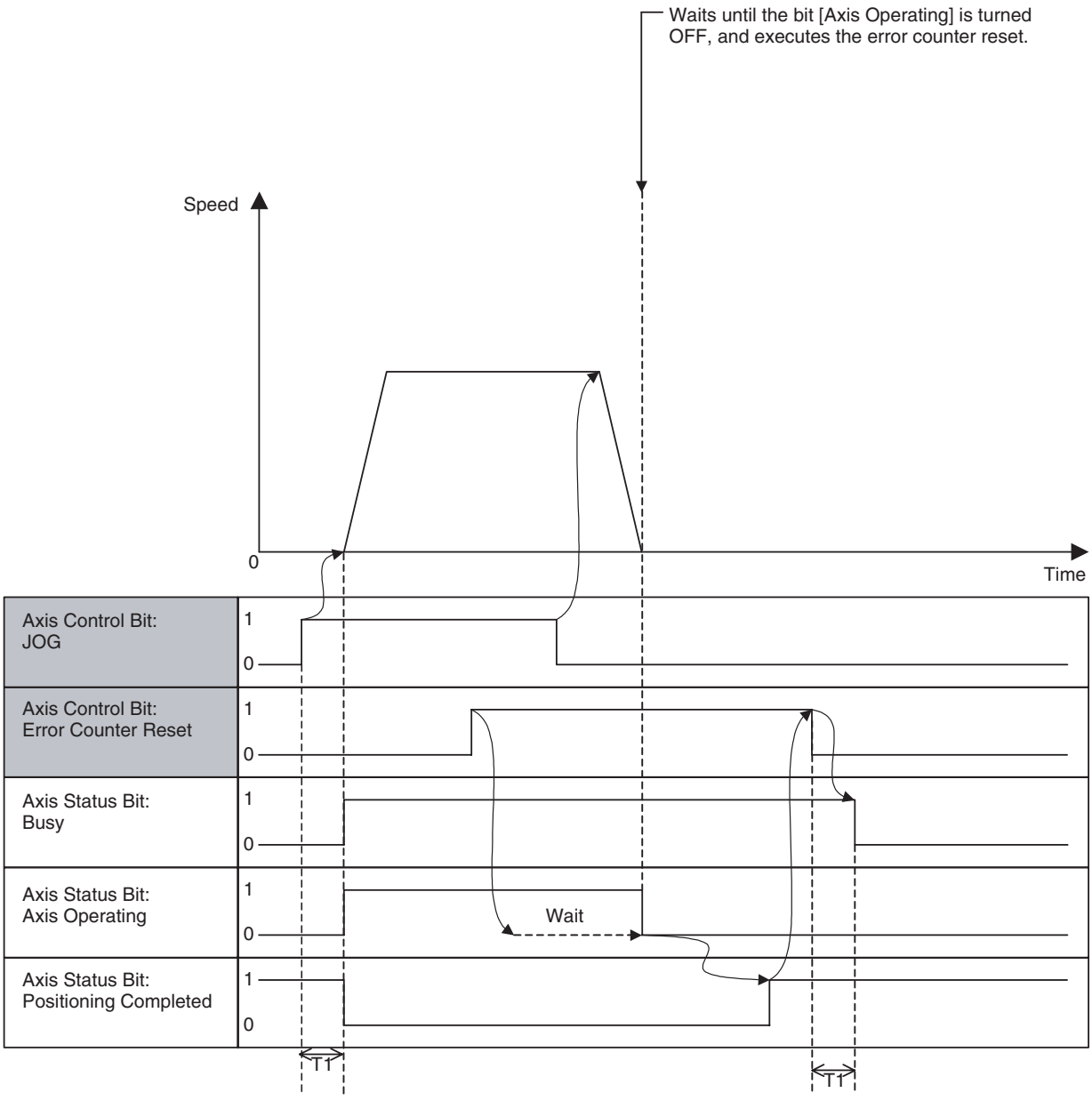
Basic operation 1 (The bit [Error Counter Reset] is turned OFF after checking the bit [Positioning Completed].):



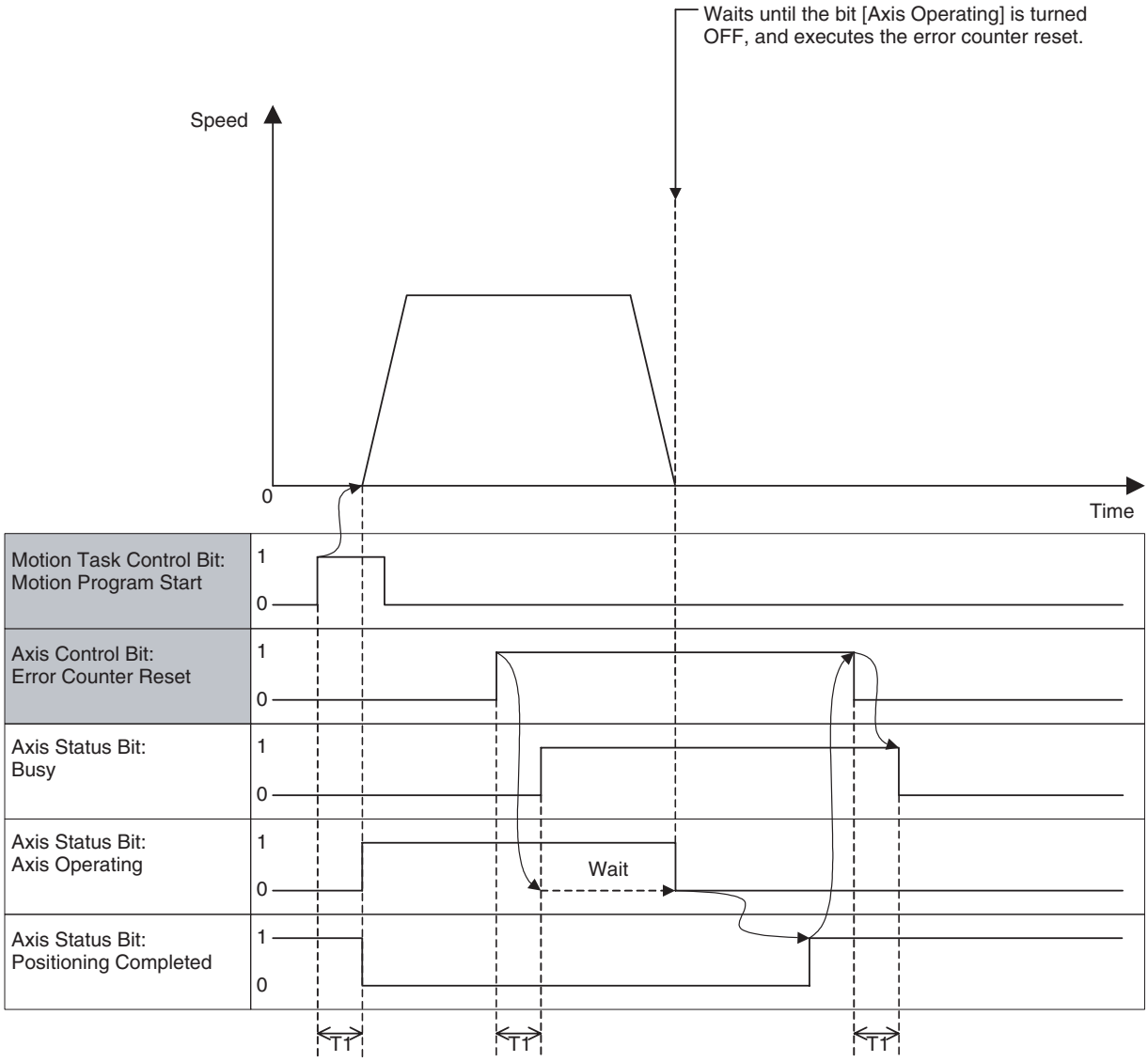
Basic operation 2 (The bit [Error Counter Reset] is turned OFF without checking the bit [Positioning Completed].):



Execution when the bit [Axis Operating] is ON (in Manual Mode):



Execution when the bit [Axis Operating] is ON (in Automatic Mode):



Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	09	Forced Origin (Axis 1) - Forced Origin (Axis 32)	Output

Function

With this bit, the present position is defined as the machine origin.

Command and Operation

Name	Specifications
Forced Origin	0: Nil 1: Nil ↑: The present position is defined as the origin on the machine coordinate system (disabled during operation). ↓: Nil

The machine origin will be defined when the bit [Forced Origin] is turned ON.

Status Condition

Name	Specifications
Machine Origin	0: Machine coordinate system FB position is outside of origin in-position range. 1: Machine coordinate system FB position is within origin in-position range.
Busy	0: Not executing any of the functions listed below. 1: Executing one of the functions listed below, or the command bit is ON. JOG, STEP, Origin Search, Machine Origin Return, Error Counter Reset, Forced Origin, and ABS Origin Setting
No Origin	0: Origin on machine coordinate system is defined. 1: Origin on machine coordinate system is not defined.
Axis Operating	0: No axis operating command 1: Axis operating command being output.
Positioning Completed	0: Outputting positioning command, or axis is outside of in-position range. 1: Not outputting positioning command, and axis is within in-position range.

Effect of Other Functions

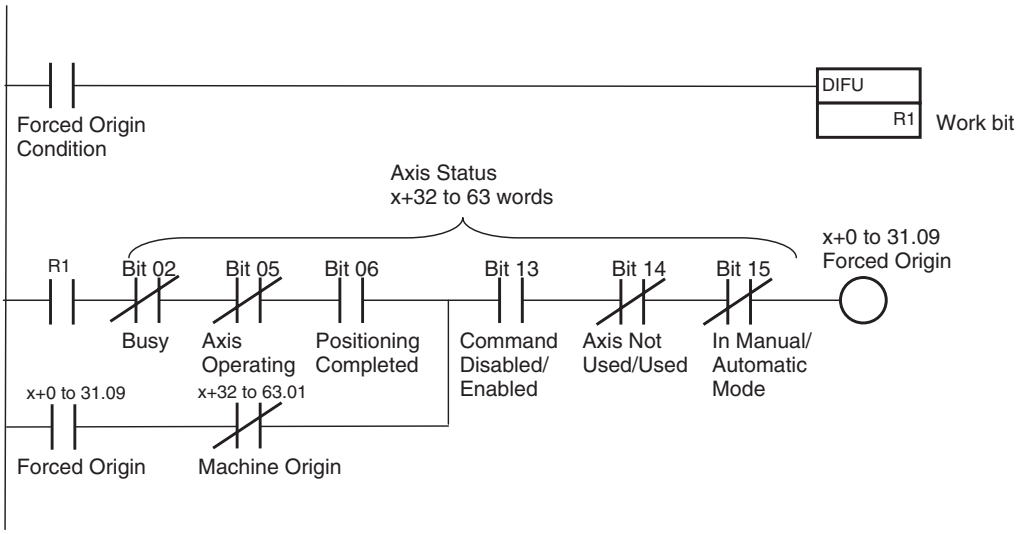
Classification	Item	Effect
Physical Status	Servo Axis	No effect
	Virtual Axis	No effect
	I/O Axis	Ignored
	Counter Axis	Ignored
Status Bits	Busy	Forced origin cannot be executed when ON.
	In Servo Lock	No effect
	No Origin	No effect
	Axis Operating	Forced origin cannot be executed when ON.
	Positioning Completed	Forced origin cannot be executed when OFF.
	Positioning Completed (No.2)	No effect
	Axis Machine Lock Status	No effect
	Command Disabled/Enabled	Forced origin cannot be executed when OFF.
	Axis Not Used/Used	Forced origin cannot be executed when ON.
	In Manual/Automatic Mode	Forced origin cannot be executed when ON.

Effect on Other Functions Nil

System Parameter The following parameter determines the position after defining the machine origin:

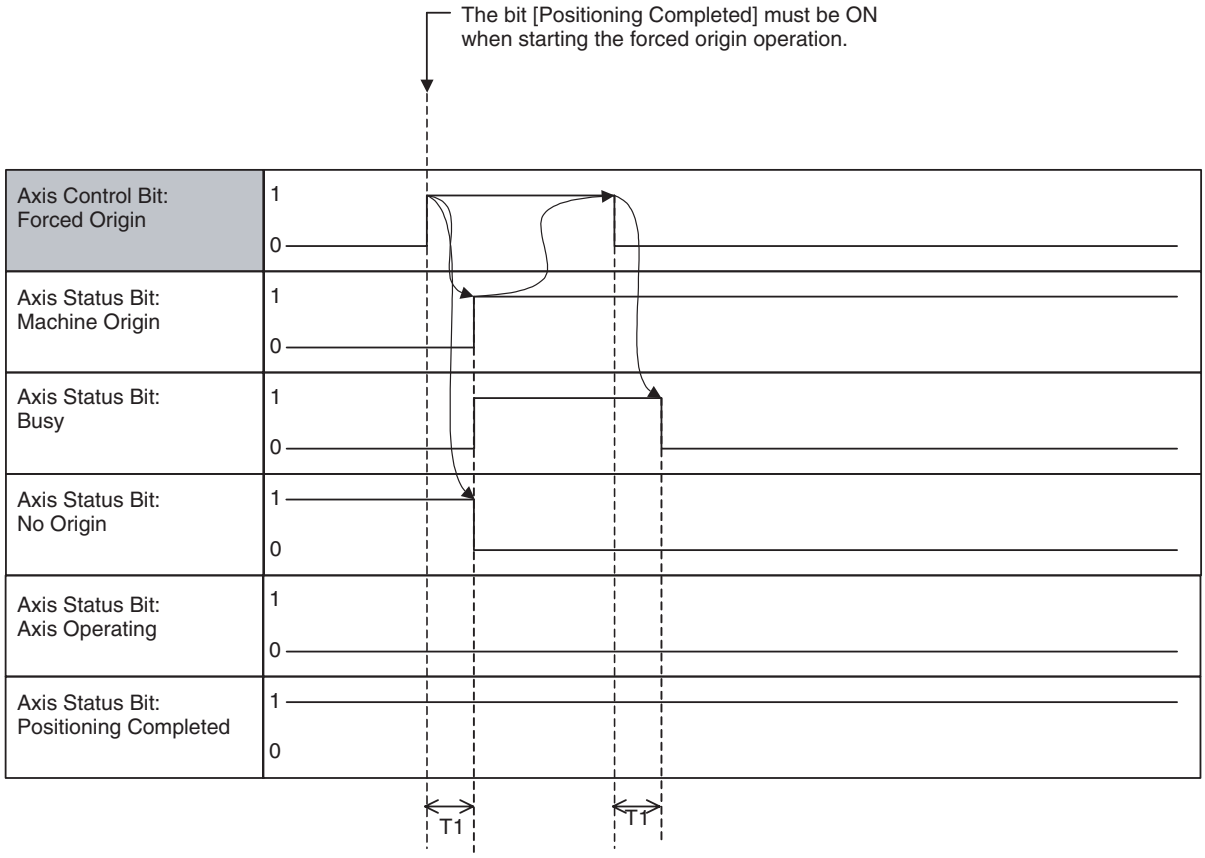
Parameter No.	Name	Remark
P4AA10	Reference (machine) origin offset	The position after forced origin execution will be the one that is specified in this parameter.

Program Example



Timing Chart

Basic operation:



Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	10	ABS Origin Setting (Axis 1) - ABS Origin Setting (Axis 32)	Output

Function

The present position will be defined as the machine origin when the bit [ABS Origin Setting] is turned ON and the positional relation between the origin and ABS encoder value is saved into the flash ROM. With this function, the need for origin searches when switching ON the ABS encoder will be eliminated.

Command and Operation

Name	Specifications
ABS Origin Setting	0: Nil 1: Nil ↑: Sets ABS encoder origin. ↓: Nil

Status Condition

Name	Specifications
Machine Origin	0: Machine coordinate system FB position is outside of origin in-position range. 1: Machine coordinate system FB position is within origin in-position range.
Busy	0: Not executing any of the functions listed below. 1: Executing one of the functions listed below, or the command bit is ON. JOG, STEP, Origin Search, Machine Origin Return, Error Counter Reset, Forced Origin, and ABS Origin Setting
No Origin	0: Origin on machine coordinate system is defined. 1: Origin on machine coordinate system is not defined.
Axis Operating	0: No axis operating command 1: Axis operating command being output.
Positioning Completed	0: Outputting positioning command, or axis is outside of in-position range. 1: Not outputting positioning command, and axis is within in-position range.

Effect of Other Functions

Classification	Item	Effect
Physical Status	Servo Axis	• ABS origin setting can be executed only on the ABS encoder axis. • If ABS origin setting is executed on the INC encoder axis, the positional relation between the origin and ABS encoder value will be cleared.
	Virtual Axis	Ignored
	I/O Axis	Ignored
	Counter Axis	Ignored

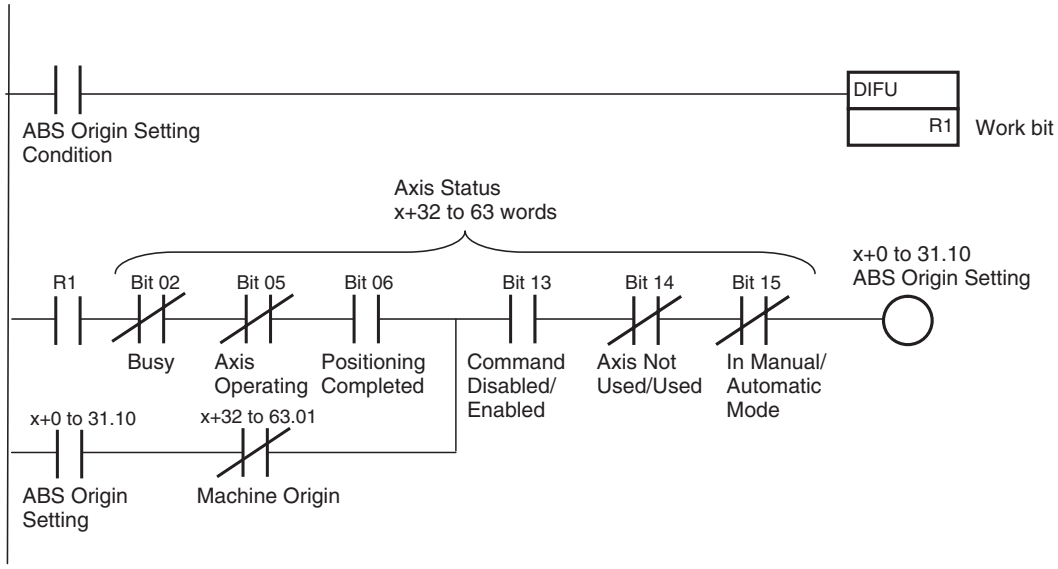
Classification	Item	Effect
Status Bits	Busy	ABS origin setting cannot be executed when ON.
	In Servo Lock	No effect
	No Origin	No effect
	Axis Operating	ABS origin setting cannot be executed when ON.
	Positioning Completed	ABS origin setting cannot be executed when OFF.
	Positioning Completed (No.2)	No effect
	Axis Machine Lock Status	No effect
	Command Disabled/Enabled	ABS origin setting cannot be executed when OFF.
	Axis Not Used/Used	ABS origin setting cannot be executed when ON.
	In Manual/Automatic Mode	ABS origin setting cannot be executed when ON.

Effect of Other Function Nil

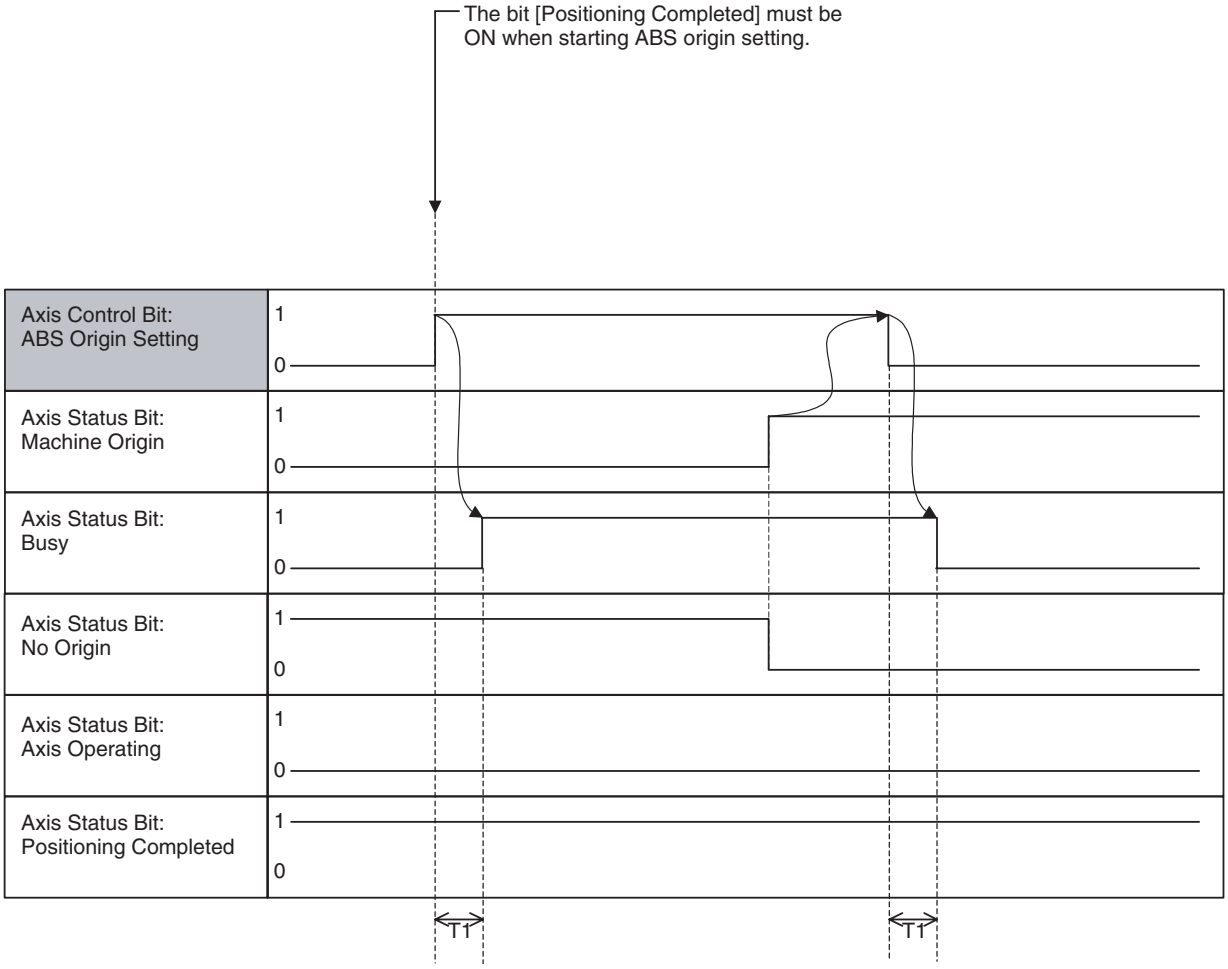
System Parameter The following system parameter determines the position after ABS origin setting:

Parameter No.	Name	Remark
P4AA12	ABS origin offset	The position after ABS origin setting will be the one that is specified in this parameter.

Program Example



Timing Chart



Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	11	Axis Override Enable (Axis 1) - Axis Override Enable (Axis 32)	Output

Function

- Override is the function to change the feed rate specified in the motion program or parameter to the user-specified speed with % specification.
- There are two types of override functions, [Task Override] and [Axis Override]. One of them is used in motion program execution depending on the speed.
- The axis override can be applied to the speed specified by operand V in the motion program or the speed set in the axis parameter.

- The relations between each command and override are shown in the table below:

Classification	Function/Name	Command	Override	Remark
Axis Movement	Positioning	MOVE	Axis Override	
	Linear Interpolation	MOVEL	Task Override	
	Circular Interpolation	MOVEC	Task Override	
	Origin Search	DATUM	Axis Override	Applicable only for origin search feed rate
	Interrupt Feeding	MOVEI	Axis Override	
	Time-specified Positioning	MOVET	Axis Override	Specified time period cannot be kept.
	Traverse	MOVETRAV	Task Override	
	Electronic Cam, Single Axis	CAM	Disable	
Axis Operation	Link Operation	MOVELINK	Disable	
	Electronic Cam, Synchronous	CAMBOX	Disable	
	Electronic Shaft	CONNECT	Disable	
	Trailing Synchronization	SYNC	Disable	
	Travel Distance Superimpose	ADDAX	Disable	
	Speed Control	SPEED	Disable	
	Torque Control	TORQUE	Disable	
Axis Operation Cancel	Trailing Synchronization Cancel	SYNCR	Disable	
	Travel Distance Superimpose Cancel	ADDAXR	Disable	
	Speed Control Cancel	SPEEDR	Disable	
	Torque Control Cancel	TORQUER	Disable	

Command and Operation

Name	Specifications
Axis Override Enable	0: Disables axis override value (override 100% is used.) 1: Enables axis override value ↑: Nil ↓: Nil
Axis Override	0 to 32767 [0.01%] 0.00% if value out of range is input.

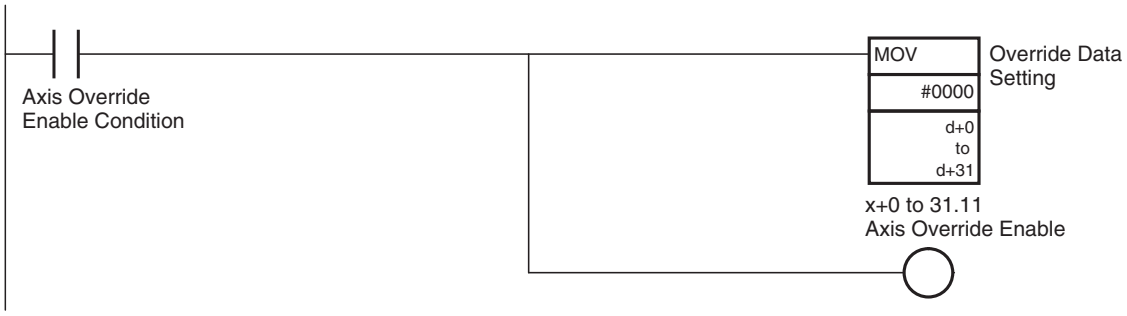
- The value in [Axis Override] is enabled only while the bit [Axis Override Enable] is turned ON. When the bit is OFF, override 100.00% is used.
- The bit [Axis Override Enable] and data [Axis Override] are always referenced.

Status Condition Nil

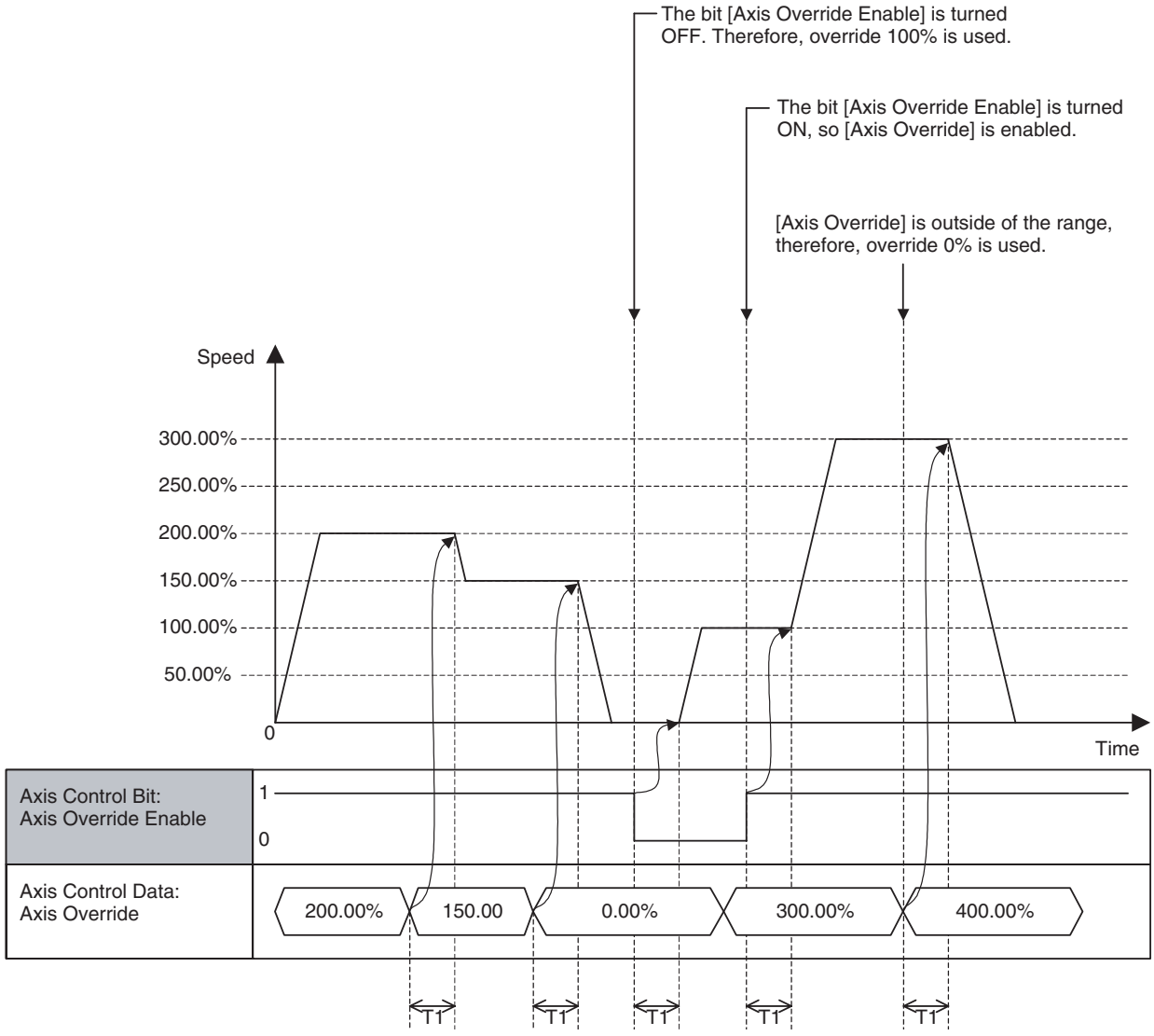
Effect of Other Functions Nil

Effect on Other Functions Speed of the functions with axis movement is affected.

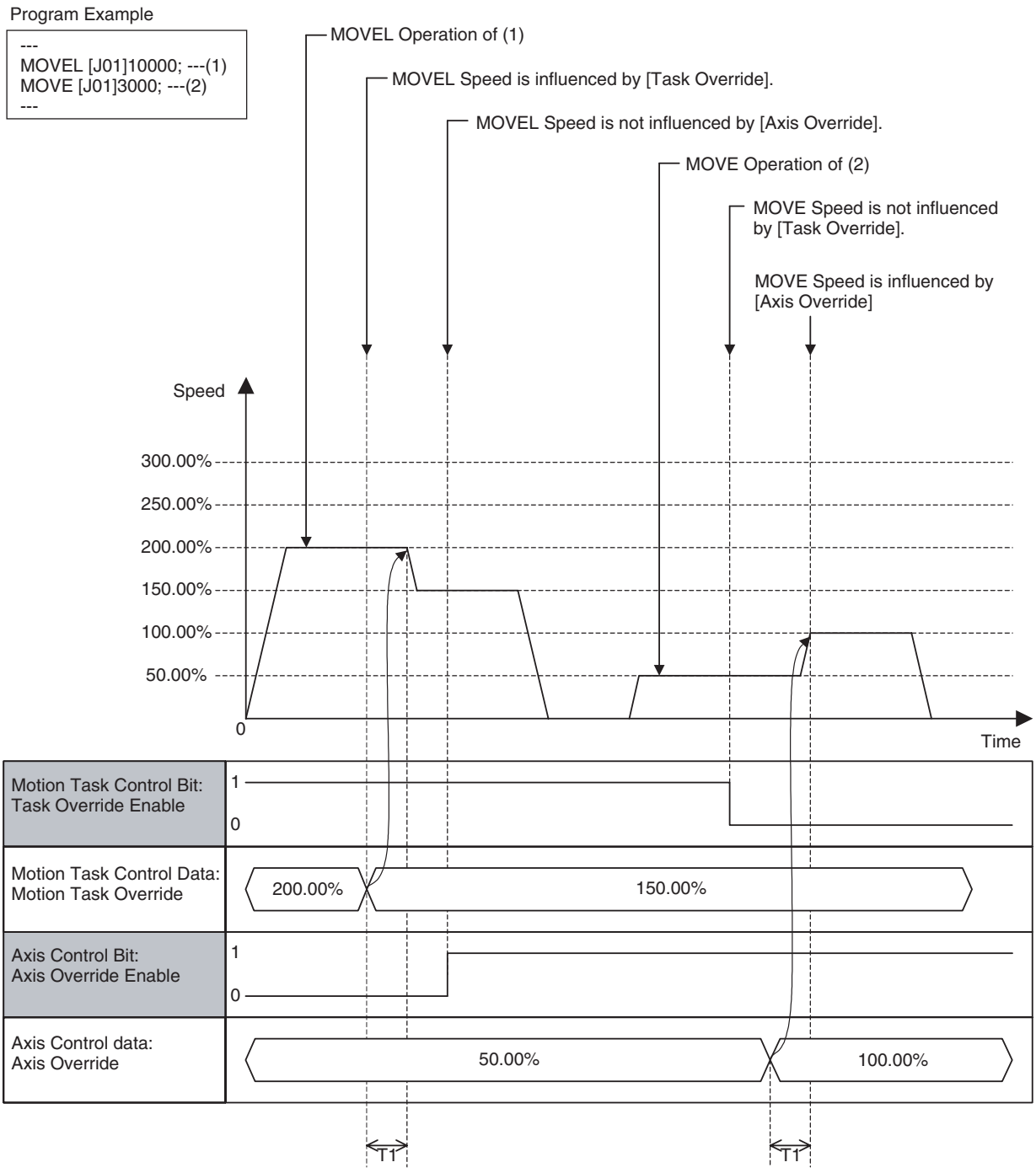
Program Example



Timing Chart **Basic Operation:**



Relation between Task Override and Axis Override:



Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	13	Axis Machine Lock (Axis 1) - Axis Machine Lock (Axis 32)	Output

Function

- With Axis machine lock, output for axis movement is stopped to debug the sequences other than the ones for the axis movement.
- Even though command output for axis is stopped, the command position will be updated and signal for the output modules will be output normally.

- When Axis machine lock status is cancelled, the command position returns to the position (Feedback present position) before the machine lock status.
- The Axis machine Lock function works on each axis independently. Therefore, make sure to take caution when the operation (interpolation, etc.) involves multiple axes.
- Even under Axis machine lock state, Servo Lock is required to use functions with axis movement.

Command and Operation

Name	Specifications
Axis Machine Lock	0: Not using Axis machine lock mode 1: Using Axis machine lock mode ↑: No ↓: No

Status Condition

Name	Function
Axis Operating	0: No axis operating command 1: Axis operating command being output.
Positioning Completed	0: Outputting positioning command, or axis is outside of in-position range. 1: Not outputting positioning command, and axis is within in-position range.
Axis Machine Lock Status	0: Not in Axis machine lock mode 1: In Axis machine lock mode
Axis Not Used/Used	0: Axis is not being used. 1: Axis is being used. (In Manual Mode: Axis is used for JOG etc., In Automatic Mode: Axis is declared in the operating program)

Status of the bit [Axis Machine Lock] is reflected in the bit [Axis Machine Lock Status].

Effect of Other Functions

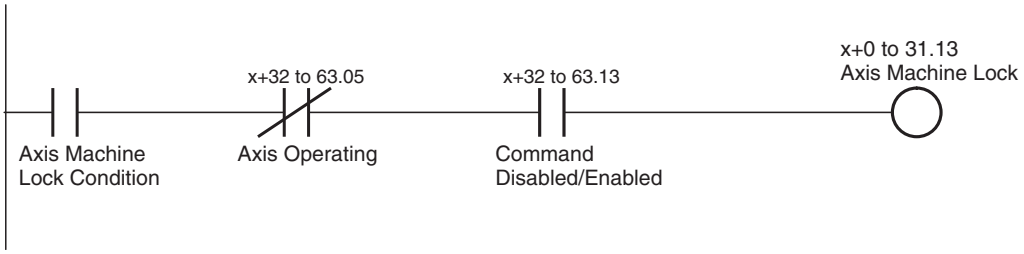
Classification	Item	Effect
Physical Status	Servo Axis	No effect
	Virtual Axis	Ignored
	I/O Axis	Ignored
	Counter Axis	Ignored
Control Status	In Position control	No effect
	In Speed control	Output for Speed command not stopped
	In Torque control	Output for Torque command not stopped

Classification	Item	Effect
Status Bits	Busy	No effect
	In Servo Lock	No effect
	No Origin	No effect
	Axis Operating	Axis machine lock state will not be changed when ON.
	Positioning Completed	No effect
	Positioning Completed (No.2)	No effect
	Axis Machine Lock Status	No effect
	Command Disabled/Enabled	Axis machine lock state is cancelled when OFF.
	Axis Not Used/Used	No effect
	In Manual/Automatic Mode	No effect

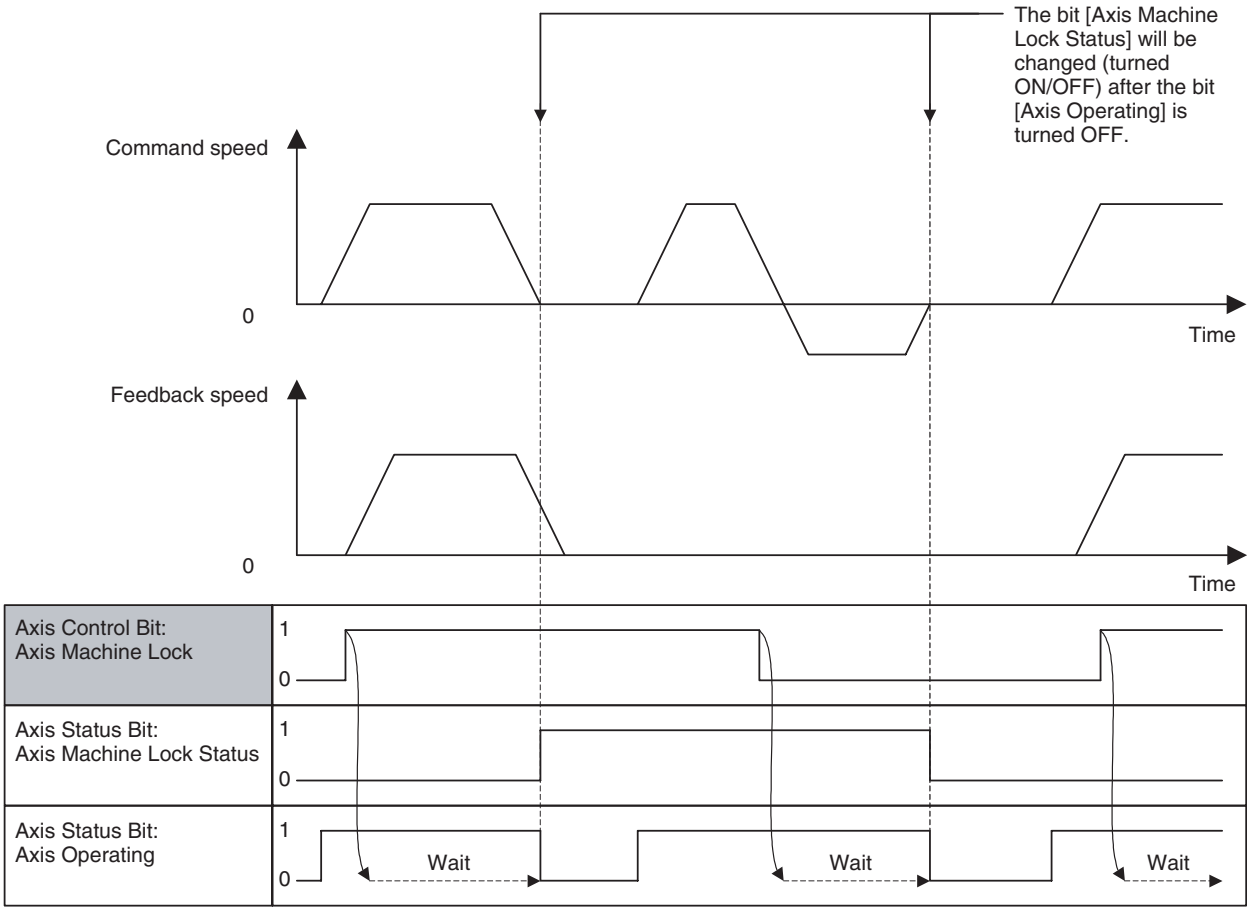
Effect on Other Functions In Axis machine lock state, the origin search operations (with DATUM command, Axis Control Bit: Origin Search) will be executed in the same way as the operations with the Axis Control Bit [Forced Origin].

System Parameter Nil

Program Example

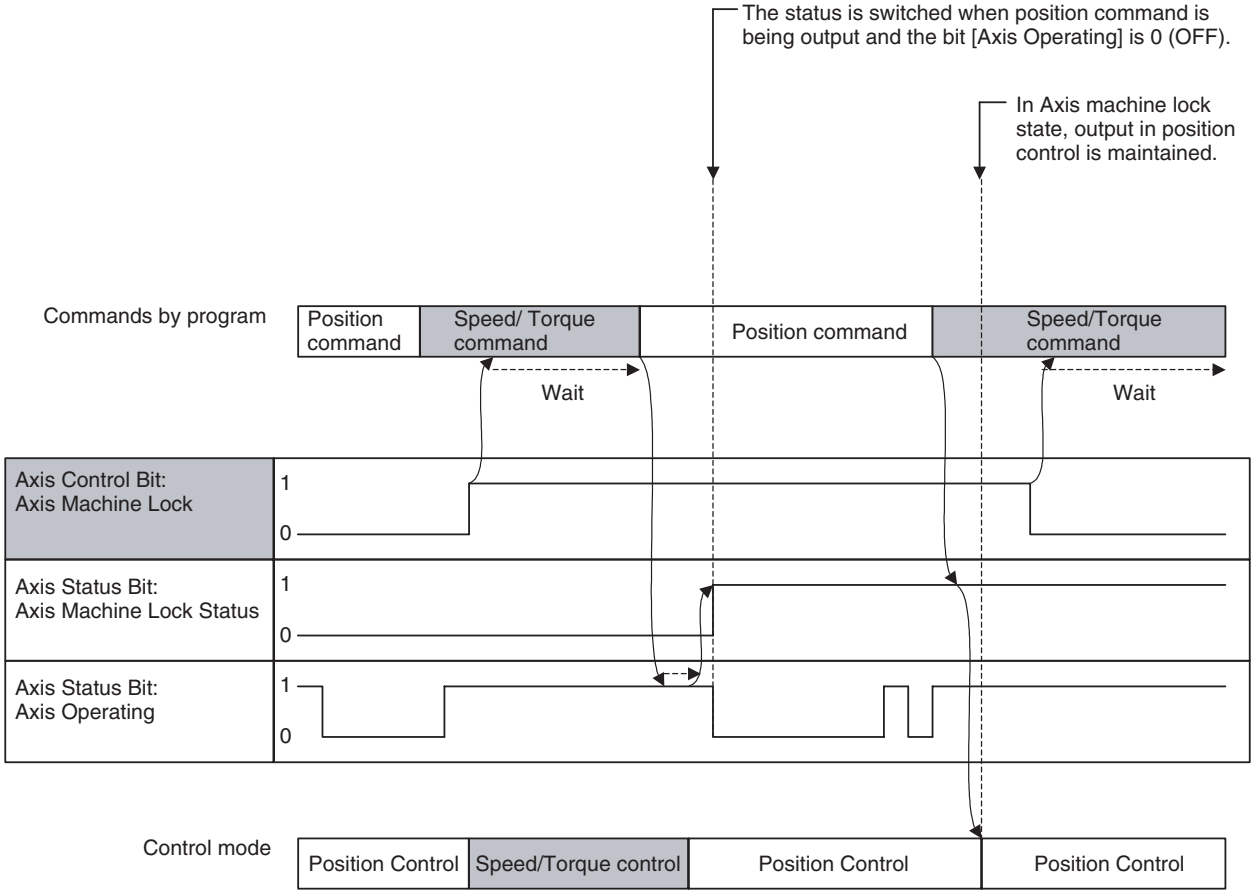


Timing Chart **Basic Operation:**



Operation in Speed or Torque Control:

In Speed or Toque Control, it is not guaranteed that the axis will not move when the command output is stopped. Therefore, the bit [Axis Machine Lock Status] is not changed (turned ON/OFF). Due to the same reason, while the bit [Axis Machine Lock Status] is 1 (ON), commands are output not as Speed or Torque command, but as Position command.



Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	15	Manual/Automatic Mode (Axis 1) - Manual/Automatic Mode (Axis 32)	Output

Function

With this bit, the operating mode of the axis is switched.

Command and Operation

Name	Specifications
Manual/Automatic Mode	0: In Manual Mode 1: In Automatic Mode ↑: Decelerates to stop the manual operation being executed ↓: Decelerates to stop the automatic operation being executed

Status Condition

Name	Specifications
Busy	0: Not executing any of the functions listed below. 1: Executing one of the functions listed below, or the command bit is ON. JOG, STEP, Origin Search, Machine Origin Return, Error Counter Reset, Forced Origin, and ABS Origin Setting
Axis Not Used/Used	0: Axis is not being used. 1: Axis is being used. (In Manual Mode: Axis is used for JOG etc., In Automatic Mode: Axis is declared in the operating program)
In Manual/Automatic Mode	0: In Manual Mode (JOG, STEP, and Origin Search can be executed.) 1: In Automatic Mode (Motion programs can be executed.)

The operating mode status is output to the bit [In Manual/Automatic Mode].

Effect of Other Functions

Conditions for each Axis Status Bit are as shown below:

Name	Condition
Busy	• Does not turn ON • The bit [Manual/Automatic Mode] can be changed (ON/OFF) in Busy state.
Servo Lock	• No effect
No Origin	• The bit [Manual/Automatic Mode] can be changed regardless of whether the origin for the machine coordinate system has been defined or not.
Axis Operating	• Does not turn ON
Positioning Completed	• The bit [Manual/Automatic Mode] cannot be changed when OFF.
Axis Machine Lock Status	• No effect
Command Disabled/Enabled	• The bit [Manual/Automatic Mode] cannot be changed when OFF.
Axis Not Used/Used	• Does not turn ON
In Manual/Automatic Mode	• No effect

Effect on Other Functions

The functions on each axis are limited depending on ON/OFF of the bit [In Manual/Automatic Mode] as shown below:

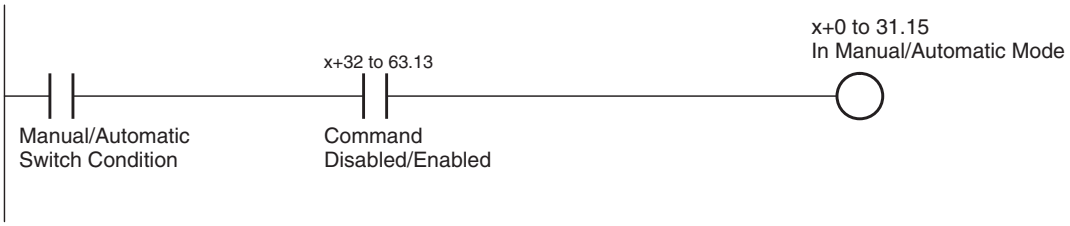
Function	In Manual/Automatic Mode	
	OFF (Manual)	ON (Automatic)
Axis Control Bit: Axis Alarm Reset	Can be executed	Can be executed
Axis Control Bit: Deceleration Stop	Can be executed	Cannot be executed
Axis Control Bit: Servo Lock	Can be executed	Can be executed
Axis Control Bit: Servo Unlock	Can be executed	Can be executed
Axis Control Bit: JOG	Can be executed	Cannot be executed
Axis Control Bit: STEP	Can be executed	Cannot be executed
Axis Control Bit: Origin Search	Can be executed	Cannot be executed
Axis Control Bit: Machine Origin Return	Can be executed	Cannot be executed
Axis Control Bit: Error Counter Reset	Can be executed	Can be executed
Axis Control Bit: Forced Origin	Can be executed	Cannot be executed
Axis Control Bit: ABS Origin Setting	Can be executed	Cannot be executed
Axis Control Bit: Axis Override Enable	Can be executed	Can be executed
Axis Control Bit: JOG/STEP Direction	Can be executed	Cannot be executed
Axis Control Bit: Axis Machine Lock	Can be executed	Can be executed

Function	In Manual/Automatic Mode	
	OFF (Manual)	ON (Automatic)
Axis Control Bit: Manual/Automatic Mode	Can be executed	Can be executed
IOWR: Present Position Preset	Can be executed	Cannot be executed

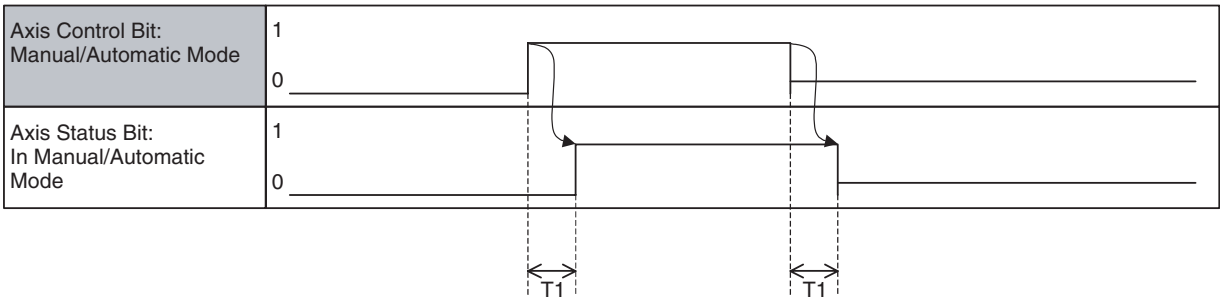
- When the bit [Manual/Automatic Mode] is turned ON (1) during a manual operation, the manual operation being executed will be interrupted by deceleration stop. The bit [In Manual/Automatic Mode] will be turned ON when the bit [Axis Not Used/Used] is turned OFF after the interruption.
- If the bit [Manual/Automatic Mode] for the axis declared by PROG command in the motion program is turned OFF (0) during an automatic operation, the program operation being executed will be interrupted by deceleration stop. The status bit [In Manual/Automatic Mode] will be turned OFF when the bit [Axis Not Used/Used] is turned OFF after the interruption.
- If the bit [In Manual/Automatic Mode] for the axis declared by PROG command is OFF (0) when starting a motion program, the bit [Start Warning] will be turned ON and the motion program cannot be executed.

System Parameter Nil

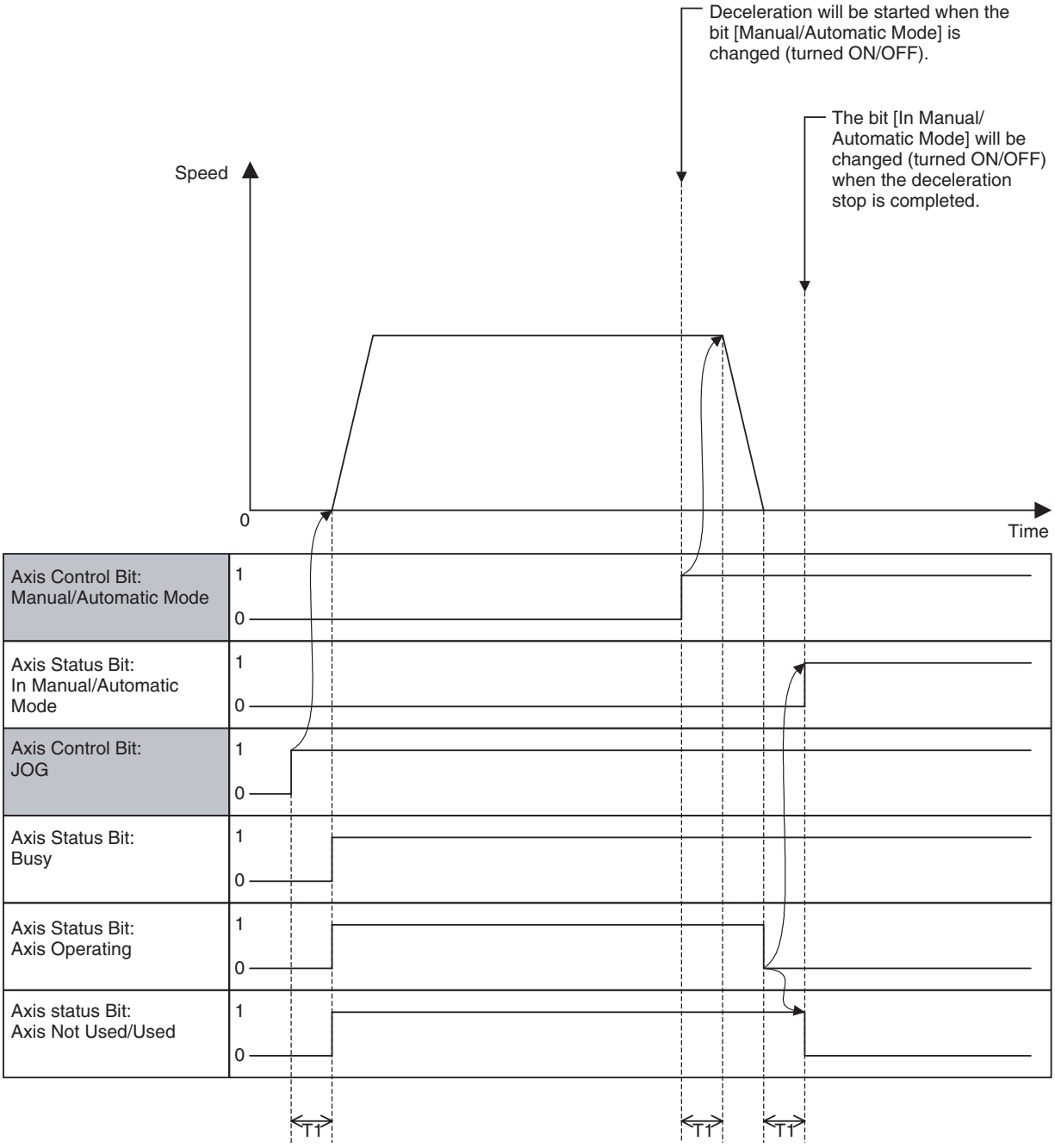
Program Example



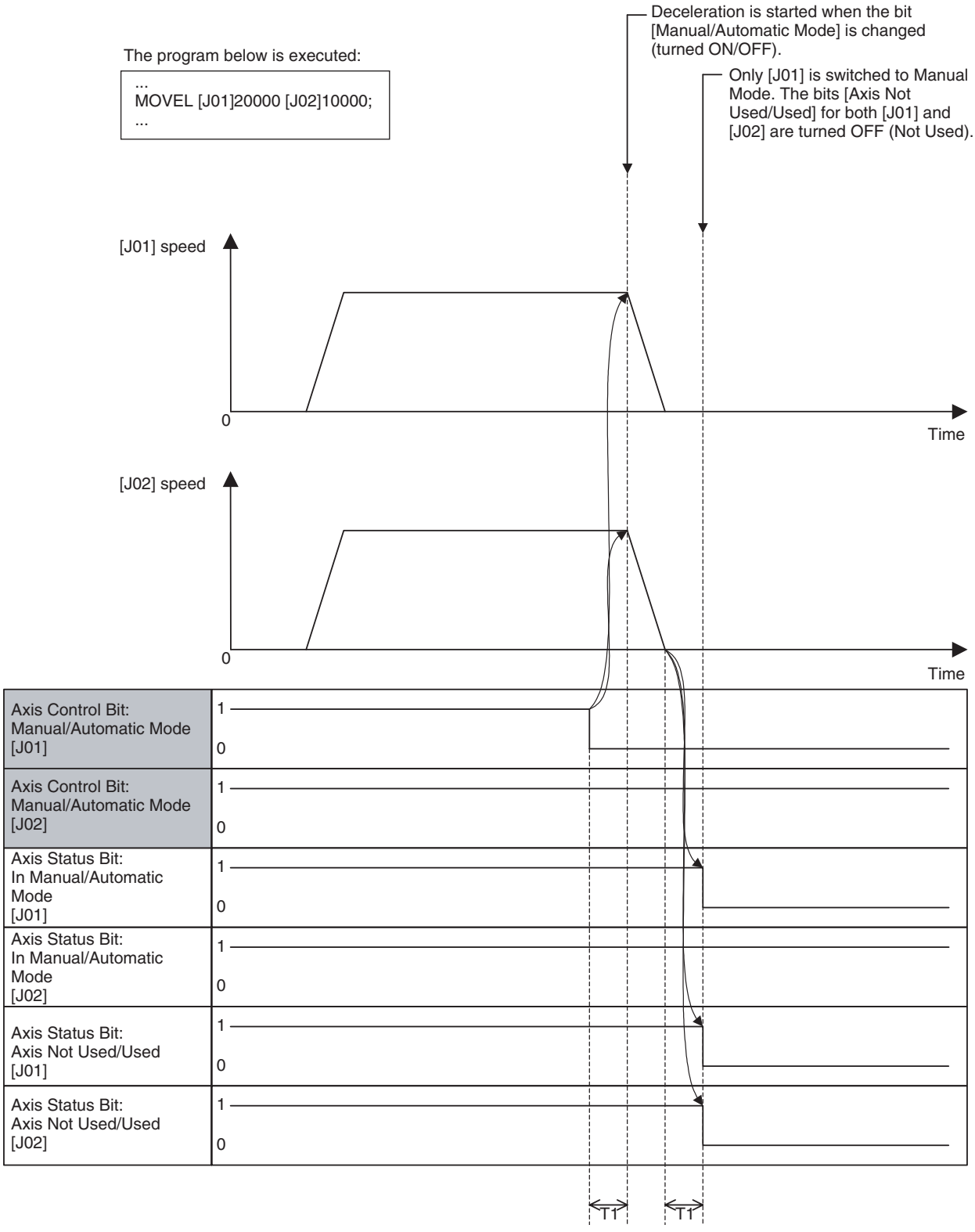
Timing chart **Basic Operation:**



Axis operation switch in Manual Mode:



Switch during program operation in Automatic Mode:



Word	Variable	Bit	Name	I/O
x+0 - x+31	IW0440 - IW045F	00	Axis Alarm Reset (Axis 1) - Axis Alarm Reset (Axis 32)	Output
x+32 - x+63	OW0440 - OW045F	00	Axis Alarm Occurring (Axis 1) - Axis Alarm Occurring (Axis 32)	Input

Function

- When an error that requires stopping the operation occurs in the MC Unit or MECHATROLINK-II slaves, it will be detected as an alarm.
- Executing alarm reset after removing the cause can clear alarms (except for some alarms).
- When communications are disconnected during normal operations, the bit [Axis Alarm Reset] will be turned ON to make the concerned axis usable again.

Command and Operation

Name	Specifications
Axis Alarm Reset	0: Nil 1: Does not turn ON the bit [Axis Alarm Occurring] ↑: Clears alarm occurring on axis level and warning on ML-10. ↓: Nil

Alarms on the axis or MECHATROLINK-II slave level will be reset when the bit [Axis Alarm Reset] is turned ON.

Name	Specifications
Axis Alarm Occurring	0: Alarm not occurring on axis or MECHATROLINK-II slave. 1: Alarm occurring on axis or MECHATROLINK-II slave.

Status Condition

Name	Specifications
Alarm Occurring	0: No alarm 1: Alarm occurring on MC Unit (linked to ERC indicator)
Axis Alarm Occurring 1-16	0: No alarm occurring on axis or the bit [Axis Alarm Reset] is ON 1: Alarm occurring on axis
Axis Alarm Occurring 17-32	0: No alarm occurring on axis or the bit [Axis Alarm Reset] is ON 1: Alarm occurring on axis
Axis Alarm	0: No alarm occurring on axis or MECHATROLINK-II slave 1: Alarm occurring on axis or MECHATROLINK-II slave
Axis Alarm Code	Outputs the code of the alarm occurring on axis

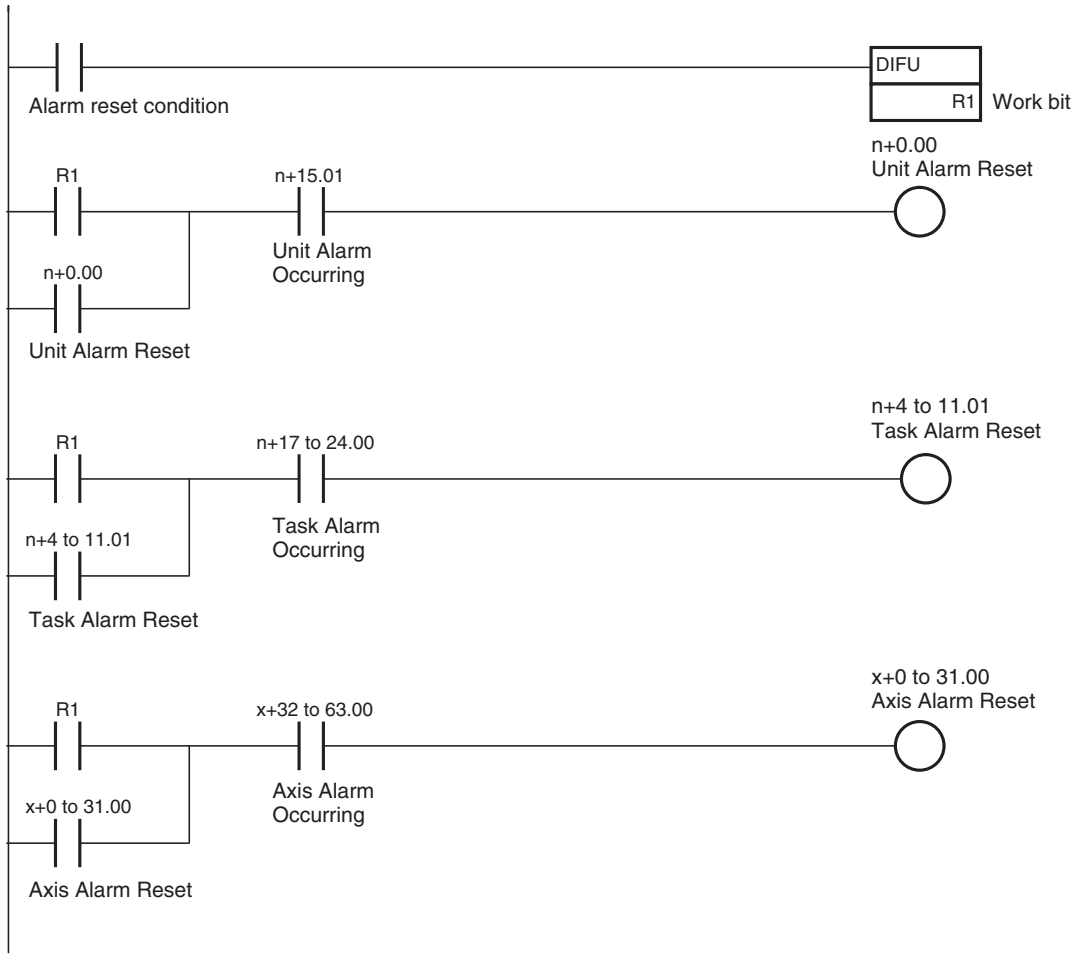
- If an alarm occurs on an axis or MECHATROLINK-II slave, the bits [Alarm Occurring], [Axis Alarm Occurring 1-32], and [Axis Alarm] will be turned ON, and the alarm code will be stored in [Axis Alarm Code].
- When several alarms occur at the same time, the code of the alarm that was detected first will be stored in [Axis Alarm Code].

Effect of Other Functions Nil

Effect on Other Functions When an alarm occurs, various functions will be affected (operation failure, operation interruption etc.).

System Parameter Nil

Program Example



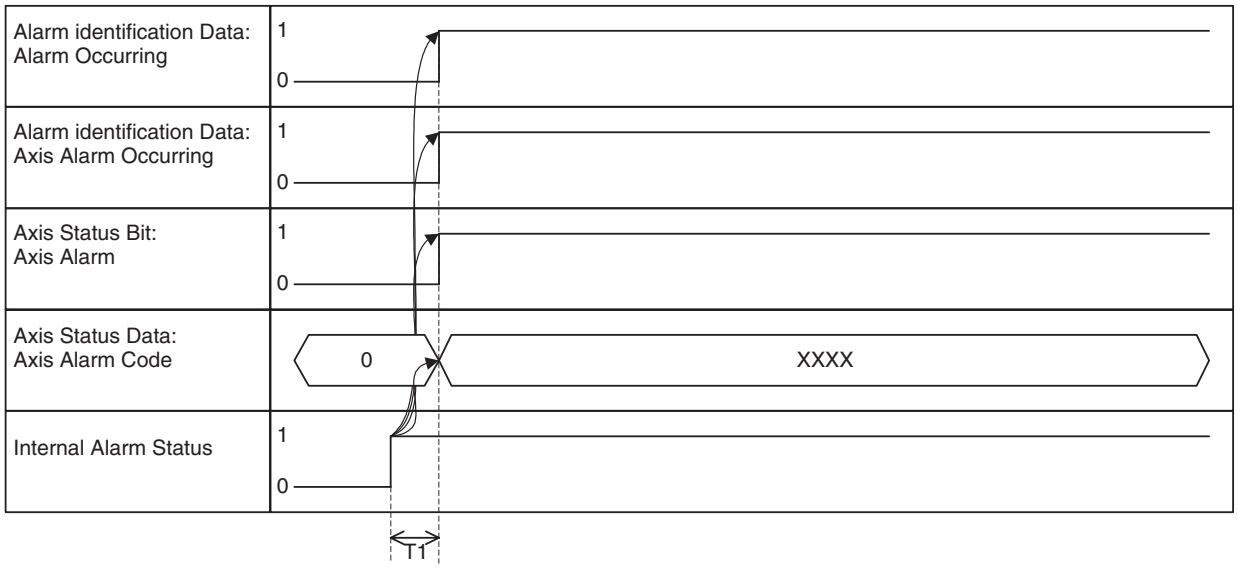
On MC Unit, there are three types of alarms:

- Unit alarm
- Task alarm
- Axis alarm

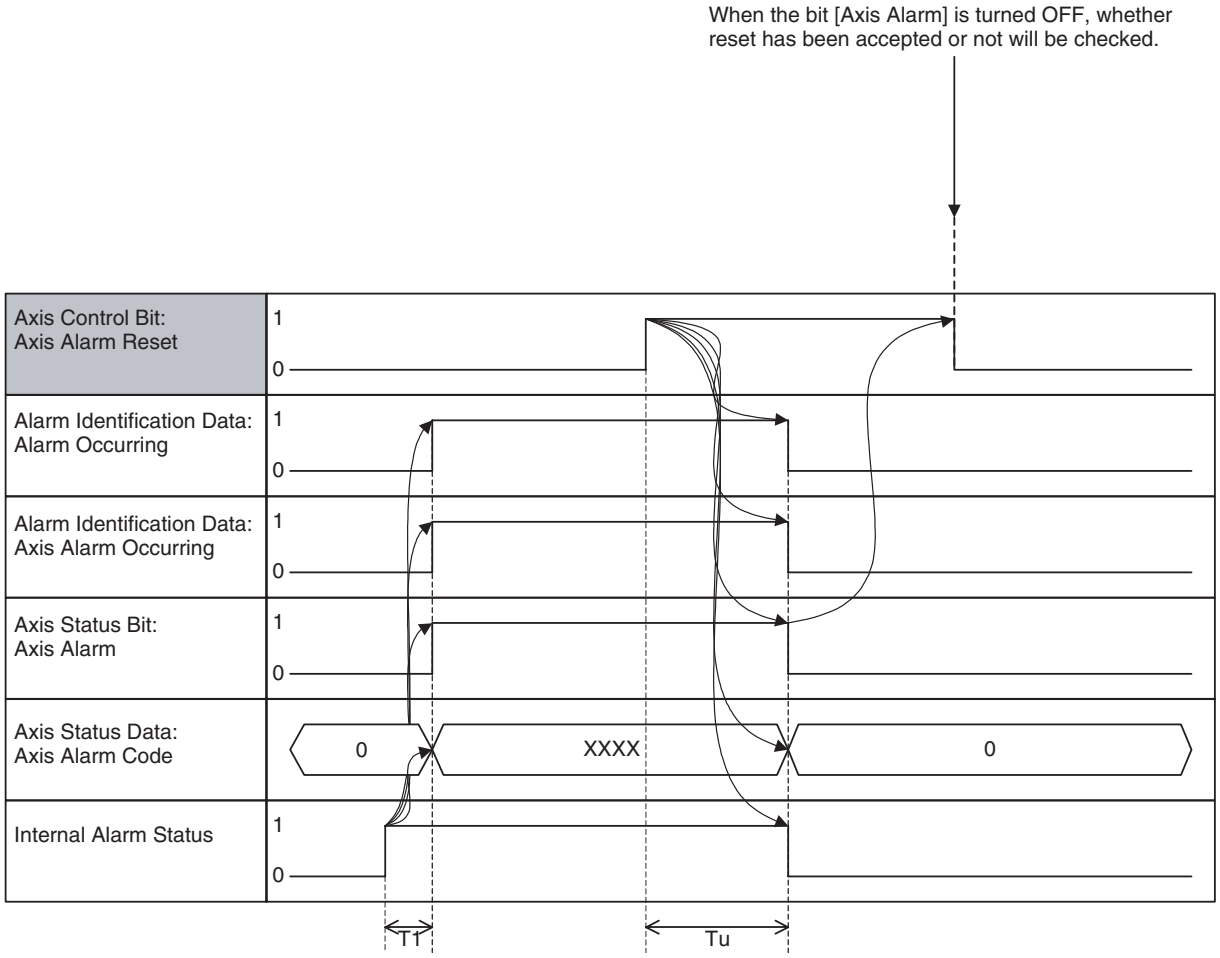
Alarms are reset on the basis of each type. Therefore, execute the alarm reset over the Unit, Task, and Axis to clear an alarm occurring on the MC Unit without fail.

Timing Chart

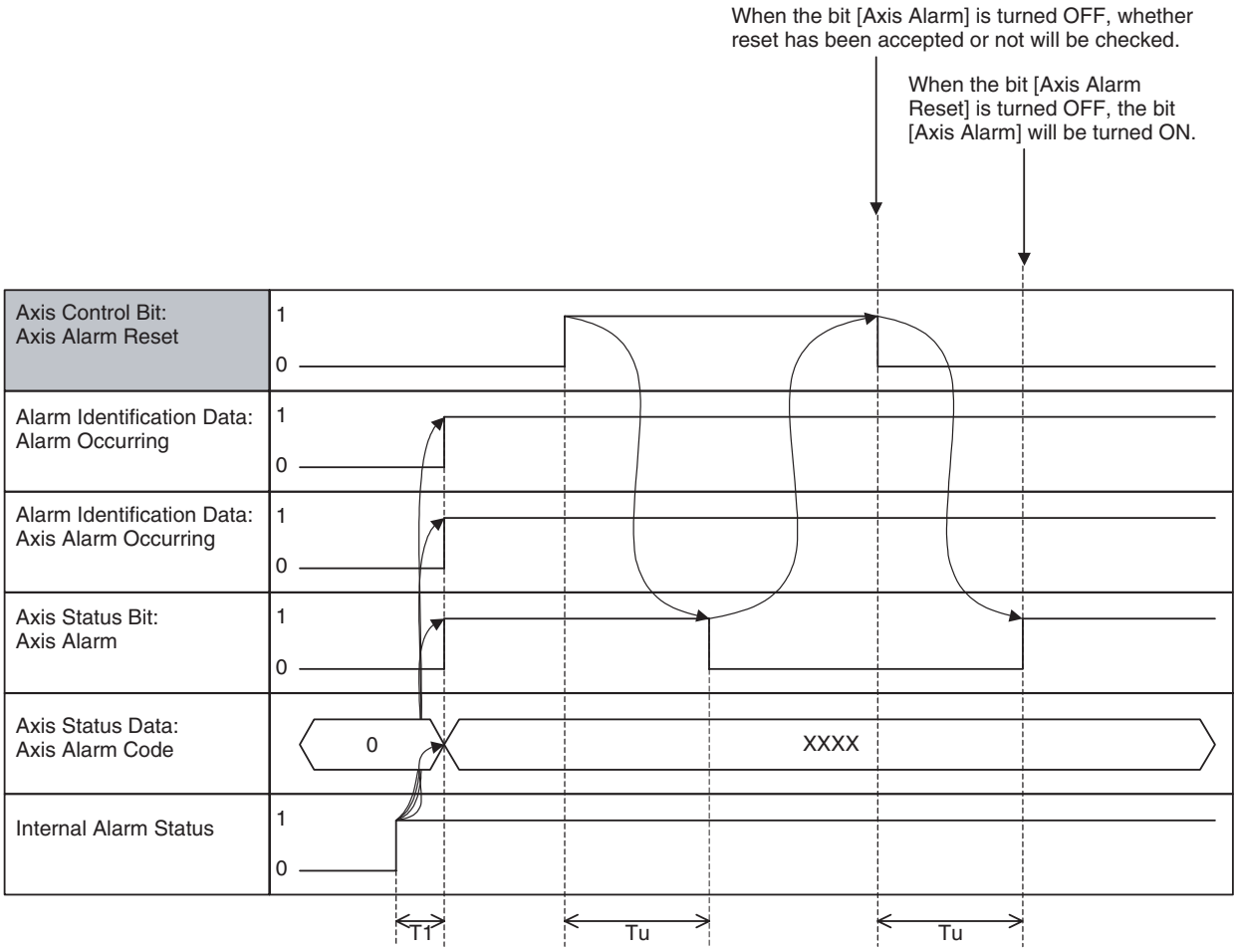
Basic Operation (Alarm Occurring):



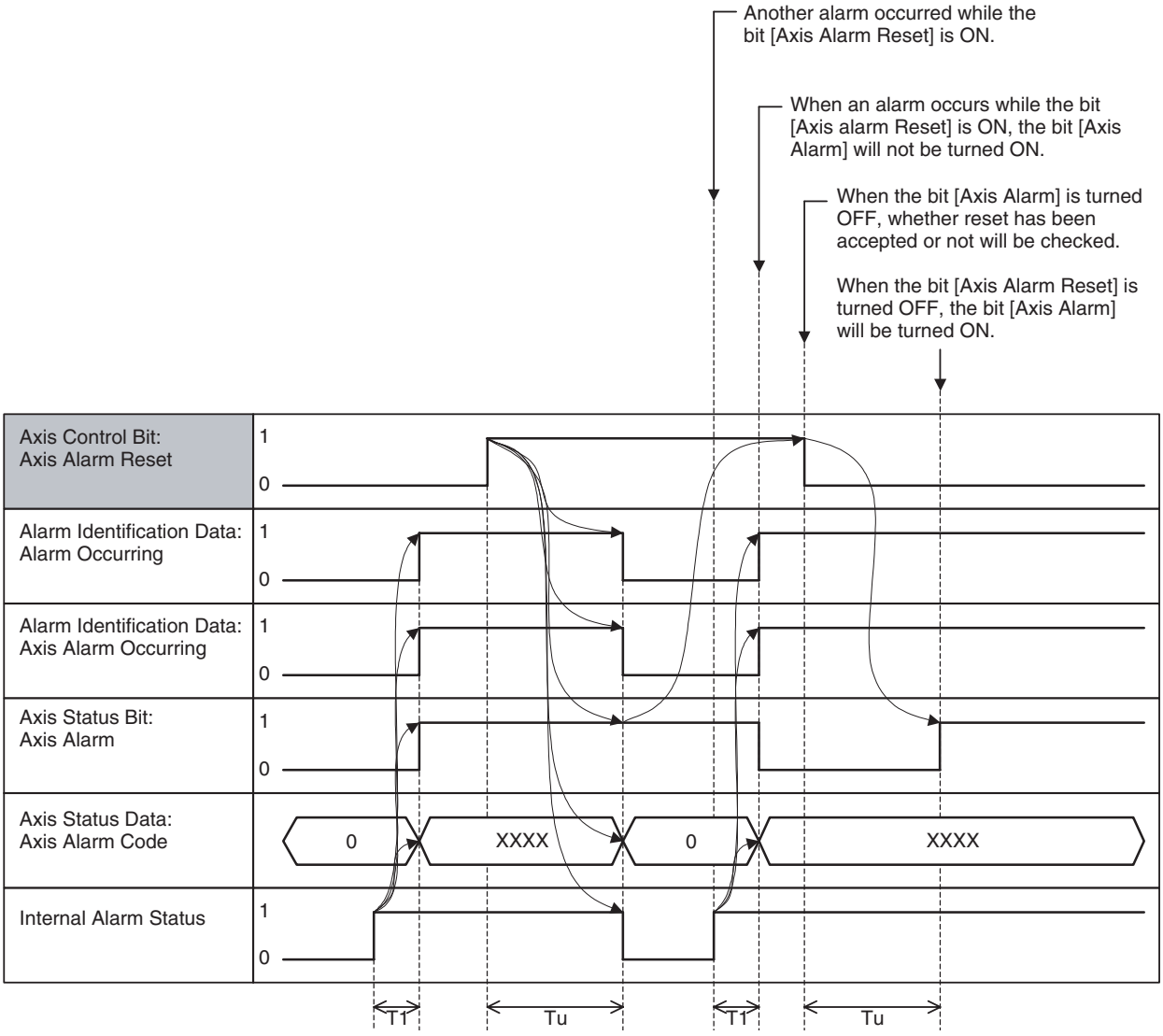
Basic Operation (Alarm Reset):



When an alarm that cannot be reset occurs:



When an alarm occurs while the bit [Axis Alarm Reset] is ON:



Word	Variable	Bit	Name	I/O
x+32 - x+63	OW0440 - OW045F	01	Machine Origin (Axis 1) - Machine Origin (Axis 32)	Input

Function

The bit [Machine Origin] indicates the status that the present position is located in the proximity of the origin on the machine coordinate system.

Status Condition

Name	Specifications
Machine Origin	0: Machine coordinate system FB position is outside of origin in-position range. 1: Machine coordinate system FB position is within origin in-position range.

- When the feedback position enters second in-position range (specified by the system parameter) of the machine origin, the bit [Machine Origin] is turned ON regardless of whether the origin has been defined or not.

- 1-shot output may occur. In that case, depending on the Scan Time of the ladder program and the Unit Scan Time of the MC Unit, the output may not be reflected in the ladder program.

Effect on Other Functions

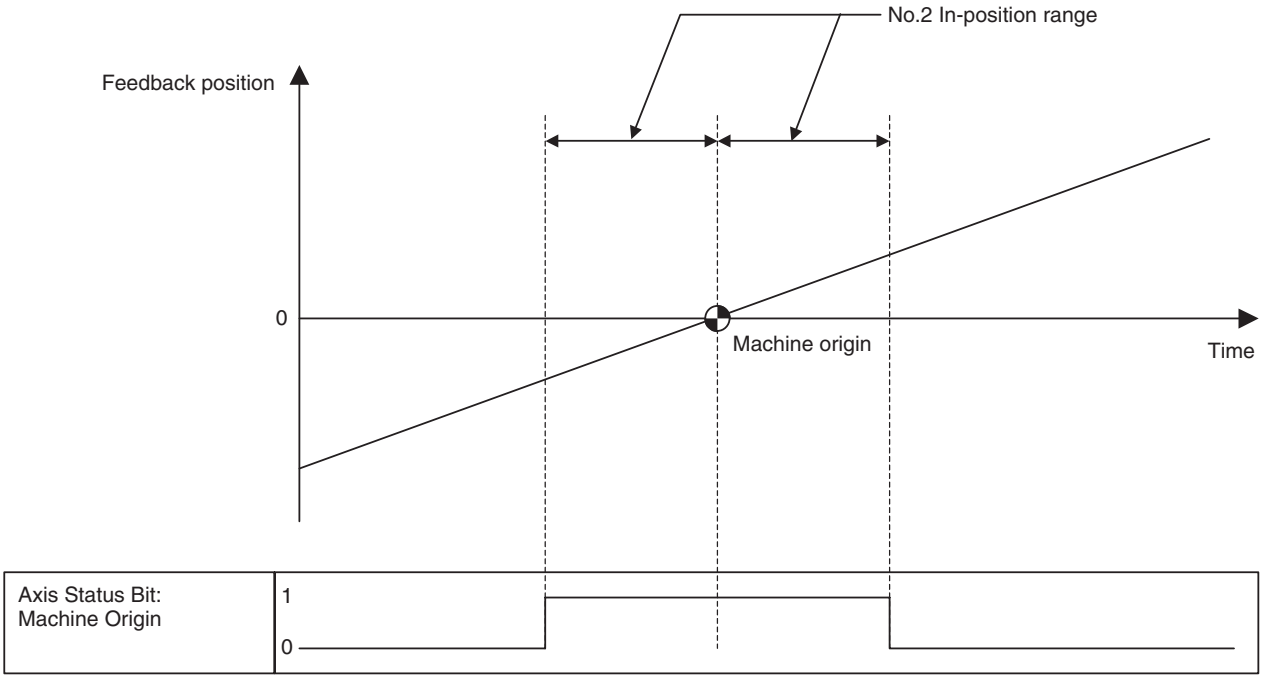
The bit [Machine Origin] does not affect other functions directly. It can be used as the status to check the completion of the Axis Control Bit [Origin Search], [Machine Origin Return], or [DATUM command].

System Parameter

The range where the bit is turned ON/OFF is determined by the following system parameter:

No.	Name
P3AA07	No.2 In-position Range

Timing Chart



Word	Variable	Bit	Name	I/O
x+32 - x+63	OW0440 - OW045F	02	Busy (Axis 1) - Busy (Axis 32)	Input

Function

The bit [Busy] indicates the status of the execution of each function on the axis level, and it is used to provide interlock among functions in the ladder program.

Status Function

Name	Specifications
Busy	0: Not executing any of the functions listed below. 1: Executing one of the functions listed below, or the command bit is ON. JOG, STEP, Origin Search, Machine Origin Return, Error Counter Reset, Forced Origin, and ABS Origin Setting

The bit [Busy] will be turned ON when the execution of the following functions is started after they were accepted, and turned OFF when the execution is completed and the command is turned OFF.

Function
Axis Control Bit: JOG
Axis Control Bit: STEP
Axis Control Bit: Origin Search
Axis Control Bit: Machine Origin Return
Axis Control Bit: Error Counter Reset
Axis Control Bit: Forced Origin
Axis Control Bit: ABS Origin Setting

Effect on Other Functions

The following functions will be restricted while the bit [Busy] is ON:

Function	Restriction
Axis Control Bit: JOG	Cannot be executed
Axis Control Bit: STEP	Cannot be executed
Axis Control Bit: Origin Search	Cannot be executed
Axis Control Bit: Machine Origin Return	Cannot be executed
Axis Control Bit: Forced Origin	Cannot be executed
Axis Control Bit: ABS Origin Setting	Cannot be executed
Axis Control Bit: JOG/STEP Direction	Cannot be executed
IOWR: Present Position Preset	Cannot be executed

System Parameter

Nil

Timing Chart

See “JOG Operation” (page 436), “STEP Operation” (page 440), “Origin Search” (page 444), “Machine Origin Return” (page 448), “Error Counter Reset” (page 452), “Forced Origin” (page 457), and “ABS Origin Setting” (page 459).

Word	Variable	Bit	Name	I/O
x+32 - x+63	OW0440 - OW045F	04	No Origin (Axis 1) - No Origin (Axis 32)	Input

Function

The bit [No Origin] indicates the status of whether the origin on the machine coordinate system is defined or not.

Status Condition

Name	Specifications
No Origin	0: Origin on machine coordinate system is defined. 1: Origin on machine coordinate system is not defined.

- When the MC Unit is powered ON, the bit [No Origin] will be turned ON. It will be turned OFF through the operations of the following functions. Executing present position preset using IOWR will not turn OFF the bit.

Function	Remark
Axis Control Bit: Origin Search	The bit [No Origin] will be turned OFF when Origin Search is completed normally. If the origin search method is “Origin at power ON”, the bit [No Origin] will be turned OFF simultaneously when the bit [Command Disabled/Enabled] is turned ON.
Axis Control Bit: Forced Origin	The bit [No Origin] will be turned OFF when Forced Origin is completed normally.

Function	Remark
Axis Control Bit: ABS Origin Setting	The bit [No Origin] will be turned OFF when ABS Control Setting is completed normally. Subsequently, the bit will be turned OFF simultaneously when the bit [Command Disabled/Enable] is turned ON.
DATUM: Origin Search	The bit [No Origin] will be turned OFF when Origin Search is completed normally. If the origin search method is "Origin at power ON", the bit [No Origin] will be turned OFF simultaneously when the bit [Command Disabled/Enabled] is turned ON.
Virtual axis or ABS encoder axis with origin setting	Always OFF for Origin Search or any other functions

- Conditions for the bit [No Origin] to be turned ON in normal operations are as follows:
  - When an origin search is started (except for when the origin search method is "Origin at power ON").
  - When the bit [Command Disabled/Enabled] is turned OFF.

Effect on Other Functions

When the bit [No Origin] is ON, the following functions will be restricted. Motion programs can be executed:

Function	Restriction
Axis Control Bit: Machine Origin Return	Cannot be executed
Software Limit	Will not be enabled

System Parameter

Nil

Timing Chart

See "Origin Search" (page 444), "Forced Origin" (page 457), and "ABS Origin Setting" (page 459).

Word	Variable	Bit	Name	I/O
x+32 - x+63	OW0440 - OW045F	05	Axis Operating (Axis 1) - Axis Operating (Axis 32)	Input

Function

The bit [Axis Operating] indicates the status of the output of operation commands for the axis.

It turns ON even when no command is being output in Axis machine lock mode.

Status Condition

Name	Specifications
Axis Operating	0: No axis operating command 1: Axis operating command being output.

- The bit [Axis Operating] changes its state (ON/OFF) for the operating commands in any one of Position, Speed, and Torque controls.
- 1-shot output may occur. In that case, depending on the Scan Time of the ladder program and the Unit Scan Time of the MC Unit, the output may not be reflected in the ladder program.

Effect on Other Functions

- The bit [Axis Operating] functions as the completion condition of the following axis operations:

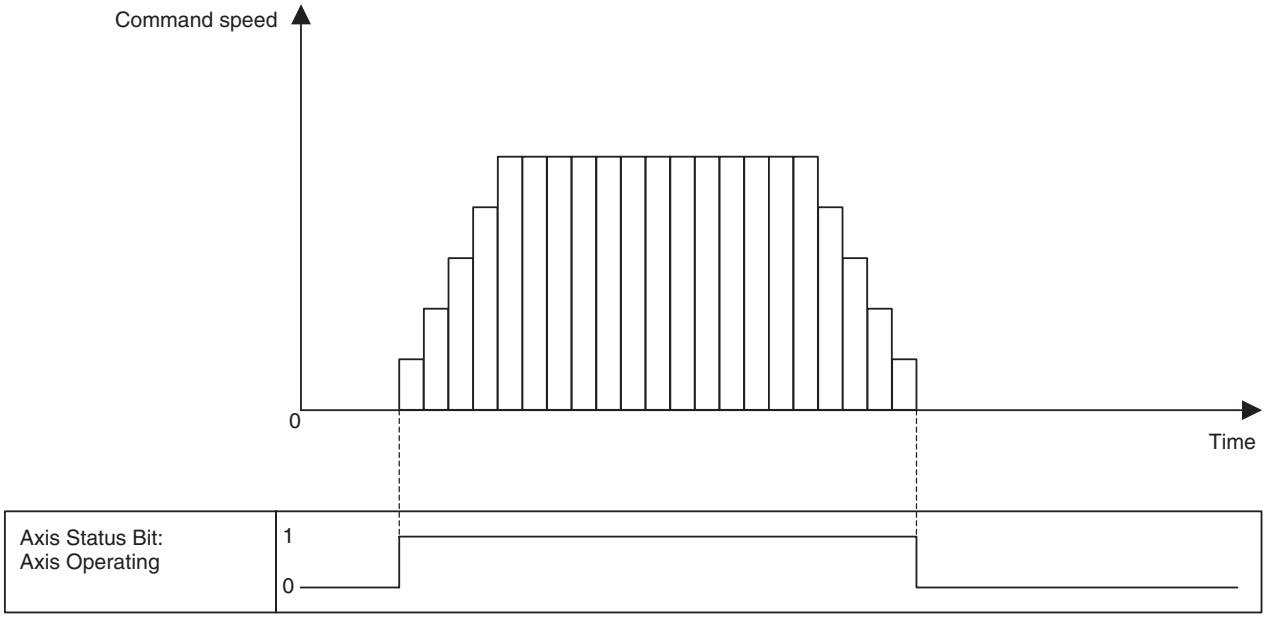
Function	Remark
Axis Control Bit: JOG	
Axis Control Bit: STEP	
MOVEL Command: Linear Interpolation	In Pass Mode

Function	Remark
MOVEC Command: Circular Interpolation	In Pass Mode
MOVETRAV Command: Traverse	In Pass Mode

- The status (ON/OFF) of Axis machine lock will not be changed while the bit [Axis Operating] is ON.

System Parameter Nil

Timing Chart **Basic Operation:**



Word	Variable	Bit	Name	I/O
x+32 - x+63	OW0440 - OW045F	06	Positioning Completed (Axis 1) - Positioning Completed (Axis 32)	Input
x+32 - x+63	OW0440 - OW045F	07	Positioning Completed (NO2.) (Axis 1) - Positioning Completed (NO2.) (Axis 32)	

Function The bits [Positioning Completed] and [Positioning Completed (NO.2)] indicate the status of positioning.

Status Condition

Name	Specifications
Positioning Completed	0: Outputting positioning command, or axis is outside of in-position range. 1: Not outputting positioning command, and axis is within in-position range.
Positioning Completed (NO2.)	0: Outputting positioning command, or axis is outside of No.2 in-position range 1: Not outputting positioning command, and axis is within No.2 in-position range.

- The bit [Positioning Completed] will be turned ON when the difference between the present position and target position enters into the in-position range (specified in the servo parameter) after position command output was completed.

- The bit [Positioning Completed (No.2)] will be turned ON when the difference between the present position and target position enters into the in-position range No.2 (specified in the system parameter) after position command output was completed.
- Both bits [Positioning Completed] and [Positioning Completed (NO.2)] are turned OFF under the conditions described below:
  - Turned OFF simultaneously when the bit [Axis Operating] is turned ON in starting the position command output.
  - When the parameter [P00004 bit04: Positioning completed signal select] is 0:
    The bits will not be turned OFF until the bit [Axis Operating] is turned ON.
  - When the parameter [P00004 bit04: Positioning completed signal select] is 1:
    The bits will be turned OFF when moving out of the in-position range.
- In Speed or Torque control, the bits are always OFF because there is no target position.
- 1-shot output may occur. In that case, depending on the Scan Time of the ladder program and the Unit Scan Time of the MC Unit, the output may not be reflected in the ladder program.

Effect on Other Functions

- The bits function as the completion condition of the following axis operations:

Function	Positioning completed/Positioning completed (NO.2)	Remark
Axis Control Bit: Origin Search	Positioning Completed	
Axis Control Bit: Machine Origin Return	Positioning Completed	
MOVEL Command: Linear Interpolation	Positioning completed (NO.2)	In Stop Mode
MOVEC Command: Circular Interpolation	Positioning Completed (NO.2)	In Stop Mode
MOVETRAV Command: Traverse	Positioning Completed (NO.2)	In Stop Mode
MOVE: Positioning	Positioning Completed	
DATUM: Origin Search	Positioning Completed	
MOVEI: Interrupt Feeding	Positioning Completed	
MOVET: Time-specified Positioning	Positioning Completed	
CAM: Electronic CAM, Single Axis	Positioning Completed	
SYNCR: Synchronization Cancel	Positioning Completed	
SPEEDR: Speed Control Cancel	Positioning Completed	Switch to position control mode checked
TORQUER: Torque Control Cancel	Positioning Completed	Switch to position control mode checked
MOVELINK: Link Operation	Positioning Completed	Depends on link option
CAMBOX: Electronic Cam, Synchronous	Positioning Completed	Depends on link option

- The bits also function as the start condition for the following functions:

Function	Start condition
Axis Control Bit: Forced Origin	Cannot be executed when not ON
Axis Control Bit: ABS Origin Setting	Cannot be executed when not ON

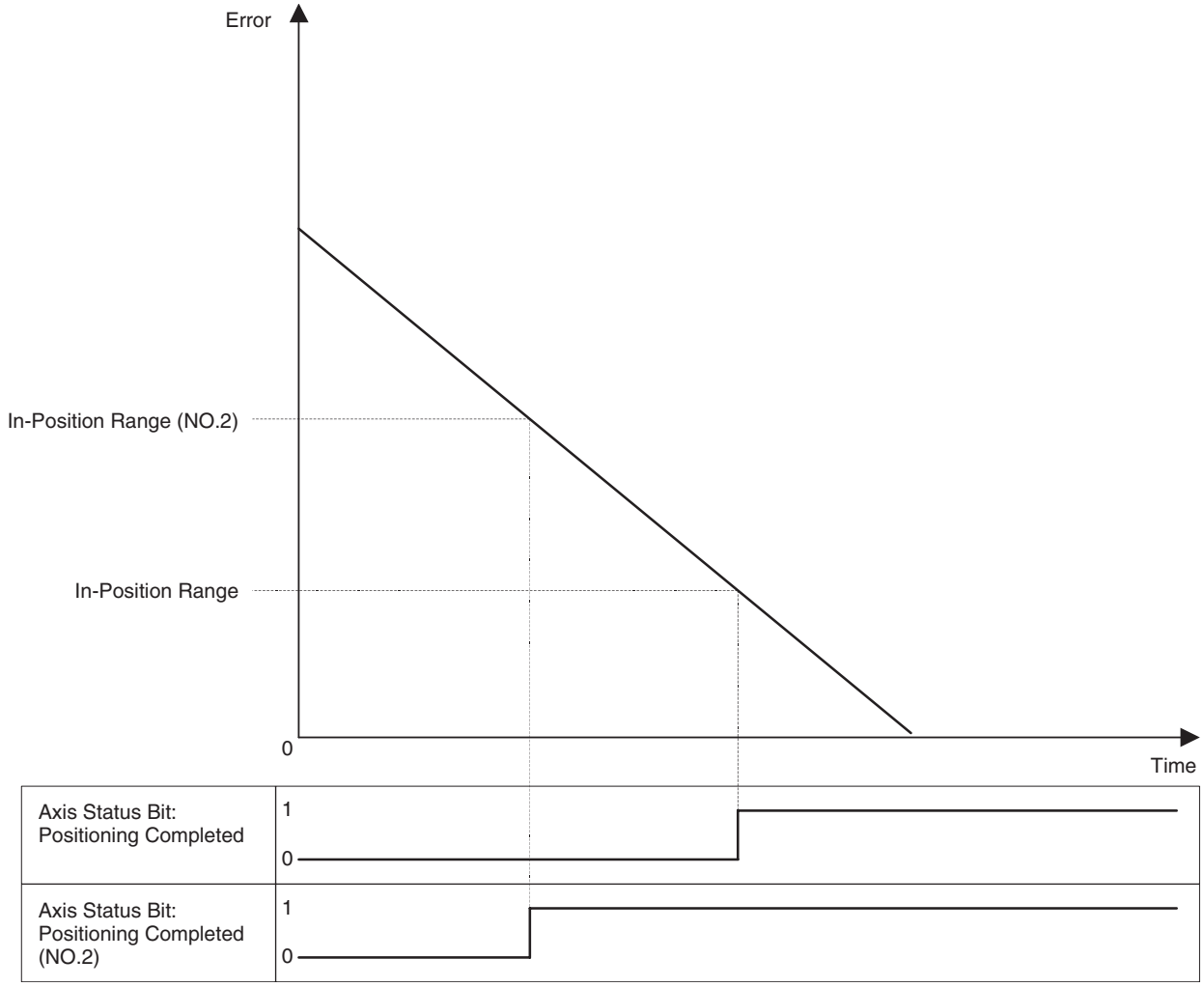
System Parameter

The range where the bits are turned ON/OFF is determined by the following system parameter:

No.	Name
Pn0500	In-Position Range
P3AA07	No.2 In-Position Range

Note It is generally recommended to set the parameters above so that [Pn0500 = P3AA07] is satisfied for the sake of positioning and interpolation feed accuracy.

Timing Chart



Word	Variable	Bit	Name	I/O
x+32 - x+63	OW0440 - OW045F	08	Error Counter Warning (Axis 1) - Error Counter Warning (Axis 32)	Input

Function

The bit [Error Counter Warning] indicates the status of whether the error amount has exceeded the threshold value or not.

Status Condition

Name	Specifications
Error Counter Warning	0: Error amount is within the range of the error counter warning value. 1: Error amount has exceeded the range of the error counter warning value.

- The bit [Error Counter Warning] will be turned ON when the error amount exceeds the error counter warning value specified in the system parameter.
- Error amount is checked only during position command output.
- 1-shot output may occur. In that case, depending on the Scan Time of the ladder program and the Unit Scan Time of the MC Unit, the output may not be reflected in the ladder program.

Effect on Other Functions

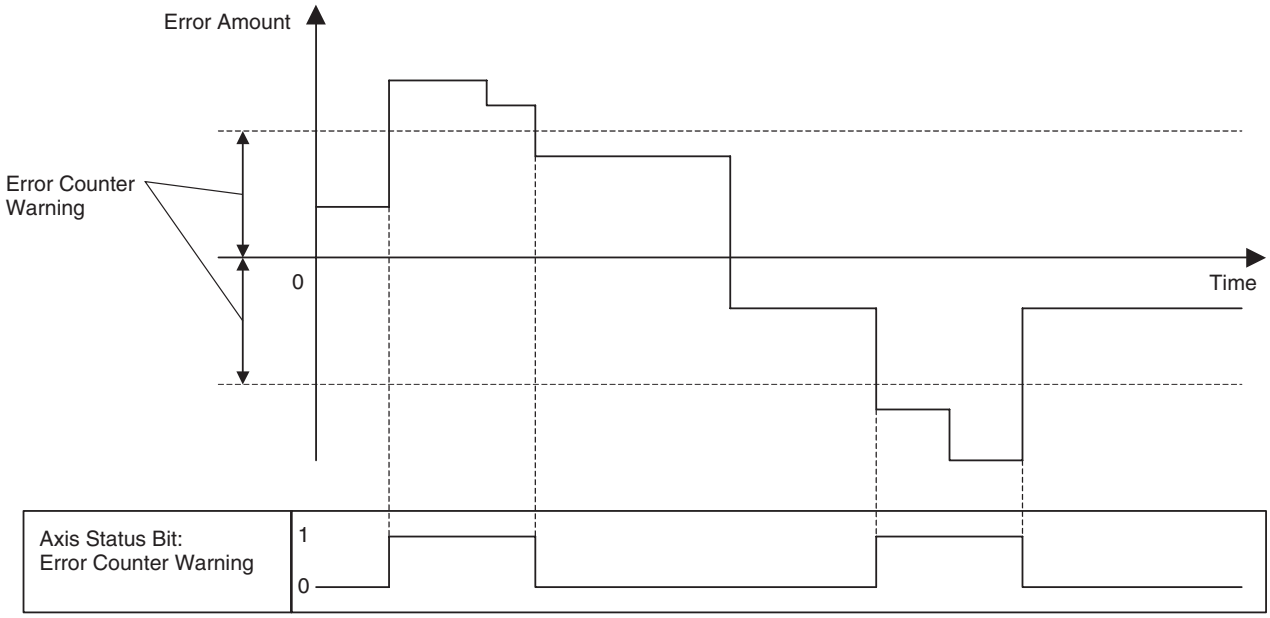
This bit functions just as a warning, i.e. there is no effect whatsoever on any operations currently being executed.

System Parameter

The range where the bit is turned ON/OFF is determined by the following system parameter:

NO.	Name
P3AA05	Error Warning Value

Timing Chart



Word	Variable	Bit	Name	I/O
x+32 - x+63	OW0440 - OW045F	10	Counter Latch Completed (Axis 1) - Counter Latch Completed (Axis 32)	Input

Function

The bit [Counter Latch Completed] indicates the counter latch status of the axis that has output the latch request through the operation of the following functions:

Function	Purpose of counter latch function	Role of latch signal
DATUM: Origin Search	Detects origin.	Trigger to decide the final stop position
MOVEI: Interrupt Feeding	Detects external signal input position.	Trigger to decide the final stop position

Function	Purpose of counter latch function	Role of latch signal
MOVELINK: Link Operation	Detects link start position.	Trigger to start synchronization
CAMB0X: Electronic Cam, Synchronous	Detects link start position.	Trigger to start synchronization
SYNC: Trailing Synchronization	Detects marker sensor ON position.	Trigger to start synchronization
LATCH: Present Position Latch	Detects latch position.	Trigger to store latch position
Axis Control Bit: Origin Search	Detects origin.	Trigger to decide the final stop position

Status Condition

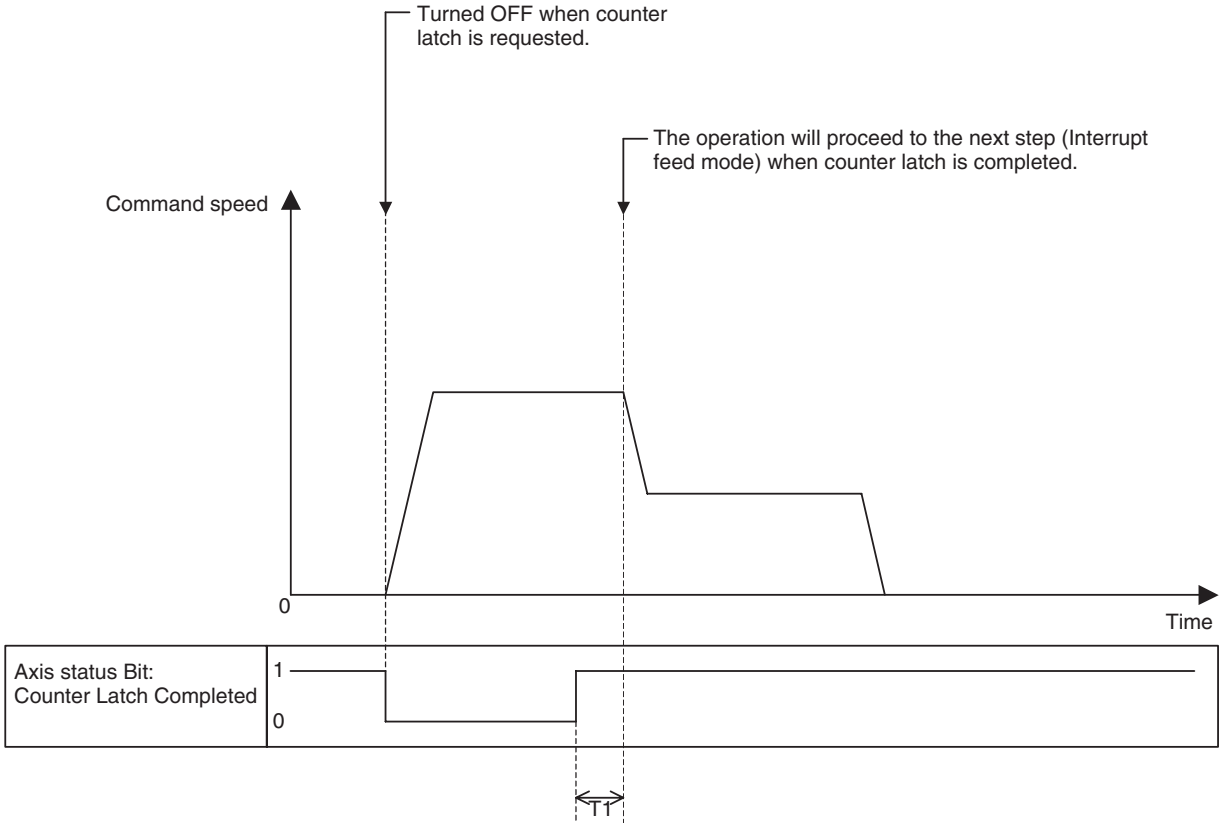
Name	Specifications
Counter Latch Completed	0: Counter Latch not completed 1: Counter Latch completed

The bit [Counter Latch Completed] will be turned ON when counter latch is completed, and turned OFF when counter latch is requested through the operation of the functions above.

Effect on Other Functions The bit functions as the condition to carry forward the operation steps for the functions in the table above.

System Parameter Nil

Timing Chart **Basic Operation (Interrupt Feeding):**



Warning	Variable	Bit	Name	I/O
x+32 - x+63	OW0440 - OW045F	11	MECHATROLINK Warning (Axis 1) - MECHATROLINK Warning (Axis 32)	Input

Function The status of the warning occurred on the MECHATROLINK-II slave is reflected in the bit [MECHATROLINK Warning].

Status Condition

Name	Specifications
MECHATROLINK Warning	0: No warning detected on MECHATROLINK-II device 1: Warning detected on MECHATROLINK-II device

1-shot output may occur. In that case, depending on the Scan Time of the ladder program and the Unit Scan Time of the MC Unit, the output may not be reflected in the ladder program.

Effect on Other Functions

- This bit functions just as a warning, i.e. there is no effect whatsoever on any operations currently being executed.
- Even if the bit [MECHATROLINK Warning] is turned ON, the bits [Alarm Occurring], [Axis Alarm Occurring 1-32], and [Axis Alarm] will not be turned ON. No alarm code will be stored in [Axis Alarm Code] neither.

System Parameter Nil

Timing Chart Nil

Word	Variable	Bit	Name	I/O
x+32 - x+63	OW0440 - OW045F	13	Command Disabled/Enabled (Axis 1) - Command Disabled/Enabled (Axis 32)	Input

Function The bit [Command Disabled/Enabled] indicates the status of whether the axis can accept a command or not.

Status Condition

Name	Specifications
Command Disabled/ Enabled	0: Not allocated or not implemented 1: Allocated and implemented (1 for virtual axis unconditionally)

- The bit for the axis that was allocated as a real axis will be turned ON when axis initialization processing is completed after communications were established. When disconnection due to communications error occurs, it will be turned OFF. Turning ON the bit [Axis Alarm Reset] may recover the communications from the disconnection.
- The bit for the axis that was allocated as a virtual axis will be turned ON when axis initialization processing is completed, and keeps the status until the MC Unit is switched OFF.
- Other conditions for the bit [Command Disabled/Enabled] to be turned OFF are as follows:
  - When communications are disconnected
  - During execution of MECHATROLINK device search

Effect on Other Functions For the axes that were allocated as real axes, the bit [Command Disabled/ Enabled] has effect on execution of all the commands and the status.

System Parameter Nil

Timing Chart Nil

Word	Variable	Bit	Name	I/O
x+32 - x+63	OW0440 - OW045F	14	Axis Not Used/Used (Axis 1) - Axis Not Used/Used (Axis 32)	Input

Function

The bit [Axis Not Used/Used] indicates the status of whether the concerned axis can be used or not. The bit [Axis Not Used/Used] reflects the execution status as compared to the bit [Busy] will not be turned OFF until the command output is turned OFF. The bit [Busy] does not reflect status in Automatic Mode while the bit [Axis Not Used/Used] reflects status in Automatic Mode.

Status Condition

Name	Specifications
Axis Not Used/Used	0: Axis is not being used. 1: Axis is being used. (In Manual Mode: Axis is used for JOG etc., In Automatic Mode: Axis is declared in the operating program)

- In Manual Mode, the bit [Axis Not Used/Used] is turned ON during execution of the following functions to indicate that the axis is being used in Manual Mode.

Function
Axis Control Bit: JOG
Axis Control Bit: STEP
Axis Control Bit: Origin Search
Axis Control Bit: Machine Origin Return

- In Automatic Mode, the bit [Axis Not Used/Used] for the axis declared in PROG command will be turned ON when the program is started to indicate that the axis is being used.
- 1-shot output may occur. In that case, depending on the Scan Time of the ladder program and the Unit Scan Time of the MC Unit, the output may not be reflected in the ladder program.

Effect on Other Functions

- In Manual Mode
  No effect. (The bit [Busy] also has effect on the functions affected by this bit. Duration of the bit [Busy] staying ON is longer than that of the bit [Axis Not Used/Used], which means that the bit [Busy] includes the bit [Axis Not Used/Used] consequentially.
- In Automatic Mode
  The axis for which the bit [Axis Not Used/Used] is ON cannot be used in other motion programs. When starting a program that declared an axis already in use, the bit [Start Warning] will be turned ON. Therefore, the motion program cannot be executed.

System Parameter

Nil

Timing Chart

For timing charts in Manual Mode, see “JOG operation” (page 436), “STEP operation” (page 440), “Origin Search” (page 444), and “Machine Origin Return” (page 448). For timing charts in Automatic Mode, see “Motion Program Start” and “Start Mode” (page 404).

SECTION 8
Establishing the Origin

This section describes how to establish the origin in the positioning system.

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8-1-1 Using Incremental Encoders 490
8-1-2 Using Absolute Encoders 491
8-2 Input Signals Required for Origin search 492
8-3 Origin Search Methods and Parameters 492
8-3-1 Origin Search Methods 492
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8-5 Absolute (ABS) Encoders 497
8-6 ABS Encoder Origin Setting 498
8-6-1 Procedure 498
8-6-2 Setting Up the Related Parameters 498
8-6-3 Setting Up the Absolute Encoder 499
8-6-4 Supplemental Information for Setting Up 501
8-6-5 Moving to the Origin 501
8-6-6 Setting the MC Unit ABS Origin 501

8-1 Overview

This section describes the method of establishing the origin for motion control systems using either incremental encoders or absolute encoders.

8-1-1 Using Incremental Encoders

In motion control systems using incremental encoders, an origin must be established and the bit [No Origin] must be turned OFF after the power is turned ON.

There are two ways to establish the origin using the MC Unit.

Operation	Description
Forced Origin	The position where the motor is stopped is defined as an origin.
Origin search	Actually moving the motor and using the limit switches, origin proximity switches, and encoder's phase-Z signal determine an origin. If the origin search method is set to "Origin at power ON" in the system parameter, the Unit will automatically define the position where the power is turned ON as the origin, without moving the motor.

Forced Origin

The position where the motor is stopped is determined as the origin (forcibly clear to 0) by turning ON the bit [Forced Origin] in the PC Interface Area. See "Forced Origin" (page 457) in SECTION 7 PC Interface Area for details on the timing chart and other details.

Word	Variable	Bit	Name	Description
x+0 - x+31	IW0440 - IW045F	09	Forced Origin (Axis 1) - Forced Origin (Axis 32)	0: Nil 1: Nil ↑: The present position is defined as the origin on the machine coordinate system (disabled during operation). ↓: Nil

Origin Search

An origin search operation can be performed by turning ON the bit [Origin Search] or by executing DATUM command (Origin Search).

Word	Variable	Bit	Name	Description
x+0 - x+31	IW0440 - IW045F	06	Origin Search (Axis 1) - Origin Search (Axis 32)	0: Nil 1: Continues origin search ↑: Starts origin search ↓: Stops origin search

■ **Origin Search in Manual/Automatic Mode**

Following the method of determining an origin, use one of the methods depending on the mode of each task as shown below:

Yes: Can be used, No: Cannot be used

Method		Manual Mode	Automatic Mode
Forced Origin bit		Yes	No
Origin Search	[Origin Search] bit	Yes	No
	DATUM	No	Yes

8-1-2 Using Absolute Encoders

With the ABS encoder, the present position can be defined by reading the absolute value from the encoder when the MC Unit is turned ON if the PLC (MC Unit) or servo driver was turned OFF once. Because of this, there is no need to perform origin searches every time when turning ON the devices. This section explains the set up procedure briefly.

For details, see *8-5 Absolute (ABS) Encoders* (page 497).

Absolute Encoder Setup

Absolute encoder data must be reset and the absolute origin for the MC Unit must be set in the following cases:

- When a Servomotor with an absolute encoder is connected for the first time or replaced
- When the battery is replaced.
- When the held absolute data is lost because the encoder cable has been plugged OFF for a long time.

Use the following procedure to set up the absolute encoder:

1,2,3...

1. Connect the motor to the machine.
2. Referring to the Servo Driver operation manual, replace the battery.
3. Referring to the Servo Driver operation manual, held values are cleared (data reset). At this point, the origin of the absolute encoder and the machine origin do not match with each other.
4. Execute Servo Lock using the MC Unit.
5. Perform an origin search to move the Servomotor axis to the origin.
6. Turn the absolute encoder OFF and ON in order to save the present value as the origin. The absolute encoder value indicating the machine origin is stored as absolute an origin setting value.

Once the setup is completed, since the present value is decided by automatically subtracting the ABS origin setting value from the value read from the encoder when the power is turned ON, no origin search will be required. For details, see *8-6 ABS Encoder Origin Setting* (page 498).

Word	Variable	Bit	Name	Description
x+0 - x+31	IW0440 - IW045F	09	ABS Origin Setting (Axis 1) - ABS Origin Setting (Axis 32)	0: Nil 1: Nil ?: Sets ABS encoder origin ?: Nil
x+0 - x+31	IW0440 - IW045F	06	Origin Search (Axis 1) - Origin Search (Axis 32)	0: Nil 1: Continues origin search ↑: Starts origin search ↓: Stops origin search

See *7-4 Interface Specifics* (page 381) for details on each bit.

8-2 Input Signals Required for Origin search

The following input signals and conditions are required to perform the origin search operation.

Parameter	Description
CW/CCW Limit Signals	Normally closed switches are required.
Origin Proximity Signal	The logic of the input signal can be changed in the parameter, so either Normally closed or Normally open switch can be used.
Encoder Phase-Z Signal	Built-in signal of the encoder on the servomotor.
External Input Signal 1,2, and 3	Normally open switches are used, and connected to the servo driver.

CW/CCW Limit Signals

These signal inputs indicate the maximum operating range of the work when the motor rotates in the direction of clockwise (CW) or counterclockwise (CCW).

Origin Proximity Signal

This signal input indicates that the axis is near the origin.

Encoder Phase-Z Signal

This signal will be output when the encoder makes one revolution.

The first phase-Z input position after the origin proximity signal input changes from ON to OFF becomes the actual machine origin.

External Input signal 1,2, and 3

Instead of encoder phase-Z signal, one of these signals determines the actual machine origin. The signal to be used can be selected in the system parameter [P4AA06: Origin determine signal].

8-3 Origin Search Methods and Parameters

8-3-1 Origin Search Methods

There are four possible settings for the origin search methods.

Origin at Power ON Mode

- The position of the motor when the power is turned ON is defined as the origin automatically.
- If an origin search is performed in this mode, the position where the origin search is started will become the origin.

Limit Reversal Mode

- The direction will be reversed if a limit input signal is input during the origin search.
- After starting the operation towards Origin search start direction at Origin search feed rate, when Origin proximity signal input (normally open) is turned ON, the speed will be changed to Origin search approach speed. At the rise of Origin determine signal input after the Origin proximity signal input has been turned OFF, the speed is changed to Origin search creep speed. The axis travels for the final travel distance to define an origin.
- When there is no Origin proximity signal input, a limit signal input can be used instead.

2-level Speed in One Direction Mode

- The origin search is performed only in one direction.
- After starting the operation towards the phase-Z detection direction at Origin search approach speed, the speed will be changed to Origin search creep speed at the rise of the Origin determine signal input and the axis travels for the final travel distance to define an origin. An alarm will occur if a limit signal input is received before the origin proximity signal input.

3-level Speed in One Direction Mode

- The origin search is performed only in one direction.
- After starting the operation towards the phase-Z detection direction at Origin search feed rate, the speed will be changed to Origin search approach speed when the Origin proximity signal input (normally open) is turned ON. The speed will be changed to the Origin search creep speed at the rise of the Origin determine signal input after the Origin proximity input signal is turned OFF and the axis travels for the final travel distance to define an origin.
- An alarm will occur if a Limit input signal is input before the Origin proximity input signal.
- When there is no Origin proximity input signal, a limit input signal can be used instead.

8-3-2 System Parameters

The following system parameters are required to perform the origin search operation. These system parameters are set using the support tool.

- Except for “Origin at power ON” mode, the origin on the machine coordinate system is determined with the external input signal specified in the parameter [P4AA06: Origin determine signal].
- After completion of an origin search, the following values remain the same as before the execution.
  - The workpiece coordinate system offset set using OFFPOS command
  - The coordinate system No. set in ORIGIN/WORK command
- If an origin search is executed for an axis using an absolute encoder, the origin on the machine coordinate system will be determined using an external input signal.
- By specifying Origin offset value, the origin on the machine coordinate system after an origin search can be set to the value other than zero. (Specify zero if not necessary.)

Parameter	No.	Value	Description
Origin search method	P4AA01	0: Origin at power ON 1: Limit reversal 2: 2-level speed in one direction 3: 3-level speed in one direction	Sets the origin search method.
Initial search direction	P4AA02	0: Same as phase-Z detection 1: Opposite of phase-Z detection	Sets the origin search start direction in Limit reversal mode (origin search method 1).
Phase-Z detection direction	P4AA03	0: + direction 1: – direction	Sets the phase-Z detection direction in the modes (origin search methods 1,2, and 3) except for Origin at power ON mode.
Origin deceleration method	P4AA04	0: Uses origin proximity 1: Uses CW/CCW	Sets whether to use origin proximity or limit input signal as the origin proximity signal for origin search methods 1 and 3.
Origin determine signal	P4AA06	0: Phase-Z 1: External input signal 1 2: External input signal 2 3: External input signal 3	Sets the signal that determines the origin.
Origin search feed rate	P4AA07	1 to 2147483647 **Note** Note that the speed is limited by 32767 command unit/unit scan.	Sets the 1st level speed of the 3-level speed origin search.

Parameter	No.	Value	Description
Origin search approach speed	P4AA08	1 to 2147483647 **Note** Note that the speed is limited by 32767 command unit/unit scan.	Sets the 2nd level speed of the 3-level speed origin search, or sets the 1st level speed of the 2-level speed origin search.
Origin search creep speed	P4AA09	1 to 2147483647 **Note** Note that the speed is limited by 32767 command unit/unit scan.	Sets the 3rd level speed of the 3-level speed origin search, or sets the 2nd level speed of the 2-level speed origin search.
Reference (machine) origin offset	P4AA10	–2147483648 to 2147483647	Sets the offset amount for the origin search. It is not used for DATUM.
Origin search final travel distance	P4AA11	0 to 2147483647	Sets the origin search final travel distance, which is an additional travel distance towards the travel direction.

8-4 Origin Search Operations

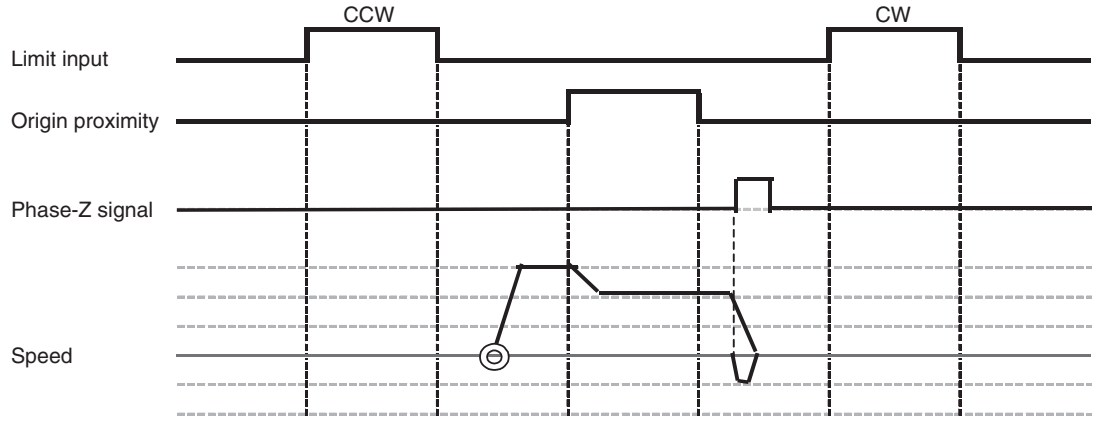
8-4-1 Overview

This section provides basic examples of origin search patterns for each mode.

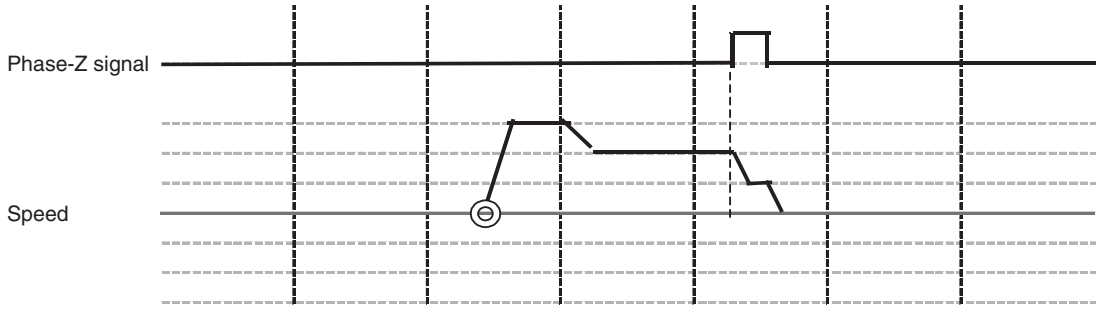
Origin at Power ON Mode The position of the motor when the power is turned ON is automatically defined as the origin. Therefore, there is no origin search operation.

Limit Reversal Mode With Origin proximity input signal, Phase-Z detection direction: + direction, Origin search start direction: Same as Phase-Z detection

When the final travel distance is zero:



When the final travel distance is specified:



Description

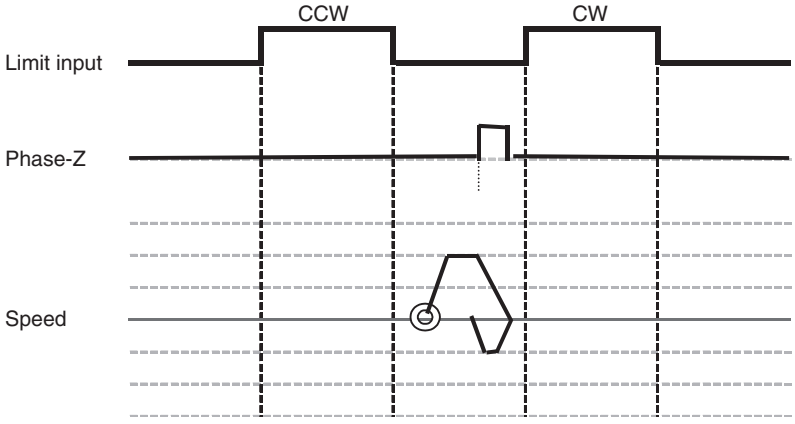
1,2,3...

1. When the origin search is executed, the axis is moved in the specified direction at the specified origin search feed rate.
2. When the origin proximity input signal is input, the speed is changed to the origin search approach speed.
3. After the origin proximity input signal is turned OFF, the speed is reduced at the first rise of phase-Z.
4. The machine origin will be defined after the axis travels back for the excess distance at the origin search creep speed.
   - If the final travel distance has been specified, the machine origin will be defined after the axis travels back for the specified distance.
   - If the reference origin offset value has been set in the system parameter, the specified value will be the machine coordinate of the stopping position.
   - The origin search operation and alarm occurrence will vary depending on the input timings of limit input signal, origin proximity input signal, and phase-Z, origin search start direction, and the position of the work when executing the origin search.

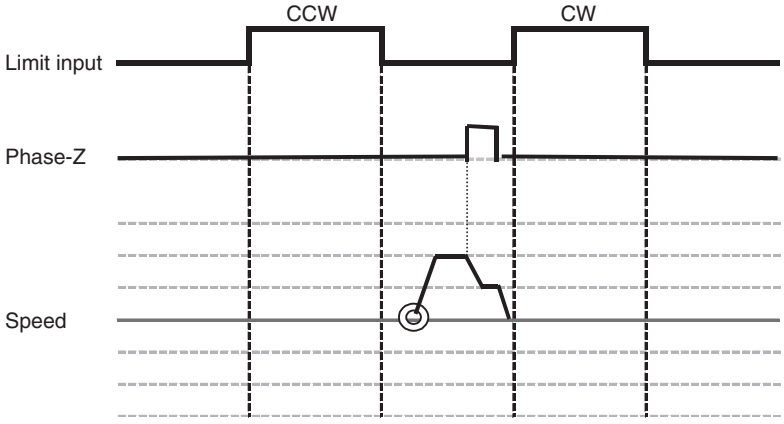
2-level Speed in One Direction Mode

When the phase-Z detection direction is + direction:

When the final travel distance is zero:



When the final travel distance is specified:



Description

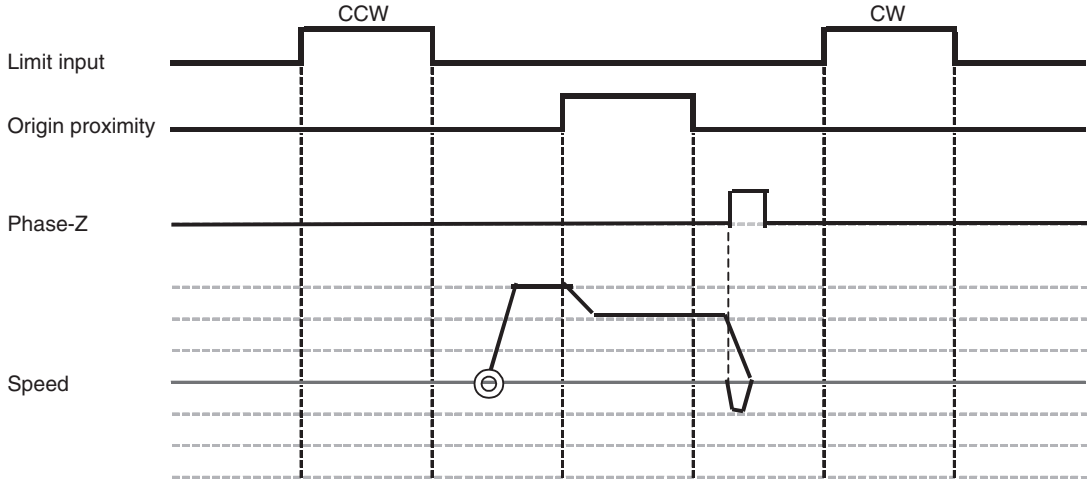
1,2,3...

1. When the origin search is executed, the axis is moved in the phase-Z detection direction at the origin search approach speed.
2. After the origin proximity input signal is turned OFF, the speed is reduced at the first rise of the phase-Z.
3. The machine origin will be defined after the axis travels back for the excess distance at the origin search creep speed.
   - If the final travel distance has been specified, the machine origin will be defined after the axis travels back for the specified distance.
   - If the reference origin offset value has been set in the system parameter, the specified value will be the machine coordinate of the stopping position.
   - The origin search operation and alarm occurrence will vary depending on the input timings of limit input signal, origin proximity input signal, and phase-Z, origin search start direction, and the position of the work when executing the origin search.

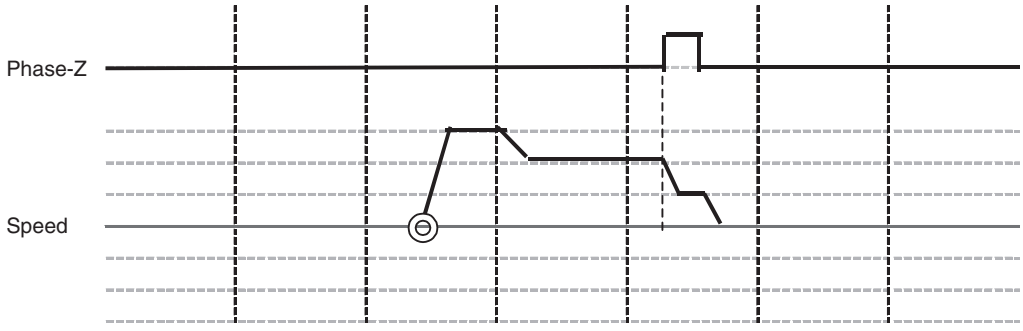
3-level Speed in One Direction Mode

With Origin proximity input signal, Phase-Z detection direction: + direction

When the final travel distance is zero:



When the final travel distance is specified:



Description

1,2,3...

1. When the origin search is executed, the axis is moved in the specified direction at the specified origin search feed rate.
2. When the origin proximity input signal is input, the speed is changed to the origin search approach speed.

3. After the origin proximity input signal is turned OFF, the speed is reduced at the first rise of phase-Z.
4. The machine origin will be defined after the axis travels back for the excess distance at the origin search creep speed.
   - If the final travel distance has been specified, the machine origin will be defined after the axis travels back for the specified distance.
   - If the reference origin offset value has been set in the system parameter, the specified value will be the machine coordinate of the stopping position.
   - The origin search operation and alarm occurrence will vary depending on the input timings of limit input signal, origin proximity input signal, and phase-Z, origin search start direction, and the position of the work when executing the origin search.

8-5 Absolute (ABS) Encoders

Overview

The absolute encoder retains absolute data by using the backup battery when the MC Unit is turned OFF. When PLC (MC Unit) is turned ON again, the absolute data is read from the absolute encoder to determine the present position. Therefore, once an origin is set, no origin search will be required after the power is turned ON (required for INC encoders).

The absolute position can be detected using the absolute encoder on the motor with a semi-closed loop system. The detector is composed of an encoder detecting the absolute position within one rotation and a counter that counts the number of rotations.

The ABS data that is stored in the ABS encoder consists of [the number of rotations from the absolute reference position (M)] and [the position within one encoder rotation (PO)]. This ABS data is read as serial data when the power for the system is turned ON. After that, the operation of an absolute encoder will be the same as that of an incremental encoder.

The absolute position PE can be found using the following expression:

$PE = M \times R + PO$

- Number of rotations from the absolute reference position: M
- Number of pulses per one encoder rotation: R
- The position within one encoder rotation: PO

The ABS encoder constantly holds the ABS data using battery even when the power is OFF. Moreover, it updates the data when there is any data change.

The battery is connected to the battery connector of the Servo Driver.

The Servo Driver reads the absolute data when the power is turned ON. Additionally, the MC Unit reads the same data to calculate the absolute position to set the machine coordinate system automatically.

Applicable Absolute Encoders

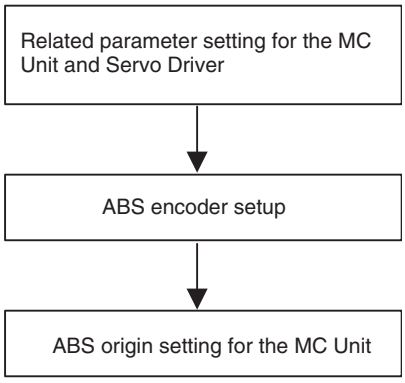
The following Servomotors with absolute encoders that can be connected to the MC Unit are provided:

OMRON W Series (R88M-W□□□□□S)
(R88M-W□□□□□T)

8-6 ABS Encoder Origin Setting

8-6-1 Procedure

Follow the procedure below to set the ABS encoder origin.



Follow the above procedure in the following cases:

- When starting up the absolute position detection system for the first time
- When the servomotor was replaced
- When alarm related to the absolute encoder occurred

8-6-2 Setting Up the Related Parameters

Parameters of MC Unit

No.	Name	Value	Remark
P1AA01	Physical axis setting	0: Not used 1~30: MLK devices 31: Reserved 32: Virtual axis	Only the MLK slaves can be used as the absolute value detection system.
P4AA12	ABS origin offset	–2147483648~2147483647	Sets the offset amount for the ABS origin setting. The present position after ABS origin setting execution will be the value set in this parameter.
P5AA04	Command unit/1 machine rotation	1~2147483647	
P5AA05	Gear ratio 1 (Motor rotation speed)	1~10,000,000	
P5AA06	Gear ratio 2 (Machine rotation speed)	1~10,000,000	
P5AA07	Axis feed mode	000000X0h X (coordinate system management) 0: Limited length 1: Unlimited length	Coordinate system management: Limited length axis and Unlimited length axis are treated differently.

Note If the parameters [P5AA04], [P5AA05], and [P5AA06] are changed after ABS origin setting, the alarm [300Dh: ABS encoder error] may occur when the power is turned ON.

Parameters of Servo Driver

No.	Name	Value	Remark
Pn002.2	Absolute encoder usage	0: Uses absolute encoder as absolute encoder. 1: Uses absolute encoder as incremental encoder.	Set 0.
Pn205	Multi-turn limit setting	0~65535	Limited length axis: 65535 (Default value) Unlimited length axis: Denominator of the deceleration ratio -1 (See note 1.)
Pn813.0	Option monitor 1 select	0: Follows analog monitor 1 (Pn003.0) 1: Follows analog monitor 1 (Pn003.1) 2: Initial multi-turn data (IMTDATA) 3: Encoder count direct value (PGCNT: after x4) 4: Motor PG initial multi-turn data direct value 5: Motor PG counter direct value 6: Motor PG counter latch direct value 7: Reserved 8: Full-closed PG counter direct value 9: Full-closed PG counter latch direct value	Set 2. (See note 2.)
Pn813.1	Option monitor 2 select	Same as above	Set 3. (See note 2.)

Note

(1) With machines such as turntable whose motor makes m rotations while its load shaft makes n rotations, the present value cannot be displayed correctly unless the multi-turn data from the ABS encoder returns to zero in every m rotations. Setting the value obtained by subtracting 1 from deceleration ratio denominator (m-1) in Pn205 will enable to display the present value correctly.

(2) Both multi-turn data and initial incremental pulses are read through the option monitor 1/2 when the power is turned ON. Set the parameters Pn813.0 and Pn813.1 appropriately so that the absolute data can be read correctly.

8-6-3 Setting Up the Absolute Encoder

Purpose

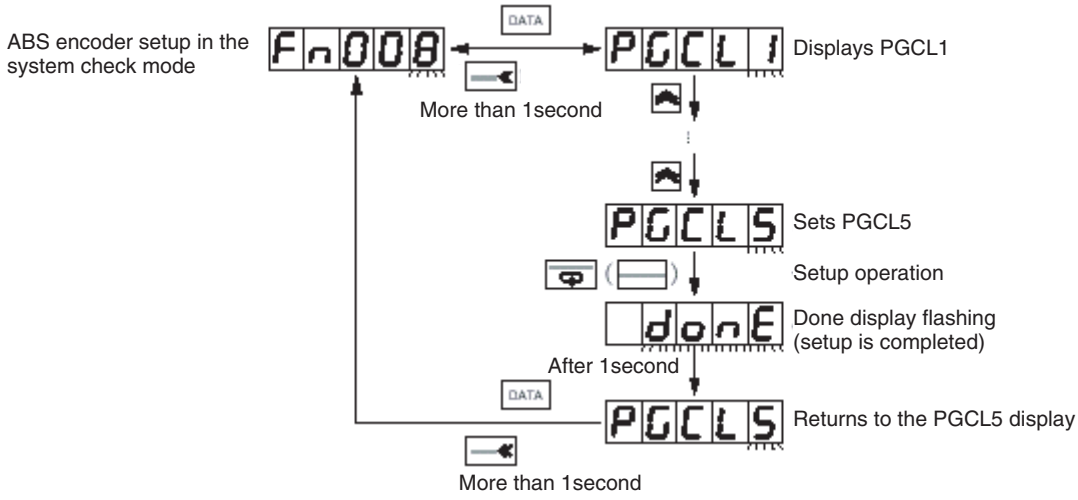
ABS encoder setup is required when clearing the rotational count data of the encoder to 0, or when the encoder has been left disconnected from the battery for a long period. Along with the ABS encoder setup, ABS origin must be set in the MC Unit. This is for resetting rotational count data of the ABS encoder, which should be accompanied by initialization of the axis present value to 0 in the MC Unit.

Setup Procedure

The following setup procedure is for the ABS encoder on OMRON W-series Servomotor.

Make sure to follow the procedure. Otherwise, errors may occur.

1,2,3... 1. Execute ABS encoder setup in the system check mode (Fn008).



Operation procedure

PR02W OPR	Key OPR	Display	Description
			Status display mode **Note** When the power is turned ON for the first time after connecting the motor with absolute encoder, A.81 (backup error) will be displayed.
			( ) Press the key to select the system check mode.
			Press the key to select the function No. Fn008.
	More than 1 second		(More than 1 second) Press the key to start the ABS encoder setup function. "PGCL1" will be displayed.
			Press the key to display "PGCL5".
			( ) Press the key. The ABS encoder setup will be processed. After completing the setup, "donE" will be displayed and flash for about 1 second.
After 1 second			After displaying "donE", "PGCL5" will be displayed again.
DATA	More than 1second		DATA (More than 1 second) Function No. in the system check mode will be displayed again.

2. Turn OFF the power once, and then ON again.

   The alarm (A.81) will not be cleared when the setup operation is completed.

   The alarm will be cleared after the power is turned OFF once (check the power-indicator goes OFF), and then ON again. If no error occurs after power ON, the setup is completed.

   If the alarm (A.81) occurs, start over the setup operation.

8-6-4 Supplemental Information for Setting Up

Setup operation explained above is required for operation check (with no load) on a motor and driver alone. When connecting the motor with the mechanical system for trial operation, another setup will be required due to the possibility that the amount of multi-turns in the ABS encoder may be too great.

Note The output range of the ABS encoder multi-turns for OMNUC W Series is between –32768 to +32767. Make sure that the operation range of the machine is within the range of multi-turns output.

Setting Up for Trial Operation

- If the alarm (A.81) occurs after replacing the battery unit, another setup will be required.
- The multi-turn data after the replacement should be different from that before battery unit replacement. Therefore, another initialization of the MC Unit will be required.

Note If the alarm does not occur after battery unit replacement, it is not necessary to initialize the MC Unit. If the battery unit is replaced correctly before its battery drain, no alarm should occur normally.

Setting Up When Replacing the Battery unit

In case of battery drain, the absolute data in the ABS encoder will be cleared. Therefore, battery unit replacement and setup are required.

Other Cases Requiring Setup

When disconnecting the encoder cable from the connector (on the driver or motor), the absolute data in the ABS encoder will be cleared. Therefore, setup operation will be required again.

8-6-5 Moving to the Origin

Use either of the following methods to move the machine to the position that will be the origin.

- Perform an origin search
- Execute JOG operation without an origin search.

Performing an Origin Search

1,2,3...

1. Set the system in Servo Lock.
2. Perform an origin search. See *8-4 Origin Search Operations* (page 494) for details on the origin search.

Jog Operation Without Performing an Origin Search

1,2,3...

1. Set the system in Servo Lock
2. Move the axis to the position to be the origin by JOG operation.

8-6-6 Setting the MC Unit ABS Origin

By setting the ABS origin, while the present position on the machine coordinate system is cleared to zero, the absolute position at that point is stored in the Flash memory.

Execute ABS origin setting after the axis was moved to the origin.

The present position (stopping) is stored in the MC Unit as the absolute origin.

Execute ABS origin setting using the bit in the PC Interface Area.

Name	Word	Variable	bit	Name	Description
Axis 1 Control Bit	x+0	IW0440	10	Absolute Origin Setting	0: Nil 1: Nil ↑: Sets ABS encoder origin ↓: Nil
Axis 2-32 Control Bits	x+1 - x+31	IW0441 - IW045F	10	The same as for Axis 1	The same as for Axis 1

- The absolute position setting value is stored in the system variable after ABS origin setting is completed. It is possible to transfer the absolute position setting value to another MC Unit through backup/restore operation using the CPU Unit's memory card.
- The absolute position setting value can be referenced using IORD instruction or the support tool. However, they cannot be edited directly. Make sure to set the absolute position setting value using ABS origin setting function.
- The addresses in the table below are for Axis 1:

Variable address	IORD address	Classification	Name	Description	Unit	Update timing
SW021E SW021F	310F	Axis	Axis 1 Status: Absolute position setting value 1: Multi-turns	The value of multi-turns of the ABS encoder in ABS origin setting	Rotation	At power ON, At ABS origin setting completion
SW0220 SW0221	3110	Axis	Axis 1 Status: Absolute position setting value 2: Initial incremental pulses	The number of initial incremental pulses of the ABS encoder in ABS origin setting	Pulse	At power ON, At ABS origin setting completion

Note

(1) It is recommended to backup the contents of ABS origin setting in the CPU Unit's memory card after ABS origin setting is completed.

(2) Make sure to set the absolute position setting value correctly. Otherwise, difference in values for positioning will occur between the MC Unit and ABS encoder.

(3) Do not execute ABS origin setting at least for one second after the main power supply for the Servo Driver or control power supply is turned ON.

SECTION 9
Other Operations

This section describes special operations for the CS1W-MCH71 Motion Control Unit, including teaching, program debugging, coordinate systems, and backup functions.

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9-1-2 Teaching Condition Setting 504
9-1-3 Teaching Execution 505
9-1-4 Teaching Status 505
9-1-5 List of Related Bits 506
9-1-6 Program Example 507
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9-2 Debugging the Program 510
9-2-1 Single Block Operation 511
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9-3 Coordinate System 514
9-3-1 Machine Coordinates and Workpiece Coordinates 514
9-3-2 Limited Length Axis and Unlimited Length Axis 515
9-3-3 Software Limit 517
9-3-4 Absolute Value Detection Function 518
9-4 Backup and Restore Function 522
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9-1 Teaching

This section describes the teaching method using the PC Interface Area.

9-1-1 Introduction

- After moving the axis to a desired position, the present position can be written into the words for position data. This process is called teaching. The address to which the present position is written is called teaching address.
- Teaching is performed for the entire unit. The axis on which teaching is executed can be specified in “Teaching axis setting”.
- When the teaching command is executed, the present position of the specified axes will be stored in the words of the teaching address specified with position data in ascending order of Axis No.
- In Teaching, the present position on the reference coordinate system is always read. Either of the following two formats of the present position can be specified.
  - The target position (present position of the command)
  - The feedback value (actual present position calculated with the encoder feedback value)
- To execute teaching, the bit [Command Disabled/Enabled] has to be ON (Command Enabled) and the bit [No Origin] has to be OFF (Origin is defined).

9-1-2 Teaching Condition Setting

- The teaching axes and teaching addresses are determined when the bit [Teaching Condition Setting] is turned ON.
- When the condition setting is completed, the bit [Teaching Condition Setting Completed] will be turned ON, which turns OFF the bit [Teaching Condition Setting]. After that, the bit [Teaching Condition Setting Completed] will be turned OFF.
- In order to check whether teaching was completed normally or not, observe the bit [Teaching Warning] when the bit [Teaching Condition Setting Completed] is turned ON.

Teaching Axis Setting

When executing teaching, the present position of which axis is to be read has to be specified. It can be specified with Teaching axis setting. Teaching axis setting 1-16 is for Axes 1 to 16 and Teaching axis setting 17-32 is for Axes 17 to 32. To make an axis a teaching object, turn ON (1) the bit corresponding to the Axis No.

Teaching Address

Teaching address specifies the address of position data in which the present position of axes is to be stored. Having the specified address as the beginning word, the present positions will be written into the words of position data in ascending order of Axis No. If Teaching condition setting is not executed after teaching execution, the teaching address will be automatically incremented for the number of axes that have been specified in the bits [Teaching Axis Setting 1-16], [Teaching Axis Setting 17-32]. If the incremented teaching addresses exceed 10239 (27FFh), the address will go back down to zero.

9-1-3 Teaching Execution

- The bit [Teaching Type] will be read when the bit [Teaching Execution] is turned ON, and the present values will be written into the position data under the conditions specified in the [Teaching Condition Setting].
- When the present position is written successfully, the bit [Teaching Execution Completed] will be turned ON, which turns OFF the bit [Teaching Execution]. After that, the bit [Teaching Execution Completed] will be turned OFF.
- In order to check whether teaching was completed normally or not, observe the bit [Teaching Warning] when the bit [Teaching Condition Setting Completed] is turned ON.
- It is possible to turn ON the bits [Teaching Condition Setting] and [Teaching Execution] simultaneously to execute them together. However, if an error occurs, it will not be possible to know in which operation the error occurred. Therefore, condition setting and execution should be executed separately.

Teaching Type

Either the feedback present position or command present position can be specified for the teaching present value.

9-1-4 Teaching Status

Teaching Warning

The bit [Teaching Warning] indicates the error status of the bits [Teaching Condition Setting] and [Teaching Execution]. The bit [Teaching Warning] is turned ON simultaneously with the bits [Teaching Condition Setting] and [Teaching Execution Completed] under the following conditions:

When Setting Teaching Condition:

- The teaching axes are not set. ([Teaching Axis Setting 1-16] = [Teaching Axis Setting 17-32] = 0)
- There are unallocated axes among the axes being specified in the bits [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32].
- The address specified in [Teaching Address] is outside of the position data addresses.
- Adding the number of axes that have been specified in the bits [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32] to the address specified in [Teaching Address] exceeds the position data address range.

When Executing Teaching:

- The bit [Teaching Execution] is turned ON when the teaching condition has not been set.
- For any of the axes specified in the bits [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32], The bit [Command Disabled/Enabled] is OFF, or the bit [No Origin] is ON.
- Adding the number of teaching axes to the address indicated in [Teaching Address Monitor] exceeds the position data address range.

Teaching Condition Setting Completed

- The bit [Teaching Condition Setting Completed] indicates completion of teaching condition setting regardless of normal or error completion.
- It will be turned OFF when the bit [Teaching Condition Setting] is turned OFF.

Teaching Execution Completed

- The bit [Teaching Execution Completed] indicates completion of teaching execution regardless of normal or error completion.

- It will be turned OFF when the bit [Teaching Execution] is turned OFF.

Teaching Address Monitor

- The status [Teaching Address Monitor] indicates the teaching address.
- When teaching is completed normally, the address displayed in [Teaching Address Monitor] will be automatically incremented for the number of axes specified in the bits [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32].

9-1-5 List of Related Bits

CIO Area Words for Unit (CPU Unit to MC Unit)

Classification	Word	Variable	bit	Name	Specifications
Unit Control bits	n+0	IW0300	03	Teaching Condition Setting	0: Nil 1: Nil ↑: Reads [Teaching Axis Setting] and [Teaching Address]. ↓: Nil
			04	Teaching Type	0: Feedback present position 1: Command present position ↑: Nil ↓: Nil
			05	Teaching Execution	0: Nil 1: Nil ↑: Writes the present position of the selected teaching type into the position data. ↓: Nil:
	n+1	IW0301	00-15	Teaching Axis Setting 1-16	0: Nil 1: Specifies the axis as teaching object ↑: Nil ↓: Nil
	n+2	IW0302	00-15	Teaching Axes Setting 17-32	0: Nil 1: Specifies the axis as teaching object ↑: Nil ↓: Nil:

CIO Area Words for Unit (MC Unit to CPU Unit)

Classification	Word	Variable	bit	Name	Specifications
Unit Status bits	n+15	OW0303	03	Teaching Warning	0: Teaching condition setting, and the execution completed normally 1: Condition error, Command disabled, No origin, or address overflow
			04	Teaching Condition Setting Completed	0: [Teaching Condition Setting] is OFF. 1: Teaching condition setting is completed (including error completion).
			05	Teaching Execution Completed	0: [Teaching Execution] is OFF. 1: [Teaching Execution] is completed (including error completion).

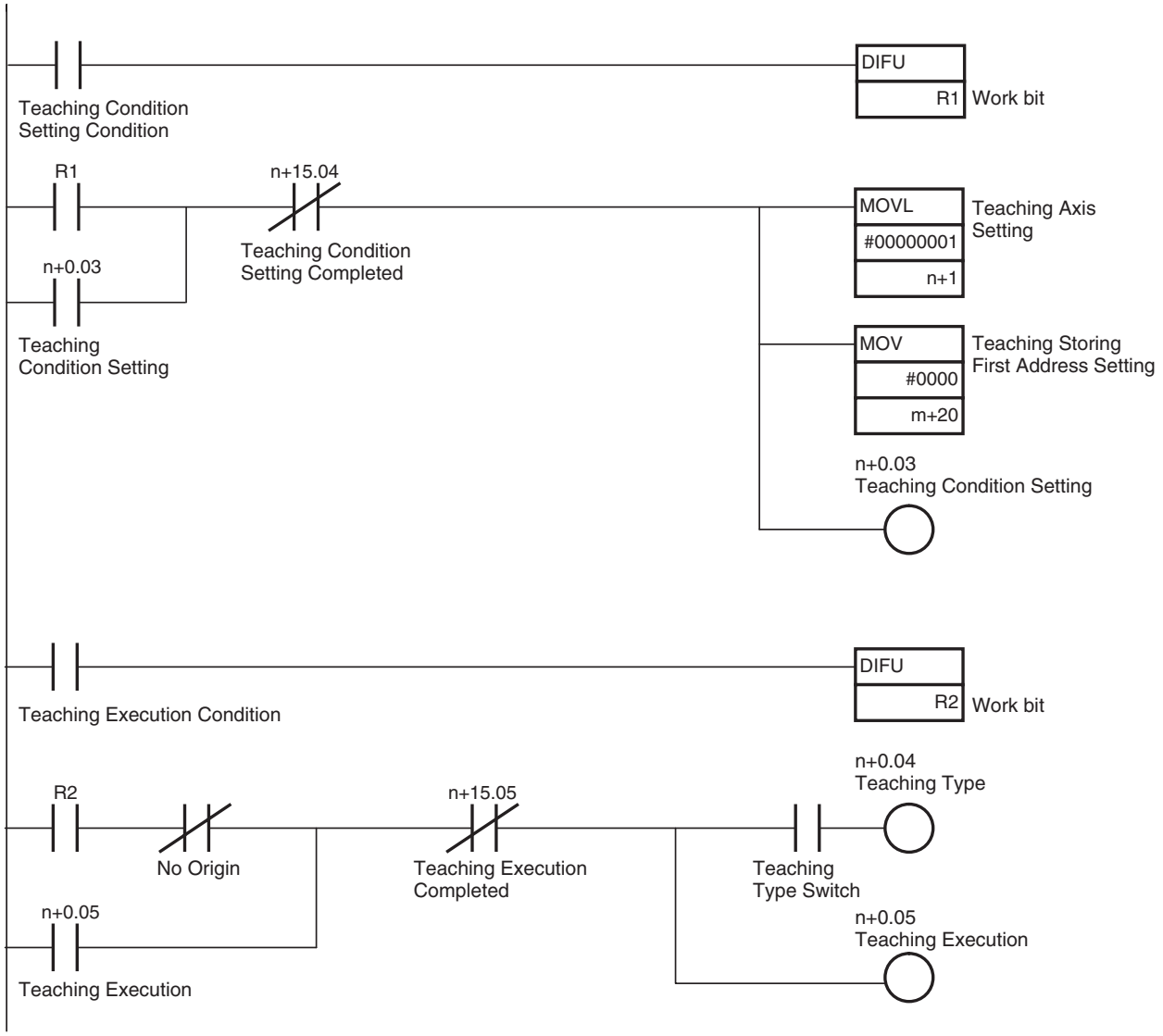
DM Area Words for Unit (CPU Unit to MC Unit)

Classification	Word	Variable	bit	Name	Specifications
Unit Control bit	m+20	IW0310	00-15	Teaching Address	Specifies the teaching start address 0-10239

DM Area Words for Unit (MC Unit to CPU Unit)

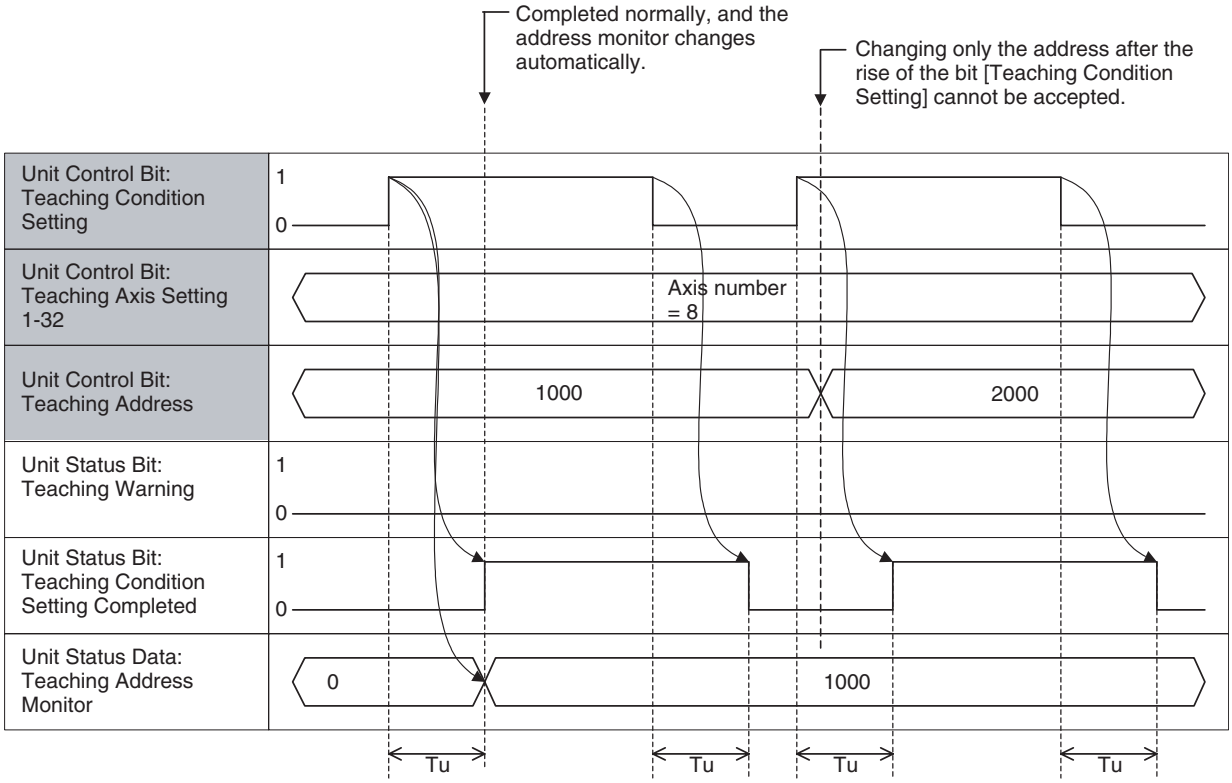
Classification	Word	Variable	bit	Name	Specifications
Unit Status data	m+39	OW0311	00-15	Teaching Address Monitor	Outputs the address of the current teaching object.

9-1-6 Program Example

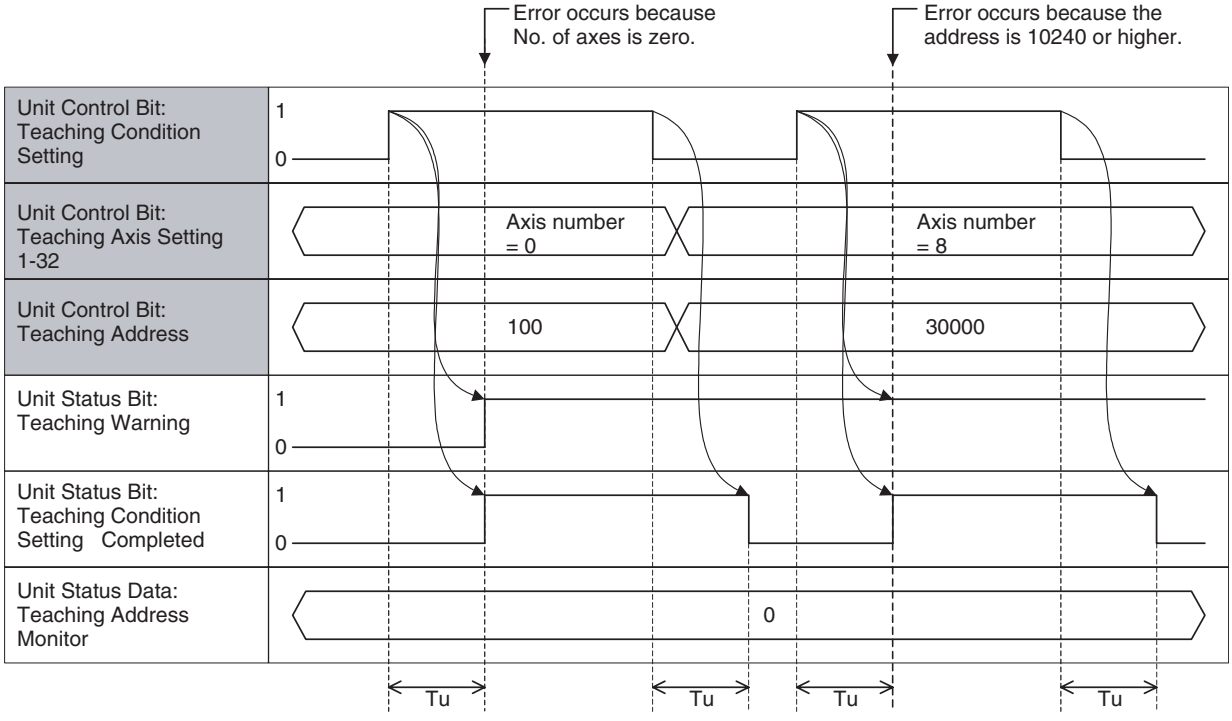


9-1-7 Timing Chart

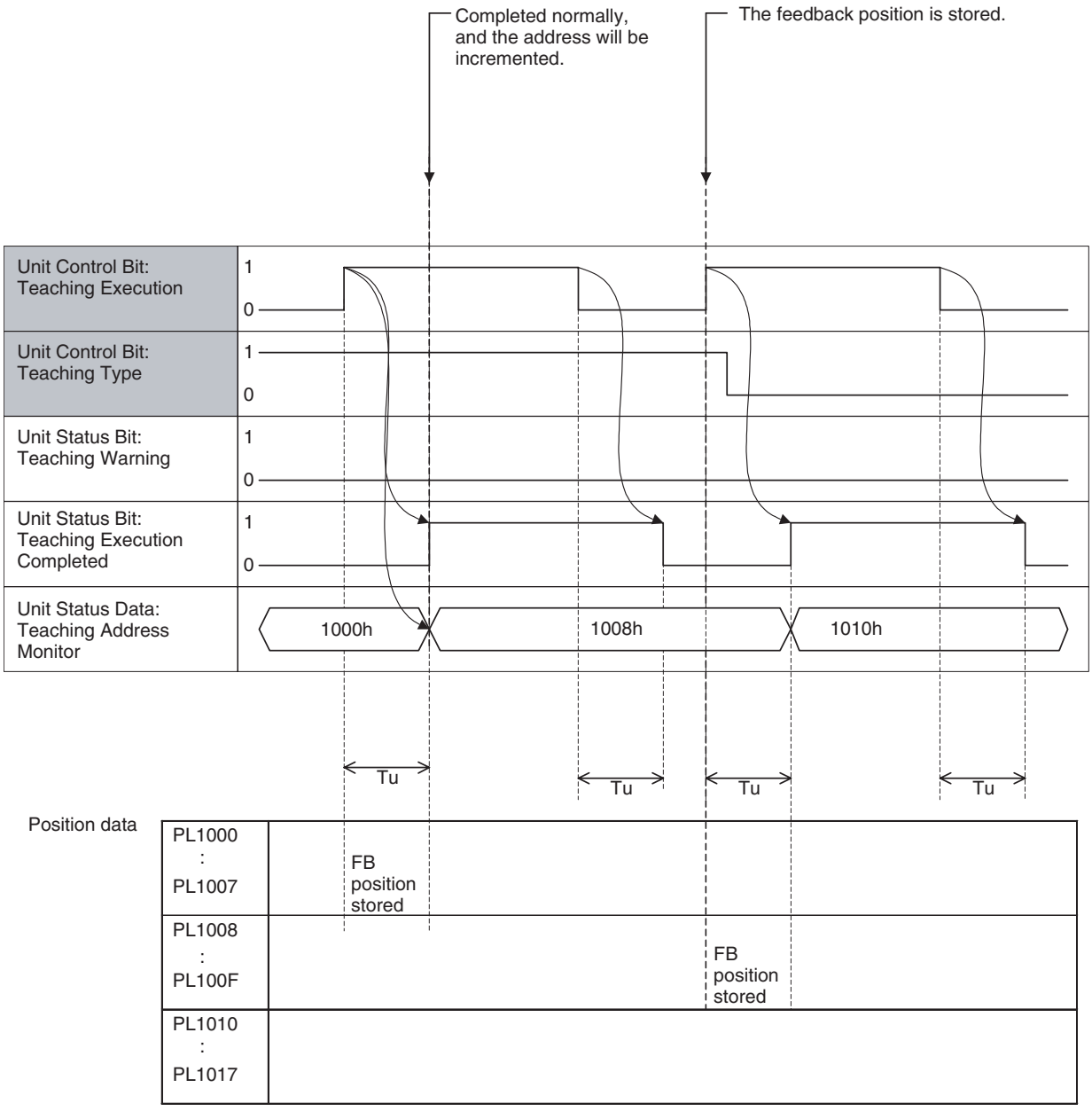
Teaching Condition Setting (Normal completion):



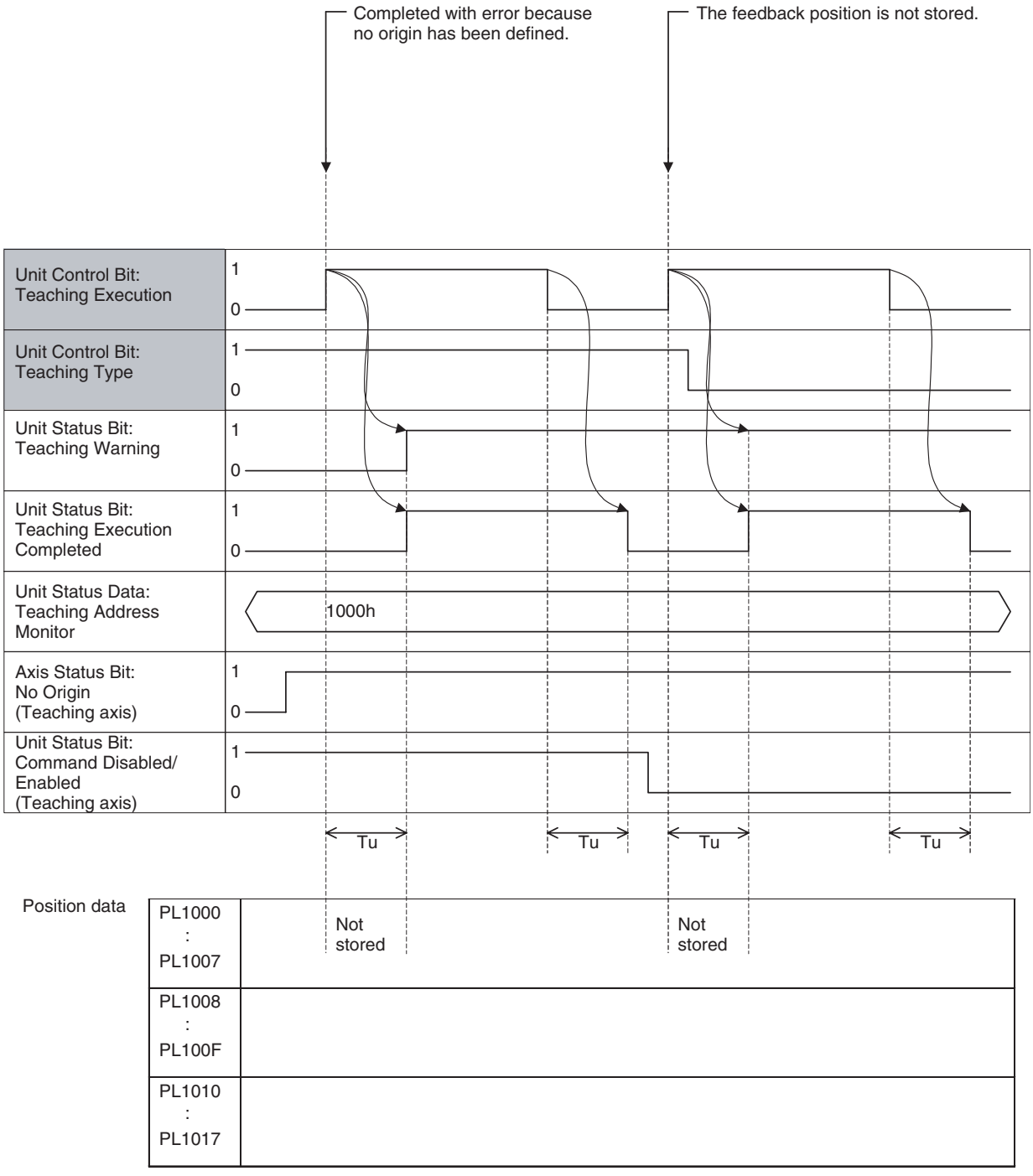
Teaching Condition Setting (Error completion):



Teaching Execution (Normal completion):



Teaching Execution (Error completion):



9-2 Debugging the Program

The debug function is described here, and the following functions are used for debugging the programs.

Debug function	Debugged program	Operation	Debugging unit
Single Block Operation	Motion program	Ladder, Support tool	Motion task
Machine Lock	Motion program	Ladder, Support tool	Axis

9-2-1 Single Block Operation

Function

- Single Block Operation is a motion program-debugging function that executes the motion program in block units so that program execution stops after each block.
- When the bit [Single Block Operation Mode] is ON, blocks not involving operations (program numbers or parallel branching labels) will be stopped.

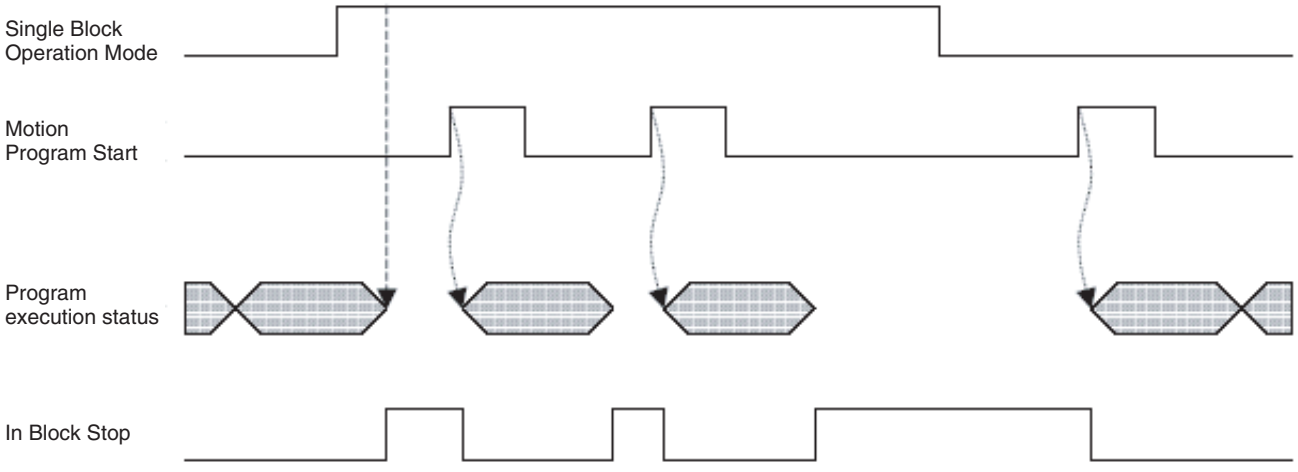
Operation

- Single Block Operation can be executed by turning ON/OFF the bit [Single Block Operation Mode] from the ladder program or the support tool.
- Single Block Operation Mode will be started when the bit [Single Block Operation Mode] is turned ON. After a block is stopped, the next block can be executed by turning ON the bit [Motion Program Start].
- The bit [Start Mode] affects the bit [Motion Program Start] in the single block operation mode. Therefore, select Start Mode 2 to execute the program block by block.

Start Mode	Behavior in the single block operation mode	Envisioned case
0, 3	Returns to the top of the program, and stops after executing the first line of the program.	Reconfirmation of a specified program
1	Executes the program from the top of the block currently being stopped, and stops at the end of the block.	Confirmation of a specified program
2	Executes from the top of the next block, and stops at the end of the block.	Confirmation for individual block.

Timing Chart

- The Unit checks ON/OFF of the bit [Single Block Operation Mode] between blocks, i.e. timing after end of the current block execution and before start of the next block execution.
- The same timing is used in Pass Mode. The program will be stopped at the end of the current block if the bit [Single Block Operation Mode] is ON before start of the next block execution. The program will not be stopped until the next block ends if execution of the next block has already started before the bit turns ON.

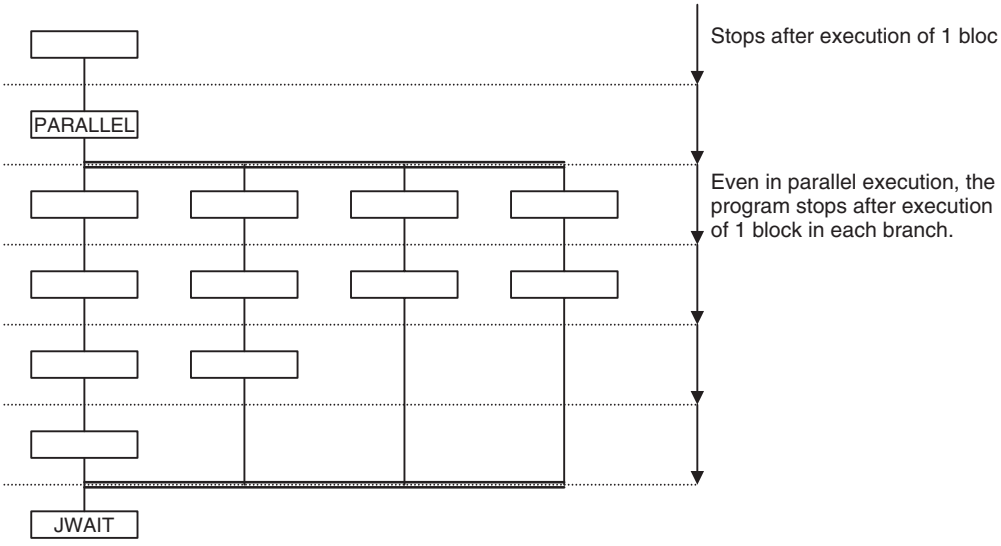


Effect on Other Tasks

Single Block Operation Mode is a function independent for each task, so there is no effect on other tasks.

Operation during Parallel Execution

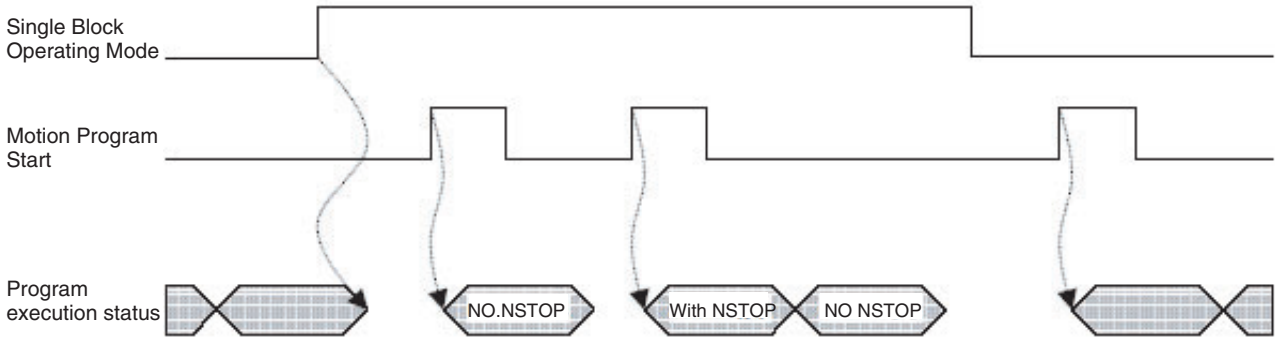
If the bit [Single Block Operation Mode] is already ON before execution of parallel branching, each branch will be executed one block at a time. At the end (JWAIT command) of parallel execution, branches follow execution of the branch with the most blocks.



When the bit [Single Block Operation Mode] is turned ON during execution of parallel branching, all the branches will be stopped at the ends of the blocks currently being executed. When each block currently being executed in all the branches is stopped, the bit [In Block Stop] will be turned ON.

Single Block Ignored (NSTOP Command)

The block with NSTOP command in the motion program will ignore the Single Block Operation Mode. The Single Block Operation Mode will be ignored even when the bit [Single Block Operating Mode] is turned ON during execution of the block with NSTOP command, and execution will stop before the block without NSTOP command.



9-2-2 Machine Lock

Function

- Machine Lock function prohibits the output of movement commands to the axes so that operation sequences other than axis operations can be debugged.
- Though the output of movement commands to the axes is prohibited, calculations for the movement commands are executed and command position will be updated.
- Machine Lock can be used not only for debugging of the motion programs, but also for debugging of the ladder program in the CPU Unit.

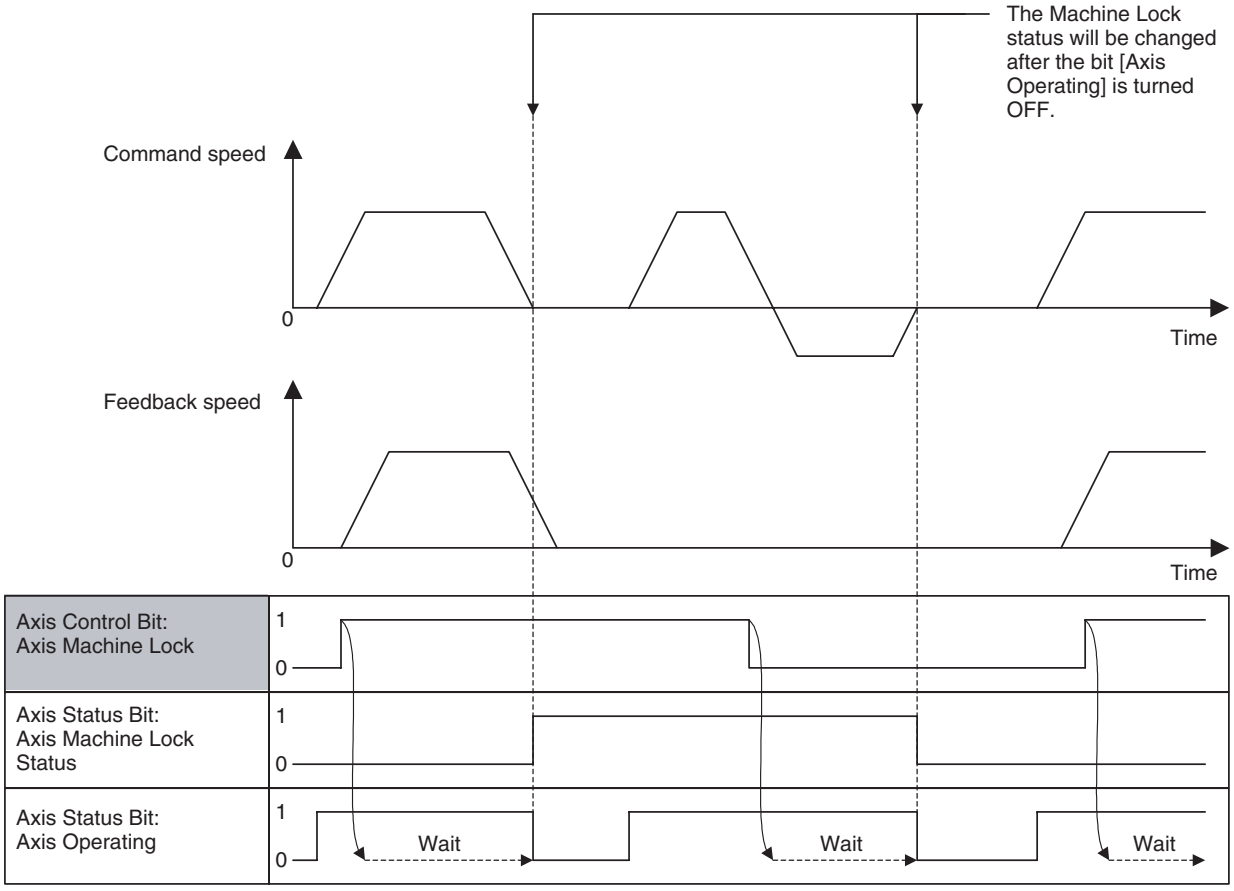
- Signals to the output modules are output normally.

Operation

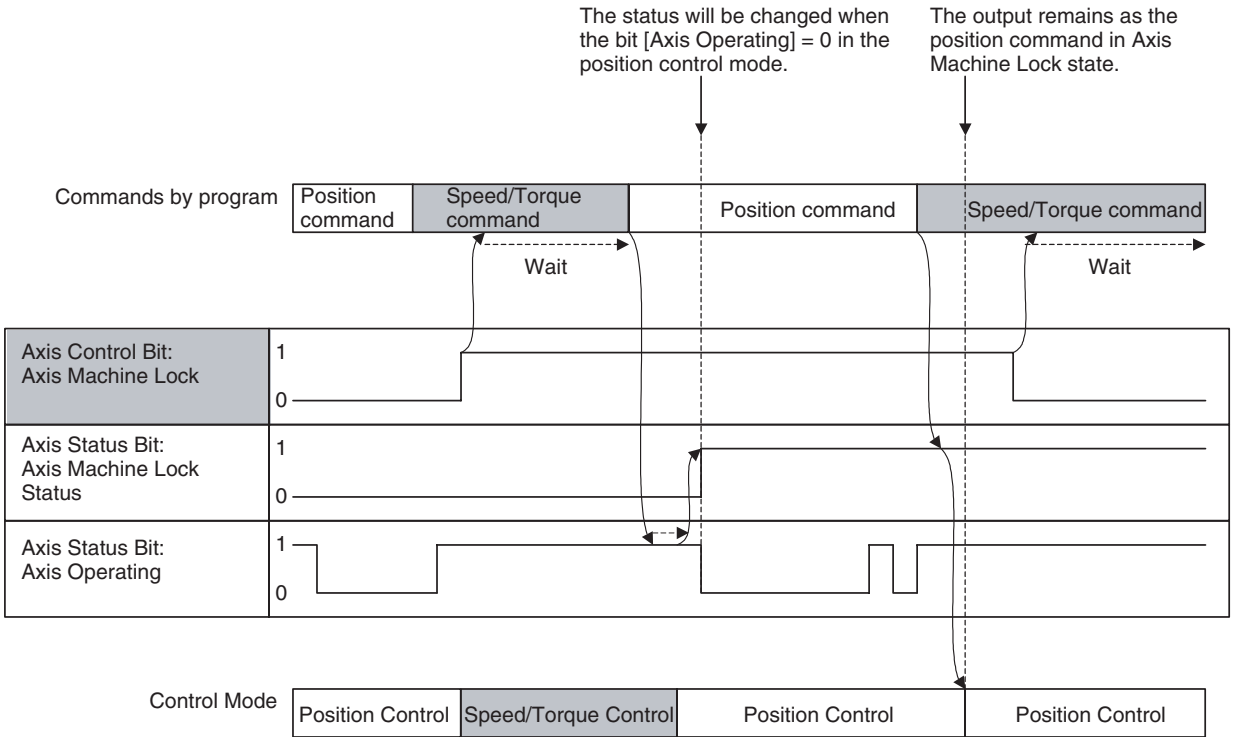
- Machine Lock can be executed by turning ON/OFF the bit [Machine Lock] from the ladder program or the support tool.
- When the Machine Lock status is cleared, the command position will be the one before the Machine Lock state.

Timing Chart

The bit [Axis Machine lock] will be checked on the timing when the bit [Axis Operating] is turned OFF, and the Machine Lock status will be changed accordingly.



The bit [Axis Machine Lock Status] is not changed (turned ON/OFF). Due to the same reason, while the bit [Axis Machine Lock Status] is 1 (ON), commands are output not as Speed or Torque command, but as Position command. (This is because the present position is not managed in the control modes other than position control mode.)



Effect

- Machine Lock is a function independent for each axis, so there is no effect of other axes.
  When Machine Lock is executed on some of the axes (not on all the axes) during an operation involving several axes, the mechanical system may operate in an unexpected way.
- In Machine Lock state, the origin search operation with DATUM command, Axis Control Bit: Origin Search will be the same as the operation of Axis Control Bit: Forced Origin. (This is to prevent the axis from moving endlessly. It is caused by the fact that the axis does not move at all in Machine Lock state and no external signal will be input.)

Operation during Parallel Execution

Regardless of parallel branching, Machine Lock status (set or reset) will be changed only in relation to the axis status.

Servo ON/OFF

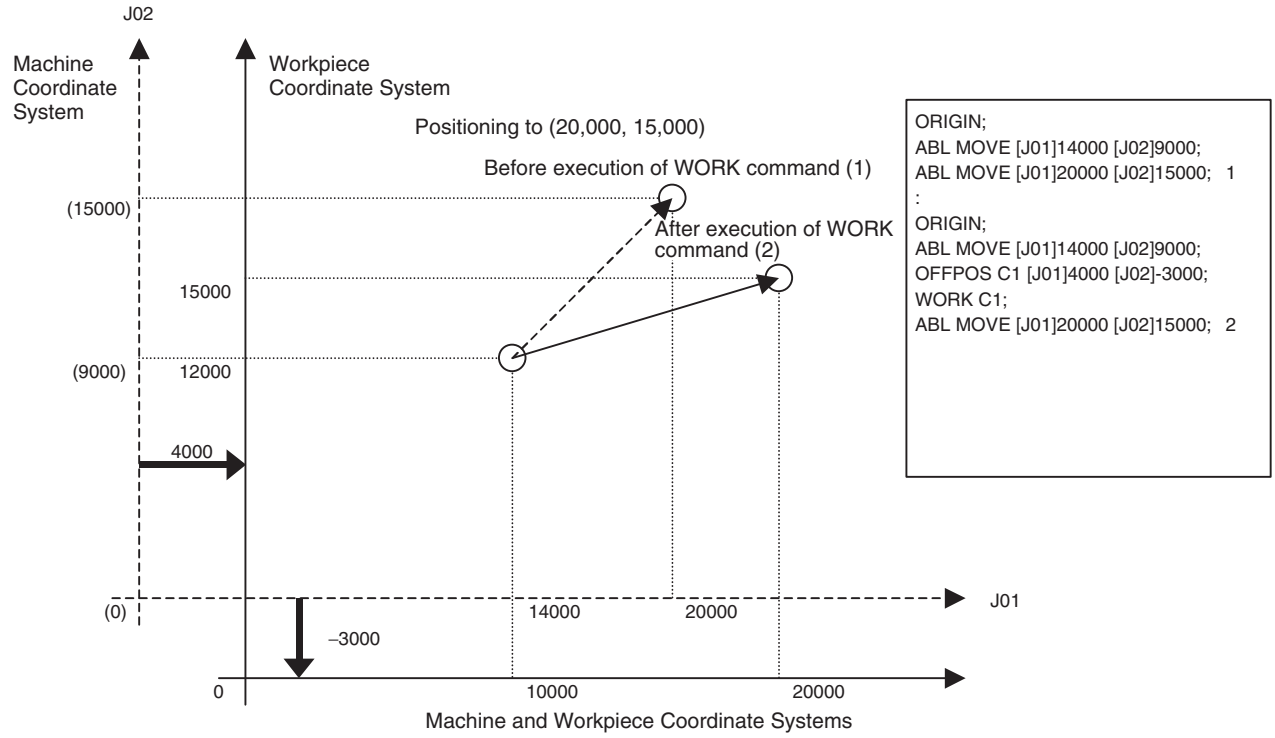
Even in Machine Lock state, Servo ON of the concerned axis is required to move the axis.

9-3 Coordinate System

9-3-1 Machine Coordinates and Workpiece Coordinates

There are two types of coordinate systems:

- Machine coordinate system:
  This is the coordinate system unique to the system that is determined by defining an origin.
- Workpiece coordinate system:
  This is the coordinate system unique to the work that is determined by adding an offset to the machine coordinate system. There are 3 of them for each axis. The offset of the workpiece coordinate system is determined by executing OFFPOS command, and executing WORK command enables the workpiece coordinate system.



Machine and Workpiece Coordinate Systems

Basic Item

- The offset value (offset value set in OFFPOS command) is the data for each axis and motion programs or motion tasks do not influence it.
- The coordinate system select (coordinate system type or number set in ORIGIN or WORK command) is the data for each motion program and axes or motion tasks do not influence it.

When starting New Program Operation

When a new main program operation is started (the first execution after the power is turned ON or execution in Start Mode = 0 or 3), the machine coordinate system will be always used. The offset value of the previously executed program will be used, however, the coordinate system select will not be inherited to the new program.

When calling a Sub-program

- When a sub-program is called, the offset value and coordinate system select of the main program will be inherited to the sub-program.
- When returning to the main program from the sub-program, the coordinate system select will be inherited.

When Parallel Branching

- When executing parallel branching using PARALLEL command, the offset value and coordinate system select will be inherited to all the branches.
- The offset value and coordinate system select changed in a branch will influence other branches.

When executing the END Command

The offset value and coordinate system select will not be initialized at the point when the program is ended by END command.

9-3-2 Limited Length Axis and Unlimited Length Axis

Either of the two types of coordinate management can be used, which can be selected in the parameter [P5AA07: Axis feed mode].

- Limited length axis:
  Used for the axes with traveling limits such as XY tables.

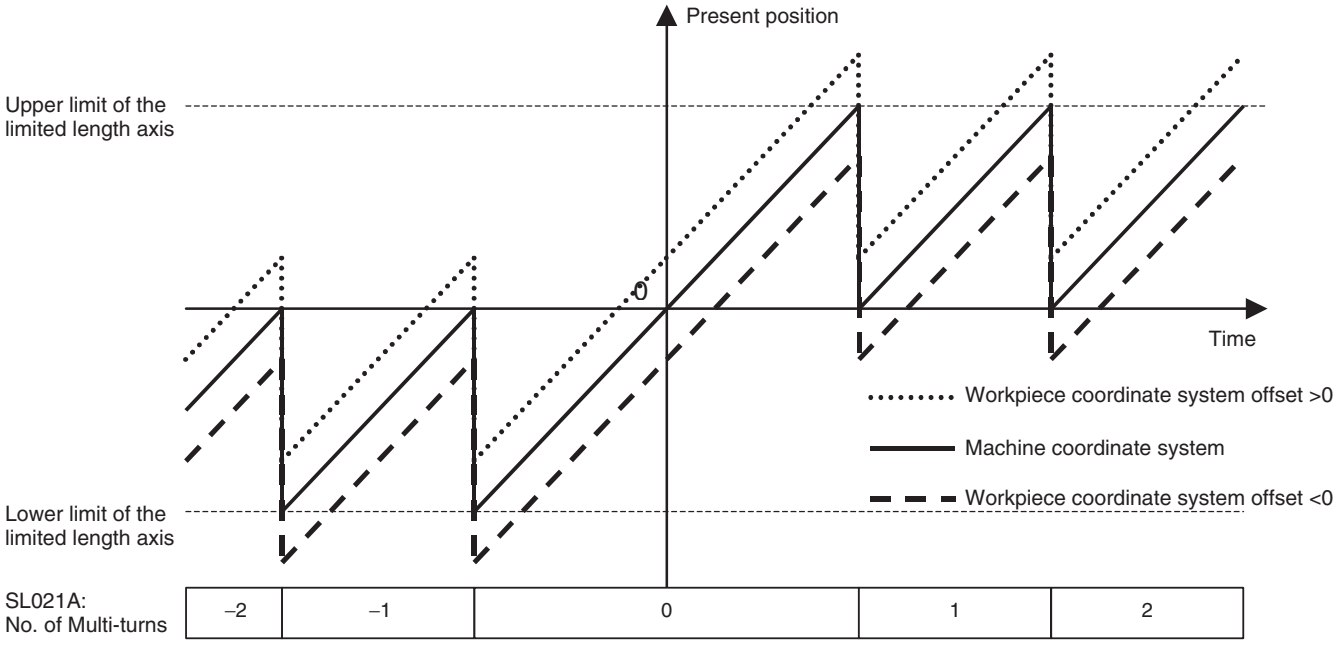
- Unlimited length axis:
  Enables to control axes that move endlessly in one direction (turntable or conveyor). For unlimited feed axes, the range for updating the present position can be set as desired.

Limited Length Axis

- Upper limit of the limited axis = (P5AA04 × P5AA06 × LONGMAX)/(No. of encoder pulses × P5AA05)
- Lower limit of the limited axis = -(P5AA04 × P5AA06 × LONGMAX)/(No. of encoder pulses × P5AA05)

  No. of encoder pulses: If the type of encoder is 16-bit, it is 65536 pulses / r (= 10000 Hex).

  P5AA04: Command unit/1 machine rotation
  P5AA05: Gear ratio 1 (Motor rotation speed)
  P5AA06: Gear ratio 2 (Machine rotation speed)



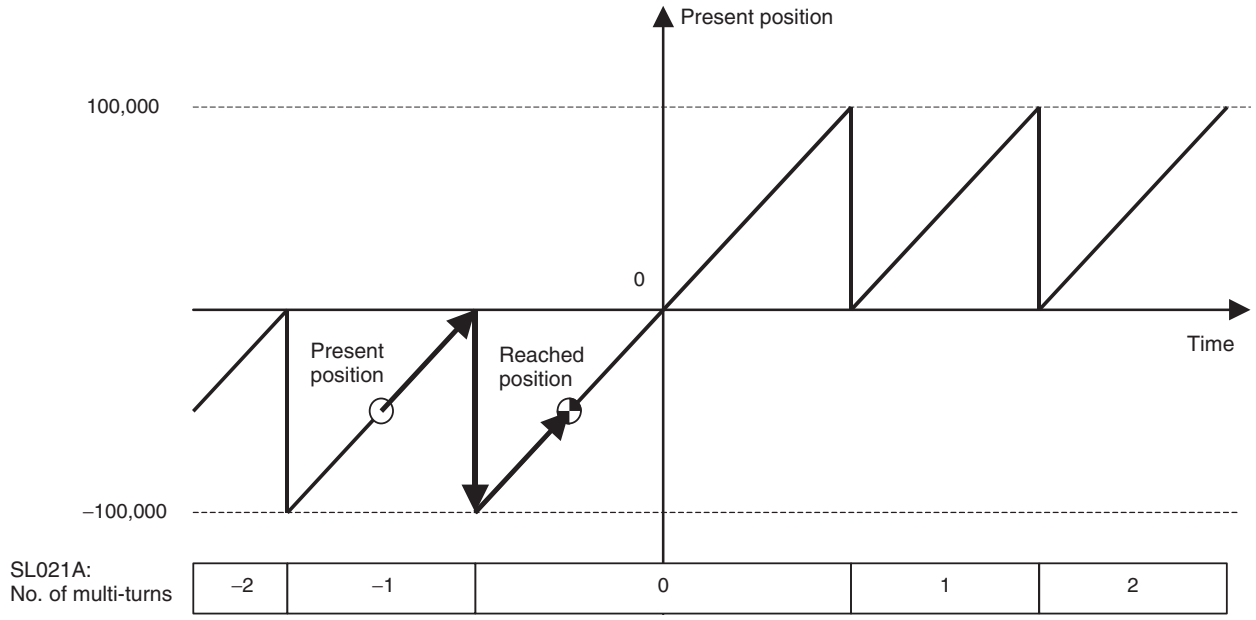
SL021A:
No. of Multi-turns is a system variable that indicates the number of times of having exceeded the upper and lower limits of the Machine coordinate system. Unless SL021A: No. of Multi-turns is zero, the target position and the reached position will not match. Therefore, make sure to use the limited length axis within the range of the upper and lower limits.

Example:
Upper limit of the limited length axis = 100,000
Lower limit of the limited length axis = –100,000
SL0206: Machine coordinate system command position = –50,000
SL021A: No. of multi-turns = –1

When executing the following program with the setting above:
PROG P0001 Q00000001;
ABL MOVE [J01]50000;
END;

Travel distance = Target position – Present position = 50000 – (–50000) = 100,000
The present position and the number of multi-turns after the execution will be;
SL0206: Machine coordinate system command position = –50,000
SL021A: No. of Multi-turns = 0

The reached position is not equivalent to the target position (see the diagram below).

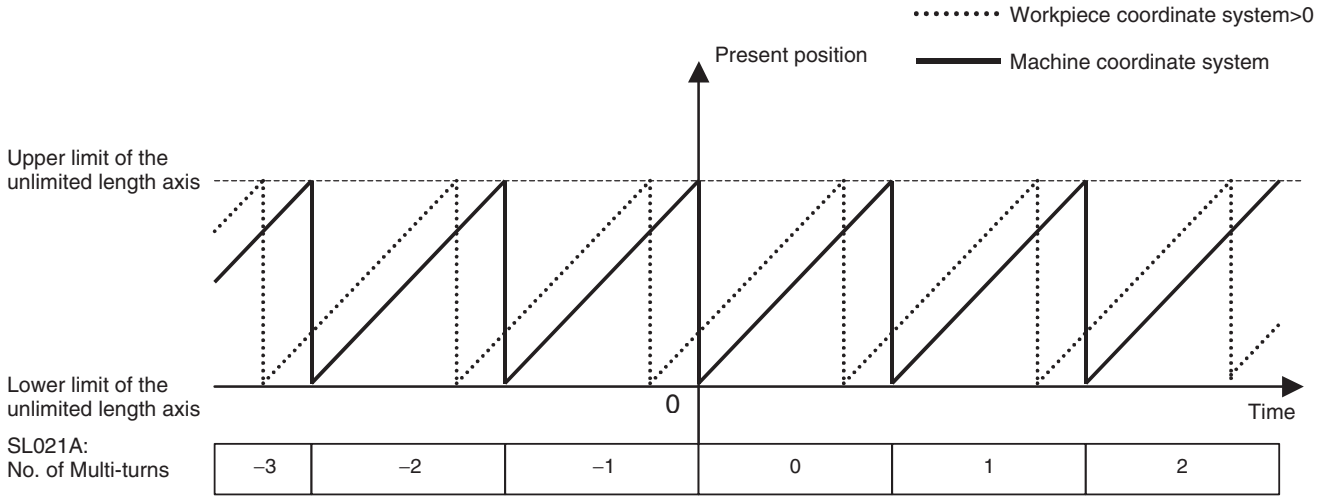


Unlimited Length Axis

- Upper limit of the unlimited length axis = P5AA04 – 1
- Lower limit of the unlimited length axis = 0

P5AA04: Command unit/1 machine rotation

With the unlimited length axis, even when SL021A: No. of multi-turns is not zero, the target position and reached position will match.



9-3-3 Software Limit

This is a function to provide software limit value on the coordinate system to prevent the machine from moving outside of the specified operating range. Normally, the limit value is set before the hardware limit sensor.

- Timing to detect the limit is only during axis movement (command output). It is not checked before operations.
- Before exceeding the limits, the following alarms will occur to stop the axis:
  - 3005h: Positive direction software limit

- 3006h: Negative direction software limit

- The software limit function is not applicable for the unlimited length axis and the axis without an origin.

Related System Parameters

No.	Name	Range	Unit	Description
P3AA02	Positive direction software limit	–2147483648~2147483647	Command unit	Limit value of the positive direction software limit
P3AA03	Negative direction software limit	–2147483648-2147483647	Command unit	Limit value of the negative direction software limit
P3AA04	Software limit enabled/ disabled	0: Both + and - software limits disabled 1: Only + software limit enabled 2: Only – software limit enabled 3: Both + and – software limits enabled.	---	Software limit enable/disable

Software Limit Range

Specification	Operation (Shaded area is the operating range.)
P3AA04 = 0	The entire area is the operating range. P3AA03 P3AA02
P3AA04 = 1	Lower than [P3AA02: + direction software limit] is the operating range. P3AA03 P3AA02 →
P3AA04 = 2	Higher than [P3AA03: – direction software limit] is the operating range. P3AA03 P3AA02 ←
P3AA04 = 3 P3AA03 < P3AA02	The area between [P3AA03] and [P3AA02] is the operating range. P3AA03 P3AA02 ← →
P3AA04 = 3 P3AA03 = P3AA02	The entire area is the operating range. P3AA02 = P3AA03
P3AA04 = 3 P3AA03 > P3AA02	The entire area is the operating range. P3AA02 P3AA03

Note Meaning of arrows.
→: The alarm [3005h: Positive direction software limit] occurs.
←: The alarm [3006h: Negative direction software limit] occurs.

9-3-4 Absolute Value Detection Function

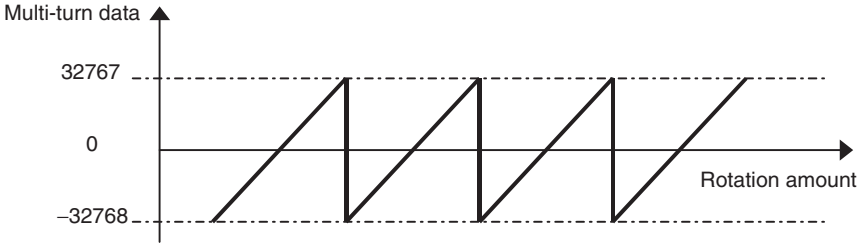
Relation Between Coordinate System and Absolute Value Detection Function

- The absolute encoder stores the multi-turn data in the internal battery backup memory. Therefore, the origin on the coordinate system can be defined without executing an origin search after the power is turned ON.
- In the MC Unit, when the bit [ABS Origin Setting] is turned ON, the relations between the absolute data read from the absolute encoder when communications were established and the coordinate system managed in the Unit will be saved in the Flash memory.

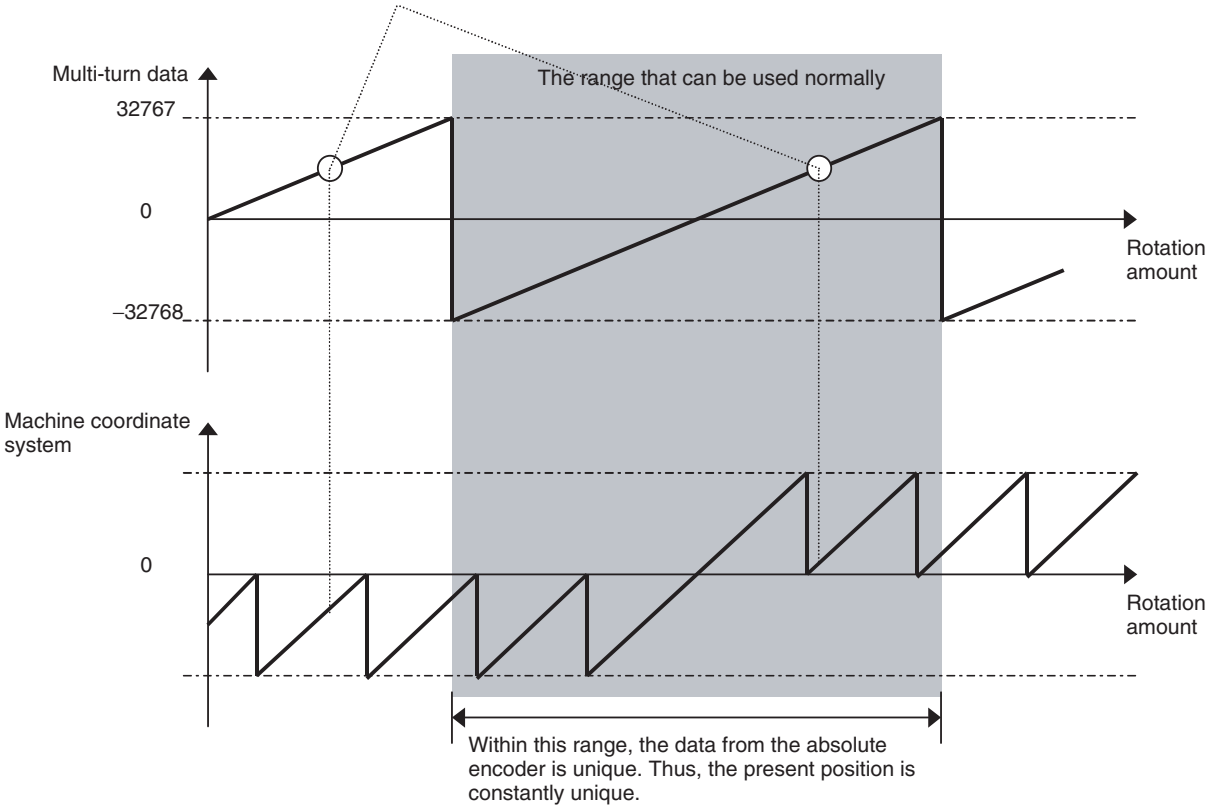
Using as Limited Length Axis

- When using an axis as the limited length axis, make sure to operate the axis within the range where the multi-turn data is not reset.

- When the servo parameter [Pn205: Multi-turn limit setting] is 65535 (default setting), the multi-turn data will change as shown below:



- There will be no problem if the axis is used within the range where the multi-turn data is between –32768 to 32767. However, if the power is turned OFF once, and ON again when the axis is outside of the range, the present position cannot be read correctly. No alarm will occur.
- If origin setting is executed near the limit of the multi-turn data, a slight movement will make the axis exceed the limit. Therefore, always initialize the multi-turn data of the encoder before executing origin setting.
- The operation that the axis is used within the ranges where the multi-turn data is reset or not reset is shown below:

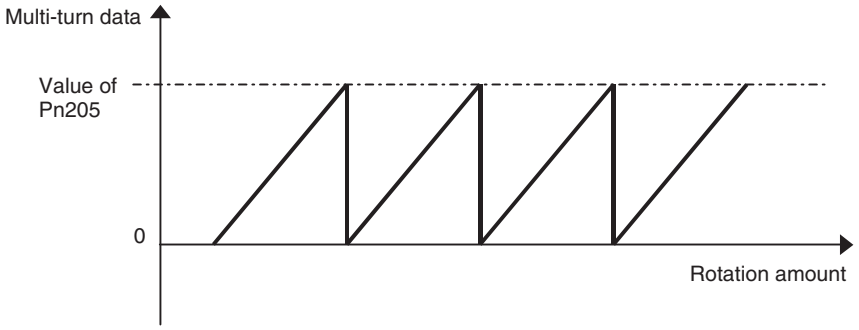


Using as Unlimited Length Axis

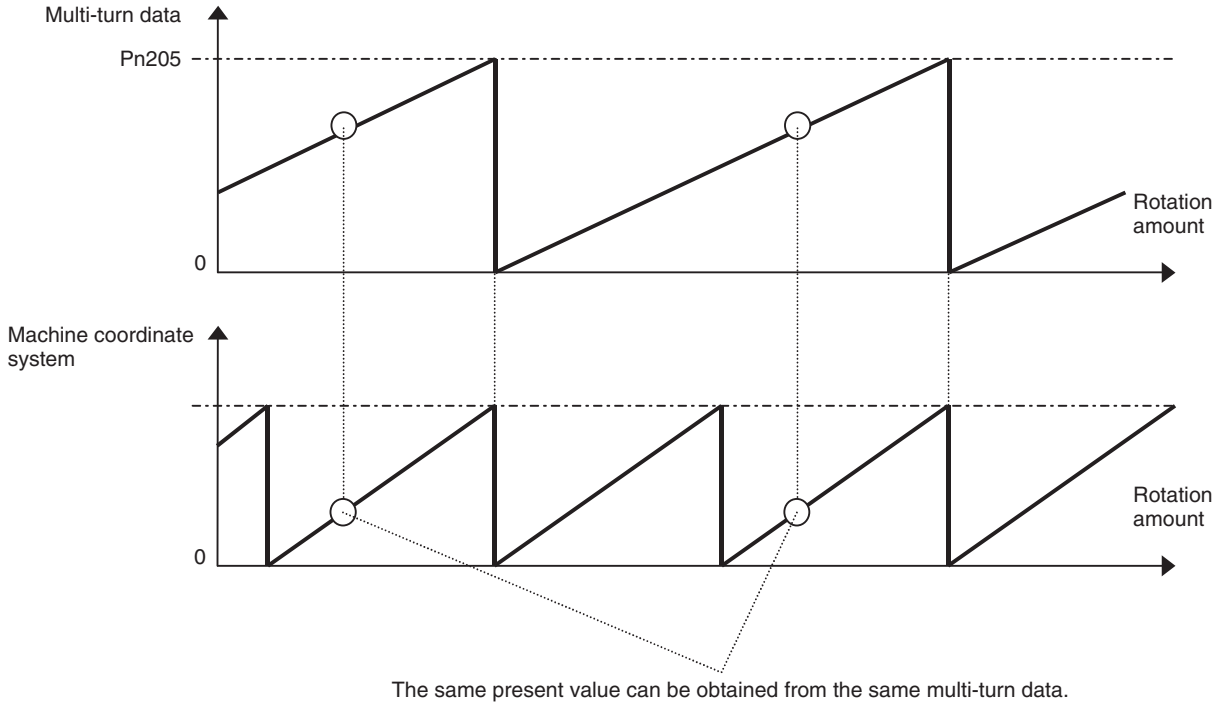
Same as the case of limited length axis, to execute the axis operation within the range where the multi-turn data is not reset, use the same setting as the one for the limited length axis. However, to execute the axis operation exceeding the limit of the multi-turn data, it is required to match the reset timing of the coordinate system managed in the MC Unit and the reset timing of the

encoder's multi-turn data. To match the timings appropriately, adjust the setting value of the parameter [Pn205: Multi-turn limit setting]. In the case where the load shaft makes n rotations while the motor makes m rotations, set the value obtained by subtracting 1 from the denominator of deceleration ratio (m-1) in Pn205.

If the value other than 65535 is set in the servo parameter [Pn205: Multi-turn limit setting], the multi-turn data will change as shown below:

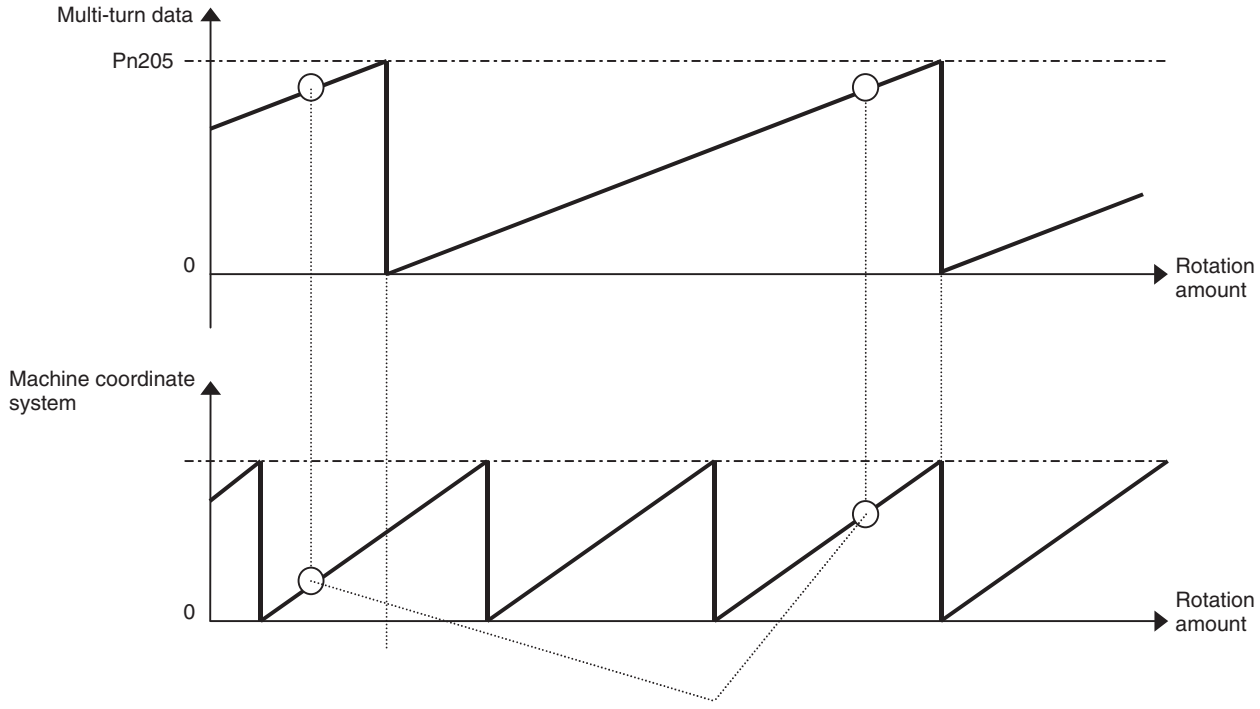


When Multi-turn Limit Setting is Adjusted



Note that, however, there is no guarantee on the value of the number of multi-turns (SL021A: Number of multi-turns) on the machine coordinate system.

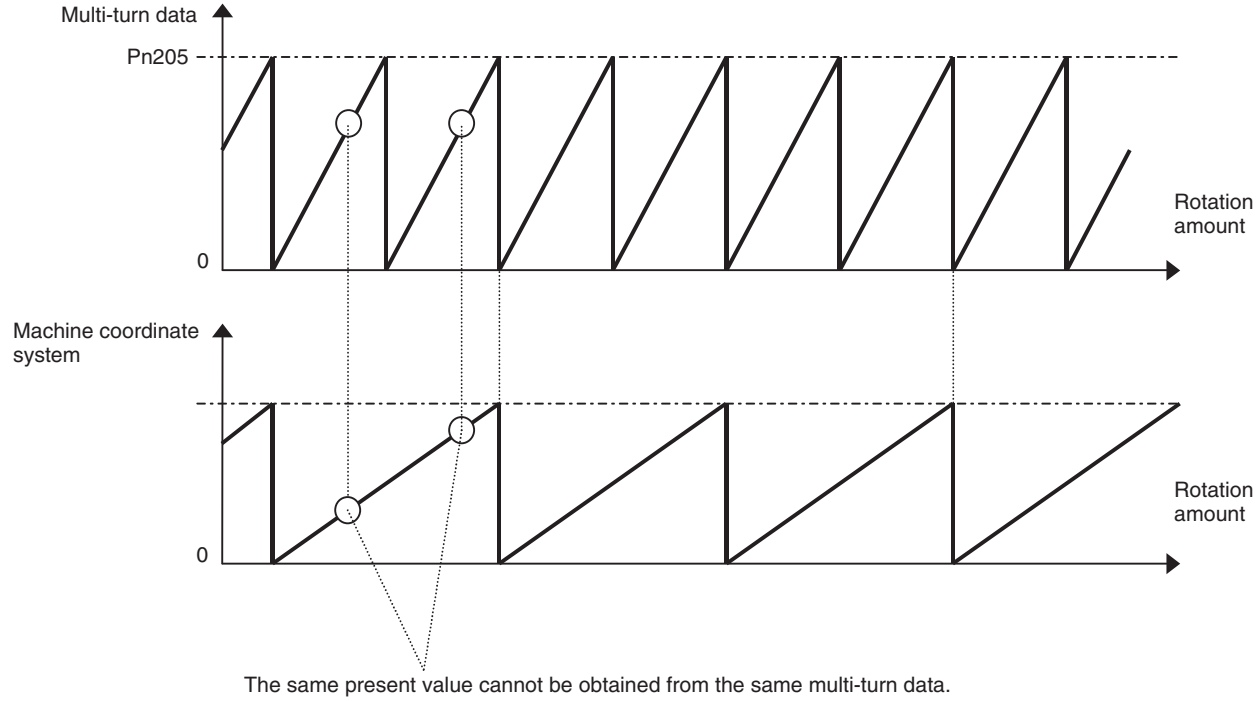
When Multi-turn Limit Setting is not Adjusted



The same present value cannot be obtained from the same multi-turn data.

When Multi-turn Reset Cycle is Shorter than Machine Coordinate System Cycle

Similar to the case above, the correct present value cannot be obtained when the reset cycle of the multi-turn data is shorter than the cycle of the machine coordinates system.



The same present value cannot be obtained from the same multi-turn data.

9-4 Backup and Restore Function

When replacing the Unit, etc., all the data in the MC Unit can be saved in the memory card of the CPU Unit at once. The saved settings can be set in another MC Unit using the memory card easily. For details, refer to the applicable CPU Unit operation manual.

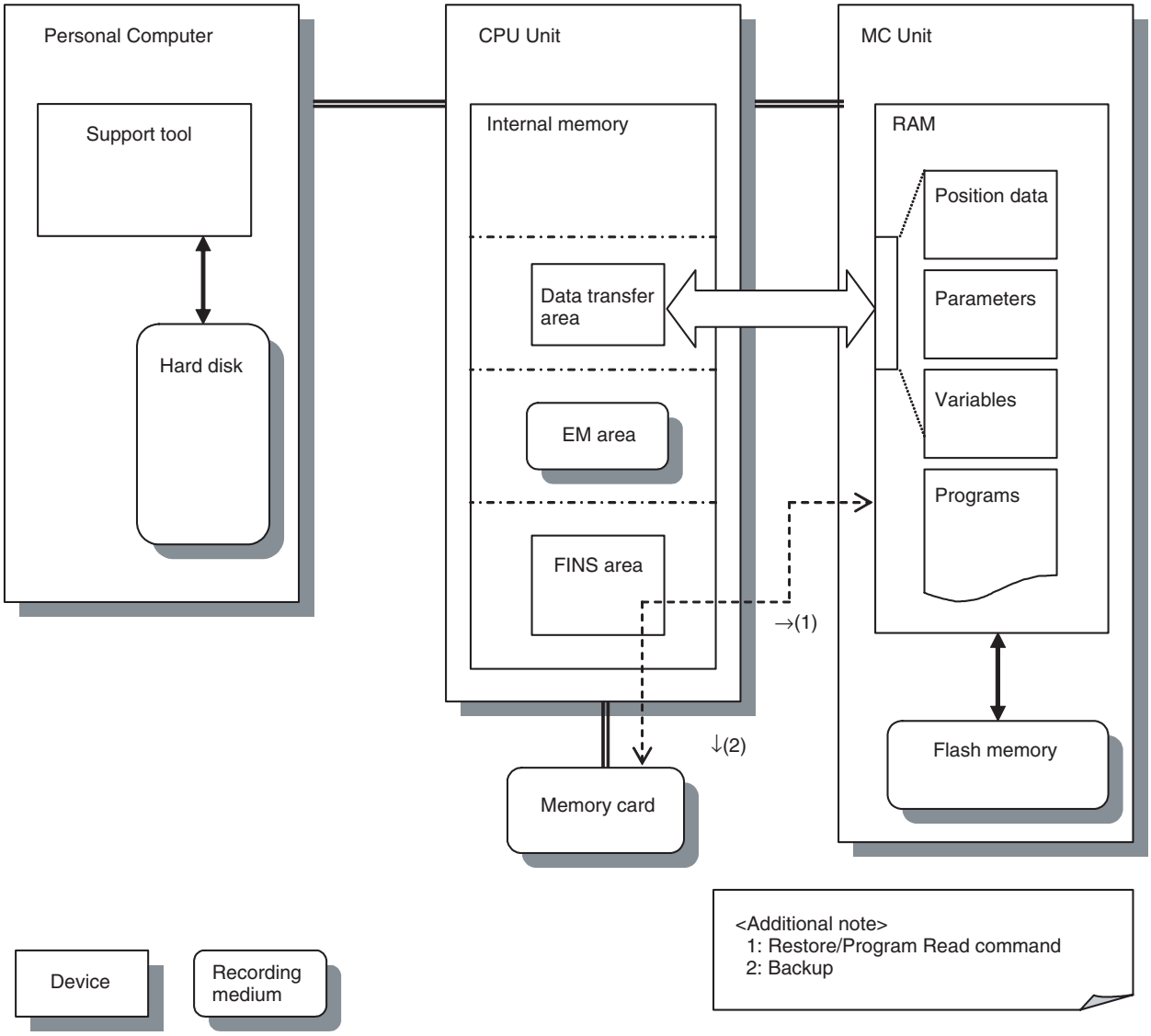
- Backup: Flash memory of MC Unit ? Memory Card of CPU
- Restore: Memory Card of CPU → Flash memory of MC Unit
  (After restore, the power has to be turned OFF once and ON again, or the Unit has to be reset.)
- Verify: Memory Card of CPU ↔ Flash memory in MC Unit
  (Verify is executed by the CPU Unit, and thus it functions as the backup for the MC Unit.
- The Memory Card capacity required to back up the data from one MC Unit is as follows:

  MC Units manufactured on 2 February 2004 (Lot No. 040202xxxx) or later: 4 MB max.
  Other MC Units: 8 MB max.

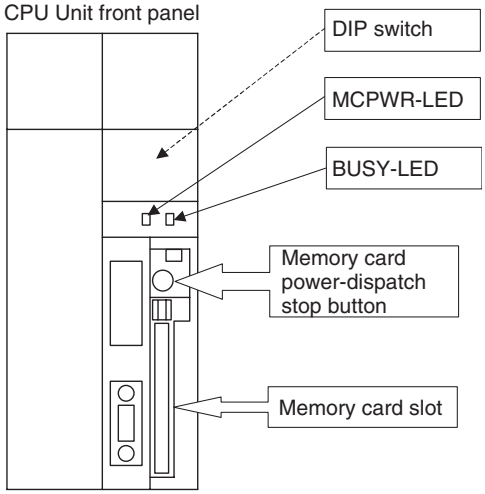
  If data from the CPU Unit is also to be backed up, we recommend Memory Cards with even larger capacities.

Applicable Data

Data	Remark
Unit model, Version info	
Motion programs	Including text and analysis, internal management data
CAM data	Including internal management data
System parameters	
Servo parameters	Including servo reading parameters
Position data	
ABS origin position data	



9-4-1 Procedures for Backup and Restore



Backup Method

1,2,3...

1. Insert the memory card and switch ON.
(MCPWR-LED on the CPU Unit front panel is lit.)
2. Turn ON the DIP switch SW7 on the front panel.
3. Press down the memory card power-dispatch stop button at least for 3 seconds.
BUSY-LED is lit and writing to the memory card starts.
(During the execution, the auxiliary bit [A34313: File Memory Operation Flag] is turned ON.)
4. Backup will be completed when MCPWR/BUSY-LED is turned OFF.
(Backup execution time is about 7 to 8 minutes.)

Restore Method

1,2,3...

1. Turn ON the DIP switch SW7 on the CPU Unit front panel.
2. Insert the memory card and switch ON.
MCPWR/BUSY-LED on the CPU Unit front panel is lit and reading from the memory card starts.
(During the execution, none of the LED indicators on the MC Unit is lit.)
3. The execution will be completed when MCPWR/BUSY-LED is turned OFF.
(The restore execution time is about 4 to 5 minutes.)
4. After completion, switch OFF the CPU Unit once. Then, turn OFF the DIP switch SW7. Finally, switch ON the CPU Unit again.
(The MC Unit will not start without this operation.)

Note For details, refer to “5-2-6 Simple Backup Function” in SYSMAC CS/CJ Series Programmable Controllers PROGRAMMING MANUAL (W394).

SECTION 10
Program Example

The section provides a programming example to demonstrate how the CS1W-MCH71 Motion Control Unit can be used.

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10-1 Program Example

This section shows several motion programs for different typical application.

10-1-1 Positioning with PTP Control

Explanation of the operation

- Positioning to the 3 points below is executed with PTP control, and the axes returns to the origin ([J01]0, [J02]0).
- When positioning is completed, 1 will be output to CPU unit using the general I/O area.

1,2,3...

1. [J01]10000, [J02]50000 1 is output to the general output (0BA0).
   ↓
2. [J01]50000, [J02]75000
   ↓
3. [J01]100000, [J02]100000 1 is output to the general output (0BA1).
   ↓
4. [J01]0, [J02]0

Program

The numbers 01) to 15) are used only for the sake of explanation. They are not needed in programming.

```
01) PROG P001 Q00000003;
02) MOVE [J01]10000 [J02]50000;
03) NOPS;
04) #OW0BA0 = 1;
05) WAIT #IW0B00 == 1;
06) #OW0BA0 = 0;
07) MOVE [J01]50000 [J02]75000;
08) DWELL T300;
09) MOVE [J01]100000 [J02]100000;
10) NOPS;
11) #OW0BA1 = 1;
12) MOVE [J01]0 [J02]0;
13) NOPS;
14) #OW0BA1 = 0;
15) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) Positioning to [J01]10000, [J02]50000 with PTP control is performed.

03) NOPS command will hold the program advance till positioning 02) is completed (within in-position range).

04) Once positioning is completed, 1 will be output to the general output (OW0BA0).

05) The program advance will be held till the general input (IW0B00) becomes 1.

06) The program will advance to the next block after the general output from 04) is cleared.

07) Positioning to [J01]50000, [J02]75000 with PTP control is performed.

08) The program waits for 3 seconds.

09) Positioning to [J01]100000, [J02]100000 with PTP control is performed.

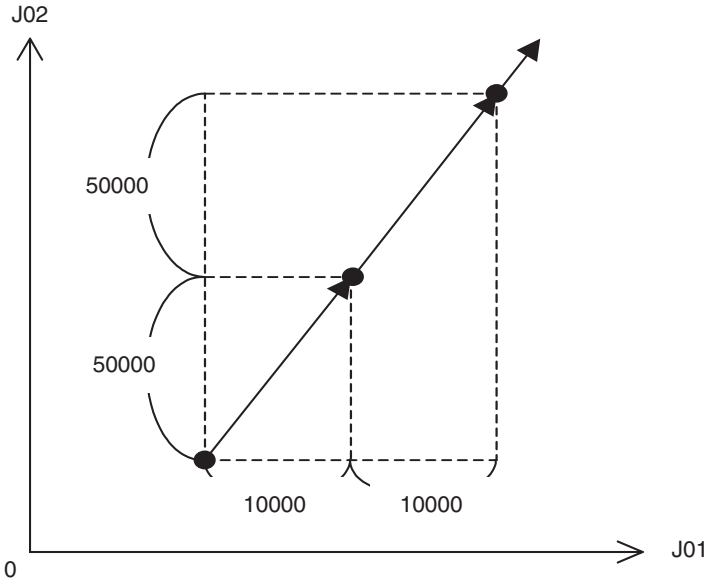
10) to 14) 1 will be output to the general output (OW0BA1) after positioning is completed and the axes will return to the origin. Once they reach the origin, the general output (OW0BA1) will be reset.

15) The program is completed.

10-1-2 Positioning with Linear Interpolation

Explanation of the operation

- At the rise of the general input (IW0B00), positioning with linear interpolation is performed from the present position to the position [J01]10000, [J02]50000.
- The positioning will be repeated up to 10 times till the content of the general input (IW0B01) becomes 1.



Program

```
01) PROG P002 Q00000003;
02) FOR W#ML0000 L10 S1;
03) IF #IW0B00 <> 1;
04) WAIT #IW0B01 == 1;
05) INC MOVEL [J01]10000 [J02]50000 F500000;
06) ENDIF;
07) NEXT;
08) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) With FOR (Repeat) command, the process through 02) to 07) is repeated 10 times.

03) When the general input (IW0B00) is not 1, the program executes the axis operation. When it is 1, the program advances to the next block without any axis operation.

04) The program will wait until the general input (IW0B01) becomes 1.

05) Positioning with linear interpolation is performed from the present position to the position [J01]10000, [J02]50000.

06) This is the end of IF command from 03).

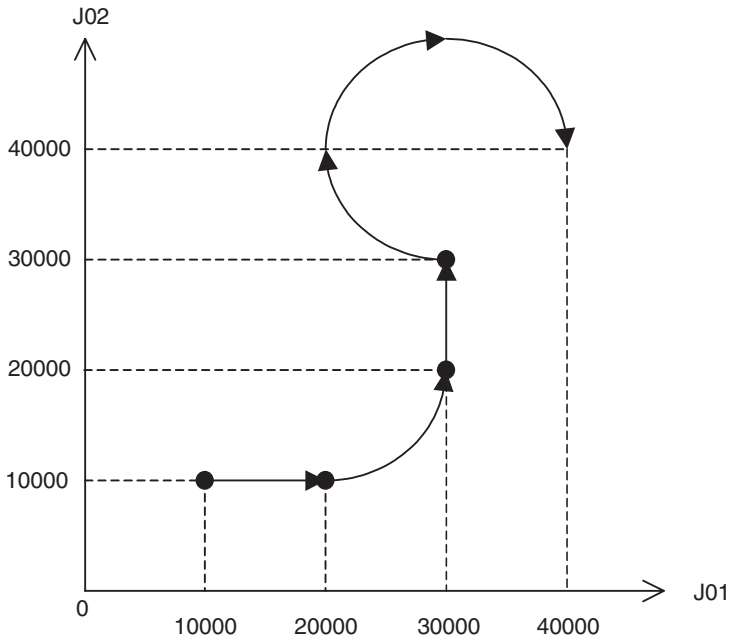
07) This is the end of FOR command from 02).

08) The program is completed.

10-1-3 Positioning with Linear and Circular Interpolation

Explanation of the operation

Positioning with the path shown below is performed combining linear and circular interpolation.



Program

```
01) PROG P003 Q00000003;
02) PASSMODE;
03) MOVEL [J01]20000 [J02]10000 F300000;
04) MOVEC Q-1 [J01]30000 [J02]20000 R10000;
05) MOVEL [J02]30000;
06) MOVEC Q1 [J01]40000 [J02]40000 I0 J10000;
07) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) Pass Mode is selected.

03) The axes move to the position [J01]20000, [J02]10000 with linear interpolation.

04) The axes move in CCW direction to the position [J01]30000, [J02]20000 with circular interpolation of radius “10000”. (Since a positive value is specified for radius, the center angle is smaller than 180 degrees (a quarter of the circle).)

05) The axes move to the position [J01]30000, [J02]30000 with linear interpolation.

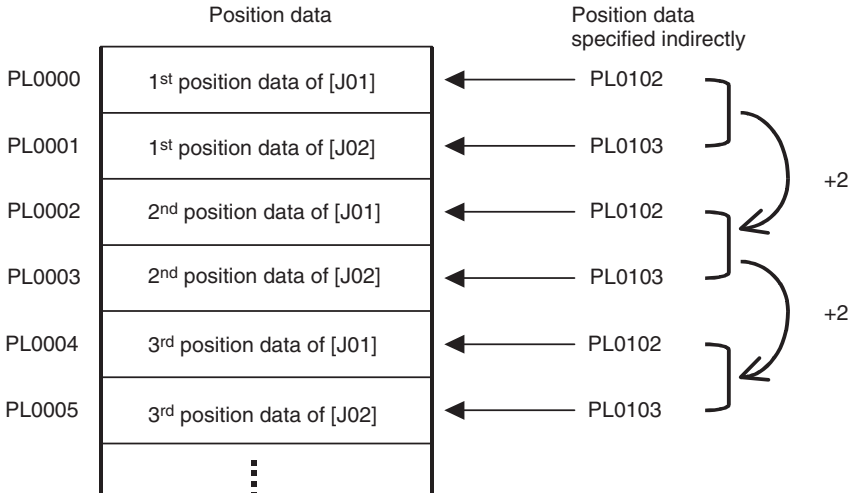
06) The axes move in CW direction to the position [J01]40000, [J02]40000 with circular interpolation having the position [J01]30000, [J02]40000 as its center.

07) The program is completed.

10-1-4 Positioning with Position Data

Explanation of the operation

Positioning is performed using indirectly specified position data.



Program

```
01) PROG P004 Q00000003;
02) STOPMODE;
03) #ML0000 = 0;
04) #PL0102 = 0;
05) #PL0103 = 1;
06) FOR W#ML0000 L3 S1;
07) #PL0100 = #PL0102;
08) #PL0101 = #PL0103;
09) IF #IW0B00 == 0;
10) MOVEL [J01]@PL0100 [J02]@PL0101 F500000;
11) ENDIF;
12) #PL0102 = #PL0102 + 2;
13) #PL0103 = #PL0103 + 2;
14) NEXT;
15) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) Stop Mode is selected.

03) The task variable for counting (ML0000) is reset.

04) The position data (PL0102) is set to 0. (The first position data read with indirect specification)

05) The position data (PL0103) is set to 1. (The first position data read with indirect specification)

06) The process through 06) to 13) is repeated 3 times.

07) The position data (PL0102) is assigned to the position data (PL0100).

08) The position data (PL0103) is assigned to the position data (PL0101).

09) When the general input (IW0B00) is not 0, the program advances to the next block without any axis operation.

10) Positioning with linear interpolation is performed reading the position data with indirect specification.

11) This is the end of IF command from 09).

12) The content of the position data (PL0102) is updated.

13) The content of the position data (PL0103) is updated.

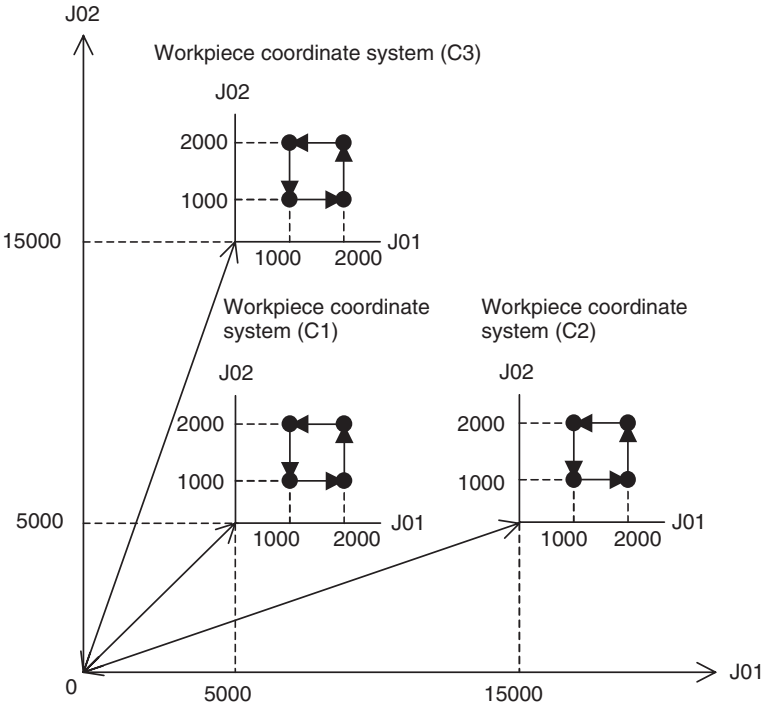
14) This is the end of FOR command from 06).

15) The program is completed.

10-1-5 Positioning with Workpiece Coordinate System with Subprograms

Explanation of the operation

Changing coordinate systems and using subprograms, the same operation is executed repeatedly in different positions on the machine coordinate system.



Program

Main program

```
01) PROG P005 Q00000003;
02) OFFPOS C1 [J01]5000 [J02]5000;
03) OFFPOS C2 [J01]15000 [J02]5000;
04) OFFPOS C3 [J01]5000 [J02]15000;
05) MOVEL [J01]0 [J02]0 F300000;
06) WORK C1;
07) GOSUB P500;
08) ORIGIN;
09) MOVEL [J01]0 [J02]0 F500000;
10) NOPS;
11) #OW0BA0 = 1;
12) WAIT #IW0B00 == 1;
13) #OW0BA0 = 0;
14) WORK C2;
15) GOSUB P500;
16) ORIGIN;
17) MOVEL [J01]0 [J02]0 F500000;
18) NOPS;
19) #OW0BA0 = 1;
20) WAIT #IW0B00 == 1;
21) #OW0BA0 = 0;
```

```
22) WORK C3;
23) GOSUB P500;
24) ORIGIN;
25) MOVEL [J01]0 [J02]0 F500000;
26) END;
```

Subprogram

```
01) PROG P500 Q00000003;
02) MOVEL [J01]0 [J02]0 F500000;
03) MOVEL [J01]1000 [J02]1000 F300000;
04) MOVEL [J01]2000;
05) MOVEL [J02]2000;
06) MOVEL [J01]1000;
07) MOVEL [J02]1000;
08) MOVEL [J01]0 [J02]0;
09) RETURN;
```

Explanation of the program

Main program

01) A program No. and axes to be used are specified.

02) to 04) Offset values for workpiece coordinate systems C1 to C3 are changed.

05) The axes move from the present position to the origin on the machine coordinate system.

06) The coordinate system is switched from the machine coordinate to the workpiece coordinate C1.

07) The subprogram (P0500) is called and executed.

08) The coordinate system is switched back to the machine coordinate.

09) The axes return to the origin on the machine coordinate system.

10) to 13) After return to the origin, 1 is output to the general output (OW0BA0) and the program will wait until the general input (IW0B00) becomes 1. Once the general input (IW0B00) becomes 1, the general output (OW0BA0) will be reset, and the program will advance to the next block.

14) The coordinate system is switched from the machine coordinate to the workpiece coordinate C2.

15) The subprogram (P0500) is called and executed.

16) The coordinate system is switched back to the machine coordinate.

17) The axes return to the origin on the machine coordinate system.

18) to 21) After return to the origin, 1 is output to the general output (OW0BA0) and the program will wait until the general input (IW0B00) becomes 1. Once the general input (IW0B00) becomes 1, the general output (OW0BA0) will be reset, and the program will advance to the next block.

22) The coordinate system is switched from the machine coordinate to the workpiece coordinate C3.

23) The subprogram (P0500) is called and executed.

24) The coordinate system is switched back to the machine coordinate.

25) The axes return to the origin on the machine coordinate system.

26) The program is completed.

Subprogram

01) A subprogram No. and axes to be used are specified.
02) The axes move from the present position to the position [J01]0, [J02]0.
03) The axes move to the position [J01]1000, [J02]1000.
04) The axis moves to the position [J01]2000.
05) The axis moves to the position [J02]2000.
06) The axis moves to the position [J01]1000.
07) The axis moves to the position [J02]1000.
08) The axes move to the position [J01]0, [J02]0.
09) The subprogram is completed and the main program is resumed.

10-1-6 Positioning with Changing Interpolation Acceleration Time Parameter

Explanation of the operation

Positioning with linear interpolation is performed while changing the interpolation acceleration time parameter.

Program

```
01) PROG P006 Q00000003;
02) PARAM P00102 = 1000;
03) MOVEL [J01]10000 [J02]5000 F500000;
04) MOVEL [J01]20000 [J02]-10000;
05) NOPS;
06) #OW0BA0 = 1;
07) WAIT #IW0B00 == 1;
08) #OW0BA0 = 0;
09) PARAM P00102 = 100;
10) MOVEL [J01]30000 [J02]10000;
11) MOVEL [J01]40000 [J02]20000;
12) MOVEL [J01]0 [J02]0;
13) END;
```

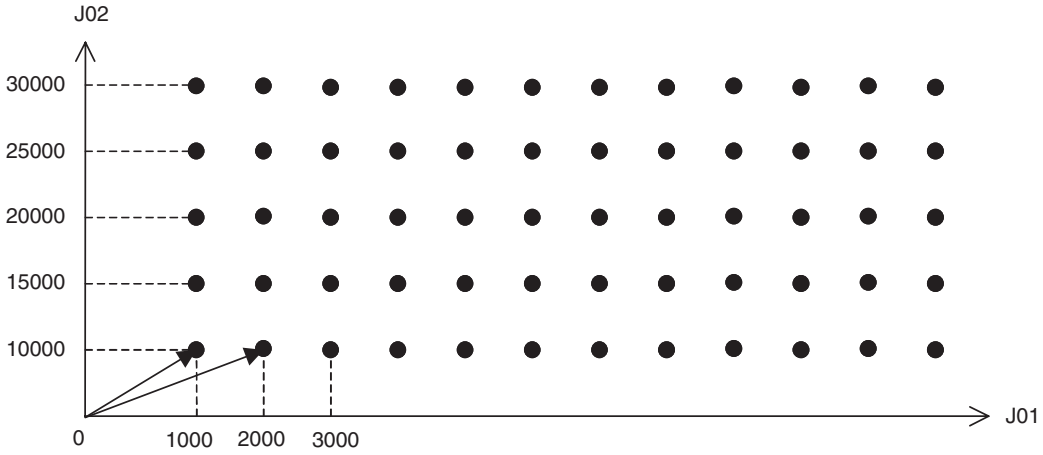
Explanation of the program

01) A program No. and axes to be used are specified.
02) The parameter [P00102: Interpolation feed acceleration time] is changed to 1000ms.
03) The axes move with linear interpolation and acceleration time of 1000ms to the position [J01]10000, [J02]5000.
04) The axes move with linear interpolation and acceleration time of 1000ms to the position [J01]20000, [J02] − 10000.
05) to 06) Once positioning is completed, 1 is output to the general output (OW0BA0).
07) to 08) Once the general input (IW0B00) becomes 1, the general output (0BA0) is reset.
09) The parameter [P00102: Interpolation feed acceleration time] is changed to 100ms.
10) The axes move with linear interpolation and acceleration time of 100ms to the position [J01]30000, [J02]10000.
11) The axes move with linear interpolation and acceleration time of 100ms to the position [J01]40000, [J02]20000.
12) The axes move with linear interpolation and acceleration time of 100ms to the position [J01]0, [J02]0.
13) The program is completed.

10-1-7 Positioning with Position Data Calculation

Explanation of the operation

- After positioning based on the initial values of position data was performed, positioning is repeated 10 times adding 1000 to the position data of [J01] each time. After that, positioning is repeated 5 times adding 5000 to the position data of [J02] each time.
- This positioning operation should look as shown below.



Program

Main program

```
01) PROG P007 Q00000003;
02) STOPMODE;
03) #DL0000 = 0;
04) #PL0011 = 10000;
05) FOR W#DL0000 L5 S1;
06) #PL0010 = 1000;
07) GOSUB P0501;
08) #PL0011 = #PL0011 + 5000;
09) NEXT;
10) END;
```

Subprogram

```
01) PROG P501 Q00000003;
02) #DL0002 = 0;
03) FOR W#DL0002 L10 S1;
04) MOVEL [J01]#PL0010 [J02]#PL0011 F300000;
05) MOVEL [J01]0 [J02]0;
06) #PL0010 = #PL0010 +1000;
07) NEXT;
08) RETURN;
```

Explanation of the program

Main program

01) A program No. and axes to be used are specified.
02) Stop Mode is selected.
03) The task variable for counting (DL0000) is reset. (For [J02])
04) The first travel distance of [J02] is entered into the position data (PL0011).
05) With FOR command, the process through 05) to 09) is repeated 5 times.
06) The first travel distance of [J01] is entered into the position data (PL0010).
07) The subprogram (P0501) is called and executed.
08) 5000 is added to the position data (PL0011) of [J02].
09) This is the end of FOR command from 05).
10) The program is completed.

Subprogram

01) A program No. and axes to be used are specified.

02) The task variable for counting (DL0002) is reset. (For [J01])

03) With FOR command, the process through 03) to 07) is repeated 10 times.

04) The axes [J01] and [J02] move based on the values in the position data (PL0010) and (PL0011) respectively.

05) The axes return to the origin.

06) 1000 is added to the position data (PL0010) of [J01].

07) This is the end of FOR command from 03)

08) The subprogram is completed and the main program is resumed.

In the program above, the operations of [J01] and [J02] are repeated using the main and subprograms, however, the same operation can be executed with only one program. See the following program.

Program 2

```
01) PROG P008 Q00000003;
02) STOPMODE;
03) #DW0000 = 0;
04) #PL0011 = 10000;
05) WHILE #DW0000 < 5;
06) #DL0002 = 0;
07) #PL0010 = 1000;
08) FOR W#DL0002 L10 S1;
09) MOVEL [J01]#PL0010 [J02]#PL0011 F300000;
10) MOVEL [J01]0 [J02]0;
11) #PL0010 = #PL0010 + 1000;
12) NEXT;
13) #DW0000 = #DW0000 + 1;
14) #PL0011 = #PL0011 + 5000;
15) WEND;
16) END;
```

Explanation of the program 2

01) A program No. and axes to be used are specified.

02) Stop Mode is selected.

03) The task variable for counting (DW0000) is reset. (For [J02])

04) The first travel distance of [J02] is entered into the position data (PL0011).

05) With WHILE command, the process through 05) to 15) is repeated until the conditional expression is satisfied (repeated 5 times).

06) The task variable for counting (DL0002) is reset. (For [J01])

07) The first travel distance of [J01] is entered into the position data (PL0010).

08) With FOR command, the process through 08) to 12) is repeated 10 times.

09) The axes [J01] and [J02] move based on the values in the position data (PL0010) and (PL0011) respectively.

10) The axes return to the origin.

11) 1000 is added to the position data (PL0010) of [J01].

12) This is the end of FOR command from 08).

13) 1 is added to the task variable for counting (DW0000) of [J02].

14) 5000 is added to the position data (PL0011) of [J02].

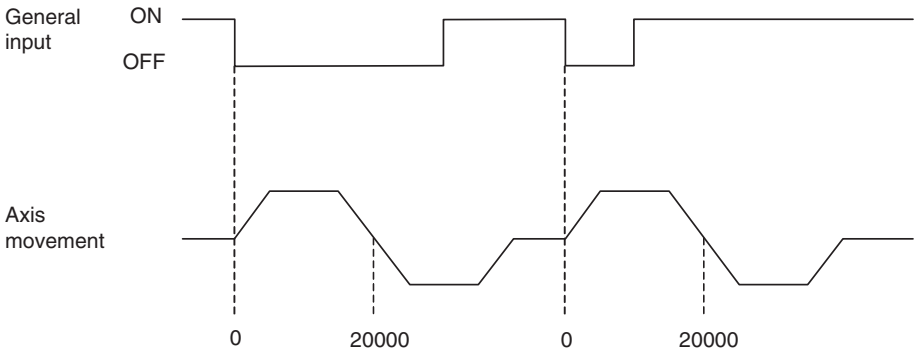
15) This is the end of WHILE command from 05).

16) The program is completed.

10-1-8 Stopping a Program with General Input

Explanation of the operation

- The program advance is held while the general input is ON.
- The axis keeps going back and forth between positions 0 and 20000 until IW0B00 becomes 1.



Program

```
01) PROG P009 Q00000001;
02) STOPMODE;
03) #IW0B00 = 0;
04) WHILE #IW0B00 <> 1;
05) WAIT #IW0B01 == 1;
06) MOVEL [J01]20000 F300000;
07) MOVEL [J01]0;
08) WEND;
09) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) Stop Mode is selected.

03) The general input (IW0B00) is set to 0.

04) With WHILE command, the process through 04) to 08) is repeated when the general input (IW0B00) is not 1.

05) The program waits until the general input (IW0B01) becomes 1.

06) Positioning with linear interpolation is performed to the position [J01]20000.

07) The axis returns to the origin.

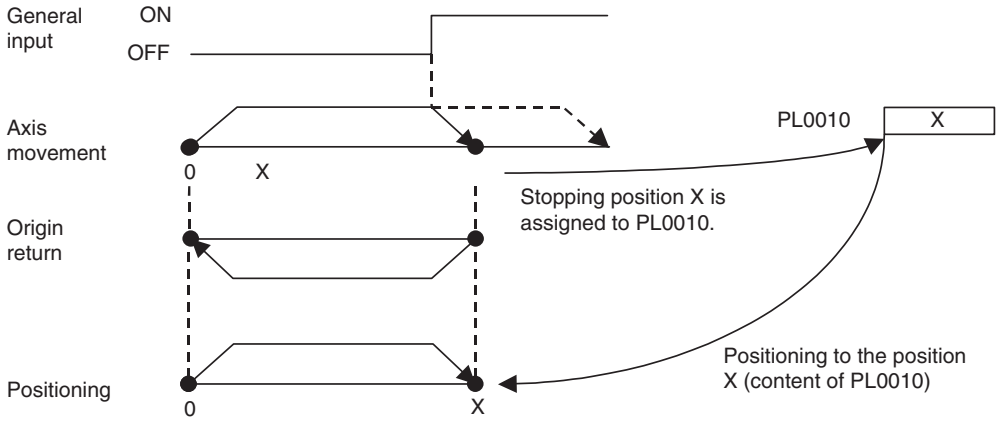
08) This is the end of WHILE command from 04).

09) The program is completed.

10-1-9 Stopping Operation with Optional End Using General Input and Assigning Position Data

Explanation of the operation

- Positioning of [J01] to the position 50000 is performed. (A position exceeding the target position)
- Once the axis reaches the target position, the operation will be stopped with optional end after deceleration.
- After the stopping position is assigned to the position data, the axis returns to the origin. After that, positioning is performed based on the assigned position data.
- This program is useful for applications such as the following: There is no original target position for positioning. A target position is decided using the external input. After a target position is decided, positioning to the target position is performed.



Program

```
01) PROG P010 Q00000001;
02) STOPMODE;
03) #PL0010 = 50000;
04) #IW0B00 = 0;
05) STOPOP #IW0B01 == 1;
06) MOVEL [J01]#PL0010 F300000;
07) NOPS;
08) #PL0010 = #SL0206;
09) WHILE #IW0B00 <> 1;
10) MOVEL [J01]#PL0010;
11) MOVEL [J01]0;
12) WEND;
13) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02 Stop Mode is selected.

03) The first travel distance (50000) is entered into the position data. (A position exceeding the target position)

04) The general input (IW0B00) is set to 0.

05) With STOPOP command, when the general input (IW0B01) becomes 1, the next block will be interrupted midway and ended.

06) Positioning of [J01] with linear interpolation to the position specified by the position data (PL0010) is performed.

07) The program waits for completion of the axis movement.

08) The stopping position is assigned to the position data (PL0010).

09) With WHILE command, the process through 09) to 12) is repeated when the general input (IW0B00) is not 1.

10) Positioning is performed based on the value in the position data (PL0010).

11) The axis returns to the origin.

12) This is the end of WHILE command from 09).

13) The program is completed.

10-1-10 Positioning of Turntable

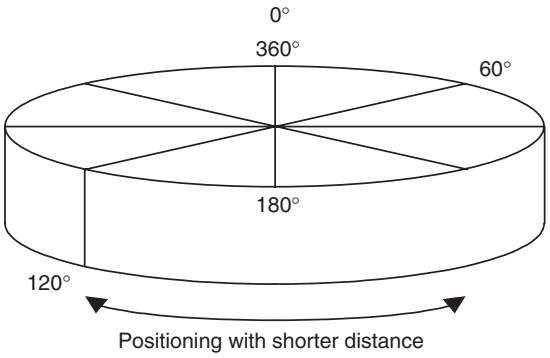
Explanation of the operation

- Positioning of a turntable is performed using the unlimited length axis function and various arithmetic operations.
- In positioning to the target position, the travel direction is determined for shorter distance.

- The target position is to be specified within the range of 0 to 360 degrees. Passing the position of 360 (0) degrees clears the present position to 0.

1,2,3...

1. Enter a target position into the position data using IOWR instruction.
2. Execute positioning by turning ON the general input for positioning.
3. 1 is output to the general output once positioning is completed.
4. 0 is output to the general output when the general input for positioning is turned OFF.
5. The process through 1 to 4 is repeated until the general input for repeat is turned ON.



Program

Main program

```
01) PROG P011 Q00000001;
02) WHILE #IW0B00 <> 1;
03) WAIT #IW0B01 == 1;
04) #PL0020 = #SL0206;
05) #PL0022 = #PL0000 - #PL0020;
06) GOSUB P502;
07) IF #PL0022 < -180;
08) #PL0002 = #PL0022 + 360;
09) #PL0022 = 360;
10) ENDIF;
11) IF #PL0022 < 180;
12) #PL0002 = #PL0022;
13) #PL0022 = 360;
14) ENDIF;
15) IF #PL0022 < 360;
16) #PL0002 = #PL0022 - 360;
17) ENDIF;
18) INC MOVEL [J01]#PL0002 F300000;
19) NOPS;
20) #OW0BA0 = 1;
21) WAIT #IW0B01 == 0;
22) #OW0BA0 = 0;
23) WEND;
24) END;
```

Subprogram

```
01) PROG P502 Q00000000;
02) WHILE #PL0022 >= 360;
03) #PL0022 = #PL0022 - 360;
04) WEND;
05) RETURN;
```

Explanation of the program

Main program

01) A program No. and axes to be used are specified.

02) With WHILE command, the process through 02) to 23) is repeated until the general input (IW0B00) becomes 1.

03) With WAIT command, the program advance will be held until the general input (IW0B01) becomes 1.

04) The present position is written to the position data (PL0020).

05) The travel distance is calculated with the target position (PL0000) and the present position (PL0020), and the result will be entered into the position data (PL0022).

06) The subprogram (P502) is called and executed.

07) to 17) The rotation direction and the travel distance are calculated and entered into the position data (PL0002).

18) Positioning is performed based on the calculated position data.

19) The program advance will be held until positioning is completed.

20) 1 is output to the general output (OW0BA0).

21) The program advance will be held until the general input (IW0B01) becomes 0.

22) 0 is output to the general output (OW0BA0).

23) This is the end of WHILE command from 02).

24) The program is completed.

Subprogram

01) A program No. and axes to be used are specified.

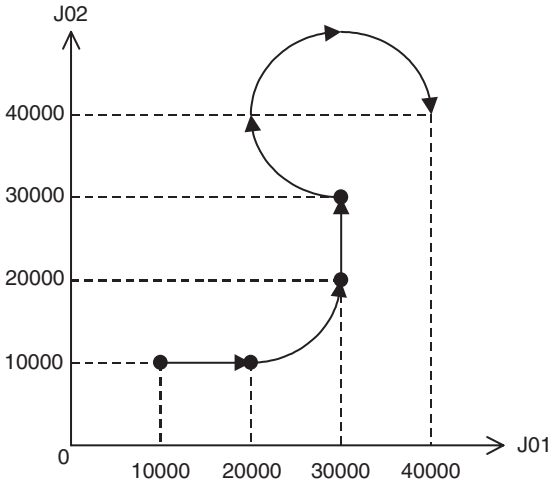
02) to 04) When data exceeding 360 degrees is entered into the position data by mistake, the target position is corrected to the value within the range 0 to 360 degrees and the main program is resumed. (When an appropriate target position is entered in the position data, the subprogram does not do anything and the main program is resumed.)

05) The program is completed and the main program is resumed.

10-1-11 Positioning with Circular Interpolation of Higher Path Accuracy

Explanation of the operation

- The operation is the same as "_Positioning with Linear and Circular Interpolation", however, the path accuracy is raised.
- When performing circular interpolation, the faster the feed rate is, the more inside of the expected circular arc the axes tend to travel. To deal with this tendency, setting higher feed forward gain can raise the path accuracy. Generally speaking, setting the feed forward gain of the servo system too high causes overrun (Overshoot) when stopping or reversing at the target position. To prevent this, the feed forward gain of 20% for linear interpolation and 60% for circular interpolation are set in this example.



Program

```
01) PROG P012 Q00000003;
02) PASSMODE;
03) #IW04C0 = 2000;
04) #IW04C1 = 2000;
05) MOVEL [J01]20000 [J02]10000 F300000;
06) #IW04C0 = 6000;
07) #IW04C1 = 6000;
08) MOVEC Q-1 [J01]30000 [J02]20000 R10000;
09) #IW04C0 = 2000;
10) #IW04C1 = 2000;
11) MOVEL [J02]30000;
12) #IW04C0 = 6000;
13) #IW04C1 = 6000;
14) MOVEC Q1 [J01]40000 [J02]40000 I0 J10000;
15) #IW04C0 = 0;
16) #IW04C1 = 0;
17) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) Pass Mode is selected.

03) to 04) The feed forward gain of 20% is set.

05) The axes move to the position [J01]20000, [J02]10000 with linear interpolation.

06) to 07) The feed forward gain of 60% is set.

08) The axes move in CCW direction to the position [J01]30000, [J02]20000 with circular interpolation of radius “10000”.

09) to 10) The feed forward gain of 20% is set.

11) The axes move to the position [J01]30000, [J02]30000 with linear interpolation.

12) to 13) The feed forward gain of 60% is set.

14) The axes move in CW direction to the position [J01]40000, [J02]40000 with circular interpolation having the position [J01]30000, [J02]40000 as its center.

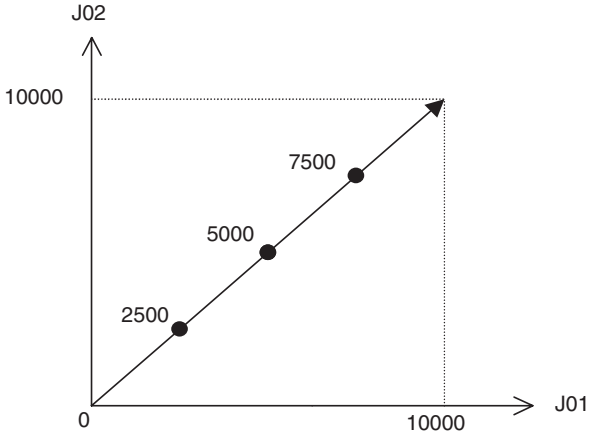
15) to 16) The feed forward gain of 0% is set.

17) The program is completed.

10-1-12 Starting Peripherals during Axis Movement

Explanation of the program

- During axis movement, peripherals can be started at specified positions without stopping the axes.
- This program enables the control of peripherals without stopping the axes; therefore, high-speed synchronous application can be realized.
- This example shows the operation to start peripherals 1, 2, and 3 accordingly when the present position of [J01] reaches 2500, 5000, and 7500 during linear interpolation with 2 axes.



Program

```
01) PROG P013 Q00000003;
02) MOVEL [J01]0 [J02]0 F300000;
03) #OW0BA0 = 0;
04) #OW0BA1 = 0;
05) #OW0BA2 = 0;
06) WAIT #IW0B00 == 1;
07) MOVEL [J01]10000 [J02]10000;
08) WAIT #SL0206 >= 2500;
09) #OW0BA0 = 1;
10) WAIT #SL0206 >= 5000;
11) #OW0BA1 = 1;
12) WAIT #SL0206 >= 7500;
13) #OW0BA2 = 1;
14) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) The axes return to the origin.

03) to 05) The general outputs (OW0BA0 to OW0BA2) are reset to 0.

06) The program will wait until the general input (IW0B00) becomes 1.

07) Positioning with linear interpolation is performed to the position [J01]10000, [J02]10000.

08) to 09) When [J01] reaches 2500, 1 will be output to the general output (OW0BA0).

10) to 11) When [J01] reaches 5000, 1 will be output to the general output (OW0BA1).

12) to 13) When [J01] reaches 7500, 1 will be output to the general output (OW0BA2).

14) The program is completed.

10-1-13 High-speed Positioning

Explanation of the operation

- The CPU Unit reads the present position of a work from a visual sensor and writes the compensated value into the MC Unit after calculation. After receiving the value, the MC Unit performs positioning to the position corresponding to the value.
- The CPU Unit transmits 2 of position data to the MC Unit using IOWR instruction and starts the MC Unit immediately.
- In this case, the data transfer to the MC Unit and the command for positioning can be executed within 1 scan.

Program

```
01) PROG P014 Q00000003;
02) WHILE #IW0B00 <> 1;
03) MOVEL [J01]0 [J02]0 F300000;
04) NOPS;
05) #OW0BA0 = 1;
06) WAIT #IW0B01 == 1;
07) #OW0BA0 = 0;
08) MOVEL [J01]#PL0000 [J02]#PL0001;
09) NOPS;
10) #OW0BA1 = 1;
11) WAIT #IW0B02 == 1;
12) #OW0BA1 = 0;
13) WEND;
14) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) With WHILE command, the process through 02) to 13) is repeated when the general input (IW0B00) is not 1.

03) The axes return to the origin.

04) to 05) After completion of positioning in 03), 1 is output to the general output (OW0BA0).

06) The program advance will be held until the general input (IW0B01) becomes 1.

07) The general output (OW0BA0) is cleared to 0.

08) The axes move to the position read from the CPU Unit using IOWR instruction.

09) to 10) After completion of positioning in 08), 1 is output to the general output (OW0BA1).

11) The program advance will be held until the general input (IW0B02) becomes 1.

12) The general output (OW0BA1) is cleared to 0.

13) This is the end of WHILE command from 02).

14) The program is completed.

10-1-14 Interrupt Feeding (MOVEI)

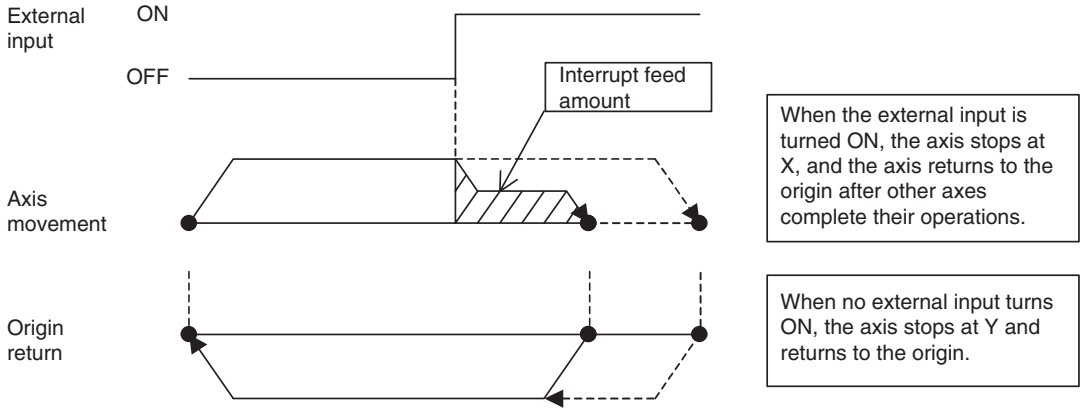
Explanation of the operation

Positioning of [J01] to 100000 is performed. (A position exceeding the target position)

Turning ON an external input stops the axis with interrupt feeding.

When positioning of [J01] is completed, other axes start operating. When other axes complete their operations, [J01] returns to the origin and 1 is output to the general output.

When no external input is turned ON, [J01] returns to the origin without operation of other axes.



Program

```
01) PROG P018 Q00000003;
02) STOPMODE;
03) MOVEI [J01]100000 D40000 V300000;
04) WAIT #SW022A == 1;
05) NOPS;
06) IF #SW022A == 2;
07) MOVEL [J02]10000 F300000;
08) MOVE [J02]0;
09) ENDIF;
10) MOVE [J01]0;
11) NOPS;
12) #OW0BA0 = 1;
13) WAIT #IW0B00 == 1;
14) #OW0BA0 = 0;
15) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) Stop Mode is selected.

03) The first travel distance (50000) is entered into the position data. (A position exceeding the target position)

04) The program will wait until the system variable (SW022A) becomes 1. (Latch being requested)

05) The program will wait for completion of positioning.

06) When the system variable (SW022A) is 2, the command of 07) is executed. When it is not 2, the program jumps to 10). (Latch completed)
(With interrupt feeding, the axis returns to the origin after operations of other axes. Without interrupt feeding, the axis returns to the origin immediately.)

07) to 08) Other axes are operated.

09) This is the end of IF command from 06).

10) The axis returns to the origin.

11) to 12) After completion of positioning, 1 is output to the general output (OW0BA0).

13) The program advance will be held until the general input (IW0B00) becomes 1.

14) The general output (OW0BA0) is cleared to 0.

15) The program is completed.

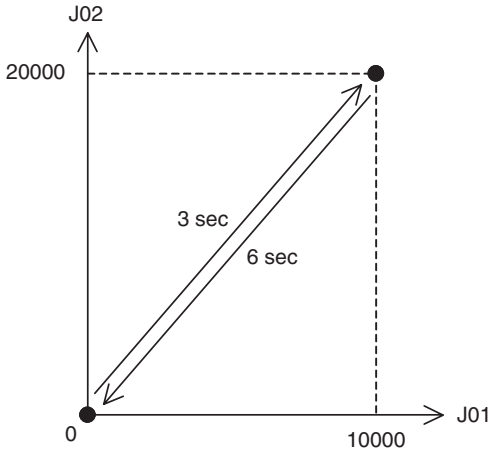
10-1-15 Time-specified Positioning (MOVET)

Explanation of the operation

- This program is used to perform positioning within a specified time period.
- This example shows the following operation; the axes move to the position [J01]10000, [J02]20000 in 3 seconds and 1 is output to the general output. When the general input becomes 1, the general output is cleared to 0. Finally, the axes return to the origin in 6 seconds.

Attention

- When the speed of the axis exceeds the maximum rapid feed rate (P2AA01), the alarm [200Bh: Time specification error] will occur.
- If override other than 100% is used, the specified time period cannot be kept.



Program

```
01) PROG P019 Q00000003;
02) MOVE [J01]0 [J02]0;
03) MOVET [J01]10000 [J02]20000 T3000;
04) NOPS;
05) #OW0BA0 = 1;
06) WAIT #IW0B00 == 1;
07) #OW0BA0 = 0;
08) MOVET [J01]0 [J02]0 T6000;
09) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) The axes return to the origin.

03) Positioning is performed to the position [J01]10000, [J02]20000 in 3 seconds.

04) to 05) After completion of positioning, 1 is output to the general output (OW0BA0).

06) The program advance will be held until the general input (IW0B00) becomes 1.

07) The general output (OW0BA0) is cleared to 0.

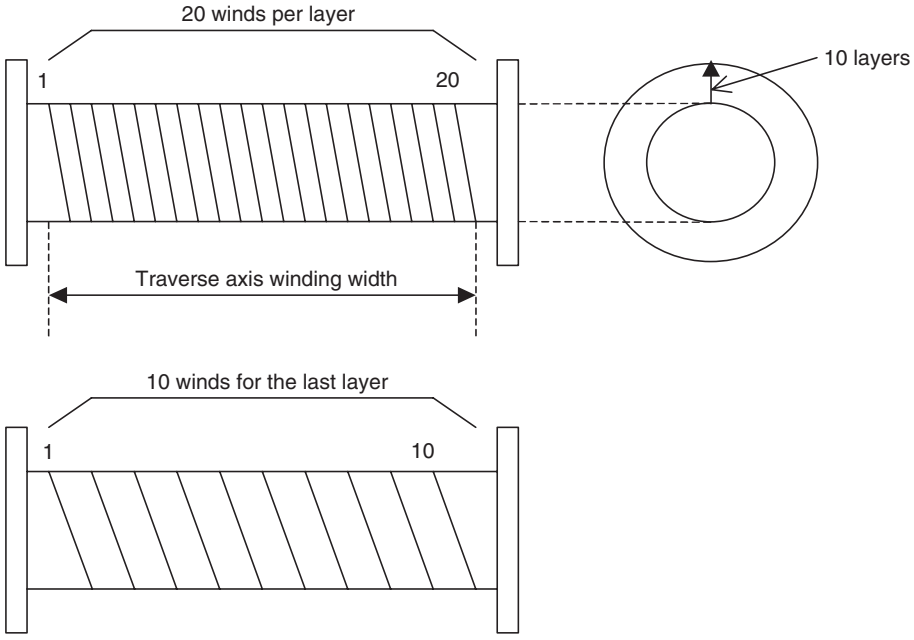
08) With MOVET command, the axes return to the origin in 6 seconds.

09) The program is completed.

10-1-16 Regular Winding to Rough Winding (MOVETRAV)

Explanation of the operation

This example shows a winder that makes 10 layers of 20 winds, and 10 winds on the 11th layer.



Program

```
01) PROG P015 Q00000003;
02) MOVETRAV Q1 [J01]7200 [J02]360 L10 F300000;
03) MOVETRAV Q1 [J01]3600 [J02]360 L1;
04) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) To make 20 winds per layer, the winding axis rotations are set to 7200 deg (360 deg × 20 winds). Also, to make 10 layers, the number of layers (L) is set to 10.

03) To make 10 winds per layer, the winding axis rotations are set to 3600 deg (360 deg × 10 winds).

04) The program is completed.

- In the program above, the rotations in normal traverse are specified. Changing the mode enables linked traverse or pitch specification.

  Mode 1: Normal traverse, Winding axis rotations = Rotations specification
  Mode 2: Normal traverse, Winding axis rotations = Pitch specification
  Mode 3: Linked traverse, Winding axis rotations = Rotations specification
  Mode 4: Linked traverse, Winding axis rotations = Pitch specification

- The example of setting the program above with pitch specification is shown in the next page.

Ex:
Calculation method of the operand <Winding axis rotations> for the above program with pitch specification

Pitch = Traverse axis winding width/No. of winds per layer
Therefore,
Pitch = 360/20 = 18 [command unit/rev]

The program should be changed as shown below:

```
01) PROG P016 Q00000003;
02) MOVETRAV Q2 [J01]18. [J02]360 L10 F300000;
03) MOVETRAV Q2 [J01]36. [J02]360 L1;
04) END;
```

Note

(1) For winding axis, unlimited feed mode (P5AA07: 0010h) has to be set.

(2) In linked traverse, up to 100 blocks can be linked, and the operation is executed in Stop Mode.

(3) The linked blocks are treated as 1 block.

(4) In linked traverse, up to 5 blocks are interpreted per Unit Scan. If more than 5 blocks are to be linked, it takes a period of time [(No. of linked blocks/5) x Unit Scan] from execution completion of the last block to operation start. (It will take longer to start execution. The operation does not stop during the linked traverse.)

(5) Linked traverse is always executed at the speed specified for the 1st traverse.

(6) When the winding axis rotations are set to 0, the alarm [2009h: Position specification error] will occur.

(7) When the traverse axis winding width is set to 0, the alarm [2009h: Position specification error] will occur.

10-1-17 Electronic Cam, Single Axis (CAM)

Explanation of the operation

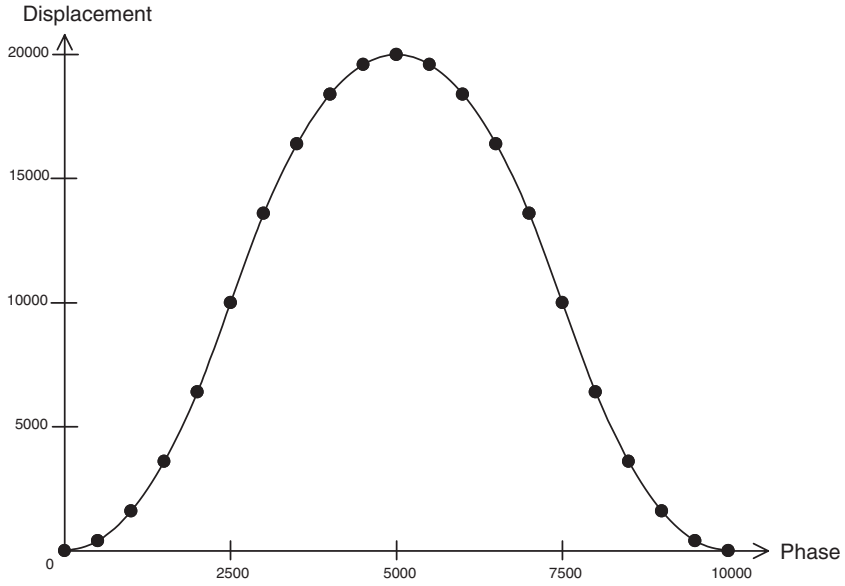
- Positioning is performed within the specified time period based on the cam data created in advance.
- This example uses the cam data already appeared in SECTION 6 (page 269) to create the cam table and to operate the axes.

1,2,3...

1. Positioning is performed with linear interpolation to the position [J01]5000, [J02]5000, and the program will wait until the general input becomes 1.
2. Once the general input becomes 1, [J01] will perform the cam operation in 10 seconds based on the cam data shown below.
3. When the cam operation is completed, 1 will be output to the general output. When the general input is cleared to 0, the axes [J01] and [J02] will return to the origin.

Cam data

Data No.	Phase	Displacement
1	0	0
2	500	400
3	1000	1600
4	1500	3600
5	2000	6400
6	2500	10000
7	3000	13600
8	3500	16400
9	4000	18400
10	4500	19600
11	5000	20000
12	5500	19600
13	6000	18400
14	6500	16400
15	7000	13600
16	7500	10000
17	8000	6400
18	8500	3600
19	9000	1600
20	9500	400
21	10000	0



Program

```
01) PROG P020 Q00000003;
02) STOPMODE;
03) MOVEL [J01]5000 [J02]5000 F500000;
04) WAIT #IW0B00 == 1;
05) CAM [J01]1 K100. T10000;
06) NOPS;
07) #OW0BA0 = 1;
08) WAIT #IW0B00 == 0;
09) #OW0BA0 = 0;
10) MOVEL [J01]0 [J02]0;
11) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) Stop Mode is selected.

03) Positioning is performed with linear interpolation to the position [J01]5000, [J02]5000.

04) The program will wait until the general input (IW0B00) becomes 1.

05) [J01] performs the cam operation in 10 seconds based on the cam table 1.

06) to 07) After positioning is completed, 1 will be output to the general output (OW0BA0).

08) The program advance will be held until the general input (IW0B00) becomes 0.

09) The general output (OW0BA0) is cleared to 0.

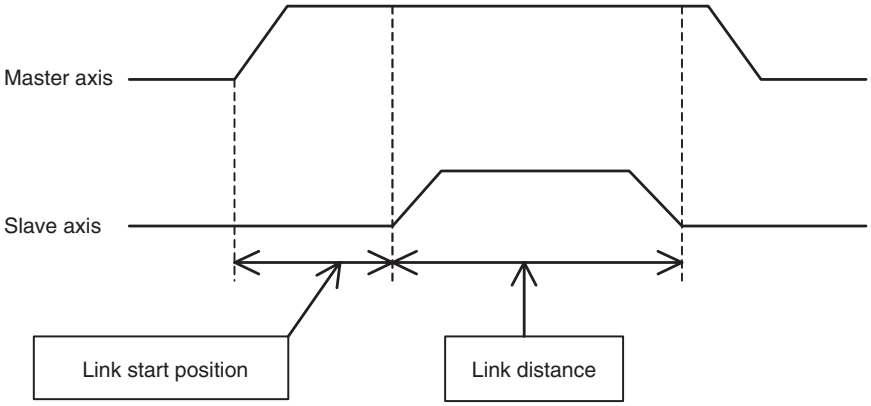
10) The axes return to the origin.

11) The program is completed.

10-1-18 Link Operation (MOVELINK)

Explanation of the operation

- Positioning is performed with a slave axis synchronizing to a specified master axis.
- In this example, the master axis will start operating when the general input becomes 1. The slave axis will start synchronization when the master axis reaches the position 15000. In this synchronization, the slave axis travels for 30000 while the master axis travels for 60000. 1 will be output to the general output once the master axis reaches the position 90000. The link operation is repeated with WHILE command.



Program

```
01) PROG P017 Q00000003;
02) #PL0010 = 0;
03) WHILE #IW0B00 <> 1;
04) OFFPOS C1 [J01]#PL0010;
05) WORK C1;
06) WAIT #IW0B01 == 1;
07) MOVELINK [J02]30000 [J01]60000 A1000 D1000 Q5 I5000;
08) INC MOVEL [J01]90000 F300000;
09) NOPS;
10) #OW0BA0 = 1;
11) WAIT #IW0B01 == 0;
12) #OW0BA0 = 0;
13) #PL0010 = #SL0206;
14) WEND;
15) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) The position data used as a workpiece coordinate is cleared to 0.

03) When the general input (IW0B00) is not 1, the process through 03) to 14) is repeated.

04) to 05) The workpiece coordinate system (C1) is enabled.

06) The program will wait until the general input (IW0B01) becomes 1.

07) The link operation, in which the slave axis travels for 30000 while the master travels for 60000, is performed. The link start position is 5000.
(The slave starts synchronization once the master reaches the position 15000.)

08) The master axis moves from the present position to the position 90000 with linear interpolation.

09) to 10) After positioning is completed, 1 will be output to the general output (OW0BA0).

11) The program advance will be held until the general input (IW0B01) becomes 0.
12) The general output (OW0BA0) is cleared to 0.
13) The present position of the master axis is entered into the position data for the workpiece coordinate.
14) This is the end of WHILE command from 03).
15) The program is completed.

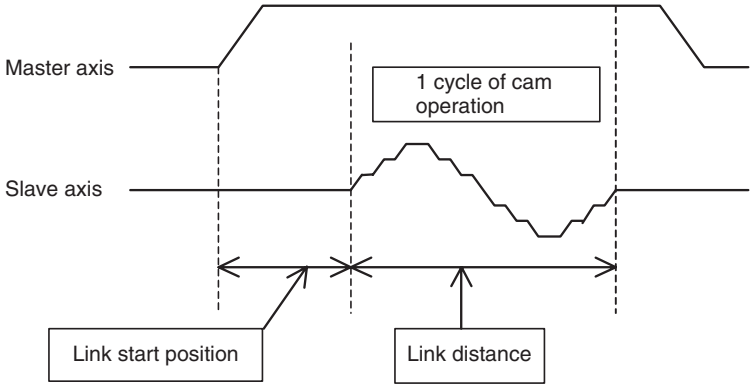
10-1-19 Electronic Cam, Synchronous (CAMBOX)

Explanation of the operation

The slave axis operates based on the cam table while synchronizing to a specified axis (master axis).

In this example, the master axis will start operating when the general input becomes 1. The slave axis will start synchronization when the master reaches the position 5000. The slave performs 1 cycle of the cam operation while the master travels for 60000. 1 will be output to the general output once the master reaches the position 90000. The synchronization is repeated with WHILE command.

The same cam data in *10-1-17 Electronic Cam, Single Axis (CAM)* (page 488) is used in this example.



Program

```
01) PROG P021 Q00000003;
02) #PL0010 = 0;
03) WHILE #IW0B00 <> 1;
04) OFFPOS C1 [J01]#PL0010;
05) WORK C1;
06) WAIT #IW0B01 == 1;
07) CAMBOX [J02]1 [J01]60000 K100. Q13 I5000;
08) INC MOVEL [J01]90000 F300000;
09) NOPS;
10) #OW0BA0 = 1;
11) WAIT #IW0B01 == 0;
12) #OW0BA0 = 0;
13) #PL0010 = #SL0206;
14) WEND;
15) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.
02) The position data used as a workpiece coordinate is cleared to 0.
03) When the general input (IW0B00) is not 1, the process through 03) to 14) is repeated.
04) to 05) The workpiece coordinate system (C1) is enabled.

06) The program will wait until the general input (IW0B01) becomes 1.

07) The slave axis performs 1 cycle of the cam operation based on the cam table 1 while the master travels for 60000.
(The slave axis will start cam operation once the master reaches the position 15000.)

08) The master axis moves from the present position to the position 90000 with linear interpolation.

09) to 10) After positioning is completed, 1 will be output to the general output (OW0BA0).

11) The program advance will be held until the general input (IW0B01) becomes 0.

12) The general output (OW0BA0) is cleared to 0.

13) The present position of the master axis is entered into the position data for the workpiece coordinate.

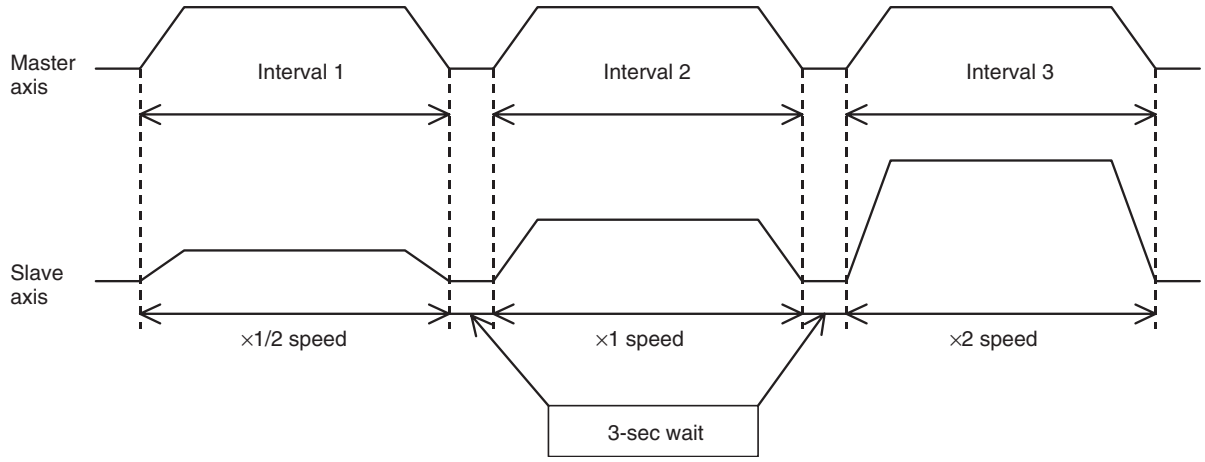
14) This is the end of WHILE command from 03).

15) The program is completed.

10-1-20 Electronic Shaft (CONNECT)

Explanation of the operation

- The slave axis operates based on the specified gear ratio while synchronizing to the master axis.
- In this example, the operation of the master axis is divided into 3 intervals. The gear ratio for the slave axis against the master axis is changed to 1/2, 1, and 2 with CONNECT command. The operation is held for 3 seconds between intervals.



Program

```
01) PROG P022 Q00000003;
02) CONNECT [J02]1 [J01]2;
03) MOVEL [J01]50000 F500000;
04) DWELL T3000;
05) CONNECT [J02]1 [J01]1;
06) MOVEL [J01]100000;
07) DWELL T3000;
08) CONNECT [J02]2 [J01]1;
09) MOVEL [J01]150000;
10) DWELL T3000;
11) SYNCR [J02];
12) MOVE [J01]0 [J02]0;
13) END;
```

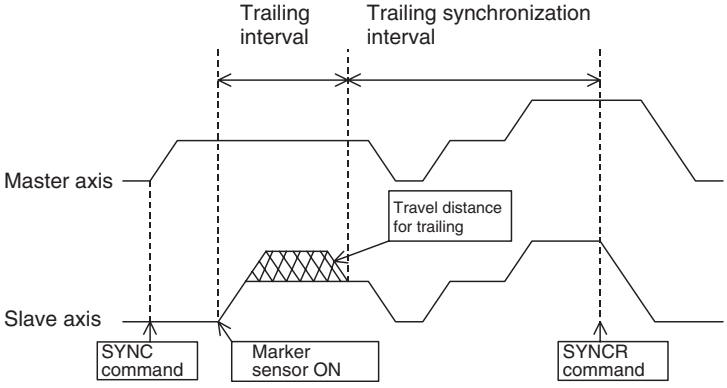
Explanation of the program

01) A program No. and axes to be used are specified.
02) The gear ratio of 1 to 2 is set.
03) The master axis moves to the position 50000 at 500rpm. (The slave synchronizes to the master and moves at 250rpm.)
04) The operation is held for 3 seconds.
05) The gear ratio of 1 to 1 is set.
06) The master axis moves to the position 100000 at 500rpm. (The slave synchronizes to the master and moves at 500rpm.)
07) The operation is held for 3 seconds.
08) The gear ratio of 2 to 1 is set.
09) The master axis moves to the position 150000 at 500rpm. (The slave synchronizes to the master and moves at 1000rpm.)
10) The operation is held for 3 seconds.
11) The synchronization is canceled.
12) The axes return to the origin.
13) The program is completed.

10-1-21 Trailing Synchronization/Synchronization Cancel (SYNC/SYNCR)

Explanation of the operation

- The slave axis will start trailing the master axis when the marker sensor (external input) turns ON. When it catches up with the master axis, synchronization with the ratio of 1 to 1 will be performed.
- In this example, trailing synchronization is performed with the slave executed by the motion task 1 and the master executed by the motion task 2. (The program starts the slave first, and then the master.)



Program 1

(Slave axis)

```
01) PROG P023 Q00000002;
02) SYNC [J02]5000 [J01]10000;
03) WAIT #SL0202 >= 80000;
04) SYNCR [J02];
05) WAIT #ML0000 == 1;
06) MOVEL [J02]0 F500000;
07) END;
```

(Master axis)

```
01) PROG P024 Q00000001;
02) MOVEL [J01]30000 F500000;
03) DWELL T5000;
04) MOVEL [J01]60000;
05) MOVEL [J01]100000 F1000000;
06) DWELL T3000;
07) #ML0000 = 1;
08) MOVEL [J01]0;
09) #ML0000 = 0;
10) END;
```

Explanation of the program

(Slave axis)

01) A program No. and axes to be used are specified.

02) The trailing synchronization with the catch-up position offset of 5000 and the marker sensor ON position of 10000 is executed.

03) to 04) The synchronization will be canceled when the present position of the slave exceeds 80000.

05) The program will wait until the global general variable (ML0000) becomes 1.

06) The slave axis returns to the origin.

07) The program is completed.

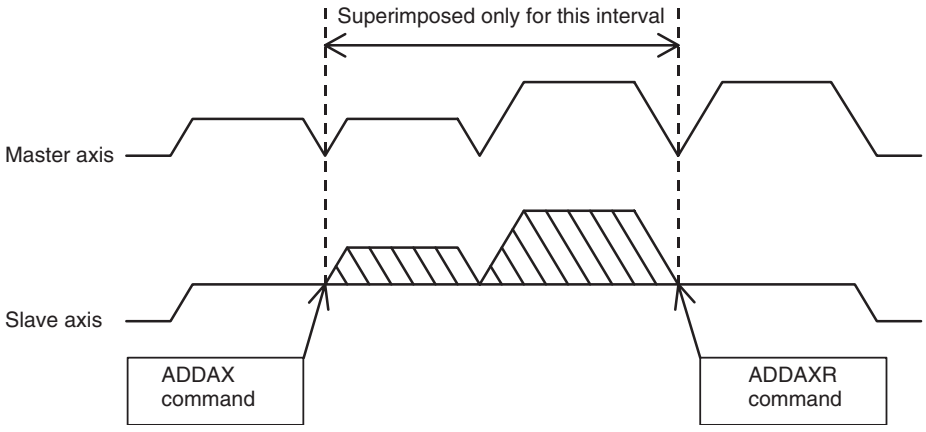
(Master axis)

01) A program No. and axes to be used are specified.
02) The master axis moves to the position 30000 at 500rpm.
03) The operation is held for 5 seconds.
04) The master axis moves to the position 60000 at 500rpm.
05) The master axis moves to the position 100000 at 1000rpm.
06) The operation is held for 3 seconds.
07) The global general variable (ML0000) becomes 1.
08) The master axis returns to the origin.
09) The global general variable (ML0000) becomes 0.
10) The program is completed.

10-1-22 Travel Distance Superimpose/Travel Distance Superimpose Cancel (ADDAX/ADDAXR)

Explanation of the operation

- The operation of the specified master axis is superimposed on the slave axis.
- In this example, the operation of the master axis is divided into 3 intervals and the operation of the 2nd interval is superimposed on the slave. (The program starts the master and slave simultaneously.)



Program

(Master axis)

```
01) PROG P025 Q00000001;
02) STOPMODE;
03) MOVEL [J01]50000 F500000;
04) NOPS;
05) #MW0000 = 1;
06) MOVEL [J01]100000;
07) MOVEL [J01]150000 F1000000;
08) NOPS;
09) #MW0000 = 0;
10) MOVEL [J01]200000;
11) DWELL T3000;
12) #MW0001 = 1;
13) WAIT #MW0002 == 1;
14) MOVEL [J01]0;
15) #MW0001 = 0;
16) END;
```

Program

(Slave axis)

```
01) PROG P026 Q00000002;
02) PARALLEL N2;
03) MOVEL [J02]200000 F500000;
04) JOINT;
05) WAIT #MW0000 == 1;
06) ADDAX [J02] [J01];
07) WAIT #MW0000 == 0;
08) ADDAXR [J02];
09) JWAIT;
10) DWELL T3000;
11) WAIT #MW0001 == 1;
12) #MW0002 = 1;
13) MOVEL [J02]0 F1000000;
14) #MW0002 = 0;
15) END;
```

Explanation of the program

(Master axis)

01) A program No. and axes to be used are specified.

02) Stop Mode is selected.

03) The master axis moves to the position 50000 at 500rpm.

04) to 05) After positioning is completed, 1 will be output to the global general variable (MW0000).

06) The master axis moves to the position 100000 at 500rpm.

07) The master axis moves to the position 150000 at 1000rpm.

08) to 09) After positioning is completed, 0 will be output to the global general variable (MW0000).

10) The master axis moves to the position 200000 at 1000rpm.

11) The operation is held for 3 seconds.

12) 1 is output to the global general variable (MW0001).

13) The program will wait until the global general variable (MW0002) becomes 1.

14) The master axis returns to the origin.

15) The global general variable (MW0001) is reset to 0.

16) The program is completed.

(Slave axis)

01) A program No. and axes to be used are specified.

02) With PARALLEL command, 03) and the process through 05) to 08) are executed in parallel.

03) The slave axis moves to the position 200000 at 500rpm.

04) This is the syntax of PARALLEL command from 02).

05) to 06) Superimposition will start when the global general variable (MW0000) becomes 1.

07) to 08) Superimposition will start when the global general variable (MW0000) becomes 0.

09) This is the end of PARALLEL command from 02).

10) The operation is held for 3 seconds.

11) The program will wait until the global general variable (MW0001) becomes 1.

12) 1 is output to the global general variable (MW0002).

13) The slave axis returns to the origin.

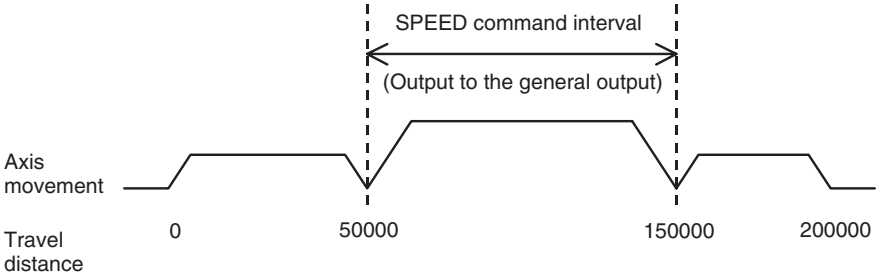
14) The global general variable (MW0002) is reset to 0.

15) The program is completed.

10-1-23 Speed Control/Speed Control Cancel (SPEED/SPEEDR)

Explanation of the operation

- The speed of a specified axis is controlled in Speed Control Mode.
- In this example, SPEED command will be executed between positions 50000 and 150000 when the axis travels from position 0 to 200000. During execution of SPEED command, 1 is output to the general output (OW0BA0).



Program

```
01) PROG P027 Q00000001;
02) MOVEL [J01]50000 F500000;
03) SPEED [J01]50. T0;
04) #OW0BA0 = 1;
05) WAIT #SL0204 >= 150000;
06) SPEEDR [J01] T0;
07) #OW0BA0 = 0;
08) MOVEL [J01]200000;
09) DWELL T5000;
10) MOVEL [J01]0;
11) END;
```

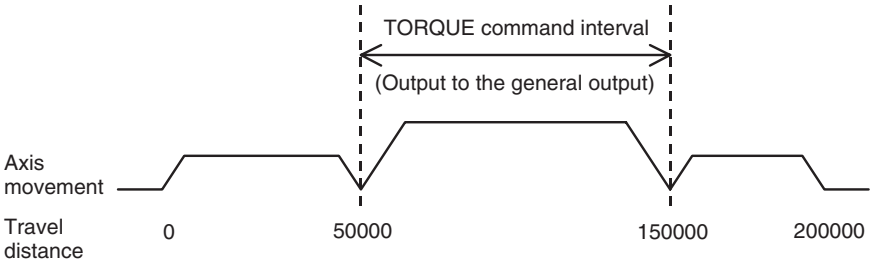
Explanation of the program

01) A program No. and axes to be used are specified.
02) The axis moves to the position 50000 with linear interpolation.
03) SPEED command operation is started with 50% of the rated speed of the motor.
04) 1 is output to the general output (OW0BA0).
05) The program will wait until the present position exceeds 150000.
06) SPEED command operation is completed.
07) The general output (OW0BA0) is reset to 0.
08) The axis moves to the position 200000 with linear interpolation.
09) The program is held for 5 seconds.
10) The axis returns to the origin.
11) The program is completed.

10-1-24 Torque Control/Torque Control Cancel (TORQUE/TORQUER)

Explanation of the operation

- The torque of a specified axis is controlled in Torque Control Mode.
- In this example, TORQUE command will be executed between positions 50000 and 150000 when the axis travels from position 0 to 200000. During execution of TORQUE command, 1 is output to the general output (OW0BA0).



Program

```
01) PROG P028 Q00000001;
02) MOVEL [J01]50000 F500000;
03) TORQUE [J01]50. T0;
04) #OW0BA0 = 1;
05) WAIT #SL0204 >= 150000;
06) TORQUER [J01] T0;
07) #OW0BA0 = 0;
08) MOVEL [J01]200000;
09) DWELL T5000;
10) MOVEL [J01]0;
11) END;
```

Explanation of the program

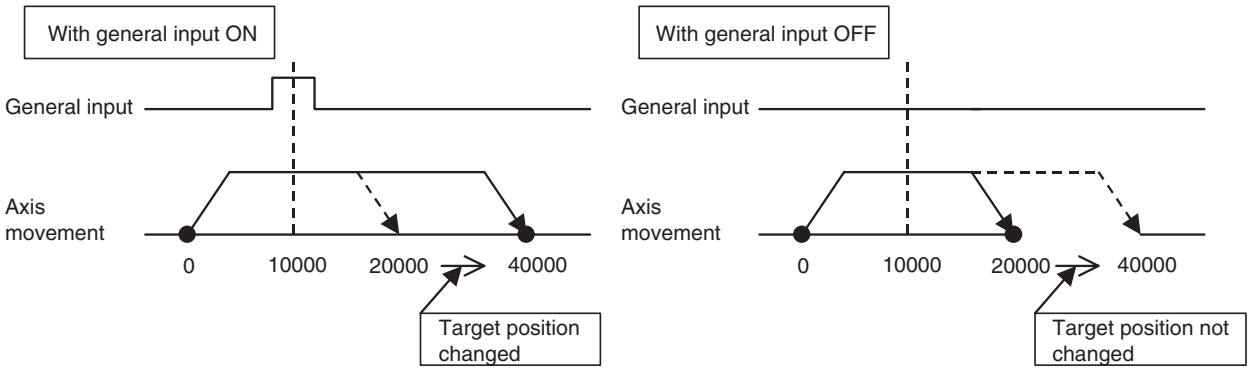
01) A program No. and axes to be used are specified.
02) The axis moves to the position 50000 with linear interpolation.
03) TORQUE command operation is started with 50% of the maximum motor torque.
04) 1 is output to the general output (OW0BA0).
05) The program will wait until the present position exceeds 150000.
06) TORQUE command operation is completed.
07) The general output (OW0BA0) is reset to 0.
08) The axis moves to the position 200000 with linear interpolation.
09) The program is held for 5 seconds.
10) The axis returns to the origin.
11) The program is completed.

10-1-25 Target Position Change (MOVEMODI)

Explanation of the operation

- A target position is changed during positioning.
- In this example, the axis is moving to the position 20000 with linear interpolation. The target position (20000) will be changed to the position 40000 if the general input is ON when the axis reaches the position 10000. If the general input is OFF, the target position will remain the same (20000).

Note Target positions can be changed only on the axes operated with MOVE command, or MOVEL command of single axis specification in Stop Mode. (MOVEMODI during execution of commands other than the ones mentioned above, or for axes not operating is ignored.)



Program

```
01) PROG P029 Q00000001;
02) STOPMODE;
03) MOVEL [J01]20000 F500000;
04) WAIT #SL0204 >= 10000;
05) IF #IW0B00 == 1;
06) MOVEMODI [J01]40000;
07) ENDIF;
08) DWELL T3000;
09) MOVE [J01]0;
10) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.
02) Stop Mode is selected.
03) The axis moves to the position 20000 with linear interpolation.

04) to 07) When the present position reaches 10000, if the general input (IW0B00) is 1, the target position will be changed to 40000. If the general input (IW0B00) is not 1, the target position will not be changed.

08) The program is held for 3 seconds.

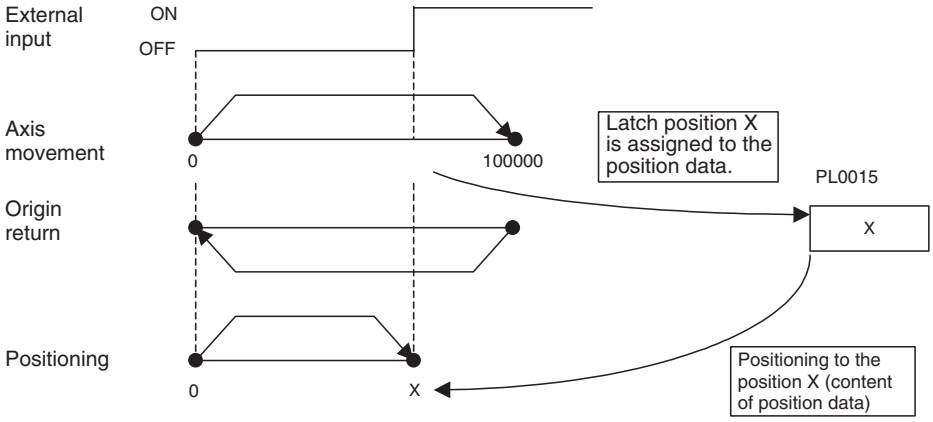
09) The axis returns to the origin.

10) The program is completed.

10-1-26 Present Position Latch (LATCH)

Explanation of the operation

- The present position of a specified axis is saved to the word for variables.
- In this example, the axis moves to the position 100000 (a position exceeding the target position). When the external input is turned ON in the midway, the position will be assigned to the position data.
- The axis movement is similar to the one of *10-1-9 Stopping Operation with Optional End Using General Input and Assigning Position Data* (page 478), however, the axis does not stop midway in the initial operation, moves to the position 100000, and returns to the origin.
- Positioning after execution of LATCH command is performed using the assigned position data. Additionally, if the latch start and end positions are specified, the rise of the external inputs outside of the range will be ignored. This can be useful when the external input turns ON twice or more due to the machine structure.



Program

```
01) PROG P030 Q00000001;
02) STOPMODE;
03) PARALLEL N2;
04) MOVEL [J01]100000 F500000;
05) JOINT;
06) LATCH [J01]#PL0015 I80000 J90000;
07) JWAIT;
08) MOVE [J01]0;
09) WHILE #IW0B00 <> 1;
10) MOVEL [J01]#PL0015;
11) MOVE [J01]0;
12) WEND;
13) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) Stop Mode is selected.

03) With PARALLEL command, 04) and 06) are executed in parallel.

04) The axis moves to the position 100000 with linear interpolation.

05) This is the syntax of PARALLEL command.

06) If the external input is turned ON between the start position 80000 and the end position 90000, the ON position will be assigned to the position data (PL0015).

07) This is the end of PARALLEL command from 03).

08) The axis returns to the origin.

09) The process through 09) to 12) is repeated when the general input (IW0B00) is not 1.

10) Positioning is performed based on the position data.

11) The axis returns to the origin.

12) This is the end of WHILE command from 09).

13) The program is completed.

10-1-27 Single Block Ignored (NSTOP)

Explanation of the operation

- The block with NSTOP command is not stopped with block stop in Single Block Operation Mode.
- For example, when debugging a program in Single Block Operation Mode, if NSTOP command is put in the blocks not containing axis movement commands, the blocks will not be stopped (other blocks with axis movement commands will be stopped). This will economizes the time and work for debugging.

Note When debugging a program in Single Block Operation Mode, Start Mode 2 has to be set in advance.

Program

```
01) PROG P031 Q00000003;
02) MOVEL [J01]50000 [J02]50000 F500000;
03) NSTOP NOPS;
04) NSTOP #PL0000 = #SL0204;
05) NSTOP #PL0001 = #PL0000 * 3;
06) NSTOP #PL0002 = #PL0001 + #PL0000;
07) NSTOP #PL0003 = #PL0002 / 4;
08) NSTOP #PL0004 = #PL0003 + #PL0000;
09) MOVEL [J01]#PL0004 [J02]#PL0004;
10) NSTOP DWELL T5000;
11) MOVEL [J01]0 [J02]0;
12) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) The axis moves to the position [J01]50000, [J02]50000 with linear interpolation.

03) to 08) Various arithmetic operations are executed. (Not stopped at the end of the block in Single Block Operation Mode)

09) Positioning is performed based on the result of the arithmetic operations.

10) The program is held for 5 seconds. (Not stopped at the end of the block in Single Block Operation Mode.)

11) The axes return to the origin.

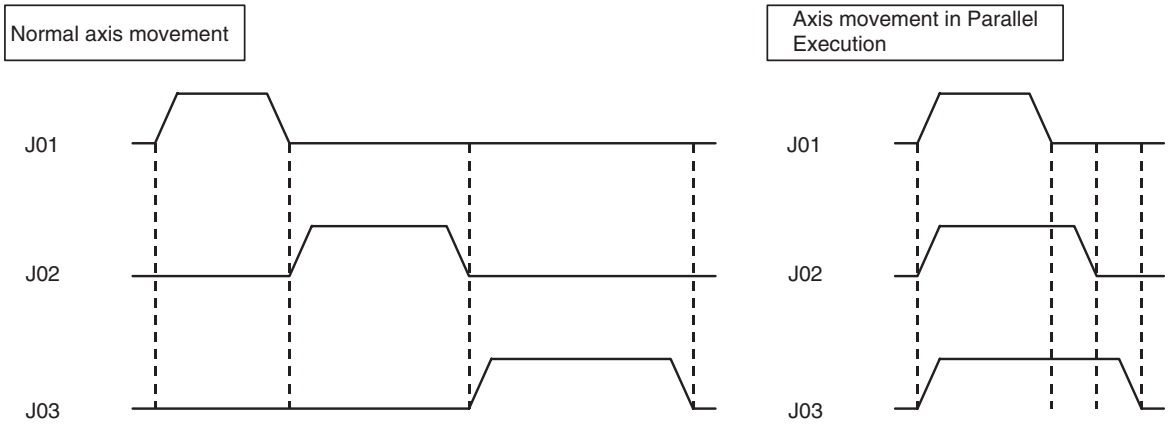
12) The program is completed.

When executing the above program to END command in Single Block Operation Mode, the start signal will be turned OFF-ON 5 times. Without NSTOP command, the start signal will be turned OFF-ON 12 times.

10-1-28 Parallel Execution (PARALLEL, JOINT, JWAIT)

Explanation of the operation

- The processing is branched and executed in parallel.
- This program is used, for example, when executing interpolation commands simultaneously.
- In this example, 3 axes are operated with linear interpolation and they are simultaneously operated with PARALLEL command.



Program

```
01) PROG P032 Q00000007;
02) PARALLEL N3;
03) MOVEL [J01]100000 F500000;
04) JOINT;
05) MOVEL [J02]150000 F500000;
06) JOINT;
07) MOVEL [J03]200000 F500000;
08) JWAIT;
09) DWELL T3000;
10) MOVE [J01]0 [J02]0 [J03]0;
11) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) With PARALLEL command, 03), 05), and 07) are executed in parallel.

03) [J01] is moved to the position 100000 with linear interpolation.

04) This is the syntax of PARALLEL command. After this block is <processing 2>.

05) [J02] is moved to the position 150000 with linear interpolation.

06) This is the syntax of PARALLEL command. After this block is <processing 3>.

07) [J03] is moved to the position 200000 with linear interpolation.

08) This is the end of PARALLEL command from 02).

09) The program is held for 3 seconds.

10) The axes return to the origin.

11) The program is completed.

10-1-29 Selective Execution (SWITCH, CASE, BREAK, SEND)

Explanation of the operation

- The processing is selectively executed according to the values of conditional variables.
- In this example, different operations are executed depending on the values of the general input at program startup.

Combination	General input 1 (0B01)	General input 2 (0B02)	[J01]	[J02]	[J03]
1	2	1	❍	×	×
2	1	2	×	❍	×
3	2	2	❍	❍	×
4	1	1	×	×	❍

Note ❍ indicates that the axis is operated.

Program

```
01) PROG P033 Q00000007;
02) WHILE #IW0B00 == 0;
03) #ML0000 = 0;
04) #MB00000 = SET #IB0B011 & #IB0B020;
05) #MB00001 = SET #IB0B010 & #IB0B021;
06) #MB00002 = SET #IB0B011 & #IB0B021;
07) WEND;
08) SWITCH #ML0000;
09) CASE 1;
10) MOVE [J01]50000;  Processing 1
11) BREAK;
12) CASE 2;
13) MOVE [J02]50000;  Processing 2
14) BREAK;
15) CASE 4;
16) MOVE [J01]50000 [J02]50000;   Processing 3
17) BREAK;
18) DEFAULT;
19) MOVE [J03]50000;   Processing 4
20) SEND;
21) MOVE [J01]0 [J02]0 [J03]0;
22) END;
```

Explanation of the program

01) A program No. and axes to be used are specified.

02) With WHILE command, the process through 02) to 07) will be repeated until the general input (IW0B00) becomes a value other than 0.

03) The conditional variable (ML0000) is reset to 0.

04) to 06) Depending on the values of the general inputs (IW0B01, IW0B02), the bit of the conditional variable (ML0000) is turned ON.

07) This is the end of WHILE command from 02).

08) to 20) With SWITCH command, when the conditional variable (ML0000) is 1, 2, or 4, processing 1, 2, or 3 will be executed respectively. Processing 4 will be executed when the conditional variable is not 1, 2, or 4.

09) to 11)Content of processing 1

12) to 14)Content of processing 2

15) to 17)Content of processing 3

18) to 19)Content of processing 4

20)This is the end of SWITCH command.

21) The axes return to the origin.

22) The program is completed.

10-2 Slave Modules

This section describes the parameter settings, the allocation area status, and the program examples for operations when the I/O module is specified as the MECHATROLINK-II device.

Note For details of functions, etc., refer to YASKAWA ELECTRIC CORPORATION's Σ-II SERIES SGDH MECHATROLINK-II APLLICATION MODULE USER'S MANUAL MODEL: JUSP-NS115 (MANUAL NO. SIEPC71080001*)".

10-2-1 Using 64-Point I/O Module

The parameter settings and the allocation example when I/O modules are connected to the MECHATROLINK device are shown below.

Explanation of the operation

Allocate 64-point I/O module at node 2 to Axis 3 of the MC Unit.

Parameter settings

Set Axis 3 to I/O in the system parameter of the MC Unit.

No.	Setting value	Name	Detail
P1AA01	2	Physical axis setting	Set node address to "2".
P1AA02	100	MLK-II device classification	I/O
P1AA03	4	Input allocation points	Input - 4 words
P1AA04	4	Output allocation points	Output - 4 words
P1AA05	0	Axis allocation first address	The first address of destination word for storing the count values (Not specified) (See note 3.)
P1AA06	0	MLK-II communications error detection	(Default value)

Note

(1) AA=03 (Axis 3)

(2) With P1AA02 set to I/O (100), 6 parameters above are valid. (Others are ignored.)

(3) The contents of the address specified here are reflected in the system variable [Current coordinate system FB position]. (For Axis 3: IL0032h_SL0260h) Only 1 word can be monitored.

I/O variables specifications

The following is the relations between the I/O module with the above parameter settings and I/O variables in the MC Unit. (The addresses are the ones for the I/O module allocated as Axis 3.)

Input variables

Address	Bit	Symbol	Name	Description
IW0030	0 to 15	-	Input (IN1) 1 to 16	Shows status of input signal (connector 1). Input 1 to Input 16
IW0031	0 to 15	-	Input (IN1) 17 to 32	Shows status of input signal (connector 1). Input 17 to Input 32
IW0032	0 to 15	-	Input (IN2) 1 to 16	Shows status of input signal (connector 2). Input 1 to Input 16
IW0033	0 to 15	-	Input (IN2) 17 to 32	Shows status of input signal (connector 2). Input 17 to Input 32

Output variables

Address	Bit	Symbol	Name	Description
OW0030	0 to 15	-	Output (OUT1) 1 to 16	Controls status of output signal (connector 1) Output 1 to output 16
OW0031	0 to 15	-	Output (OUT1) 17 to 32	Controls status of output signal (connector 1) Output 17 to output 32
OW0032	0 to 15	-	Output (OUT2) 1 to 16	Controls status of output signal (connector 2) Output 1 to output 16
OW0033	0 to 15	-	Output (OUT2) 17 to 32	Controls status of output signal (connector 2) Output 17 to output 32

- Appropriate parameter settings enable data link between I/O variable addresses of each axis and the I/O module.
- For details of the I/O variable area, see *4-6 I/O Variables* (page 138).

10-2-2 Using Counter Module

This section describes the parameter settings, the initial module settings, and the allocation examples when the counter module is connected to the MECHATROLINK device.

Explanation of the operation

Allocate the counter module at node 4 to Axis 5 of the MC Unit.

Parameter settings

Set Axis 5 to I/O in the system parameter of the MC Unit.

No.	Setting value	Name	Detail
P1AA01	5	Physical axis setting	Set the address to “5”.
P1AA02	100	MLK-II device classification	I/O
P1AA03	5	Input allocation points	Input - 5 words
P1AA04	6	Output allocation points	Output - 6 words
P1AA05	10051Hex	Axis allocation first address	The first address of destination word for storing the count values IW0051 (See note 3.)
P1AA06	0	MLK-II communications error detection	(Default value)

Note

(1) AA=05 (Axis 5)

(2) With P1AA02 set to I/O (100), 6 parameters above are valid. (Others are ignored.)

(3) The contents of the address specified here are reflected in the system parameter [Current coordinate system FB position]. (For Axis 5: IL0051h_SL02C0h) Only 1 word can be monitored.

Program for initial setting

When using the counter module with the MC Unit, the initial setting for the counter module has to be performed through the motion program.

```
PROG P000 Q00000000;
;*** Counter module initial setting
#OW0050 = 0;
WAIT #IW0050 == 1;
#OW0052 = 0;---------Pulse count setting (Phase A, B, ×1)
#OB00500 = 1;---------Counter 1 mode setting
WAIT #IB00501 == 1;  ---- → Mode setting completed normally
#OB00500 = 0;   ---------Mode setting reset
WAIT #IB00501 == 0; ------ → Mode setting completed normally (Flag OFF monitored)
;
```

```
;*** Present position preset
#OL0052 = 2147483647;---present position setting value
#OB00502 = 1;---------Present value setting ON
WAIT #IB00501 == 1;   --- → Present position setting completed
#OL0052 = 0;---------Present position setting value (cleared)
#OB00502 = 0;---------Present value setting OFF
WAIT #IB00501 == 0;   --- → (Flag OFF monitored)
#OB00503 = 1;   ---------Counting enabled
END;
```

Note

(1) Make sure to create a program to confirm a response for a command.

(2) After setting is completed, turn ON "Counter 1 count enable (OW0050-3bit)". With the output variable OFF, the present value of the counter on the MC Unit cannot be monitored.

(3) When executing a synchronous command having the input of the counter module as the master axis, the link option "When master axis is detected" cannot be used to start synchronization (ignored). The link option "When master axis reaches link start position" can be used.

(4) Executing present position preset on the module during execution of synchronous command makes the MC Unit to recognize (though not true) that the axis was moved from the position before the preset to the one after the preset, which causes the slave axis to operate.

I/O variables specification

The following is the relations between the counter module with the above parameter settings and I/O variables in the MC Unit. (The addresses are the ones for the counter module allocated as Axis 5.)

Input variables

Address	Bit	Symbol	Name	Description
IW0050	0	RDY	Ready	Indicates the result of self-diagnosis for the module. ON: Normal OFF: Abnormal
	1	ACK	Setting normal	Indicates the setting operation was completed normally. Stays ON while the setting signal is ON.
	2	ERR	Setting error	Indicates the setting operation caused an error. Stays ON while the setting signal is ON.
	3 to 7		Not used	
	8	CARY1	Counter 1, Carry	Turns ON for 1 scan when counter's current value with incremental pulses exceeded counter's upper limit value.
	9	BORW1	Counter 1, Borrow	Turns ON for 1 scan when counter's current value with decremental pulses exceeded counter's lower limit value.
	10	N1	Counter 1, Notch output status	Indicates the status of external Notch output. ON: External Notch being output
	11	L1	Counter 1, Latch input status	Indicates the status of external Latch input. ON: External Latch being input
	12	CARY2	Counter 2, Carry	Turns ON for 1 scan when counter's current value with incremental pulses exceeded counter's upper limit value.
	13	BORW2	Counter 2, Borrow	Turns ON for 1 scan when counter's current value with decremental pulses exceeded counter's lower limit value.
	14	N2	Counter 2, Notch output status	Indicates the status of external Notch output. ON: External Notch being output
	15	L2	Counter 2, Latch input status	Indicates the status of external Latch input. ON: External Latch being input

Address	Bit	Symbol	Name	Description
IW0051	0 to 15		Monitor	Content of monitor is to be as follows through the initial setting: • Current value • Latch data • Mode settings • Notch point setting value 1 (counter 1) • Notch point setting value 1 (counter 2) • Current set value
IW0052				
IW0053				
IW0054				

Note Content of monitor

Monitor type	IW0051	IW0052	IW0053	IW0054
Current value	Counter 1, Current value (Lower byte)	Counter 1, Current value (Upper byte)	Counter 2, Current value (Lower byte)	Counter 2, Current value (Upper byte)
Latch data	Counter 1, Latch data (Lower byte)	Counter 1, Latch data (Upper byte)	Counter 2, Latch data (Lower byte)	Counter 2, Latch data (Upper byte)
Mode setting	Counter 1, Mode		Counter 2, Mode	
Notch point setting value 1 (Counter 1)	Counter 1, Notch point (Lower limit) (Lower byte)	Counter 1, Notch point (Lower limit) (Upper byte)	Counter 1, Notch point (Upper limit) (Lower byte)	Counter 1, Notch point (Upper limit) (Upper byte)
Notch point setting value 2 (Counter 2)	Counter 2, Notch point (Lower limit) (Lower byte)	Counter 2, Notch point (Lower limit) (Upper byte)	Counter 2, Notch point (Upper limit) (Lower byte)	Counter 2, Notch point (Upper limit) (Upper byte)
Current set value	Counter 1, Current set value (Lower byte)	Counter 1, Current set value (Upper byte)	Counter 2, Current set value (Lower byte)	Counter 2, Current set value (Upper byte)

⚠ **Caution** Monitor (IW0051 to IW0054) and Setting values (OW0052 to OW0055) use the same address (register) depending on the mode. Therefore, make sure that the timings of setting and monitor do not overlap.
In addition, make sure to reset the set values to “0” after the setting is completed. In some mode, data of the setting values (OW0052 to OW0055) is enabled immediately when the mode is set. Therefore, expected operations may not be performed unless the previous settings are reset to “0”.

Output variables

Address	Bit	Symbol	Name	Description
OW0050	0	M-SET1	Counter 1 Mode set	The counter mode setting signal ON: Mode setting signal is effective
	1	N-SET1	Counter 1 Notch point setting	The notch point setting preset signal Notch point is set at the rise of the signal (OFF-ON).
	2	P-SET1	Counter 1 Current value setting	The counter's current value preset signal Current value is set at the rise of the signal (OFF-ON).
	3	C-ENB1	Counter 1 Count enable	Input pulses can be counted when this is ON. ON: Count enabled
	4	N-ENB1	Counter 1 Notch output enable	Notch output can be output when this is ON. ON: Notch output enabled
	5	P-RES1	Counter 1 Current value reset	Counter's current value is reset to "0". Current value is reset at the rise of the signal (OFF-ON).
	6	N-RES1	Counter 1 Notch output reset	Latch status for notch output is reset. Latch status is reset at the rise of the signal (OFF-ON).
	7	L-RES1	Counter 1 Count value reset	Input status of external latch is reset. Input status is reset at the rise of the signal (OFF-ON).
	8	M-SET2	Counter 2 Mode set	The counter mode setting signal ON: Mode setting signal is effective
	9	N-SET2	Counter 2 Notch point setting	The notch point setting preset signal Notch point is set at the rise of the signal (OFF-ON).
	10	P-SET2	Counter 2 Current value setting	The counter's current value preset signal Current value is set at the rise of the signal (OFF-ON).
	11	C-ENB2	Counter 2 Count enable	Input pulses can be counted when this is ON. ON: Count enabled
	12	N-ENB2	Counter 2 Notch output enable	Notch output can be output when this is ON. ON: Notch output enabled
	13	P-RES2	Counter 2 Current value reset	Counter's current value is reset to "0". Current value is reset at the rise of the signal (OFF-ON).
	14	N-RES2	Counter 2 Notch output reset	Latch status for notch output is reset. Latch status is reset at the rise of the signal (OFF-ON).
	15	L-RES2	Counter 2 Count value reset	Input status of external latch is reset. Input status is reset at the rise of the signal (OFF-ON).
OW0051	0	N-ON1	Counter 1 Forced notch output	Notch output is forced ON. ON: Forced output
	1	N-ON2	Counter 2 Forced notch output	Notch output is forced ON. ON: Forced output
	2 to 7		Not used	
	8	MON1	Monitor 1	Combining the ON/OFF status of Monitor 1 to 3 enables monitoring of the followings. • Counter current value • External latch data • Status • Mode settings • Counter 1, Notch point setting value • Counter 2, Notch point setting value • Current set value
	9	MON2	Monitor 2	
	10	MON3	Monitor 3	
	11 to 15		Not used	

Address	Bit	Symbol	Name	Description
OW0052	0 to 15		Setting values	The following 3 counter data settings are available: • Mode settings • Notch point setting • Current value setting
OW0053				
OW0054				
OW0055				

Program example

With the above settings, the program that makes the slave axis [J04] link to the input of the counter module [J05] as the master axis is shown below (The same specification method as the normal axes can be used):

```
PROG P001 Q00000009; Link option (Start position)
WAIT #OB00503 == 1;---------- Counter, monitor started
WHILE #IB03411 == 1;---------- Task 2 start switch
MOVELINK [J01]100 [J05]100 A0 D0 Q4 I100 B1;------  Link operation (Start position)
NOPS;
WEND;
SYNCR [J05];----------Synchronization completed
END;
```

Note Start positions or travel distances for the counter module are processed only with pulses.

10-2-3 Using Pulse Output Module

The following shows the parameter settings and the allocation example when the pulse output module is connected to the MECHATROLINK device.

Explanation of the operation

Allocate the pulse output module at node 2 to Axis 3 of the MC Unit.

Parameter settings

Set the Axis 3 to I/O in the system parameter of the MC Unit.

No.	Setting value	Name	Detail
P1AA01	2	Physical axis setting	Set the address to “2”.
P1AA02	100	MLK-II device classification	I/O
P1AA03	6	Input allocation points	Input - 6 words
P1AA04	6	Output allocation points	Output - 6 words
P1AA05	10032Hex	Axis allocation first address	The first address of destination word for storing the count values IW0032 (See note 3.)
P1AA06	0	MLK-II communications error detection	(Default value)

Note

(1) AA=03 (Axis 3)

(2) With P1AA02 set to I/O (100), 6 parameters above are valid. (Others are ignored.)

(3) The contents of the address specified here are reflected in the system parameter [Current coordinate system FB position]. (With Axis 3: IL0032h_SL0260h) Only 1 word can be monitored.

I/O variables specifications

The following is the relations between the pulse output module with the above parameter settings and I/O variables in the MC Unit. (The addresses are the ones for the pulse output module allocated as Axis 3.)

Input variables

Address	Bit	Symbol	Name	Description
IW0030 Word 1	0	RDY1	Ready (Word 1)	Indicates the result of self-diagnosis for the module. ON: Normal OFF: Abnormal
	1	Not used		
	2	MONSEL1	Monitor parameters	Indicates that the parameters are being monitored.
	3	Not used		
	4	PACK1	Parameter settings normal	Indicates that the setting operation was completed normally. Stays ON while the setting signal is ON.
	5	PNACK1	Parameter setting error	Indicates that the setting operation caused an error. Stays ON while the setting signal is ON.
	6, 7	Not used		
	8	MOV1L	Positioning	Indicates that the positioning operation is being performed.
	9	JOG1L	JOG operation	Indicates that the JOG operation is being performed.
	10	ZRN1L	Zero point return	Indicates that the zero point return operation is being performed.
	11	Not used		
	12	OVER1	Overheat input status	Indicates the status of the external overheat input. (External input terminal)
	13	TIMING1	Magnetic excitation timing input status	Indicates the status of the external magnetic excitation timing input. (External input terminal)
	14	ZRN1	Zero point signal input status	Indicates the status of the external zero point signal input. (External input terminal)
	15	IN1	General-purpose input status	Indicates the status of the external general-purpose input. (External input terminal)
IW0031 Word 2	0	RDY2	Ready (Word 2)	Indicates the result of self-diagnosis for the module. ON: Normal OFF: Abnormal
	1	Not used		
	2	MONSEL2	Monitor parameters	Indicates that the parameters are being monitored.
	3	Not used		
	4	PACK2	Parameter settings normal	Indicates that the setting operation was completed normally. Stays ON while the setting signal is ON.
	5	PNACK2	Parameter setting error	Indicates that the setting operation caused an error. Stays ON while the setting signal is ON.
	6, 7	Not used		
	8	MOV2L	Positioning	Indicates that the positioning operation is being performed.
	9	JOG2L	JOG operation	Indicates that the JOG operation is being performed.
	10	ZRN2L	Zero point return	Indicates that the zero point return operation is being performed.
	11	Not used		
	12	OVER2	Overheat input status	Indicates the status of the external overheat input. (External input terminal)
	13	TIMING2	Magnetic excitation timing input status	Indicates the status of the external magnetic excitation timing input. (External input terminal)
	14	ZRN2	Zero point signal input status	Indicates the status of the external zero point signal input. (External input terminal)
	15	IN2	General-purpose input status	Indicates the status of the external general-purpose input. (External input terminal)

Address	Bit	Symbol	Name	Description
IW0032 IW0033			Word 1 Monitor register	Appropriate setting enables monitoring of the following values of Word 1. • Current position • Parameter settings • Alarm status
IW0034 IW0035			Word 2 Monitor register	Appropriate setting enables monitoring of the following values of Word 2. • Current position • Parameter settings • Alarm status

Output variables

Address	Bit	Symbol	Name	Description
OW0030 Word 1	0	ARST1	Alarm reset	This is the alarm-reset command. Alarm is reset at the rise of the signal (OFF-ON).
	1	CAN1	Cancel	This signal cancels axis movement. Axis movement is canceled at the rise of the signal (OFF-ON).
	2	MONSEL1	Monitor selector	This signal switches the monitor mode. OFF: Current position monitor, ON: Parameter monitor
	3	PSET1	Parameter set/Monitor selector	This is the signal that sets or monitors parameters.
	4 to 7	PRM10 to PRM13	Parameter No. selector	Parameter No. is selected using this signal.
	8	MOV1	Positioning	This signal starts positioning operation. Operation is started at the rise of the signal (OFF-ON).
	9	JOG1	JOG operation	This signal controls JOG operation. ON: Run OFF: Stop
	10	ZRN1	Zero point return	This signal starts the zero point return operation. Operation is started at the rise of the signal (OFF-ON).
	11	REV1	JOG/Zero point return direction	This signal determines the start direction for JOG operation and zero point return operation. OFF: Forward ON: Reverse
	12	Not used		
	13	COFF1	Output current OFF	This signal controls the status of the output current OFF terminal. OFF: Output current ON ON: Output current OFF
	14	BFREE1	Electromagnetic brake release	This signal controls the status of the electromagnetic brake release output terminal. OFF: Electromagnetic brake is used. ON: Electromagnetic brake is released.
	15	OUT1	General-purpose output	This signal controls the status of the general-purpose output terminal. OFF: General-purpose output is OFF. ON: General-purpose output is ON.

Address	Bit	Symbol	Name	Description
OW0031 Word 2	0	ARST2	Alarm reset	This is the alarm-reset command. Alarm is reset at the rise of the signal (OFF-ON).
	1	CAN2	Cancel	This signal cancels axis movement. Axis movement is canceled at the rise of the signal (OFF-ON).
	2	MONSEL2	Monitor selector	This signal switches the monitor mode. OFF: Current position monitor, ON: Parameter monitor
	3	PSET2	Parameter set/Monitor selector	This is the signal that sets or monitors parameters.
	4 to 7	PRM20 to PRM23	Parameter No. selector	Parameter No. is selected using this signal.
	8	MOV2	Positioning	This signal starts positioning operation. Operation is started at the rise of the signal (OFF-ON).
	9	JOG2	JOG operation	This signal controls JOG operation. ON: Run OFF: Stop
	10	ZRN2	Zero point return	This signal starts the zero point return operation. Operation is started at the rise of the signal (OFF-ON).
	11	REV2	JOG/Zero point return direction	This signal determines the starting direction for JOG operation and zero point return operation. OFF: Forward ON: Reverse
	12	Not used		
	13	COFF2	Output current OFF	This signal controls the status of the output current OFF terminal. OFF: Output current ON ON: Output current OFF
	14	BFREE2	Electromagnetic brake release	This signal controls the status of the electromagnetic brake release output terminal. OFF: Electromagnetic brake is used. ON: Electromagnetic brake is released.
	15	OUT2	General-purpose output	This signal controls the status of the general-purpose output terminal. OFF: General-purpose output is OFF. ON: General-purpose output is ON.
OW0032 OW0033			Word 1 data register	Appropriate setting enables setting of the following values of Word 1. • Target position setting • Parameter settings
OW0034 OW0035			Word 2 data register	Appropriate setting enables setting of the following values of Word 2. • Target position setting • Parameter settings

Meaning of the parameters No. select and setting value of the pulse output module

Parameter No.	Parameter No. setting				Name	Setting range (units)	Initial setting
	PRMn3	PRMn2	PRMn1	PRMn0			
00	OFF	OFF	OFF	OFF	Reserved for system		
01	OFF	OFF	OFF	ON	Output mode	0: CW, CCW pulses 1: + signed pulses	0
02	OFF	OFF	ON	OFF	In JOG operation • JOG speed • JOG accel/decel time	JOG speed: 1 to 50000 (10 pps) Accel/decel time 50 to 5000 (100 ms)	Speed: 500 Time: 100

Parameter No.	Parameter No. setting				Name	Setting range (units)	Initial setting
	PRMn3	PRMn2	PRMn1	PRMn0			
03	OFF	OFF	ON	ON	In zero point return • Zero point return speed • Zero point return Accel/ decel time	Zero point return speed: 1 to 50000 (10 pps) Zero point return Accel/ decel time: 50 to 5000 (100 ms)	Speed: 500 Time: 100
04	OFF	ON	OFF	OFF	In zero point return • Approach speed • Creep speed	Approach speed: 1 to 50000 (10 pps) Creep speed: 1 to 50000 (10 pps)	Approach: 100 Creep: 50
05	OFF	ON	OFF	ON	In positioning • Positioning speed • Positioning Accel/decel time	Positioning speed: 1 to 50000 (10 pps) Positioning Accel/decel time: 50 to 5000 (100 ms)	Speed 500 Time 100
06	OFF	ON	ON	OFF	Reserved for system		
07	OFF	ON	ON	ON	Reserved for system		
08	ON	OFF	OFF	OFF	Acceleration/deceleration mode	0: Single-stage symmetric 1: Two-stage symmetric 2: Single-stage asymmetric	0
09	ON	OFF	OFF	ON	In two-stage acceleration/ deceleration • Switching speed • Second-stage Accel/ decel time	Switching speed: 1 to 50000 (10 pps) Second-stage Accel/ decel time: 50 to 5000 (100ms)	Speed 250 Time: 100
10	ON	OFF	ON	OFF	In asymmetrical accel/ decel operation • Acceleration time • Deceleration time	Acceleration time: 50 to 5000 (100 ms) Deceleration time: 50 to 5000 (100 ms)	Accel: 100 Decel: 100
11	ON	OFF	ON	ON	Asymmetrical Accel/decel bias speed **Note** Set smaller value than the positioning speed.	Bias speed: 1 to 50000 (10 pps)	Speed 0
12	ON	ON	OFF	OFF	Current position setting	Current position: −2147483647 to 2147483647 (pulse)	Current position: 0
13	ON	ON	OFF	ON	Reserved for system		
14	ON	ON	ON	OFF	Reserved for system		
15	ON	ON	ON	ON	Reserved for system		

n = Word No. (1 or 2)

Program examples

- When operating the pulse output module from the MC Unit, the operating conditions have to be set first. After that, start commands can be sent. (When starting operations consecutively under the same operating conditions, sending a start command can start operations if the operating conditions have been already set.)
- This following shows the program examples required for JOG operations and positioning operations.

⚠ **Caution** When operating an axis with the pulse output module, make sure to set the Output Current OFF signal (OW0030 bit13) to "1". If an axis movement command bit is turned ON with the Output Current OFF signal (OW0030 bit13) set to "0", the alarm [03: Move reference when output current is OFF] will occur. (This alarm only occurs on the MECHATROLINK module. It does not occur on the MC Unit.)

JOG operation

- The settings of the parameter No. 02 (JOG speed, JOG Accel/decel time) for word 1 are changed and JOG operation is performed.
- Controlling the status of the general-purpose I/O area (PORT_A) starts and stops the JOG operation.

```
PROG P002 Q00000000; Pulse output module (JOG operation)
WAIT #IB00300 == 1;  --------  Pulse unit ready
#OW0030 = 0;   ---------------  Output bit reset
;
;*** JOG parameter setting***
#OB00304 = 0;              Parameter No. specification (02)
#OB00305 = 1;              Parameter No. specification (02)
#OB00306 = 0;              Parameter No. specification (02)
#OB00307 = 0;              Parameter No. specification (02)
#OW0032 = 600;  -------------  JOG speed data
#OW0033 = 200;  -------------  Accel/decel time data
#OB00303 = 1; ------------------  Parameter settings started
WAIT #IB00304 == 1; ----------  Parameter setting completed
#OW0030 = 0;  ----------------  Output bit reset
#OB00304 = 0;              Parameter No. specification (00)
#OB00305 = 0;              Parameter No. specification (00)
#OB00306 = 0;              Parameter No. specification (00)
#OB00307 = 0;              Parameter No. specification (00)
;
;*** JOG start ***
WHILE #IW0B00 == 1;
#OB0030F = 1;------- Servo ON
#OB0030D = 1;------ Output current OFF signal ON
IF #IW0B01 == 1;  ---  External input for JOG operation (General-purpose I/O
area: PORT_A)
#OB00309 = 1;   -----------  JOG started
ELSE;
#OB00309 = 0;   ----------    JOG stopped
ENDIF;
WEND;
#OB0030F = 0;    --------    Servo OFF
#OB0030D = 0;    --------    Output current OFF signal OFF
END;
```

Positioning operation

- The settings of the parameter No. 05 (Positioning speed, Positioning Accel/decel time) for word 1 are changed and positioning is performed.
- Controlling the status of the general-purpose I/O area (PORT_A) starts and stops positioning operation.

```
PROG P002 Q00000000; Pulse output module (Positioning operation)
WAIT #IB00300 == 1;   -------  Pulse unit ready
#OW0030 = 0;   ---------------  Output bit reset
;
;*** Positioning parameter setting ***
#OB00304 = 1;              Parameter No. specification (05)
```

```
#OB00305 = 0;            Parameter No. specification (05)
#OB00306 = 1;            Parameter No. specification (05)
#OB00307 = 0;            Parameter No. specification (05)
#OW0032 = 2000;  ------------  Positioning speed data
#OW0033 = 100;  -------------  Positioning Accel/decel time data
#OB00303 = 1; ------------------  Parameter setting started
WAIT #IB00304 == 1; ----------  Parameter setting completed
#OW0030 = 0;  ----------------  Output bit reset
#OB00304 = 0;            Parameter No. specification (00)
#OB00305 = 0;            Parameter No. specification (00)
#OB00306 = 0;            Parameter No. specification (00)
#OB00307 = 0;            Parameter No. specification (00)
;
;*** Positioning target position setting ***
#OL0032 = #PL0010;   ------  Value in Position data (PL0010) substituted
;
;*** Positioning operation ***
WHILE #IW0B00 == 1;
#PL0010 = #IL0C40;
#OB0030F = 1;   ----- Servo ON
#OB0030D = 1;   ----- Output current OFF signal ON
IF #IW0B01 == 1; ----- External input for starting positioning (general-purpose
I/O area: PORT_A)
#OB00308 = 1;  ------ Positioning started
ENDIF;
WAIT #IB00308 == 0; ----- Positioning completed
#OB00308 = 0;  ---------- Positioning start bit reset
WEND;
#OB0030F = 0;     ------- Servo OFF
#OB0030D = 0;     ------ Output current OFF signal OFF
END;
```

Monitor parameters

- When checking the parameters that have been set, users cannot see the data directly. An example of checking methods is shown below.
- The setting of the parameter No. 02 (JOG speed, JOG Accel/decel time) for word 1 is read and assigned to desired variables.

```
PROG P003 Q00000000; Pulse output module (Parameter setting monitor)
WAIT #IB00300 == 1;   -------  Pulse unit ready
#OW0030 = 0;   ---------------  Output bit reset
;
;*** Read parameter setting ***
#OB00304 = 0;            Parameter No. specification (02)
#OB00305 = 1;            Parameter No. specification (02)
#OB00306 = 0;            Parameter No. specification (02)
#OB00307 = 0;            Parameter No. specification (02)
#OB00302 = 1; ------------------  Data to be monitored selected
#OB00303 = 1; ------------------  Parameter setting started
WAIT #IB00304 == 1; ----------  Parameter setting completed
;
;*** Parameter read ***
#PL0000 = #IL0032;  ---------  Assigned to position data (Parameter data)
;
#OW0030 = 0;  ----------------  Output bit reset
```

```
#OB00304 = 0;          Parameter No. specification (00)
#OB00305 = 0;          Parameter No. specification (00)
#OB00306 = 0;          Parameter No. specification (00)
#OB00307 = 0;          Parameter No. specification (00)
END;
```

10-3 Others

Example 1

This program may be the automatic operation of a simple 'pick and place' machine (eg., PCB mounting machine). The real machine will need another motion programs as 'homing sequence', 'manual operation' and PC program.

```
PROG P004 Q00000007;Pick & Place
;-------------------------------------------------------------------------------
;The application consist on a pick and place operation with high torque detection
;in the axes to detect mechanical lockings.
;Axes 1 & 2 are an X-Y table and Axis 3 is the vertical axis. Two sensors confirm
;that the vertical axis is in the 'up' or 'down' position.
;-------------------------------------------------------------------------------
;The example shows:
; - Simple PTP movements
; - Parallel programming
; - Use of different variables
;-------------------------------------------------------------------------------
;Variable initialization
#OB0BA20=0;
#MW0000=0;
;
ABL;
;
;Set the axes to RUN
#IB04402=1; AXIS1 on
#IB04412=1; AXIS2 on
#IB04422=1; AXIS3 on
WAIT #OB04403==1; Wait for confirmation AX1
WAIT #OB04413==1; Wait for confirmation AX2
WAIT #OB04423==1; Wait for confirmation AX3
#IB04402=0;
#IB04412=0;
#IB04422=0;
;
;Infinite operation loop
WHILE 1==1;
  IF #IB0B020==1;  Bit0 in Input variable 2 (from PLC) is the 'start' signal
     #DB00000=0;
     ;In parallel we are checking the current in the drives
     ;and making the movement
     PARALLEL N2;
       WHILE #DB00000==0;
         IF #SL0214>20000; Torque in Axis 1
           #MB00000=1;
         ELSE;
           #MB00000=0;
```

```
            ENDIF;
            IF #SL0244>20000; Torque in Axis 2
              #MB00001=1;
            ELSE;
              #MB00001=0;
            ENDIF;
            IF #SL0274>20000; Torque in Axis 3
              #MB00002=1;
            ELSE;
              #MB00002=0;
            ENDIF;
           ;If any of the drives has a torque bigger than 200% we set a bit
;in an output variable (for PLC control)
            IF #MW0000>0;
              #OB0BA20=1;
            ENDIF;
          WED;
        JOINT;
          ;Pick and place sequence:
          ; - Go to 'pick piece' position
          MOVEL[J01]500 [J02]300 F200;
          ; - Pick the piece
          MOVE [J03]50;
          WAIT #IB0B001==1; Bit for 'Down operation completed'
          MOVE [J03]0;
          WAIT #IB0B002==1; Bit for 'Pick/place operation completed
          ; - Go to 'place piece' position
          MOVEL[J01]0 [J02]0 F100;
          ; - Place the piece
          MOVE [J03]50;
          WAIT #IB0B001==1;
          MOVE [J03]0;
          WAIT #IB0B002==1;
          ;Flag to indicate that the cycle has finished
          #DB00000=1;
        JWAIT;
      ENDIF;
    WEND;
    END;
```

Example 2

This example is the motion program for a ‘Bag making’ machine. The machine consist in a feeding roll that feeds the bag plastic film that is soldered and cutted. The program receives two data from the MMI (via the PC backplane): the feed length and the speed in bags/minute. With this data the program calculates, in a sub-program, the suitable profile (acceleration and deceleration ramps and maximum speed). The machine has two operation modes: without mark, that is, making a fixed movement; or with mark, that is, correcting the movement depending on the position of a printed mark. The cutter is activated by the program via a flag (bit).

The program for a real machine will need some modification as windowing of the registration mark, undetected marks alarm counter, etc.

```
PROG P005 Q00000001;Bag making
;-------------------------------------------------------------------------------
;Bag making with mark needs to configure a registration input in the
servodrive
;it is necessary to set P50108 (eg=xxxxxx03h) and Pn511 (eg=6xxxh)
```

```
as required.
;-------------------------------------------------------------------------------
;VARIABLES FROM/TO PLC:
;IW0B00 is bag length
;IW0B01 is speed (bag/min)
;IW0B02 is a bitwise word to give the bits to start (b0) and the confir-
mation
;       than the cutter is in the STOP position (b2)
;IW0B03 is the expected distance to move after the mark
;OW0BA0 Gives the START order to the cutter (rising edge)
;OTHER VARIABLES:
;MW0006 is the overflow value of the position, depends on the axis
settings and
;       must be higher than the maximum bag length
;MW0005 is the Offset value that must be applied to the workpiece co-
ordinate to
;       start from zero position.
;MW0002 is the maximum speed of the bag calculated in the sub-pro-
gram to match
;       the cycle.
;-------------------------------------------------------------------------------
;The example shows:
; - Use of sub-programs
; - Simple calculation
; - Parameter writing
; - Use of movements with registration
;-------------------------------------------------------------------------------

#MW0006=8192;
;Set the axes to RUN
#IB04402=1; AXIS1 on
WAIT #OB04403==1; Wait for confirmation AX1
#IB04402=0;
;
INC;
GOSUB P550;
;
WHILE 1==1;
;
  ;Update the ramps and maximum speed to match the cycle
  ;only when distance or speed changes
  IF #IW0B00<>#DW0000;
    GOSUB P550;
    #DW0000=#IW0B00;
  ENDIF;
  IF #IW0B01<>#DW0001;
    GOSUB P550;
    #DW0001=#IW0B01;
  ENDIF;
;
  ;Wait for cutter in STOP position
  WAIT #IB0B022==1;
;
  IF #IB0B020==0;
  ;Cutting without mark
```

```
    MOVE [J01]#IW0B00;
  ELSE;
  ;Cutting with mark
    MOVEI [J01]#IW0B00 D#IW0B03 V#ML0002;
  ENDIF;
;
  ;Activate bag cutter (rising edge in OB0BA00)
  DWELL T10;
  WAIT #SW0228==0; Check that the movement has finished
  #OB0BA00=1;
  DWELL T20;
  #OB0BA00=0;
;
WEND;
END;
```

```
PROG P550 Q00000000;Bag Making Profile Calculation
;Calculation of maximum speed and ramps
;To make the movement in the desired time
;Considering T/3 acceleration
;          T/3 at speed
;          T/3 deceleration
;---------------------------------------
;
#ML0010=60000/#MW0001; Time per bag (ms)
#ML0012=#ML0010/3; Acceleration time (ms)
PARAM P20105= #ML0012;
PARAM P20106= #ML0012;
;
#ML0002=#MW0000*3;
#ML0002=#ML0002/2;
#ML0002=#ML0002/#ML0010; Maximum speed
PARAM P20103=#ML0002;
PARAM P20101=#ML0002;
;
RETURN;
```

Example 3

This example describes the operation of a flying shear, to cut material to a programmed length on the fly. The example shows the use of a 'counter unit'. This counter unit (PL2900) is a Yaskawa device via Mechatrolink II that allows connecting to the system a line-driver encoder as master encoder.

```
PROG P006 Q00000011;Flying Shear with counter unit
;-------------------------------------------------------------------------
;In this example a counter unit is used to use an incremental line-driv-
er
;encoder as master axis (axis 5). Then:
; - P10501=5     (AXIS 5)
; - P10502=100   (I/O remote unit)
; - P10503=5     Number of input points
; - P10504=6     Number of output points
; - P10505=10051h First allocation address (corresponds with
IW0051)
;-------------------------------------------------------------------------
;Setting for the counter unit
#OW0050=0;
#OW0052=2; A,B pulses x4 multiplier
#OB00500=1; Counter initialization
```

```
WAIT #IB00501==1; Initialization completed
#OB00500=0;
#OB00503=1; Counter 1 enabled
;
;Set the axes to RUN
#IB04402=1; AXIS1 on
WAIT #OB04403==1; Wait for confirmation AX1
#IB04402=0;
;
WHILE 1==1;
  ;IW0B01 is the cutting length from the PLC
  #MW0000=#IW0B01-550;
  ;
  IF #IB0B000==1; START bit
    MOVELINK [J01]50 [J05]100 A100 D0; Acceleration synchronized
    MOVELINK [J01]200 [J05]200 A0 D0; Following part
    #OB0BA00=1; Activate shear
    MOVELINK [J01]50 [J05]100 A0 D100; Deceleration synchronized
    #OB0BA00=0; Stop shear
    MOVELINK [J01]-300 [J05]400 A100 D100; Return to origin
    MOVELINK [J01]0 [J05]#MW0000 A0 D0; Wait distance
  ENDIF;
WED;
END;
```

Example 4

This example shows how to handle with the safety and the sequence of other motion programs without the direct management of the PC. This is useful when you want a fast reaction or a local control in the MCH. Depending on the operation maybe it is necessary to disable some automatic data exchange between PC and MCH (P00007 and P00008).

```
PROG P000 Q00000000;SHELL
;--VARIABLES:
;----- OW0BA0=Alarm status
;----- OW0BA2=Shell status
;----- IW0B00=RUN/STOP/RESET from PLC
;----- DW0000=Auxiliary task variable
;----- MW0000=Application program status
;
#MW0000=0;
#OW0BA2=0;   Status= Initial
#DB00000=0;  Task variable: Rising edge to start program
GOSUB P500;  Initialization
#OW0BA2=1;   Status= Stopping programs
GOSUB P501;  STOP all programs
#OW0BA2=2;   Status= System stopped
;
WHILE 1==1;  Infinite loop
  ;Conditions to generate an alarm or warning
  #OB0BA00=#OB03000;  Any alarm active
  #OB0BA01=#IB0B002; Stop active
  #OB0BA02=!#SB021C4; Main power not active in axis 1
  #OB0BA03=!#SB024C4; Main power not active in axis 2
  #OB0BA04=!#SB027C4; Main power not active in axis 3
  #OB0BA05=!#SB02AC4; Main power not active in axis 4
  #OB0BA06=!#SB02DC4; Main power not active in axis 5
  ;
```

```
  IF #OW0BA0==0;   IF NO ALARM
    IF #OW0BA2<>4;
      #OW0BA2=2;System stopped
    ENDIF;
    IF #IB0B001==0;
      #DB00000=1;
    ENDIF;
    IF #IB0B001==1;
      IF #DB00000==1;
        #DB00000=0;
        GOSUB P502;
        #OW0BA2=4;  Programs running
      ENDIF;
    ENDIF;
  ELSE;           IF ALARM
    IF #OW0BA2==4; IF programs running
      #OW0BA2=1;  Stopping programs
      GOSUB P501; STOP programs
      #MW0000=0;
    ENDIF;
    #OW0BA2=3; System in Alarm or Warning
    #DB00000=0;
    IF #IB0B000==1;  Wait for the reset signal
      #IB03410=1;  Task 2 Alarm Reset
      #IB03420=1;  Task 3 Alarm Reset
      ;---- RESET FOR OTHER TASKS (if necessary) ----
      #IB04400=1;  Axis 1 Alarm Reset
      #IB04410=1;  Axis 2 Alarm Reset
      #IB04420=1;  Axis 3 Alarm Reset
      #IB04430=1;  Axis 4 Alarm Reset
      #IB04440=1;  Axis 5 Alarm Reset
      DWELL T10;
      #IB03410=0;
      #IB03420=0;
      #IB04400=0;
      #IB04410=0;
      #IB04420=0;
      #IB04430=0;
      #IB04440=0;
    ENDIF;
  ENDIF;
  ;
WEND;
;
END;
PROG P500 Q00000000;INITIALISATION
;-------------------------------------------------------------------
;INITIALISATION SUB-PROGRAM
;Put here all the initialization settings
;-------------------------------------------------------------------
#IB0440F=1;  Axis 1 in Automatic
#IB0441F=1;  Axis 2 in Automatic
#IB0442F=1;  Axis 3 in Automatic
#IB0443F=1;  Axis 4 in Automatic
#IB0444F=1;  Axis 5 in Automatic
```

```
#IB03417=1;  Override Task 1
;Override for the rest of the tasks
#IB0B002=1;  STOP is NC
#OW0BA0=0;
;etc.
RETURN;
PROG P501 Q00000000;STOP all Programs
;STOP MOTION PROGRAMS
#IB03414=1;    STOP Motion Task 2 immediately;
#IB03424=1;    STOP Motion Task 3 immediately;
WAIT #OB03411==0; Wait for confirmation;
WAIT #OB03421==0; Wait for confirmation;
#IB03414=0;
#IB03424=0;
;
;STOP AXES
#IB04403=1; AXIS1 off
#IB04413=1; AXIS2 off
#IB04423=1; AXIS3 off
#IB04433=1; AXIS4 off
#IB04443=1; AXIS5 off
WAIT #OB04403==0; Wait for confirmation AX1
WAIT #OB04413==0; Wait for confirmation AX2
WAIT #OB04423==0; Wait for confirmation AX3
WAIT #OB04433==0; Wait for confirmation AX4
WAIT #OB04443==0; Wait for confirmation AX5
#IB04403=0;
#IB04413=0;
#IB04423=0;
#IB04433=0;
#IB04443=0;
;
RETURN;
PROG P502 Q00000000;RUN Application program
;-------------------------------------------------------------------
;Load the suitable motion programs in its task and run the task 2 and
3
;-------------------------------------------------------------------
#IW0362=1;       Load program 1 in TASK 2
#IW0363=10000;   Override for task 1 to 100%
#IB03411=0;
DWELL T10;
#IB03411=1;      Start TASK 2 (Rising edge)
WAIT #OB03411==1; Wait for confirmation
#IB03411=0;
;
#IW0364=2;       Load program 2 in TASK 3
#IW0365=10000;   Override for task 3 to 100%
#IB03421=0;
DWELL T10;
#IB03421=1;      Start TASK 3 (Rising edge)
WAIT #OB03421==1; Wait for confirmation
#IB03421=0;
;
RETURN;
```

```
PROG P503 Q00000000;ALARM management
;-------------------------------------------------------------
;Write here the necessary actions to do in front of an alarm.
;Specially notifying to the PLC what happened
;-------------------------------------------------------------
#OW0BA1=1111;
RETURN;
```

SECTION 11
Troubleshooting

This section describes how to troubleshoot problems that may occur when using the CS1W-MCH71 Motion Control Unit.

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11-1 Troubleshooting

This section provides tables to refer to when a particular problem occurs. The tables provide a general description of the nature of various potential problems, the probable cause, items to check, and suggested countermeasures.

For more detailed explanations, refer to “11-2 COUNTERMEASURES” (page 11-9) onwards.

11-1-1 Items to Check First

If a problem occurs, investigate the problem after checking the following items first.

No.	Category	Items to check	Checked
1	Installation environment	Is the environment dusty?	
2		Are there any conducting materials (such as metals, carbon, etc.) in the environment that could get into the equipment?	
3		Is the ambient temperature higher than the level shown in the specifications?	
4		Is there excessive moisture (from humidity, water usage, etc.)?	
5		Are there corrosive materials in the environment (acid, salt, sulfur, etc.)?	
6		Is there a source of noise nearby (such as a welding machine or inverter)?	
7	Wiring	Are signal lines and power lines placed in separate ducts?	
8		Is the proper grounding provided?	
9		Does the power supply have a noise filter?	
10	Recent changes	Has there been recent construction (involving welding, and so on)?	
11		Has a power supply been added recently?	
12		Has there been changes or additions to the system (including programs)?	
13	Accidents	Was there any lightning nearby?	
14		Was there any interruption caused by a fuse or breaker?	
15		Is the power OFF?	

11-1-2 Problems and Countermeasures

- If any errors that are not covered in the following tables occur, print out the contents of the PC Interface Area and related DM Area words using the CX-Programmer or other Support Tools and provide them to your OMRON representative.
- If an operation cannot be properly executed, it may be that a program or parameters were not saved when they were transferred. Upload the parameters, programs, or position data from the MC Unit and open the file and check to be sure that the data was transferred and saved properly.
- If an operation cannot be properly executed, there may be an error in data or signal exchange between the ladder program and the MC Unit. Try performing the operation with the Support Tool. If the operation can be performed using the Support Tool, then there may be a problem with the ladder program. Use the CX-Programmer data trace function to check whether the data is being exchanged at the correct timing.

No.	Problem	Probable causes	Item to check	Remedy
1	The CPU Unit's RUN indicator does not light when the power is turned ON.	Power supply lines are wired incorrectly.	Check the power supply wiring.	Correct the power supply wiring.
2		The power supply voltage is low.	Check the power supply.	Check the power supply capacity and correct the power supply.
3		An internal fuse has blown.	Check the fuses.	Replace the fuse and determine what caused it to blow. (Refer to the troubleshooting section in the applicable CPU Unit operation manual).
4		The power supply is defective.	Check the power supply.	Replace the power supply.
5	Only the MC Unit's Run indicator fails to light when the power is turned ON.	The power supply capacity is insufficient.	Add up the power supply capacity for all of the Units mounted to the same Backplane, including the CPU Unit, and compare that to the power supply capacity of the Power Supply Unit. If the combined capacity of the Units is greater than that of the power Supply Unit, then they cannot be properly used.	• Increase the power supply capacity. • Change the configuration so that the power supply capacity at the Backplane is not exceeded.
6		The MC Unit is defective.		Replace the MC Unit.
7	Servo cannot be locked.	The MC Unit is not operating.	Is the RUN indicator lit?	Check No.5.
8		Instructions cannot be received from the ladder program because the MC Unit's operation mode is in the tool mode.	Check the operation mode using the support tool.	Set the mode to RUN mode or CPU mode.
9		Another axis control bit is ON at the same time.	• Check whether another axis control bit is ON at the same time. • Try executing Servo Lock using the support tool.	Turn OFF the other axis control bit and turn ON the bit [Servo Lock]. (Change the ladder program.)
10		The MC Unit is defective.		Replace the MC Unit
11	The motor is not turning.	The servo is not locked.	• Check whether the Servo Driver is operating. • Check the MC Unit axis status to see whether servo is locked.	Execute Servo Lock and then turn the motor. (Change the ladder program.)
12		The wiring is incorrect between the MC Unit and the Servo Driver.	• Check the wiring with a tester. • Change the connecting cables.	Correct the wiring.
13		A run prohibit input, such as POT or NOT, of W-series Servo Driver is enabled (OFF with default setting) (when Cn-01 bits 2 and 3 are 0).	Check the run prohibit inputs with the Support Tool.	• Turn OFF the Servo Driver run prohibit input. • Disable (ON with default setting) the Servo Driver run prohibit input.
14		The Servo Driver is in the internally set speed control mode (and is not receiving MC Unit speed reference).	Check the Servo Driver setting.	Correct the Servo Driver setting.
15		A Servo Driver alarm has occurred.	Check the contents of the Servo Driver alarm.	If there is an alarm, follow the instructions.
16		The mechanical axis is locked.	Check whether there is a mechanical limit or lock in effect.	Manually release the mechanical lock.
17		The MC Unit is defective.		Replace the MC Unit.

No.	Problem	Probable causes	Item to check	Remedy
18	Origin search cannot be executed.	An error or warning has been generated.	Check the contents of the error or warning.	If there is an error or warning, follow the instructions.
19		The Servo Driver's origin proximity input is wired incorrectly.	Use the Support Tool's input signal monitor function to check whether the sensors are turning ON and OFF normally.	Correct the wiring.
20		The communications cable to the Servo Driver is not correctly connected.	Check the communications cable.	Correct the wiring.
21		The direction of rotation does not match the direction of the limit input.	If axis rotation is reaching the mechanical limit without reversing direction, use the Support Tool to check whether the limit inputs are turning ON and OFF normally.	Correct the limit input wiring.
22		The limit input is wired incorrectly.	Check the limit input wiring.	Correct the limit input wiring.
23		Origin search cannot be executed because the Unit is in Automatic Mode. (Excluding DATUM command)	• Monitor the bit [Automatic Mode]. • Set the mode to Program Mode and forcibly set only the bit [Origin Search].	Set the mode to Manual Mode and then execute Origin Search. (Change the ladder program.)
24		Instructions cannot be received from the ladder program because the operating mode of the MC Unit is Tool Mode.	Check the operating mode with the Support Tool.	Set the mode to RUN Mode or CPU Mode.
25	Origin search cannot be executed.	Another axis control bit is ON at the same time.	• Check whether another axis control bit is ON at the same time. • Try executing Origin search using the Support Tool.	Turn OFF the other axis control bit and then turn ON the bit [Origin Search]. (Change the ladder program.)
26		Not entering the in-position range.	• Is the MC Unit parameter's in-position range too narrow? • Is the Servo Driver gain too low?	• Increase the MC Unit parameter's in-position range. • Increase the Servo Driver or MC Unit gain.
27		The origin search creep speed is too fast.	Check the origin search creep speed.	Decrease the origin search creep speed.
28		The parameters are set incorrectly.	Upload and check the MC Unit parameters with the Support Tool.	Set the parameters correctly, transfer them to the MC Unit, and write them to flash memory.
29		The MC Unit is defective.		Replace the MC Unit.
30	The origin established by the origin search sometimes changes.	There is some looseness in couplings or other mechanical connections.	Check whether there is any deviation from the markings at the couplings between the motor and axes, or at any other connections.	Tighten up the connections.
31		There is no origin margin.	Monitor the origin margin using the Support Tool. If the value is near the Servomotor's Encoder resolution x the ratio (1, 2, or 4), or near zero, a deviation of one motor revolution may occur at the time of the origin search due to even a minute change in the timing of sensor inputs.	Remove the motor coupling and adjust it by about a 1/4 turn, so that the origin margin pulses will be about 1/2 of the Servomotor's encoder resolution x the ratio (1, 2, or 4), and then try executing the origin search again.

No.	Problem	Probable causes	Item to check	Remedy
32	Motor rotation is unstable.	The parameters are set incorrectly.	Check the MC Unit parameters with the Support Tool.	Set the parameters correctly, transfer them to the MC Unit, and write them to flash memory.
33		The Servo Motor power lines and encoder lines are wired incorrectly.	Check the Servo Motor power lines and encoder lines.	Correct the wiring.
34		There is eccentricity in the couplings connecting the Servomotor axis and the mechanical system. There may be loose screws or load torque fluctuation due to the meshing of pulley gears.	Check the machinery. Try turning the motor with no load (i.e., with the machinery removed from the coupling).	Adjust the machinery.
35		The gain adjustment is insufficient.		• Execute Servomotor auto-tuning. • Manually adjust the Servomotor gain. • Adjust the servo parameters with the Support Tool.
36	Motor rotation is unstable.	The wrong Servomotor is selected (so it cannot be adjusted).	Check the torque and inertia ratio and select another Servomotor.	Change to a suitable Servomotor.
37		The Servomotor bearings are damaged.	Turn OFF the Servo Driver power. If the Servomotor has a brake, turn ON the brake power supply and release the brake, and then manually turn the motor's output shaft with the motor's power line disconnected (because the dynamic brake may be applied).	Replace the Servomotor.
38		The Servomotor windings are disconnected.	With a tester, check resistance between the Servomotor's U, V, and W power lines. There should be a proper balance between the line resistances.	Replace the Servomotor.
39	Rotation is reversed.	The Servo Driver is set for reverse rotation.	Check the System Parameter setting using the Support Tool.	Correct the setting for the direction of Servo Driver rotation.
40		During an origin search: The origin proximity sensor polarity does not match the parameter setting (in the MC Unit) for the origin proximity input polarity.	Check the parameter setting and the sensor polarity.	Correct the parameter setting.
41		During an origin search: The origin proximity input wiring is faulty.	With the Support Tool, check whether the origin proximity input status is correct.	Correct the origin proximity input wiring.

No.	Problem	Probable causes	Item to check	Remedy
42	The positioning completed signal is not output or is delayed. (The next operation cannot be started.)	The in-position range set in the MC Unit parameters is too narrow, and the axis is not in the in-position range. (If it is not in the in-position range, the next operation cannot be started because the preceding operation is not completed.)		Increase the in-position range set in the MC Unit parameters.
43		The Servo Driver gain is too low.		Adjust the Servo Driver gain and increase the MC Unit position loop gain.
44		The axis is not in the in-position range due to external pressure applied when positioning is stopped.	With the Support Tool, monitor the error counter and check whether the axis is in the in-position range.	If positioning is stopped outside of the in-position range due to external pressure (occurs in pressing application, etc.), Increase the in-position range in the Motion program.
45	There are unusual noises.	The machinery is vibrating.	Check for foreign objects in the machinery's moving parts, and inspect for damage, deformation, and looseness.	Make any necessary repairs.
46		The speed loop gain is insufficient. (The gain is too high.)		Perform auto-tuning. Manually adjust (decrease) the gain.
47		The wrong Servomotor is selected (so it cannot be adjusted).	Check the torque and inertia ratio and select another Servomotor.	Change to a suitable Servomotor.
48		There is eccentricity in the couplings connecting the Servomotor axis and the mechanical system.		Adjust the mounting of the Servomotor and machinery.
49	Vibration is occurring at the same frequency as the application frequency.	Inductive noise is being generated.	• Check whether the Servo Driver control signal lines are too long. • Check whether the control signal lines and power lines are bundled together.	• Shorten the control signal lines. • Separate the control signal lines and the power lines. • Use a low-impedance power supply for the control signal lines.
50		The control signals are not properly grounded.	• Check whether the control signal shield is properly grounded at the Servo Driver. • Check whether the control signal lines are in contact with the ground.	Correct the wiring.

No.	Problem	Probable causes	Item to check	Remedy
51	The motor axis is vibrating unsteadily.	The gain adjustment is insufficient. (The gain is too low.)		• Perform auto-tuning. • Manually adjust (increase) the gain.
52		The gain cannot be adjusted because the mechanical rigidity is too weak.	This particularly tends to occur in systems with vertical axes, scalar robots, palletizers, and so on, which place a torsion load on the axes.	• Increase the mechanical rigidity. • Re-adjust the gain.
53		The mechanical structure is producing stick slip (high-viscosity static friction).		• Perform auto-tuning. • Manually adjust the gain.
54		The wrong Servomotor is selected (so it cannot be adjusted).	Check the torque and inertia ratio and select another Servomotor.	Change to a suitable Servomotor.
55		The Servomotor or the Servo Driver is defective.		Replace the Servomotor or the Servo Driver.
56	There is slippage in positioning.	The slippage is not constant. Malfunction due to noise.	Is specified cable being used?	Use specified cable.
57		The shield is not properly grounded at the Servo Driver.	Check the ground wiring.	Correct the wiring.
58		The cable between the MC Unit and the Servomotor is too long.		The maximum cable length is 50 meters.
59		The cable between the MC Unit and the Servo Driver is not separated from other power lines.	Check whether the cable is separated from other power lines.	Separate the cable from other power lines.
60		There is malfunctioning due to noise from a welding machine, inverter, etc.	Check whether there is a device such as a welding machine or inverter nearby.	Separate the Unit from the noise source.
61		There is slippage in the mechanical system.	Check for slippage by marking the mechanical connections.	Tighten the connections.
62	Communications Alarm is generated.	There is incorrect connection of communications cable between the MC Unit and MLK devices.	Check the communications cable connection and breaking of wire.	• Correct wiring of the communications cable. • Replace the communications cable.
63	The MC Unit cannot receive absolute data (when an absolute encoder is used).	The Servo Driver's setup parameters are not correct.		W Series: Turn Off (0) Servo Driver parameter Pn002 digit No.2.
64	The absolute value read at turning ON is different from the one at turning OFF. (when an absolute encoder is used).	There is mechanical slippage.	Check whether the motor turns while the power is OFF.	
65		The Servo Driver parameter settings are not correct.	Check the Servo Driver parameters.	Turn Off (0) Servo Driver parameter Pn000 digit No.0 of the W ≡series

No.	Problem	Probable causes	Item to check	Remedy
66	The speed drops (comes to a temporary stop) during pass (continuous) operations.	The minimum pass time is not assured.	Calculate the travel time by dividing the travel distance by the speed, and check whether the minimum pass time is being satisfied.	Calculate the minimum pass time plus the operations in progress, and adjust the target distance and speed so that the travel time will be at least that much.
67	When the Motion Program is paused and then restarted, it starts over from the beginning instead of continuing from the pause.	When the bit [Motion Program Start] is turned ON at the restart, the bit [Start Mode] is '0' or '3'.	Check the ladder program or perform a data trace.	To resume program execution from the point where it was paused, make sure the bit [Start Mode] is either '1' or '2' before turning ON the bit [Motion Program Start].

11-2 Countermeasures

11-2-1 Error Diagnosis Function

- The error diagnosis function stops the system if normal operations become difficult due to system hardware or software malfunction, or stops programs and other such operations from operating due to some other cause.
- If an error occurs, LED output is generated, a four-digit hexadecimal alarm code is output to the words allocated in the CIO Area and system variable, and as a general rule, operation is stopped (by System stop, Execution stop, Deceleration stop, Emergency stop, or servo OFF).
- The error that has occurred is stored in the system variable as the error log. But it is not backed up. To save the error log even after a restart, use the IORD instruction to read the error log from the CPU Unit and then it must be saved in the CPU Unit.

Error Classification

MC Unit errors are classified into two types: Alarms, and warnings. Refer to the following table for explanations of each type.

Error type	Operation when error occurs	Servo OFF	Notification method	Clearing method
Alarm	System stop Servo OFF	Yes	LED lit Sets alarm bit and alarm code in the allocated area. • System variable • Error log **Note** But if it occurs when the power is turned ON, only method is the LED output.	• Alarm reset. • Turn the power supply OFF, then ON again. (Restart) • Replace the Unit.
	Immediate stop Deceleration stop Execution stop	No		
Warning	Continues	No	Sets warning bit in the allocated area.	• Warning does not have to be reset. • Cleared when the cause is removed.

Alarms

- The alarm status is output as LED, Alarm bit, Alarm code, and Error log.
- Alarms are categorized depending on the Alarm type and Alarm rank as shown below:

Alarm types

Alarms are categorized, depending on where they occurred, as shown below. The alarm code corresponding to the type is to be output:

Alarm type	Details	Alarm code
Unit-related alarm	Alarm related to the entire MC Unit	0001h – 00FFh
Reserved	---	1001h – 10FFh
Motion task-related alarm	Alarm related to motion tasks	2001h – 20FFh
Axis-related alarm	Alarm related to axes	3001h – 30FFh
MLK Device alarm	Alarm and warning detected in MECHATROLINK-II device	4000h – 40FFh

The lower byte (rightmost two digits) indicates the alarm code for the MECHATROLINK-II device. Since there is an alarm code [00h] in the servo driver, [4000h] is considered to be the alarm.

Alarm Ranks

Alarms are also categorized, depending on what they stop, as shown below:

Stop Rank	Generated Area	Unit status after occurrence	Recovery method
System stop	All	After Servo OFF (if it is possible), system shuts down.	Restart, turn power OFF then ON again, or replace the Module.
Servo OFF	Unit	Serve OFF for all the axes.	Remove the cause, and then reset the alarm.
	Motion task	Servo OFF for all the axes being used in the motion task.	
	Axis MLK device	Servo OFF only for the axis where the alarm was generated. If the axis is used in a motion task, stops the motion task. (Immediately stops the other axes).	
Immediate stop	Unit	Immediate stop for all the axes.	Remove the cause, and then reset the alarm.
	Motion task	Immediate stop for all the axes being used in the motion task.	
	Axis MLK device	Immediate stop only for the axis where the alarm was generated. If the axis is used in a motion task, stops the motion task. (Immediately stops the other axes).	
Deceleration stop	Unit	Deceleration stop for all the axes.	Remove the cause, and then reset the alarm.
	Motion task	Deceleration stop for all the axes being used in the motion task.	
	Axis MLK device	Deceleration stop only for the axis where the alarm is generated. If the axis is used in a motion task, stops the motion task. (Deceleration stop for the other axes).	
Warning	All	The operation is continued.	Remove the cause, and then reset the alarm. Note that, however, the following warnings do not require the alarm reset: • Teaching warning • Speed clamp warning • Start warning • Error counter warning

Note MLK device stands for the MECHATROLINK-II device.

Alarm Occurrence Sequence

When an alarm occurs, it is generated in the following sequence.

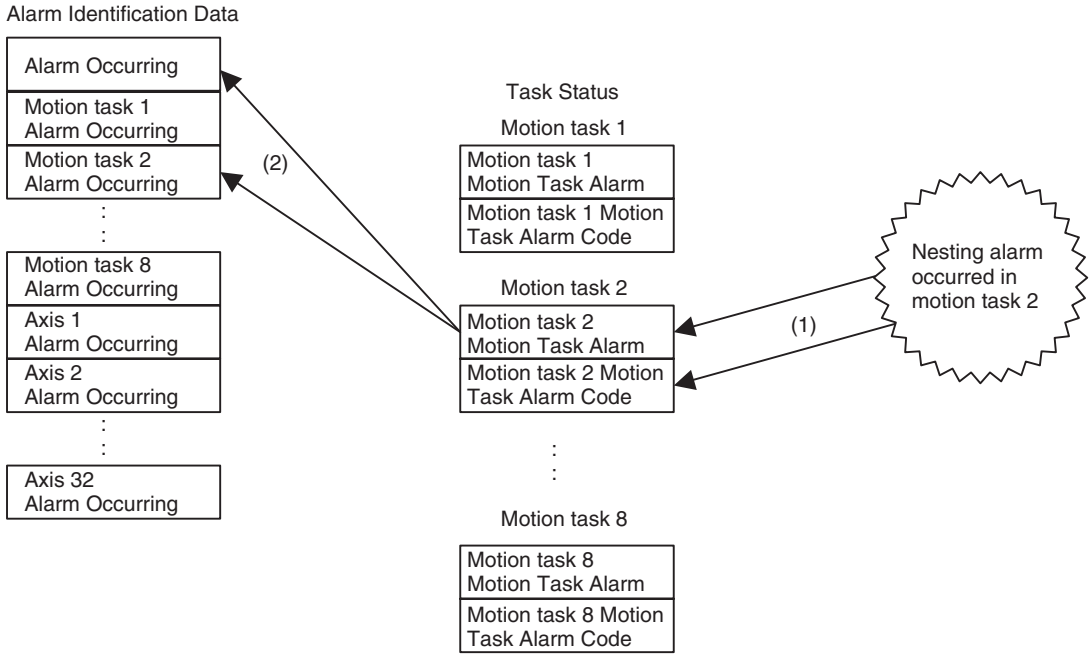
When a motion task-related alarm occurs:

1,2,3...

1. Task status
   The bit [Motion task alarm] is turned ON, and the alarm code is set.
2. Alarm identification data
   The bit [Alarm Occurring] is turned ON, and the bit [Motion Task Alarm Occurring] is turned ON.

(Processing Image)

Note The following diagram shows the case where an alarm (nesting error) occurs in motion task 2.



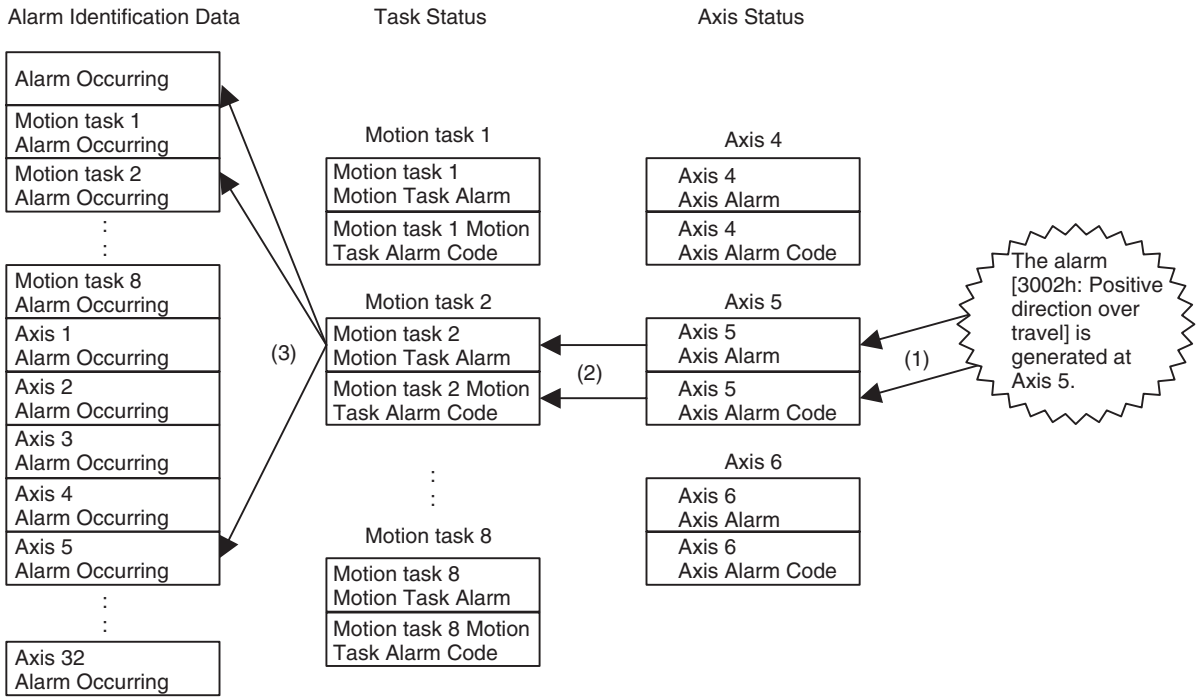
When an axis-related alarm occurs:

1,2,3...

1. Axis status
   The bit [Axis Alarm] is turned ON, and the alarm code is set.
2. Motion task status
   The bit [Motion Task Alarm] is turned ON, and the alarm code [2008h: Axis alarm generated] is set.
3. Alarm identification data:
   The bit [Alarm Occurring] is turned ON, the bit [Motion Task Alarm Occurring] is turned ON, and the bit [Axis Alarm Occurring] is turned ON.

(Processing Image)

Note The following diagram shows the case where the alarm [3002h: Positive direction over travel] occurs on the physical axis 5 when controlling the physical axes 4 to 6 with motion task 2.



Warnings

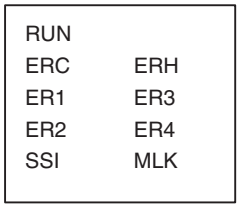
Warnings, though notified, have no effect on system operations. Warnings are output to the following bits:

Word	Name	Probable cause and remedy
n+15 d03	Teaching Warning	**If occurred when setting the teaching conditions:** • Teaching axes have not been specified. ([Teaching Axis Setting 1-16] = [Teaching Axis Setting 17-32] = 0) Set axes to be teaching objects appropriately. • There are axes among the ones specified as teaching objects in [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32] that have not been allocated. Check if the specified axes have been allocated correctly. • [Teaching Address] specified is outside of the position data range. Set the address within the range of “0 to 10239”. • Adding the No. of axes specified in [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32] to [Teaching Address] exceeds the position data range. Set the address so that it will not exceed “10239” even after the addition. **If occurred when executing teaching:** • [Teaching Execution] was turned ON without setting teaching conditions. Check if [Teaching Condition Setting Completed] is ON. • The bit [Command Disabled/Enabled] for any of the axes specified in [Teaching Axis Setting 1-16] and [Teaching Axis Setting 17-32] is OFF (disabled), or the bit [No Origin] for any of the axes is ON (No origin has been defined). Check the bits and correct them as needed. • Adding the No. of teaching axes to [Teaching Address Monitor] exceeds the position data range. Set the address so that it will not exceed “10239” even after the addition.
n+17 d04 : n+24 d04	Speed Clamp Warning (For each motion task)	Executing override to the speed specified in a motion program caused the speed to exceed [P2AA01: Maximum rapid feed rate] of axis parameters; The speed is being limited by the speed set in the parameter. Check if the override value is appropriate, or the setting of the maximum rapid feed rate is correct. (The operation does not stop.)

Word	Name	Probable cause and remedy
n+17 d05 : n+24 d05	Start Warning (For each motion task)	• A motion task was started when the bit [Deceleration Stop] or [Block Stop] had been ON. Check if the bits are OFF. • A motion task was started with [Motion Program No.] other than 0 to 499. Check if [Motion Program No.] is within 0 to 499. • The motion program specified with [Motion Program No.] does not exist. Create and download an appropriate program using the Support Tool, or check if the specified program No. is correct. • The axis status bit [Command Disabled/Enabled] for the axis specified with PROG command is OFF (Disabled). Check if the axis is in the command enabled state. • The axis status bit [Axis Not Used/Used] for the axis specified with PROG command is ON (Used). Check if the other tasks being executed are using the axis. • The axis status bit [Manual/Automatic Mode] for the axis specified with PROG command is OFF (Manual). Check if the specified axis is in Automatic Mode. • An alarm has occurred, or the unit status bit [External Forced Stop Request] is ON. Remove the cause of the alarm and reset the alarm.
x+32 d08 : x+63 d08	Error Counter Warning (For each axis)	• The error amount has exceeded the error counter warning value specified in the system parameter. Check if the specified error counter warning value is appropriate for the machine being used. (The operation does not stop.)
x+32 d11 : x+63 d11	MECHATROLINK Warning (For each axis)	• A warning has occurred on a MECHATROLINK slave. Check the applicable slave.

11-3 Error Indicators

The LED indicator at the top of the MC Unit's front panel indicates the following errors:



11-3-1 Errors During Initial Processing

The following table shows the errors that occur during the MC Unit's initialization processing:

Status	LED: ON: Lit, OFF: Not lit, -: Not change, *: Custom						
	RUN	**ERC**	**ERH**	**ER1**	**ER2**	**ER3**	**ER4**
Watchdog timer timeout error	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Unit No. setting error PLC Unit initial processing error Other CPU error FINS error during initial processing	OFF	OFF	ON	OFF	OFF	OFF	OFF
FINS error during restore	OFF	ON	OFF	OFF	OFF	OFF	OFF
Unit classification error	OFF	ON	ON	OFF	OFF	OFF	OFF
Hardware test error: FLASH error	OFF	ON	OFF	ON	OFF	OFF	OFF
Hardware test error: RAM error	OFF	ON	OFF	OFF	ON	OFF	OFF
Hardware test error: CPU error	OFF	ON	OFF	OFF	OFF	ON	OFF
Hardware test error: System software error	OFF	ON	OFF	OFF	OFF	OFF	ON

11-3-2 Errors During Normal Operation

Status	LED: ON: Lit, OFF: Not lit, -: Not change, *: Custom						
	RUN	ERC	ERH	ER1	ER2	ER3	ER4
PLC WDT error	-	-	ON	OFF	OFF	OFF	OFF
PLC cyclic service monitor error	-	-	ON→OFF (Recover)	-	-	-	-
Bus error (PC21 bus error)	-	-	ON	-	-	-	-
Power failure (power failure prevision)	-	-	-	-	-	-	-
CPU fatal error	-	-	ON	-	-	-	-
CPU non-fatal error	-	-	-	-	-	-	-
Event transmission warning generated	-	-	-	-	-	-	-
Panic generated	*	*	-	*	*	*	*
Unit level alarm generated	-	ON	-	ON	-	-	-
Motion task level alarm generated	-	ON	-	-	-	ON	-
Axis or MLK device slave node level alarm generated	-	ON	-	-	-	-	ON
Normal operation	ON	OFF	OFF	OFF	OFF	OFF	OFF
System stop	OFF	-	-	-	-	-	-

Refer to the sections *11-4 Unit-related Alarm Codes* to *11-6 Axis-related Alarm Codes* for details on the alarm codes.

Among these alarm codes, the code of the alarm generated first will be output to n+11 in the allocated bit area.

11-4 Unit-related Alarm Codes

Unit-related Alarm Codes (Codes: 0001h to 00FFh)

When a unit-related alarm occurs, the following bits will indicate the status:

Word	Address	Name
n+12.00	OB03000	Alarm Occurring
n+12.01	OB03001	Unit Alarm Occurring
n+15.01	OB03031	Unit Alarm
m+38	OW0310	Unit Alarm Code

List of Alarm Codes

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Main board code error	0370h	0003h	0003h	System code area error on the main board.	Any time	System stop	Disabled
Main board RAM error		0004h	0004h	RAM error in the main board.	Any time	System stop	Disabled
WDC error between the main board and sub-board.		0005h	0005h	WDC error was generated between the main board and sub-board.	Any time	System stop	Disabled
Internal HW-WDT error		0006h	0006h	Internal HW-WDT error	Any time	System stop	Disabled
Sub- board code error		0013h	0013h	System code area error on the sub-board.	Any time	System stop	Disabled
User program error		0026h	0026h	User program area error.	Any time	System stop	Disabled
CAM data error		0027h	0027h	CAM data area error	Any time	System stop	Disabled

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
PLC WDT error	0001h	0000h	0030h	WDT error on CPU Unit occurred. Follow the instructions in the applicable PLC manual.	Any time	System stop	Disabled
PLC cyclic service monitor error	0002h	Monitor Time [ms]	0031h	CPU Unit did not execute end refresh processing within cyclic service monitor time. Check end refresh prohibition in CPU system setup. If prohibited, cancel it and turn the power OFF once, and then ON again. Increase CPU Unit cyclic service monitor time and turn the power OFF once, then ON again.	Any time	Deceleration stop	Disabled
Bus error (PC21bus error)	000Eh	0000h	0032h	Bus error occurred between CPU Unit and MC Unit.	Any time	System stop (Including event)	Disabled
CPU fatal error	0015h	0000h	0033h	CPU fatal error occurred. Follow the instructions in the applicable PLC manual.	Any time	System stop	Disabled
CPU non-fatal error	0016h	0000h	---	Follow the instructions in the applicable PLC manual.	Any time	---	---

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Flash memory error	0370h	0040h	0040h	The following data could not be written in the Flash memory. • Protect data • ABS origin position data • System parameters • Servo parameters • Position data • User program • CAM data Try to save the data again. Replace MC Unit if this error persists after retrying several times.	When FLASH saving	Deceleration stop	Disabled
Unit deceleration stop		0041h	0041h	Deceleration stop input of MC Unit was turned ON. After confirming the safety in the surrounding area, turn OFF the bit [Deceleration Stop] and execute [Unit Alarm Reset].	When deceleration stop is input.	Deceleration stop	Enabled
CPU memory error		0044h	0044h	The following error occurred between CPU Unit and MC Unit: • This error occurs when custom data area or custom I/O area of MC Unit is allocated to CPU's EM area, and when the specified EM areas are overlapping in executing the file memory function of CPU Unit, or when restoring the power after allocating custom data area or custom I/O area to the EM area already specified with the file memory function. • Release the file memory function of CPU Unit, correct the allocation of the area used for the file memory function so that it does not overlap with the area used for custom data area or custom I/O area of MC Unit and reset the alarm, or correct the allocation of the area used for custom data area or custom I/O area so that it does not overlap with the area used for the file memory function and restore the power.	Any time	Deceleration stop	Enabled

11-5 Motion Task-related Alarm Codes

Motion task alarm codes are common for all tasks, but the alarm code output area is different for each task. The following are the alarms that occur in program execution.

Motion Task-related Alarm Code (Code: 2001h to 20FFh)

When a Motion task-related alarm occurs, the following bits will indicate the status:

Word	Address	Name
n+12.00	OB03000	Alarm Occurring
n+12.03 : n+12.10	OB03003 : OB0300A	Motion Task Alarm Occurring 1 : Motion Task Alarm Occurring 8
n+17.00 : n+24.00	OB03400 : OB03470	Motion task 1 Motion Alarm : Motion task 8 Motion Alarm
m+42 : m+70	OW0360 : OW037C	Motion task 1 Motion Task Alarm Code : Motion task 8 Motion Task Alarm Code

List of Alarm Codes

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
No Program	0372h - 0379h	2001h	2001h	The sub-program to be executed with GOSUB command does not exist. Create and download an appropriate program with the Support Tool, or check if the program No. specified by GOSUB is correct.	When GOSUB is executed.	Deceleration stop	Enabled
Sub-program nesting error		2002h	2002h	There are six or more sub-program nesting levels. Check the applicable program and correct the nesting to five levels or less.	When GOSUB is executed.	Deceleration stop	Enabled
Variable address error		2003h	2003h	Attempted to access the addresses other than “PL0000 to PL27FF” when specifying position data indirectly. Check the applicable program and correct the position data area specified indirectly to PL0000 to PL27FF.	When indirect specification is used	Deceleration stop	Enabled
Divide-by –zero alarm		2004h	2004h	Zero division has occurred in an operation command. Check if the calculation formula or the assigned values are correct.	When operation command is executed.	Deceleration stop	Enabled
Operation overflow		2005h	2005h	Operation result cannot be stored. Check if the calculation formula or the assigned values are correct.	When operation command is executed.	Deceleration stop	Enabled
Program error		2006h	2006h	The program to be executed is corrupted. Download the applicable program with the Support Tool, save it to the F-ROM, and restore the power. The followings can be the causes of the program destruction. • Destruction of data in memory due to external noise • The power of PLC (MC Unit) was turned OFF while writing to Flash memory was in progress.	When a program is executed.	Immediate stop	Disabled

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Axis reservation disable	0372h - 0379h	2007h	2007h	The axis that was declared in a program could not be reserved. • The operating mode is set to Manual Mode. Make sure the applicable axis is not in use, and switch to Automatic Mode. • The axis is used in another program. Wait until the program is completed, or stop the program to start ≅another program. • Axes to be used in subprogram are not reserved in the main program. Reserve all the axes to be used in the subprogram with PROG in the main program. • The axis that has not been declared was selected. Check if the axes to be used in the program are specified correctly. If the specification is correct, declare the axes with PROG. • In parallel execution, etc., a main program tried to use the axis already declared by a subprogram. Correct the program to operate the axis after the subprogram is completed. • In parallel execution, etc., a subprogram tried to declare the axis already being operated by a main program. Correct the program to call the subprogram after the block currently using the axis is completed.	When a program is executed.	Deceleration stop	Enabled
Axis alarm generated		2008h	2008h	An alarm has occurred in an axis controlled by a task. Remove the cause of the axis alarm, and reset the alarm.	When a program is executed.	Deceleration stop	Enabled
Position specification error		2009h	2009h	The position specified with axis movement commands (except for CAM), axis operation commands, SYNCR, MOVEMODI, OFFPOS, and LATCH exceeded the allowable position range. Since the range of pulse unit system is expressed in 32-bit, the allowable range has to satisfy the following formula: –Command unit limit ≤Command unit system position ≤ +Command unit limit Command unit limit [on machine] ≥ 2147483647 [on motor] × (P5AA04 [Command unit/1 machine rotation] × P5AA06 [on machine]) / (9001h [No. of encoder pulses/1 motor rotation] × P5AA05 [on motor]) Correct the applicable position to satisfy the formula above. When specifying with real numbers, check the setting value of the axis parameter [P5AA02: Position command decimal point position]. • With Traverse (MOVETRAV command): This error occurs when the operand “Winding axis rotations” = 0. Correct the program so that “Winding axis rotations” is not 0.	When a command including an operand is executed.	Deceleration stop	Enabled

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Speed specification error	0372h - 0379h	200Ah	200Ah	The following operands have exceeded the allowable range: • F (MOVEL, MOVEC, MOVETRAV), V (MOVEI, MOVET), SPEED command. Correct the applicable operands. When specifying with real numbers, check the setting value of the task parameter [P00M10: Interpolation feed decimal point position].	When a command including an operand is executed.	Deceleration stop	Enabled
Time specification error		200Bh	200Bh	The following operands have exceeded the allowable range: • T (MOVET, CAM, SPEED, TORQUE, SPEEDR, TORQUER, DWELL) Correct the applicable operands. • With Time-specified Positioning (MOVET command): [Speed of each axis] = Travel distance of each axis/Positioning time This error occurs when the speed specified by the above formula exceeds the axis–speed parameter [P2AA01: Maximum rapid feed rate]. Check if the setting of the parameter is correct, and if so, correct the program.	When a command including an operand is executed.	Deceleration stop	Enabled
Number specification error		200Ch	200Ch	The following operands have exceeded the range: • C (WORK, OFFPOS), E, S (CAM, CAMBOX, FOR) Correct the applicable operands. • With CAM, CAMBOX: This error occurs when setting the operands as [Starting data number] = [Ending data number], or when setting the operands as [Starting data number] ≥ [Ending data number] in using global general variables or position data for cam data. • When using cam table for cam data, correct the program as [Starting data number] ≠ [Ending data number]. When using global general variables or position data, correct the program as [Starting data number] < [Ending data number].	When a command including an operand is executed.	Deceleration stop	Enabled
Count specification error		200Dh	200Dh	The following operands have exceeded the range: • L (MOVEC, MOVETRAV, FOR), N (PARALLEL, SFTR, SFTL, XFER, CLEAR) Correct the applicable operands. • With PARALLEL: This error occurs when setting the value exceeding the Max. No. of branches for the unit (the value set in the system parameter [P00002: No. of parallel branches]). Either correct (increase) the system parameter [P00002: No. of parallel branches], or correct (decrease) the No. of branches of the PARALLEL command for the motion program.	When a command including an operand is executed.	Deceleration stop	Enabled

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Mode specification error	0372h - 0379h	200Eh	200Eh	The following operand has exceeded the range. • Q (MOVEC, MOVETRAV, MOVELINK, CAMBOX) Correct the applicable operands.	When a command including an operand is executed.	Deceleration stop	Enabled
Other operand error		200Fh	200Fh	The following operands have exceeded the range. • K (CAM, CAMBOX) • B (MOVELINK, CAMBOX, CONNECT, SYNC, ADDAX) • TORQUE • SIN, COS, ASIN, ACOS, SQT, LGN, BIN, BCD Correct the applicable operands.	When a command including an operand is executed.	Deceleration stop	Enabled
---		2010h	2010h	---	---	---	---
Circular interpolation travel distance over		2011h	2011h	Travel distance specified in MOVEC is too great. • The tangent arc length has exceeded 2147483647. Check the program and correct the setting value so that it will not exceed the allowable range. (When specifying with variables, check if the substitution formula is correct.) • The radius has exceeded 2147483647. Check the program and correct the setting value so that it will not exceed the allowable range. (When specifying with variables, check if the substitution formula is correct.)	When MOVEC is executed.	Deceleration stop	Enabled
Circular interpolation radius error		2012h	2012h	The following instructions have been given in MOVEC. In Radius specification: The radius is specified to 0. • Check the program and correct the radius to the value larger than 0. (When specifying with variables, check if the substitution formula is correct.) • In Center specification: The start or end point, and the center are at the same position. Check the program and correct it so that the start or end position are not on the center.	When MOVEC is executed.	Deceleration stop	Enabled

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Control mode error	0372h - 0379h	2014h	2014h	• A position control command (MOVE, etc.) or speed control command (SPEED) was executed during Torque control (TORQUE). Correct the program so that position control commands or speed control command will not be executed during TORQUE execution. • SPEED or TORQUE was executed during position control command execution. Correct the program so that SPEED or TORQUE will not be executed during position control command execution. • Position control commands other than MOVE was executed during SPEED command execution. Correct the program so that any position control command other than MOVE will not be executed during SPEED command execution.	When TORQUE/ Position control command/ SPEED is executed.	Deceleration stop	Enabled
---		2015h	2015h	---	---	---	---
Same axis specification multiplicity		2016h	2016h	• Multiple commands were executed on the same one axis using parallel branches. (Or when a main program is trying to use the axis being used by the subprogram called by the main program, etc.) Correct the program so that multiple commands are not executed on one axis from multiple rows in the program. • Axis movement command was executed on the axis, which is in synchronous execution as a slave axis. Correct the program so that any axis movement command will not be executed during synchronization. • The axis, which was specified as a slave axis has been a slave axis of the different type of synchronous command. Correct the program so that any slave axis is not shared between commands. • When a command requiring a latch input was executed, and the latch range parameter is being written, another latch-requiring command was executed on the same axis. Correct the program so that any latch-requiring command will not be executed on the same axis, or the timings do not overlap.	When a program is executed.	Deceleration stop	Enable
---		2017h	2017h	---	---	---	---
Synchronous slave axis specification error		2018h	2018h	The axis that is specified as a slave axis has already been used as the master axis. When an axis is to be operated as a slave axis of an axis and the slave axis is to be used as a master axis of another axis, the program (to change the order of specification) has to be arranged so that the axis is specified as a slave axis of an axis first, and then as a master of another axis.	When synchronous command is executed.	Deceleration stop	Enabled

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Parameter setting error	0372h - 0379h	2019h	2019h	<PARAM> System parameters: • Attempted to change a parameter that cannot be changed after restoring the power. • Attempted incorrect parameter setting. Check the program so that correct values can be set. (When specifying with variables, check if the substitution formula is correct.) Servo parameters: • Attempted to change a parameter that cannot be changed after restoring the power. • Attempted to set incorrect setting value • Attempted to set incorrect number. • Attempted to change parameter of other tasks or undeclared axes. Check and correct the program so that correct values can be set. (When specifying with variables, check if the substitution formula is correct.) • Attempted to set servo parameters on virtual axes or I/O axes. Servo parameters cannot be set on virtual axes and I/O axes. Correct the program. <LATCH> • The contents of [900Ah: Positive latch enabled range] and [900Bh: Negative latch enabled range] in the motor parameters are not written correctly. After checking the applicable axis and if the motor model is correct, transfer the motor parameters and save them to F-ROM (when individual, specify servo parameter), and restore the power. <SPEED> • The contents of [900Dh: Position loop gain] and [900Eh: Position loop gain index] in the motor parameter are not written correctly. After checking the applicable axis and if the motor model is correct, transfer the motor parameters and save them to F-ROM (when individual, specify servo parameter), and restore the power.	When PARAM, LATCH, SPEED are executed.	Deceleration stop	Enabled
Axis declaration error		201Ah	201Ah	Axis other than servo/virtual axis is included in the axis declaration. Check the parameter [P1AA02: MECHATROLINK-II device classification] of the applicable axis. If the setting of the parameter is correct, correct the program.	When PROG is executed.	Deceleration stop	Enabled

11-6 Axis-related Alarm Codes

Axis related alarm codes are common for all axes, but the alarm code output area is different for each axis.

Axis-related Alarm Code (Code: 3001h to 30FFh)

When an axis-related alarm occurs, the following bits will indicate the status:

Word	Address	Name
n+12.00	OB03000	Alarm Occurring
n+13.00 : n+14.15	OB03010 : OB0302F	Axis Alarm Occurring 1 : Axis Alarm Occurring 32
x+32.00 : x+63.00	OB04400 : OB045F0	Axis 1 Axis Alarm : Axis 32 Axis Alarm
d+32 : d+125	OW0480 : OW04DD	Axis 1 Alarm Code : Axis 32 Alarm Code

List of Alarm Codes

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
---	037Ah - 0399h	3001h	3001h	---	---	---	---
Over travel, positive direction		3002h	3002h	• The over travel signal in positive direction has turned ON during axis movement. • After resetting the alarm, attempted to operate the axis in the positive direction with the positive direction over travel signal ON. Move the axis in the negative direction manually.	Any time	Immediate stop	Enabled
Over travel, negative direction		3003h	3003h	• The over travel signal in negative direction has turned ON during axis movement. • After resetting the alarm, attempted to operate the axis in the negative direction with the negative direction over travel signal ON. Move the axis in the positive direction manually.	Any time	Immediate stop	Enabled
Over travel, both directions		3004h	3004h	• The over travel signals in both directions have turned ON during axis movement or when the axis was about to move. • After resetting the alarm, attempted to operate the axis with the over travel signals in both directions ON. Check if the over travel signals for both directions are wired correctly.	Any time	Servo OFF	Enabled
Software limit, positive direction		3005h	3005h	• The axis entered the software limit area in positive direction during axis movement with the origin defined. Check if the setting value of the axis parameter [P3AA02: Positive direction software limit] is correct. (The error may occur when executing circular interpolation right on the software limit values.) If the setting value is incorrect, set a larger limit value. When the value is correct, correct the program or travel distance of the axis.	Any time	Deceleration stop	Enabled

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Software limit negative direction	037Ah - 0399h	3006h	3006h	• The axis entered the software limit area in negative direction during axis movement with the origin defined. Check if the setting value of the axis parameter [P3AA02: Negative direction software limit] is correct. (The error may occur when executing circular interpolation right on the software limit values.) If the setting value is incorrect, set a larger limit value. When the value is correct, correct the program or travel distance of the axis.	Any time	Deceleration stop	Enabled
Servo OFF		3007h	3007h	• The axis that received a movement command is in Servo OFF state. (In operations with programs, this alarm will occur when the applicable axis is specified at the beginning of the block and a movement command is executed for the axis that is in Servo OFF state.) Switch the axis to Servo lock state. • Servo OFF was executed for the axis receiving a movement command. Do not execute Servo Unlock during axis movement.	When axis movement starts/ During axis movement.	Servo OFF	Enabled
Synchronous communications alarm		300Ah	300Ah	An error was occurred in the MECHATROLINK synchronous communications. The followings are the possible causes: • Disconnection, breakage of MECHATROLINK cable Check the MECHATROLINK cable. • Communications error caused by noise Remove the cause of the noise. When this error persists even after providing these remedies, the Driver (NS115) or MC Unit may be broken. Replace the broken one with a new unit.	Any time	Servo OFF	Enabled
Communications alarm		300Bh	300Bh	Detected MECHATROLINK communications errors twice in a row. Or the No. of error detections specified in [P1AA06: MECHATROLINK-II communications error detection setting] has been exceeded. The followings are the possible causes: • Disconnection, breakage of MECHATROLINK cable Check the MECHATROLINK cable. • Communications error caused by noise Remove the cause of the noise. When this error persists even after providing these remedies, the Driver (NS115) or MC Unit may be broken. Replace the broken one with a new unit.	Any time	Servo OFF	Enabled

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Command timeout	037Ah - 0399h	300Ch	300Ch	A MECHATROLINK command could not be completed within a fixed period of time (10 seconds). The followings are the possible causes: • Disconnection, breakage of MECHATROLINK cable Check the MECHATROLINK cable. • Communications error caused by noise Remove the cause of the noise. When this error persists even after providing these remedies, the Driver (NS115) or MC Unit may be broken. Replace the broken one with a new unit.	Any time	Servo OFF	Enabled
Absolute encoder error		300Dh	300Dh	Data from the ABS encoder could not be processed normally. • Initial multi-turn value exceeds the multi-turn limit. Set the same value in the driver parameter [Pn205: Multi-turn limit setting] and the motor parameter [900C: Multi-turn limit]. After the setting is completed, restore the power, reset the alarm, and perform the origin setting. • After origin setting, the following values related to B/A were changed. **Note** B = No. of encoder pulses × P5AA05 A = P5AA04 × P5AA06 B/A is integer calculation and the result is to be reduced. After the change was made (saving to F-ROM), restore the power, reset the alarm, and perform origin setting. • The multi-turn limit value in the driver parameter or the motor parameter was changed after origin setting. After the change was made (saving to F-ROM), restore the power, reset the alarm, and perform origin setting. (When the multi-turn value of the driver parameter was changed, make sure to perform "Absolute encoder multi-turn amount setting change" on the driver.) • Servo driver is set as an incremental encoder. Set the driver parameter Pn002 digit No. 2 to "0" (used as an absolute encoder) and restore the power. • Disconnection, breakage of encoder cable Check the encoder cable. • Communications error caused by noise Remove the cause of the noise. When this error persists even after providing these remedies, the encoder or MC Unit may be broken. Replace the broken one with a new unit.	When synchronous communications starts	Servo OFF	Enabled

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Over travel already ON	037Ah - 0399h	300Eh	300Eh	The limit switch in the direction of the search was already ON when a one direction-mode origin search was executed. Check the status of the limit switch in the origin search start direction. Also check and correct the origin search start position. (See *8-4 Origin Search Operations* (page 494) for details.)	In origin search	Immediate stop	Enabled
Origin proximity reverse alarm		300Fh	300Fh	The limit reversal mode origin search cannot be performed because the limit switch in the direction of the search turned ON while the search was reversing. Check the status of the limit switch in the origin search start direction. And check and correct the positions of the origin proximity limit switch and the limit switch.	In origin search	Immediate stop	Enabled
Over travel reverse alarm		3010h	3010h	The limit reversal mode origin search cannot be performed because the limit switch or deceleration LS in the opposite direction of the search turned ON while the search was reversing due to over travel signal ON in the direction of the origin search. Check the status of the limit switch in the origin search start direction. And check and correct the positions of the origin proximity limit switch and the limit switch.	In origin search	Immediate stop	Enabled
Synchronous slave axis speed over		3011h	3011h	With synchronous commands (MOVELINK, CAMBOX, CONNECT, SYNC, ADDAX), the speed of the slave axis exceeded the speed specified in [P2AA01: Maximum rapid feed rate]. Check if the setting value in the parameter is correct. If it is correct, correct the program. With CAMBOX, check also the displacement of the CAM data.	When a program is executed	Deceleration stop	Enabled
Excessive error alarm		3012h	3012h	Position error exceeded the setting value of the axis parameter [P3AA06: Position error alarm detection value]. Check if the set value is appropriate for the system configuration and correct it as needed. When the value is correct, check the followings: • Breakage of encoder cable • Malfunction caused by noise • Unadjusted servo system • Unadjusted or unprepared machine system These causes are to be removed.	Any time	Servo OFF	Enabled
MECHATROLINK-II slave axis error 1		3013h	3013h	An error occurred on a MECHATROLINK-II slave axis. Check the MECHATROLINK slave of the applicable node No. and remove the cause of the error.	Any time	Servo OFF	Enabled

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
MECHATROLINK-II slave axis error 2	037Ah - 0399h	3014h	3014h	An error occurred on a MECHATROLINK-II slave axis. Check the MECHATROLINK slave of the applicable node No. and remove the cause of the error.	Any time	Deceleration stop	Enabled
Axis classification error		3015h	3015h	Attempted to execute a command that cannot be executed as an axis. (The command that requires an external signal (MOVEI, etc.) was executed on the virtual axis, or the winding axis of MOVETRAV is not set as an unlimited length axis, etc.) Correct the applicable parameters or program.	When a command is executed.	Deceleration stop	Enabled
No origin proximity signal		3016h	3016h	During an origin search in the limit reversal mode, there was no deceleration limit switch in between over travel of both directions. Provide the origin proximity limit switch, or check if the limit switches themselves or wiring is normal.	In origin search	Immediate stop	Enabled
Origin proximity and over travel simultaneously ON		3017h	3017h	During an origin search, the deceleration limit switch and the over travel in direction of the search were turned ON simultaneously. Check if the origin proximity signal, or over travel signals for both directions are wired correctly.	In origin search	Immediate stop	Enabled
No origin signal		3018h	3018h	During an origin search, the over travel signal turned ON while waiting for the origin signal (while waiting for the rise of phase-Z after the fall (ON to OFF) of the origin proximity limit switch). Check if the settings of the axis parameter [P4AA06: Origin determine signal] and the servo parameter [Pn511: Input signal select 5] are correct (if the applicable signal is enabled). If the settings are correct, check the followings: • Problem on Phase-Z of the encoder • Breakage of encoder cable • Too small distance between the origin proximity limit switch and the limit switch These causes are to be removed.	In origin search	Immediate stop	Enabled

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Excessive speed command	037Ah - 0399h	3019h	3019h	The axis speed has exceeded maximum rapid feed rate during the following command execution: • MOVEL (Axes except for the one with the longest travel distance) • MOVEC (Linear axis: if not specified with the tangential speed of the circular interpolation portion.) • MOVETRAV (Traverse axis) • CAM Check if the speed set in [P2AA01: Maximum rapid feed rate] is correct. If it is not correct, set a higher speed. If it is correct, lower the feed rate of the program or lower the speed using override.	When a program is executed	Deceleration stop	Enabled
Counter latch resource violation		301Ah	301Ah	With DATUM, MOVEI, MOVELINK, CAMBOX, SYNC, and LATCH commands, attempted to execute the functions simultaneously that require the counter latch. Check the axis specified for the Latch and correct the program so that there are no redundant specifications (executing LATCH command on the axis already executing LATCH command, executing LATCH command on the axis waiting for the synchronization start conditions to be satisfied, or etc.).	When a command that needs counter latch function is executed	Deceleration stop	Enabled
Gear ratio range error		3040h	3040h	Relations between the No. of encoder pulses and command unit is not normal. When the following expression is not satisfied, the error will occur: 1/7FFFFFFFh ≤ B/A ≤ 7FFFFFFFh **Note** B = No. of encoder pulses × P5AA05 A = P5AA04 × P5AA06 B/A is integer calculation and the result is to be reduced. Set the parameters so that the formula above is satisfied.	Real axis: When connected Virtual axis: When power is ON	Servo OFF	Disabled

11-7 MLK Device Alarm Codes

MLK(MECHATROLINK-II) device alarm codes are valid for all axes, but the alarm code output area is different for each axis.

MLK Device Alarm Code (Code: 4000h to 40FFh)

Alarm occurring and alarm codes are set in the following allocations.

Word	Address	Name
n+12.00	OB03000	Alarm Occurring
n+13.00 : n+14.15	OB03010 : OB0302F	Axis Alarm Occurring 1 : Axis Alarm Occurring 32
x+32.00 : x+63.00	OB04400 : OB045F0	Axis 1 Axis Alarm : Axis 32 Axis Alarm
d+32 : d+125	OW0480 : OW04DD	Axis 1 Alarm Code : Axis 32 Alarm Code

List of Alarm Codes

Name	Error log		Alarm code	Cause and remedy	Timing	Rank	Reset
	Error code	Detail code					
Depending on the device	037Ah - 0399h	4000h + Alarm code of each device	4000h + Alarm code of each device	Depending on the device. Follow the directions of the applicable manuals.	Depending on the device	Depending on the device	Enabled

For details of the alarm codes, refer to the following manuals of YASKAWA ELECTRIC CORPORATION.

- Σ-II SERIES SGDH MECHATROLINK-II APPLICATION MODULE USER'S MANUAL
  MODEL: JUSP-NS115 (MANUAL NO. SIEPC71080001*)
- Machine Controller MP900 Series MECHATROLINK System USER'S MANUAL
  (MANUAL NO. SIEZ-C887-5.1)

The operations are stopped according to the rank of [MECHATROLINK-II slave axis error 1] or [MECHATROLINK-II slave axis error 2]. Although it is written that the alarm resets are all enabled, the alarms that cannot be reset on the slave side will be detected again.

11-8 Servo Driver Warnings

The W-series Servo Drivers provide various warnings. The warning, causes, and corrections are given in the following table.

Display	Name	Cause and correction
A.91	Overload	This warning is given before an overload alarm (A.71 or A.72) is reached. An alarm is likely to occur if operation is continued without any changes. Check the load to see if it is suitable.
A.92	Regenerative overload	This warning is given before a regeneration overload alarm (A.32) is reached. An alarm is likely to occur if operation is continued without any changes. Check the load to see if it is suitable.
A.94	Data setting warning	A setting was made out of range using MECHATROLINK-II communications. Check the data number and data setting range specified with the PARAM command or the personal computer Support Software.
A.95	Command warning	The command received via MECHATROLINK-II communications could not be executed under the current conditions. This warning will occur under conditions like the following: • An attempt was made to lock the servo when the Servo Driver's main circuit was OFF. • An attempt was made to read or write Servo Driver parameters using the PARAM command or the Miel while communications were in progress for the Digital Operator or W-Mon. • The same station address (node address) is set for more than one node.
A.96	Communications warning	A communications error has occurred. If a communications warning occurs twice consecutively, a communications alarm (A.E6) will occur. This warning will occur under conditions like the following: • The same station address (node address) is set for more than one node. • Vibration, Shock, or Peripheral Device Noise Take the following countermeasures against vibration, shock, and peripheral device noise. Vibration/Shock Countermeasures • Make sure the communications connector is inserted properly. • Check for vibration and shock in the equipment or peripheral devices when A.96 occurs. If there is any suspect vibration or shock, take measures in the equipment so that the vibration or shock is not transmitted to the motion control system. • Remove any stress being applied to the cables in bundling or wiring them. Noise Countermeasures • An noise-isolating transformer is installed for each system to separate power supply circuits so that noise does not affect other systems. Separate power supplies are installed as follows: • Do not use a power supply for more than one system. • Use wiring with minimal voltage drop from the power reception system to the equipment. • Wire the system using separate paths from other systems. • Use an independent ground for the secondary side of the transformer with an independent ground pole. • Separate power lines as far as possible from signal lines to prevent inductive noise (30 cm min. recommended). • Place power lines in a metal conduit pipe and ground the pipe. • Use shielded cables, twisted-pair cables, etc., for signal lines and keep wiring distances as short as possible. • Do not bundle power lines together with signal lines or run them parallel with signal lines. • Ground the common of the shield in shielded cables at only one point. Do not create loops by connecting more than one point. • Ground to 100 Ω or less. • To reduce common impedance, connect ground wires from the equipment to the ground plate in star connections. • Do not use crossover wiring to wire grounds.

11-9 Error Log

Up to twenty errors detected and notified on the MC Unit can be stored in the system variable in the MC Unit as the error log.

The system variables (error log) will be cleared when the power is restored or the Unit is restarted. To store the error log, use the IORD instruction to make the CPU Unit read and store it.

The error log is composed of 2 words for the number of stored records, and 120 (6 words × 20 error records) words.

11-9-1 Area Configuration

Variable addresses	IORD addresses	Name	Description
SW0010	3008h	Error log: No. of stored records	Outputs the number of errors occurred after the power ON. 0-20
SW0011		Error log: No. of actual records	Outputs the number of errors occurred after the power ON. 0-64000
SW0012	3009h	Error log 1: Error code	Outputs the code of the error.
SW0013		Error log 1: Detailed data	Outputs detailed data of the error.
SW0014	300Ah	Error log 1: Minute, Second	Outputs minutes and seconds of the time when the error was generated.
SW0015		Error log 1: Day, Hour	Outputs days and hours of the time when the error was generated.
SW0016	300Bh	Error log 1: Year, Month	Outputs year and month of the time when the error was generated.
SW0017		Reserved	Reserved
:			
SW0084	3042h	Error log 20: Error code	Outputs the code of the error.
SW0085		Error log 20: Detailed data	Outputs detailed data of the error.
SW0086	3043h	Error log 20: Minute, Second	Outputs minutes and seconds of the time when the error was generated
SW0087		Error log 20: Day, Hour	Outputs days and hours of the time when the error was generated.
SW0088	3044h	Error log 20: Year, Month	Outputs year and month of the time when the error was generated.
SW0089		Reserved	Reserved

- Errors are recorded up to 20 starting from the oldest error stored as Error log 1.
- From the 21st error on, the oldest error is deleted and the newest is overwritten. For example, the 21st error is stored in the Error log 1, the 22nd error is stored in the Error log 2, and so on.
- The newest error is stored in the Error log with the number indicated by the remainder of dividing SW0011: Error log No. of actual records by 20.

Error code

The error codes are classified into the CPU errors and MC Unit errors.

CPU Error Codes

Error code (Hex)	Error name	Detailed code		Cause
		1st byte	2nd byte	
0001	CPU WDT error	00	00	The watchdog timer alarm occurred on CPU Unit. Provide remedy following instructions in the manual of the CPU Unit.
0002	CPU cyclic service monitor error	Monitor time (ms)		Time out of the cyclic monitor time. The followings are the possible causes: • End refresh is prohibited on CPU Unit. • The scan time of CPU Unit is too long. Remedies: Enable end refresh Set the longer cyclic monitor time.
000E	CPU bus error	00	00	CPU Unit Bus error
0015	Fatal CPU error	00	00	Fatal error occurred on CPU Unit. Check if MC Unit is mounted on the backplane correctly. If the error persists even after the checking and correction, CPU Unit or the backplane may be broken. Replace it as needed.
0016	Non-fatal CPU error	00	00	Non-fatal error occurred on CPU Unit. Provide remedy following instructions in the manual of CPU Unit.
0108	Routing error	In a command: When SNA < 80 Hex D7:OFF D6 to D0:SNA	D7 to D0:SA1	Transfer not possible because there is no Unit for the specified unit number Normally, this error does not occur. If it should occur, report to OMRON.
010D	Routing error	SNA>=80Hex D7:OFF D6 to D0:0	D7 to D0:SNA (SNA>=80Hex)	Transfer not possible because the destination address in the routing table has not been set. Normally, this error does not occur. If it should occur, report to OMRON.
010E	Routing error	In a response: When DNA<80Hex D7:ON	D7 to D0:DA1	Transfer not possible because of a routing table error. Normally, this error does not occur. If it should occur, report to OMRON.
0118	Incorrect packet error	D6 to D0:DNA DNA>=80Hex D7:ON	D7 to D0:DNA	An incorrect packet has been transferred. Normally, this error does not occur. If it should occur, report to OMRON.
0124	Routing error	D6 to D0:0	(DNA>=80Hex)	Routing not possible because the maximum frame length has been exceeded. Normally, this error does not occur. If it should occur, report to OMRON.
0601	Panic generated	Panic data		Set if trap processing has been executed. Normally, this error does not occur. If it should occur, report to OMRON.

MC Unit Error Codes

In the detailed codes of each error, the alarm code of each error is set. Therefore, all the alarms will be stored in the error log.

Error code (Hex)	Error name	Detailed code		Cause
		1st byte	2nd byte	
0370	Unit-related alarm	Code of the alarm that has occurred		An alarm related to the Unit has occurred. The same remedy of the corresponding alarm code should be provided.
0371	Reserved			
0372	Motion task 1 Alarm	Code of the alarm that has occurred		An alarm related to motion task 1 has occurred. The same remedy of the corresponding alarm code should be provided.
0373	Motion task 2 Alarm	Code of the alarm that has occurred		An alarm related to motion task 2 has occurred. The same remedy of the corresponding alarm code should be provided.
:	:	Code of the alarm that has occurred		:
0379	Motion task 9 Alarm	Code of the alarm that has occurred		An alarm related to motion task 8 has occurred. The same remedy of the corresponding alarm code should be provided.
037A	Axis 1 Alarm	Code of the alarm that has occurred		An alarm related to axis 1 has occurred. The same remedy of the corresponding alarm code should be provided.
037B	Axis 2 Alarm	Code of the alarm that has occurred		An alarm related to axis 2 has occurred. The same remedy of the corresponding alarm code should be provided.
:	:	Code of the alarm that has occurred		:
0398	Axis 31 Alarm	Code of the alarm that has occurred		An alarm related to axis 31 has occurred. The same remedy of the corresponding alarm code should be provided.
0399	Axis 32 Alarm	Code of the alarm that has occurred		An alarm related to axis 32 has occurred. The same remedy of the corresponding alarm code should be provided.

SECTION 12
Maintenance and Inspection

This section describes the maintenance and inspection procedures required to keep the CS1W-MCH71 Motion Control Unit in optimum condition.

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12-1 Routine Inspection

In order for your MC Unit to continue operating at optimum condition, periodic inspections are necessary.

12-1-1 Inspection Points

The main components of the Unit are semiconductors and have a long service life, but depending on the operating environment, there may be more or less deterioration of these and other parts. A 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. Checks to be sure that the power supply, ambient temperature, humidity, and other specifications are within the specifications. Be sure that these are no loose screws and that all battery and cable connections are secure. Clean any dust or dirt that has accumulated.

Periodic Inspection Items

No.	Item	Inspection points	Criteria	Remarks
1	I/O Power Supply	Measure the voltage variations at the I/O power supply terminal block. Do they meet the standard?	DC24V: DC21.6 to 26.4V	With a voltage tester, check between the terminals and make sure that the power supply falls within the acceptable range.
2	Environment conditions	Is the ambient temperature within the acceptable range? (When used in a panel, the ambient temperature inside the panel must be checked.)	0-55 degrees Celsius	With a thermometer, check the ambient temperature inside the panel and make sure that it falls within the acceptable range.
		Is the ambient humidity within the acceptable range? (When used in a panel, the ambient humidity inside the panel must be checked.)	10 to 90%RH (with no condensation)	With a hydroscope, check the ambient humidity inside the panel and make sure that it falls within the acceptable range, and check if there is possibility of condensation due to sudden temperature change.
		Is the Unit exposed to direct sunlight?	It must not be exposed to direct sunlight.	Shield the Unit from direct sunlight.
		Is there any accumulation of dust (especially iron dust) or salts?	There must be none of these present.	Remove any accumulation of dust (especially iron dust) or salts and protect against them.
		Is the Unit exposed to any spray of water, oil, or chemicals?	It must not be exposed to any of these.	Protect the Unit from water, oil, and chemicals.
		Is the location subject to corrosive or flammable gases?	The Unit must not be exposed to these.	Check for smells or use a gas sensor.
		Is the 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 location near any source of noise?	There must be no noise.	Move the noise source away from the Unit or apply countermeasures.

No.	Item	Inspection points	Criteria	Remarks
3	Installation and wiring	Is the MC Unit securely mounted?	There must be no looseness.	With a Phillips screwdriver, tighten all mounting screws.
		Are the cable connectors properly inserted and locked?		Carefully insert and lock all cable connectors.
		Are there any loose screws in the external wiring?		With a Phillips screwdriver, tighten all screws in the external wiring.
		Are any crimp terminals for external wiring too close together?	There must be sufficient space between them.	Do a visual check and separate the terminals as required.
		Are any external cables about to break?	There must be no external abnormalities.	Do a visual check, and connect or replace cables as required.

Required Tools

Required tools

- Phillips screwdriver
- Voltage tester or digital voltage meter
- Industrial alcohol ad clean cotton cloth

Equipment that may be required depending on the case

- Oscilloscope
- Synchroscope
- Thermometer, hydrometer

12-1-2 Handling Precautions

- Turn OFF the power before replacing the Unit.
- If a Unit is found to be faulty and is replaced, check the new Unit again to ensure there are no errors.
- When returning a faulty Unit for repair, make a detailed record of the Unit's malfunction and take it together with the Unit to your nearest OMRON office or sales representative.
- If a contact is not good, put some industrial alcohol on a clean cotton cloth and wipe the surface. After doing this, install the Unit.
- Before restarting operation, transfer the required programs, position data, and system parameters to the MC Unit that was changed, and save them to the flash memory.

12-1-3 Procedure for replacing an MC Unit

Follow the procedure below when it is necessary to replace an MC Unit.

1,2,3...

1. Make a note of the unit number of the MC Unit to be replaced.
2. To retain the status and settings of the MC Unit that is to be replaced, execute the backup operation of the CPU Unit to save the MC Unit's data, parameters, or programs into a memory card. For the operation procedure, refer to the *User Manual for the CPU Unit 'Programming' (SBCA-313)*.
3. Turn OFF the power supply.
4. To facilitate rewiring, carefully label the cables that are to be disconnected.
5. Replace the MC Unit, and reconnect the wiring as before.
6. Set the unit number for the MC Unit.
7. Turn ON the power supply to the PLC.
8. Read the data, parameters, or programs that are saved in the memory card to the MC Unit through the CPU Unit's backup operation.

9. Turn OFF the power supply to the PLC.

The replacement of the MC Unit is completed.

12-1-4 Procedure for replacing a Servo Driver

Follow the procedure below when it is necessary to replace a Servo Driver.

1,2,3...

1. Turn OFF the PLC and the Servo Driver.
2. To facilitate rewiring, carefully label the cables that are to be disconnected.
3. Replace the Servo Driver, and reconnect the wiring as before.
4. Turn ON the Servo Driver and PLC.
5. Set the bit [Servo Parameter Save] ON using the Programming Console or the ladder program on PLC to save servo parameters in the MC Unit into the Servo Driver.
6. Turn OFF the PLC and the Servo Driver.

The replacement of the Servo Driver is completed.

12-1-5 Procedure for replacing the NS115

Follow the procedure below when it is necessary to replace the NS115.

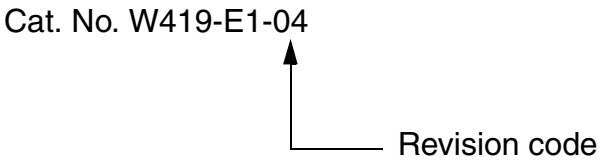
1,2,3...

1. Turn OFF the PLC and the Servo Driver.
2. To facilitate rewiring, carefully label the cables that are to be disconnected.
3. Replace the NS115, and reconnect the wiring as before.
4. Turn ON the Servo Driver and PLC.
5. Turn ON the bit [Servo Parameter Save] using the Programming Console or the ladder program on PLC to save NS115 parameters in the MC Unit into the new NS115.
   The Servo Driver parameters will also be transferred from the MC Unit and saved at this time.
6. Turn OFF the PLC and the Servo Driver.

The replacement of the NS115 is completed.

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
1	February 2003	Original production
2	May 2003	Additional Explanation and Revision Accompanied by Error Correction 0-9,0-14,0-15,0-16,0-17,0-18,1-4,1-5,1-9,1-12,1-14,1-16,1-17,1-18,1-19,1-20,2-2, 2-3,2-4,2-5,2-6,2-7,3-2,3-9,4-2,4-3,4-5,4-6,4-7,4-8,4-9,4-10,4-11,4-12,4-14,4-16, 4-17,4-21,4-22,4-24,4-25,4-26,4-31,4-34,4-57,4-58,4-60,4-61,4-62,4-63,4-67,4-68, 4-69,4-70,4-71,4-75,4-77,4-79,4-80,4-83,4-86,4-92,5-4,5-11,5-12,5-14,5-15,5-16, 5-17,5-18,5-19,5-20,6-2,6-3,6-4,6-5,6-10,6-15,6-16,6-18,6-21,6-26,6-29,6-41,6-42, 6-44,6-45,6-47,6-48,6-49,6-51,6-53,6-54,6-55,6-56,6-58,6-61,6-62,6-63,6-64,6-65, 6-67,6-68,6-70,6-72,6-74,6-76,6-77,6-78,6-79,6-80,6-81,6-82,6-83,6-84,6-85,6-86, 6-87,6-88,6-89,6-90,6-91,6-92,6-93,6-94,6-95,6-96,6-97,6-98,6-99,6-100,6-101, 6-102,6-103,6-104,6-105,6-106,6-107,6-108,6-109,6-110,7-5,7-11,7-13,7-20,7-21, 7-22,7-23,7-27,7-29,7-32,7-35,7-36,7-37,7-38,7-44,7-46,7-48,7-49,7-50,7-51,7-55, 7-56,7-60,7-61,7-65,7-66,7-68,7-69,7-70,7-71,7-72,7-76,7-78,7-81,7-83,7-84,7-85, 7-87,7-88,7-97,7-104,7-106,7-107,7-108,7-109,7-114,7-117,7-121,7-122,7-124, 7-125,7-126,7-127,7-128,7-130,7-132,8-2,8-3,8-4,8-6,8-11,9-8,9-9,9-15,9-19,11-4, 11-5,11-8,11-9,11-10,11-11,11-13,11-14,11-17,11-19,11-20,11-21,11-22
3	December 2003	Programs Examples added (Section 10), their explanations added. Additional Explanation and Revision Accompanied by Error Correction 0-15,0-16,0-17,0-18, 1-2 to 1-5, 1-7 to 1-9,1-11 to 1-14, 1-16, 1-17, 1-19,2-3, 3-3, 3-5, 3-9, 3-13 to 3-22, 4-2 to 4-36, 4-38, 4-40, 4-41, 4-44, 4-57, 4-58, 4-81, 4-84, 4-100 to 4-111, 4-113, 4-114, 4-116,5-2 to 5-4, 5-20,6-5, 6-7 to 6-9, 6-12, 6-14 to 6-16, 6-18, 6-19, 6-22 to 6-25, 6-28 to 6-32,6-38, 6-42, 6-44, 6-45, 6-47, 6-48, 6-50 to 6-54, 6-56 to 6-58, 6-60, 6-61, 6-63 to 6-65, 6-67, 6-68, 6-70 to 6-72 to 6-77, 6-80, 6-83 to 6-86, 6-89, 6-92, 6-97 to 6-99, 6-101 to 6-106, 6-109, 6-110, 6-115, 7-3, 7-6, 7-7, 7-11,7-15, 7-20 to 7-32, 7-51, 7-56, 7-61, 7-62, 7-63, 7-66 to 7-68, 7-70 to 7-72, 7-76, 7-84, 7-89, 7-91, 7-95, 7-99, 7-120, 7-128, 7-129, 7-138, 8-2, 8-3, 8-14,9-8, 9-13,9-20,11-10, 11-12, 11-14 to 28, 12-3
04	September 2004	Ladder Programs added (to where they are helpful), their explanations added. Explanations added and revisions made including correction of errors. Safety precautions added and changed.

OMRON CORPORATION
FA Systems Division H.Q.
66 Matsumoto
Mishima-city, Shizuoka 411-8511
Japan
Tel: (81)55-977-9181/Fax: (81)55-977-9045

Regional Headquarters

OMRON EUROPE B.V.
Wegalaan 67-69, NL-2132 JD Hoofddorp
The Netherlands
Tel: (31)2356-81-300/Fax: (31)2356-81-388

OMRON ELECTRONICS LLC
1 East Commerce Drive, Schaumburg, IL 60173
U.S.A.
Tel: (1)847-843-7900/Fax: (1)847-843-8568

OMRON ASIA PACIFIC PTE. LTD.
83 Clemenceau Avenue,
#11-01, UE Square,
Singapore 239920
Tel: (65)6835-3011/Fax: (65)6835-2711

OMRON

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