Panasonic®

PROGRAMMABLE CONTROLLER

FP7 Motion Control Unit

User's Manual

[Applicable models]

FP7 Motion Control Unit (EtherCAT type)

- 16-axis type (Product number AFP7MC16EC)
- 32-axis type (Product number AFP7MC32EC)
- 64-axis type (Product number AFP7MC64EC)

WUME-FP7MCEC-01

2016.9 | panasonic.net/id/pidsx/global

Safety Precautions

Observe the following notices to ensure personal safety or to prevent accidents.
To ensure that you use this product correctly, read this User's Manual thoroughly before use.
Make sure that you fully understand the product and information on safety.
This manual uses two safety flags to indicate different levels of danger.

WARNING

If critical situations that could lead to user's death or serious injury is assumed by mishandling of the product.

-Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.
-Do not use this product in areas with inflammable gas. It could lead to an explosion.
-Exposing this product to excessive heat or open flames could cause damage to the lithium battery or other electronic parts.

CAUTION

If critical situations that could lead to user's injury or only property damage is assumed by mishandling of the product.

-To prevent excessive exothermic heat or smoke generation, use this product at the values less than the maximum of the characteristics and performance that are assured in these specifications.
-Do not dismantle or remodel the product. It could cause excessive exothermic heat or smoke generation.
-Do not touch the terminal while turning on electricity. It could lead to an electric shock.
-Use the external devices to function the emergency stop and interlock circuit.
-Connect the wires or connectors securely.
The loose connection could cause excessive exothermic heat or smoke generation.
-Do not allow foreign matters such as liquid, flammable materials, metals to go into the inside of the product. It could cause excessive exothermic heat or smoke generation.
-Do not undertake construction (such as connection and disconnection) while the power supply is on. It could lead to an electric shock.

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PLC_EC

Introduction

Thank you for buying a Panasonic product. Before you use the product, please carefully read the installation instructions and the users manual, and understand their contents in detail to use the product properly.

Types of Manual

- There are different types of users manual for the FP7 series, as listed below. Please refer to a relevant manual for the unit and purpose of your use.
- The manuals can be downloaded on our website:
  http://industrial.panasonic.com/ac/e/dl_center/manual/

Unit name or purpose of use		Manual name	Manual code
FP7 Power Supply Unit FP7 CPU Unit		FP7 CPU Unit Users Manual (Hardware)	WUME-FP7CPUH
FP7 CPU Unit		FP7 CPU Unit Command Reference Manual	WUME-FP7CPUPGR
		FP7 CPU Unit Users Manual (Logging Trace Function)	WUME-FP7CPULOG
		FP7 CPU Unit Users Manual (Security Function)	WUME-FP7CPUSEC
	Instructions for Built-in LAN Port	FP7 CPU Unit Users Manual (LAN Port Communication)	WUME-FP7LAN
		FP7 CPU Unit User's Manual (EtherNetIP Communication)	WUME-FP7CPUETEX
		FP7 CPU Unit Users Manual (EtherNet IP communication)	See our web site.
		FP7 Web Server Function Manual	See our web site.
	Instructions for Built-in COM Port FP7 Extension Cassette (Communication) (RS-232C/RS485 type)	FP7 series Users Manual (SCU communication)	WUME-FP7COM
	FP7 Extension Cassette (Communication) (Ethernet type)	FP7 series Users Manual (Communication cassette Ethernet type)	WUME-FP7CCET
	FP7 Extension (Function) Cassette Analog Cassette	FP7 Analog Cassette Users Manual	WUME-FP7FCA
FP7 Digital Input/Output Unit		FP7 Digital Input/Output Unit Users Manual	WUME-FP7DIO
FP7 Analog Input Unit		FP7 Analog Input Unit Users Manual	WUME-FP7AIH
FP7 Analog Output Unit		FP7 Analog Output Unit Users Manual	WUME-FP7AOH
Thermocouple Multi-analog Input Unit RTD input unit		Thermocouple Multi-analog Input Unit RTD Input Unit Users Manual	WUME-FP7TCRTD
FP7 Multi Input/Output Unit		FP7 Multi Input/Output Unit Users Manual	WUME-FP7MXY
FP7 High-speed Counter Unit		FP7 High-speed Counter Unit Users Manual	WUME-FP7HSC

Unit name or purpose of use	Manual name	Manual code
FP7 Pulse Output Unit	FP7 Pulse Output Unit Users Manual	WUME-FP7PG
FP7 Positioning Unit	FP7 Positioning Unit Users Manual	WUME-FP7POSP
FP7 Serial Communication Unit	FP7 series Users Manual (SCU communication)	WUME-FP7COM
PHLS System	PHLS System Users Manual	WUME-PHLS
Programming Software FPWIN GR7	FPWIN GR7 Introduction Guidance	WUME-FPWINGR7

Glossary

To make explanations simple, abbreviations are used for the following terms.

Abbreviation	Name	Description
FP7 MC Unit	FP7 Motion Control Unit	The product name of the unit described in this manual.
CMI	Control Motion Integrator	The software for stting parameters of FP7MC Unit.

As for the following terms, they are expressed differently in software, manuals and specification concerning FP7 MC Unit and Servo Amplifier A5B.

FP7 MC Unit	A5B	Description
Station address	Station alias	This shows the unit numbers allocated to slaves on EtherCAT network. The left two terms have the same meaning.
-	General-purpose monitor input	Five inputs of symbols SI-MON1 to SI-MON5 are allocated on the A5B side.
General-purpose input	-	On the FP7 MC Unit side, eight signals of A5B are treated as "general-purpose input" and can be monitored through the unit memory. NOT, POT, HOmE, SI-MON1 to SI-MON5 For using it in combination with FP7 MC Unit, SI-MON3 and SI-MON4 are used as limit inputs. NOT and POT are not used.
-	General-purpose output	On the A5B side, one input of symbol EX-OUT1 is allocated.
General-purpose output	-	On the FP7 MC Unit side, one signal to A5B are treated as "general-purpose output" and can be written through the unit memory. EX-OUT1

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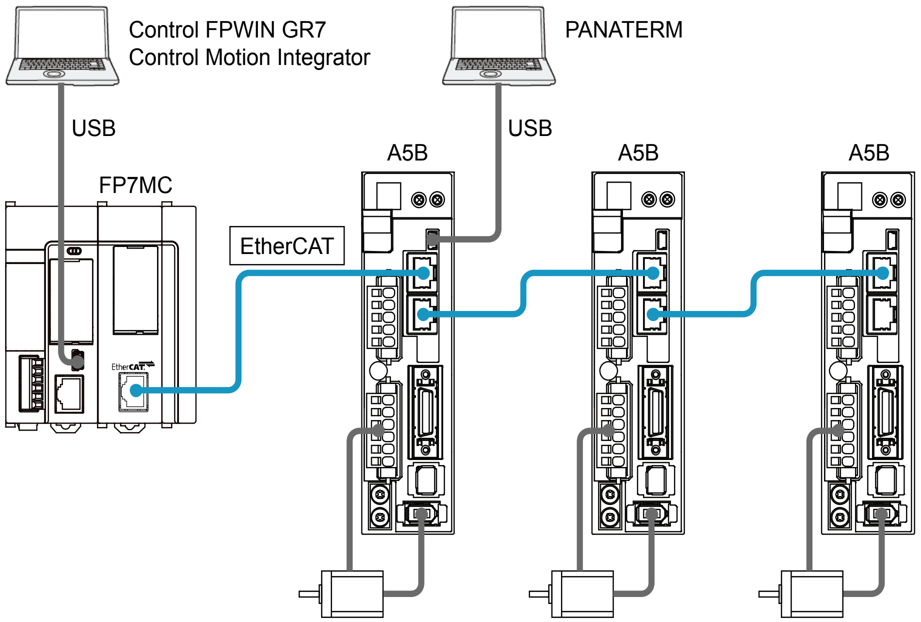
Unit Functions and Restrictions

1.1 Functions of Motion Control

1.1.1 Functions of Unit



■ **Controlling Servo Motor MINAS A5B series through EtherCAT**

FP7 Motion Control Unit (hereafter FP7 MC Unit) adopts EtherCAT communication and controls servo motors. It achieves wiring saving by network connection and high-speed control.

(Note): EtherCAT® is a registered trademark of Beckhoff Automation Gmbh in Germany and a technology protected by a patent.

■ **Setting using dedicated software "Control Motion Integrator"**

Dedicated software "Control Motion Integrator" (sold separately) is provided for easily configuring the setting of EtherCAT communication and parameters of position control.

1.1.2 List of Models

■ Main unit

Product name	Max. number of control axes	Product no.
FP7 Motion Control Unit (Abbreviated name: FP7 MC Unit)	16 axes/unit	AFP7MC16EC
	32 axes/unit	AFP7MC32EC
	64 axes/unit	AFP7MC64EC

■ Related software

Product name		Application	Product no.
Programming software FPWIN GR7		This software is used for configuring the whole FP7 system and creating user programs.	For the latest information, see our web site.
Software Control Motion Integrator		This software is used for configuring FP7 MC Unit and monitoring the state.. ● EtherCAT communication parameters ● Setting of positioning parameters ● Setting of positioning tables	For the latest information, see our web site.
	Key Unit	For installing a USB port (Note 3)	AFPSMTKEY
Setup support software PANATERM		This software is used for setting parameters and monitoring the states of Servo Amplifier A5B series.	For the latest information, see our web site.

(Note 1): For the latest information on FPWIN GR7 and Control Motion integrator, see the following web site.
http://industrial.panasonic.com/ac/e/fasys/plc/software/fpwingr7/index.jsp

(Note 2): For the latest information on PANATERM, see the following web site.
https://industrial.panasonic.com/ww/products/motors-compressors/fa-motors/ac-servo-motors/minas-a5-panaterm

(Note 3): All the functions of Control Motion Integrator can be used free of charge for 60 days after the installation. For using the "EtherCAT communication setting" function continuously after the elapse of 60 days, the key unit should be installed.

■ Required files for EtherCAT communication

The setup information (ESI files) required for EtherCAT communication is included in the installation data of software "Control Motion Integrator".

(Note): ESI (EtherCAT Slave Information)

1.2 Restrictions

1.2.1 Supported Functions

FP7 MC Unit is designed in conformity with the specifications and standard of EtherCAT®, however, FP7 MC Unit Ver.1 supports the items listed in the following table only.

■ Comparison with EtherCAT specifications

Item	EtherCAT specifications	Supported items by FP7 MC Unit
Transmission system	100BASE-TX	Same as on the left.
Baud rate	100 Mbps	Same as on the left.
Trasmission distance	Max. 100 m between nodes	Same as on the left.
Transmission cable	STP cable, category 5/5e	Always use a cable of category 5e or higher.
Topology	Line, Daisy chain, Star, Tree	Daisy chain (without brach)
Max. number of connected units	65535	64
Connectable device	EtherCAT-compatible devices	Panasonic AC serv motor A5B series (EtherCAT-compatible type)

■ Control mode

<table>
<tr><th>Control mode of EtherCAT</th><th>Supported function of A5B</th><th>Supported items by FP7 MC Unit</th></tr>
<tr><td>Cyclic position control mode (csp)</td><td>Supported</td><td>The cyclic position control mode (csp) is used when using it in combination with FP7 MC Unit.</td></tr>
<tr><td>Profile position control mode (pp)</td><td>Unsupported</td><td rowspan="2">Only the home return position control mode (Method33/34/37) is supported. The cyclic position control mode (csp) is used when using it in combination with FP7 MC Unit.</td></tr>
<tr><td>Home return position control mode (hm)</td><td>Supported</td></tr>
<tr><td>Interpolation position control mode (ip)</td><td>Unsupported</td><td>When using it in combination with FP7 MC Unit, FP7 MC Unit performs the interpolation control.</td></tr>
<tr><td>Cyclic speed control mode (csv)</td><td rowspan="4">Supported</td><td rowspan="4">Unsupported</td></tr>
<tr><td>Profile speed control mode (pv)</td></tr>
<tr><td>Cyclic torque control mode (cst)</td></tr>
<tr><td>Profile torque control mode (tq)</td></tr>
</table>

1.2.2 Restrictions by Power Consumption in FP7 System

The unit has the following internal current consumption. Make sure that the total current consumption is within the capacity of the power supply with consideration of all other units used in combination with this unit.

Name	Product no.	Consumption current
FP7 Motion Control Unit	AFP7MC16EC AFP7MC32EC AFP7MC64EC	180 mA or less

1.2.3 Applicable Versions of FPWINGR7 and FP7 Units

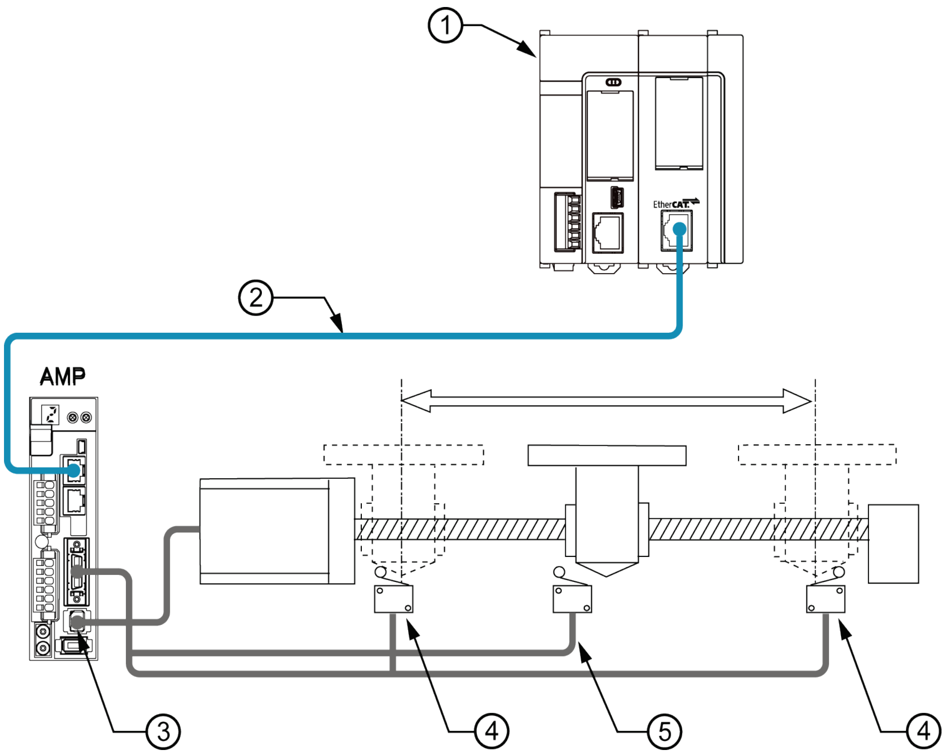
For using FP7 MC Unit, the following versions of FPWIN GR7 and units are required.

Item	Applicable versions
Programming tool software FPWIN GR7	Ver.2.12 or later
FP7 CPU Unit	There is no restriction on the version. For using the EC packet monitor function of FP7 MC Unit, use FP7 CPU Unit (Ethernet function- built-in type).

1.3 System Configuration

1.3.1 Example of System Configuration

The following figure shows the example of the configuration of one axis when using over limit switches and a near home switch.



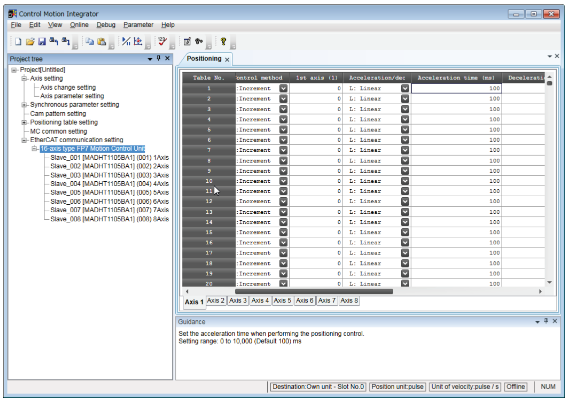
■ Configuration of devices

No.	Item	Explanation
①	FP7	The above figure shows the minimum configuration that FP7 CPU Unit, FP7 MC Unit and an end unit are combined. For FP7 MC Unit, the units for 16 axes, 32 axes, and 64 axes are available.
②	Shielded twisted pair (STP) cable	FP7 MC Unit and Servo Amplifier A5B are connected with a shielded twisted pair (STP) cable.
③	Servo Amplifier A5B	The units of the number of required axes areconnected.
④	Over limit switch	The over limit switches are connected to the servo amplifier. When using the servo amplifier in combination with FP7 MC Unit, the over limit switches are connected to the terminals allocated to the general-purpose monitor inputs of the servo amplifier (SI-MON3/SI-MON4).
⑤	Near home switch	The near home switch is connected to the servo amplifier. It is connected to the terminal allocated to the near home input (HOME).

1.3.2 Type of Software

The following three softwares are used for using the system combining FP7 MC Unit and Servo Amplifier A5B.

■ Control Motion Integrator Ver.1.0



Application:

This software is used for setting parameters of FP7 MC Unit, monitoring the state and test operations.

- Setting of EtherCAT communication parameters
- Setting of positioning parameters
- Setting of positioning tables, etc.

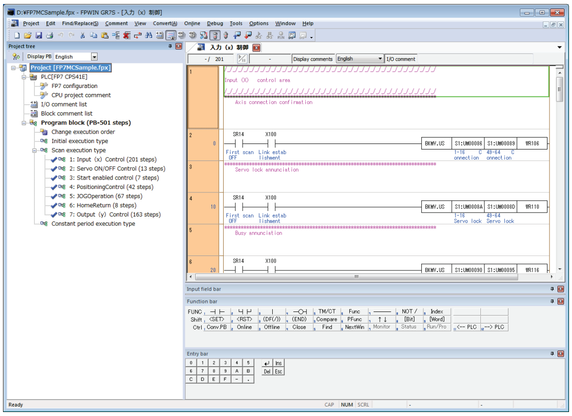
Download destination:

FP7 MC Unit

Connection with the unit:

Connect to the USB port of FP7 CPU Unit.

■ FPWIN GR7 Ver.2.12



Application:

This software is used for configuring the whole FP7 system and creating user programs.

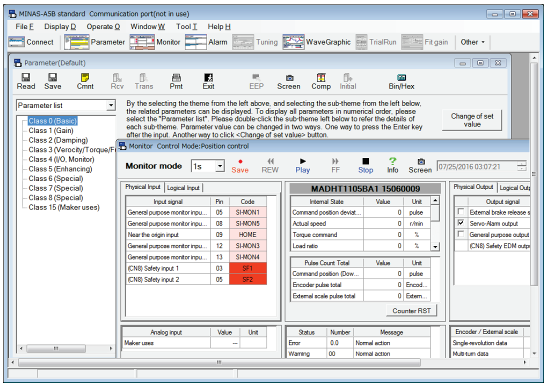
Download destination:

FP7 CPU Unit

Connection with the unit:

Connect to the USB port of FP7 CPU Unit.

■ PANATERM Ver.6.0



Application:

This software is used for setting parameters and monitoring the states of Servo Amplifier A5B series.

Download destination:

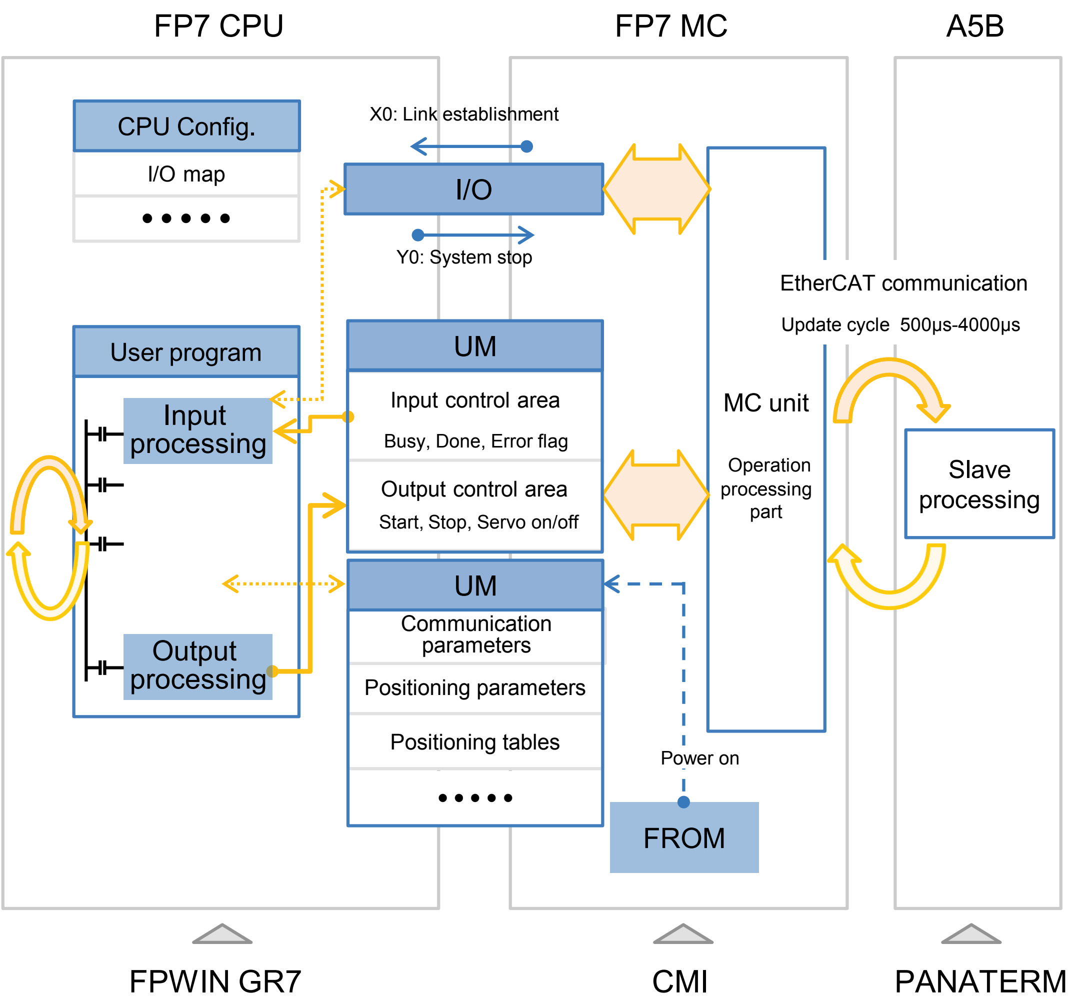
Servo Amplifier A5B

Connection with the unit:

Connect to the USB port of Servo Amplifier A5B.

1.4 Mechanism of Processing

1.4.1 Schematic View



1.4.2 Operation When Powe Supply Turns On

- FP7 MC Unit reads the "parameters for FP7 MC Unit" stored in the FROM (FlashROM) within the unit and sets them in the memory areas within the unit.
- FP7 MC Unit starts the communication with the slaves (servo amplifiers) connected to EtherCAT. Once the links with the slaves (servo amplifiers) are established, it is notified to FP7 CPU Unit by the input relay (X0).
- When the mode setting switch is set to RUN mode, FP7 CPU Unit checks that the state of the FP7 system is correct, switches the mode to RUN mode, and executes user programs.

1.4.3 Start/Stop by User Programs

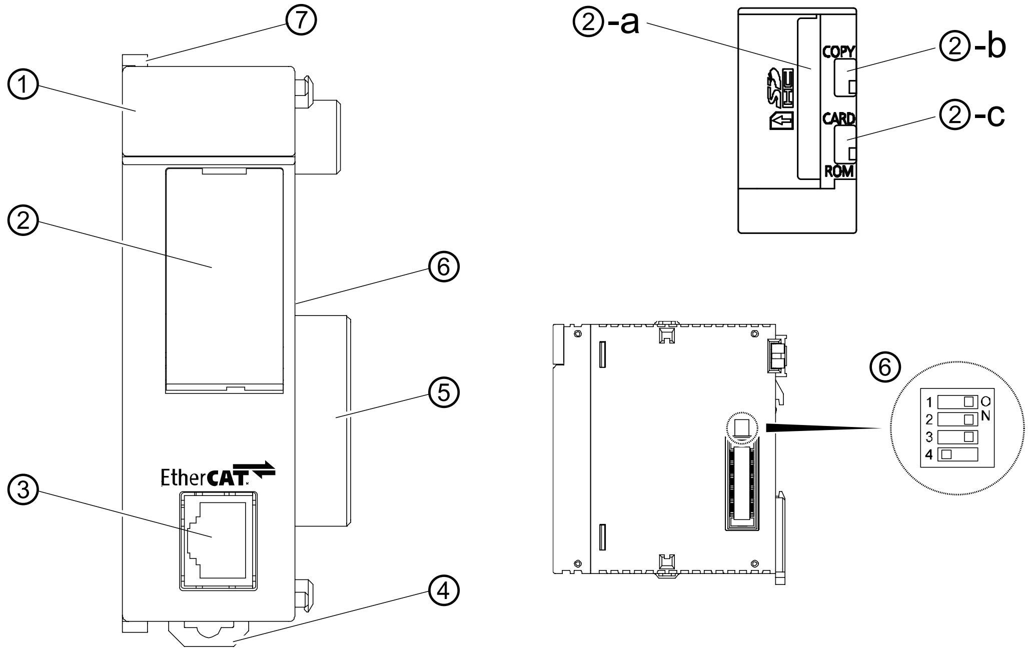
- In the case of FP7 MC Unit, main I/O signals to execute various controls (such as positioning, JOG operation, home return, and stop) are allocated to the unit memories (UM).
- In the unit memories (UM) "Output control area", request signals to perform stop control are allocated. In the unit memories "Input control area", flags such as busy flag and error flag to check the start conditions are allocated.
- FP7 MC Unit controls operations by reading or writing data to these unit memories.

2

Names and Functions of Parts

2.1 Names and Functions of Parts

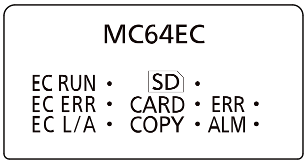
2.1.1 Names and Functions of Parts



■ Names and functions of parts

No.	Name	Function
①	Operation monitor LEDs	Indicates the state of EtherCAT communication, the occurrence states of unit's errors and alarms.
②	Card cover	A SD memory card slot is located under the cover.
	a: Card slot	An SD memory card is inserted.
	b: COPY switch	This is provided for expansion. Use the switch at the factory default (lower side) as it is.
	c: Memory selector switch	This is provided for expansion. Use the switch at the factory default (lower side) as it is.
③	Network connector (RJ45)	This is the connector for connecting to EtherCAT.
④	DIN hook	This hook is used to install the unit on a DIN rail.
⑤	Unit connector	Connects the internal circuits between units.
⑥	Mode setting switch	This switch is used for the system. Use this at the factory default (no.1-3: ON, no.4: OFF) as it is.
⑦	Fixing hook	This hook is used to fix units.

2.1.2 Operation monitor LEDs

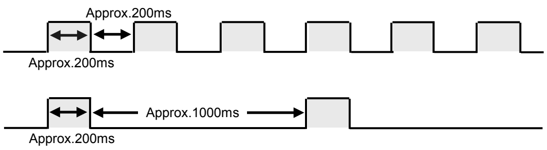


LED	Color	Status	Description	
—	Blue	ON	Turns on when the power is supplied to the unit.	
EC RUN	Green	OFF	INIT state	Indicates the state of the ESM (EtherCAT State Machine) of EtherCAT communication. Refer to the next page for details.
		Blinking	Pre-Operational state	
		Single flash	Safe-Operational state	
		ON	Operational state	
EC ERR	Red	OFF	No error	Indicates errors in EtherCAT communication.
		ON	EtherCAT communication error	
EC L/A	Green	OFF	LINK is not established.	Indicates the LINK state of EtherCAT communication.
		Blinking	LINK is established. Data is sent/received.	
		ON	LINK is established. Data is not sent/received.	
[SD]	Green	ON	SD memory card is beng accessed.	
		OFF	Other than the above state.	
CARD	Green	(Reserved for system)		
COPY	Green	(Reserved for system)		
ERR	Red	ON	Unit error occurs.	
		Blinking	Unit warnig occurs.	
		OFF	Other than the above states.	
ALM	Red	ON	Unit alarm occurs.	
		OFF	Other than the above state.	

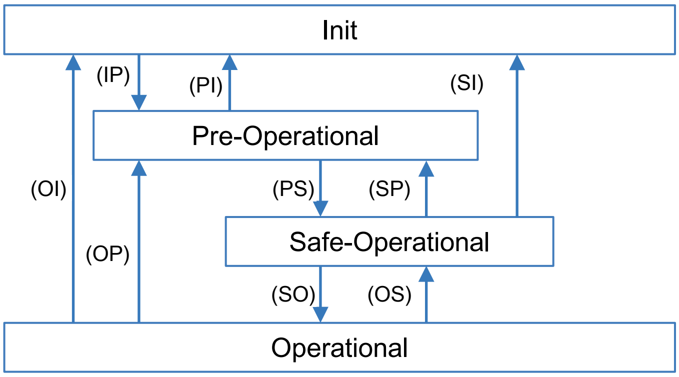
(Note 1): Blinking and single flash of EC RUN are activated as below.

Blinking

Single flash



2.1.3 ESM (State Transition Diagram)



Reference: Created by us based on "Operating principle of EtherCAT" issued by ETG

ESM state (Abbr.)	SDO communication Send/Receive	PDO communication (S→M)	PDO communication (M→S)	Description
Init	Not available	Not available	Not available	The state that the communication part is being initialized, and data cannot be sent/received using SDO (Mailbox) and PDO.
Pre-Operational (PreOP)	Available	Not available	Not available	The state that data can be sent/received using SDO (Mailbox).
Safe-Operational (SafeOP)	Available	Available	Not available	The state that data can be sent/recevied using SDO (Mailbox) and data can be sent (from slaves to master) using PDO.
Operational (OP)	Available	Available	Available	The state that data cannot be sent/received using SDO (Mailbox) and PDO.

(Note): S: Slave, M: Master

■ What is ESM (EtherCAT State Machine)?

- ESM shows the state of the communication determined as the specifications of EtherCAT.
- The state transition is performed between FP7 MC Unit and Servo Amplifier A5B, an any settings or programming by users are not required.

■ Confirmation method

- The state of ESM can be confirmed by the operation monitor LED "EC RUN" on the front side of FP7 MC Unit.
- When communication is performed, "Operational (OP)" (EC RUN LED) is ON, and the input relay (X0 (Link established)" of FP7 MC Unit is ON.

3

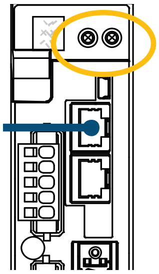
Installation and Wiring

3.1 Settings of Servo Amplifier A5B

3.1.1 Checking Rotary Switches

When using FP7 MC Unit in combination with Servo Amplifier A5B, the address of the EtherCAT network is set by the software CMI.

- Set the rotary switch of Station Alias (ID) on the front side of Servo Amplifier A5B to "00".
- The parameter: Pr7.40 of Servo Amplfiier A5B should be always set to "0".



■ Switch setting

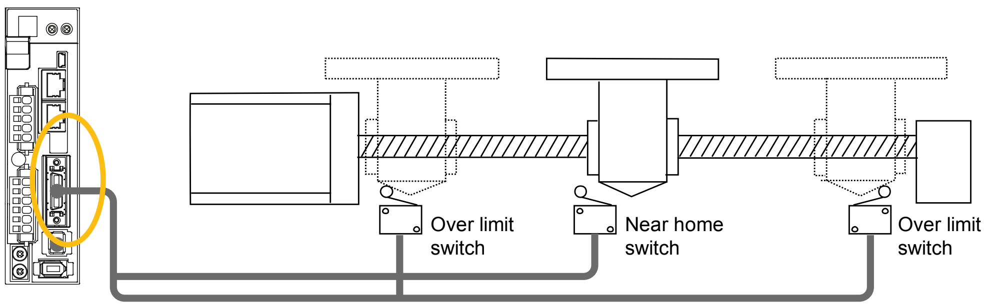
Setting value	Front panel display		Function
	MSD	LSD	
0	0	0	The settings on the FP7 MC Unit side that is the higher master are valid. Make the setting using the setting software CMI.

◆ **REFERENCE**

- **For the setting method of station addresses using software CMI, refer to "4.4 Setting of Network Configuration".**

3.1.2 Connection of Input Signals

For the system which uses the over limit switches and near home switch, connect them to the I/O connector of Servo Amplifier A5B.



■ I/O connector (X4): Allocation of functions at the factory setting

X4 connector		Function at the factory setting			Application on the FP7 MC Unit side
Name	**Pin no.**	**Signal name**	**Code**	**Logic**	
SI1	5	General-purpose monitor input 5	SI-MON5	A contact	It can be only monitored by the unit memories..
SI2	7	CW over-travel inhibit input	POT	B contact	Do not allocate POT or NOT.
SI3	8	CCW over-travel inhibit input	NOT	B contact	
SI4	9	Near home input	HOME	A contact	It is used as a near home input.
SI5	10	External lutch input 1	EXT1	A contact	It can be only monitored by the unit memories..
SI6	11	External lutch input 2	EXT2	A contact	
SI7	12	General-purpose monitor input 3	SI-MON3	A contact	It is used as limit +.
SI8	13	General-purpose monitor input 4	SI-MON4	A contact	It is used as limit -.

(Note 1): The above table shows the allocation before shipment. It varies according to the setting of PANATERM.

◆ **KEY POINTS**

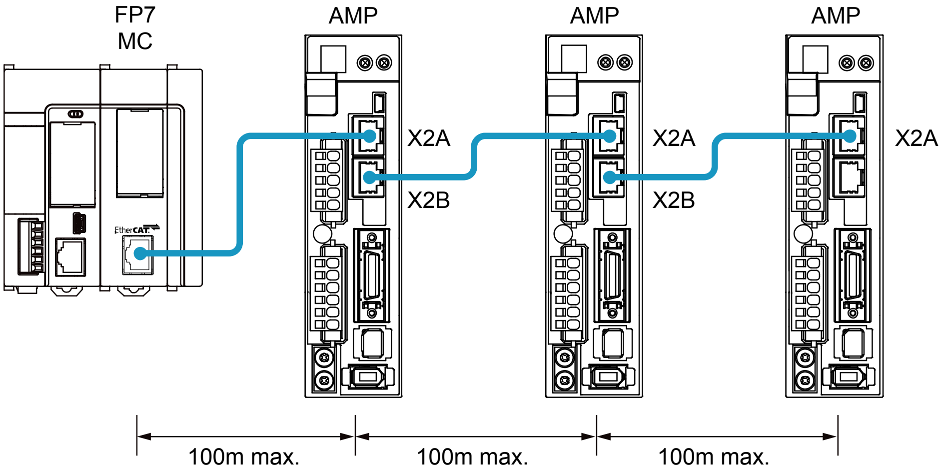
- **When using FP7 MC Unit in combination with Servo Amplifier A5B, the general-purpose inputs (SI-MON3 and SI-MON4) are used as limit inputs. For using the general-purpose monitor inputs (SI-MON3 and SI-MON4) as limit inputs, the setting of the limit switch should be set to "A: Enabled" in the "Axis parameter setting" menu of CMI.**
- **The over-travel inhibit inputs (POT, NOT) cannot be used as the limit inupts on the MC Unit side. Do not allocate the over-travel inhibit inputs (POT, NOT) to the I/O connector (X4) of Servo Amplfiier A5B.**

◆ **REFERENCE**

- **For details of the parameter settings, refer to "4.5 Connection of Limit and Near Home Switches".**

3.2 Connection of Network

3.2.1 Wiring



- The cable connected to FP7 MC Unit is connected to the connector X2A of Servo Amplifer A5B.
- The distance between each node should be within 100m.

3.2.2 Precautions on Wiring

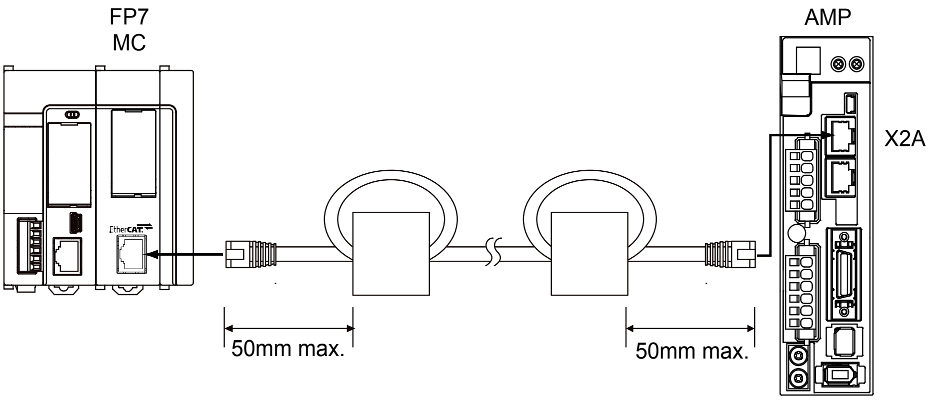
- Always use shielded twisted pair (STP) cables that are compatible with category 5e or higher.
- Turn off the power supply of the system before wiring cables.
- To prevent the cable from coming off, securely connect the connector of the cable to the network connector (RJ45 connector) of the unit.
- Hubs for EtherCAT and Ethernet cannot be used.

☛ To the next page

■ Conformity conditions to EMC Directive

Although this product conforms to EN61131-2 for the European EMC Directive (EMC Directive 2004/108/EC), the following wiring condition is required.

- Always use shielded twisted pair (STP) cables that are compatible with category 5e or higher.
- Attach ferrite cores at two points on the FP7 MC Unit side and Servo Amplifier A5B side, and wire the cable to make a loop. Recommended ferrite core: Takeuchi Industry Co., Ltd. SFT-72SN or equivalent



4

Basic Procedure

4.1 Section Details

The following are the procedures of configuring basic settings by connecting FP7 MC Unit and Servo Amplifier A5B. Confirm them before setting parameters and creating programs.

■ Operation procedure

	Item	Used tool	Outline of operation
①	Registration in I/O map of the unit	FPWIN GR7	Regiser the unit configuration of the FP7 system on the "I/O map" dialog box.
			Download the "I/O map" information to FP7 CPU Unit.
②	Allocation of used axes	CMI	Register the "configuration of axes" controlled by FP7 MC Unit in the "Used axis" setting dialog box.
③	Registration of network configuration	-	Set the rotary switch of Servo Amplifier A5B to "00".
			Turn on the powers of Servo Amplifier A5B and FP7.
		CMI	Start "EtherCAT Configurator" and register slaves in accordance with the configuration to be used.
			Set station addresses and axis numbers.
			Download the "slave registration" information to FP7 MC Unit.
			Turn on and off the powers of Servo Amplifier A5B and FP7, and then turn them on again.
			Confirm the communication state by LEDs or the monitor of CMI.
④	Confirmation of the connections of limit and near home switches (Option)	-	Connect the limit and near home input switches to Servo Amplifier A5B.
		PANATERM	Set the input logic. Monitor the input state.
		CMI	Enable the functions on the FP7 MC Unit side. Set the input logic.
			Download the set information to FP7 MC Unit.
			Monitor whether the limit and near home inputs are loaded or not.
⑤	Storage of files	FPWIN GR7 CMI PANATERM	Save created files.

4.2 Registration in I/O Map

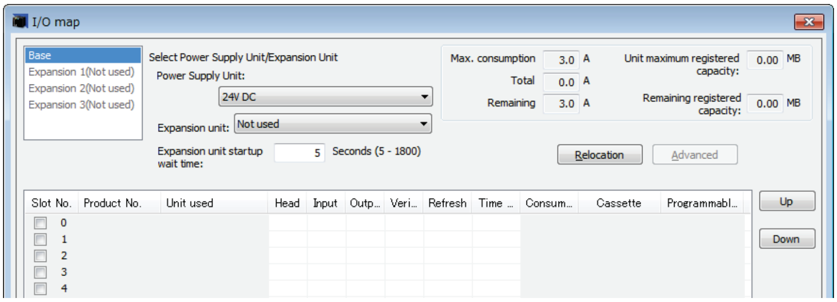
4.2.1 Creation of I/O map

Before setting parameters or creating programs, register units to be used in the I/O map. The I/O is created on FPWIN GR7. The following procedure is explained on the condition that FPWIN GR7 has already started.

◆ **PROCEDURE**

1. Select "Options" > "FP7 Configuration" > "I/O map" in the menu bar.

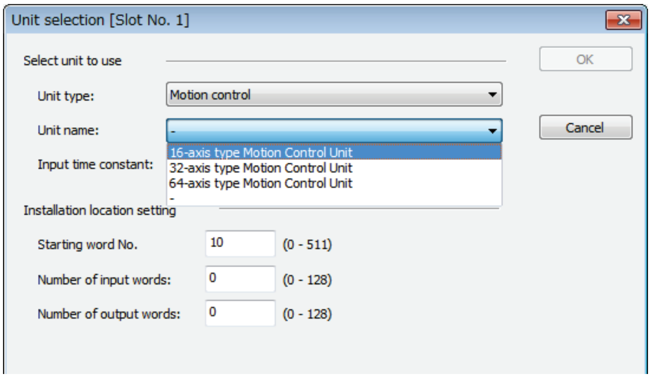
The "I/O map" dialog box is displayed.



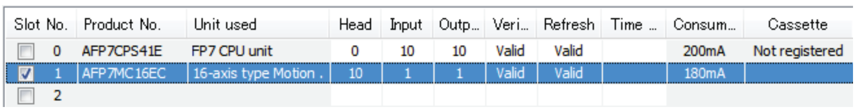
2. Double-click a desired slot.

The unit selection dialog box is displayed.

3. Select "Motion control" for "Unit type" and select the unit name used, and press the "OK" button.



The selected unit is registered in the I/O map.



4. Confirm the I/O map, and press the "OK" button.

The unit selection dialog box is displayed.

4.2.2 Download of I/O map

The created I/O map is downloaded to the CPU unit as part of configuration information. Perform the following operations on FPWIN GR7.

■ Download to the CPU unit

The I/O map is saved in the CPU unit together with program data. Execute "Online" > "Download to PLC".

4.2.3 Storage of I/O map

The created I/O map is saved as project data as part of configuration information. Perform the following operations on FPWIN GR7.

■ Save as files

- To save the I/O map as "Entire project", execute "Project" > "Save As".
- To save only the "I/O map setting" information, press the "Save Setting" button in the "I/O map" setting dialog box.

4.2.4 Confirmation of I/O Allocation

- I/O numbers allocated to the unit are decided by registering them in the I/O map.
- I/O numbers vary depending on the starting word number registered for the slot where the unit is installed.

Example) When the starting word number is 10, the "link establishment flag" of FP7 MC Unit is X100, and "system stop request signal" is Y100.

◆ **REFERENCE**

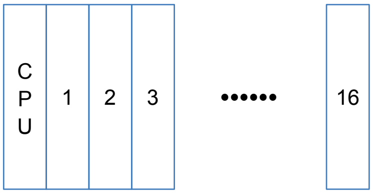
- **For details, refer to "15.2 I/O Allocation".**

4.2.5 Confirmation of Slot Numbers

Slot numbers are decided by registering units in the I/O map. Slot numbers are used when reading or writing the values of unit memories by user programs. They are also used when performing the data monitoring on FPWIN GR7.

■ Slot number

Slot numbers are decided by each installation position of units. They are counted from the unit closest to the CPU unit.



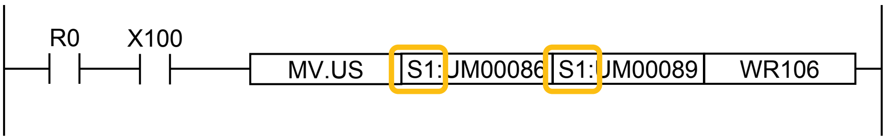
■ Display on the I/O map of FPWIN GR7

Slot numbers are specified in the "I/O map" dialog box of FPWIN GR7.

Slot No.	Product No.	Unit used	Head	Input	Outp...	Veri...	Refresh	Time ...	Consum...	Cassette	Programmabl...
☐ 0	AFP7CPS41E	FP7 CPU unit	0	10	10	Valid	Valid		200mA	Not registered	Not registered
☑ 1	AFP7MC16EC	16-axis type Motion .	10	1	1	Valid	Valid		180mA		
☐ 2											

■ Using by user programs

The following shows the case that reads values of unit memories using a user program. A slot number is specified at the beginning of a target operand.



4.3 Setting of Used Axes

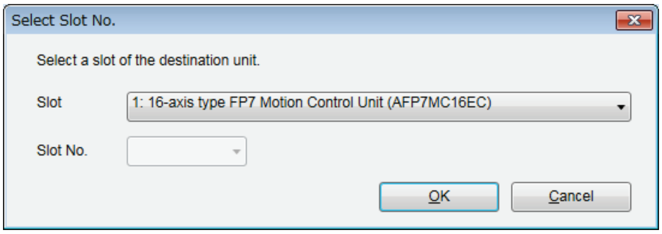
4.3.1 Registration of Used Axes

Axes to be used in FP7 MC Unit are allocated by CMI. The following procedure is explained on the condition that FP7 MC Unit has been already allocated in the I/O map.

◆ **PROCEDURE**

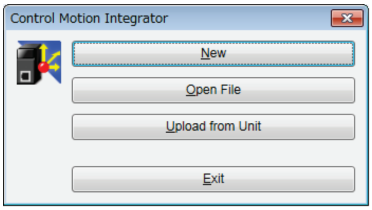
1. Select "Tools" > "Control Motion Integrator" from the menu bar of FPWIN GR7.

The "Select Slot no." dialog box is displayed.



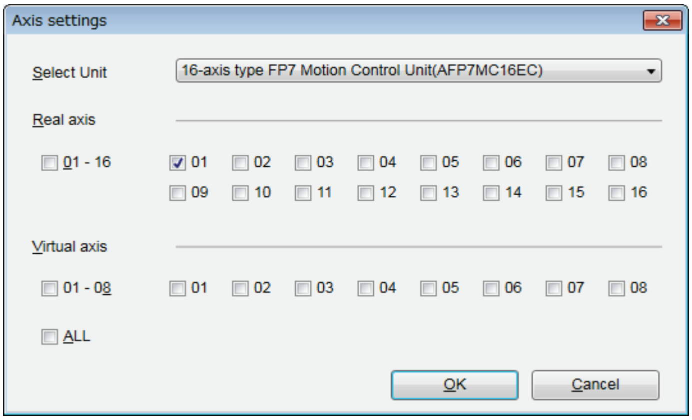
2. Select the slot number and unit of the FP7 MC Unit that the setting is made, and press the [OK] button.

"CMI" is activated, and the start dialog box is displayed.



3. Press the [New] button.

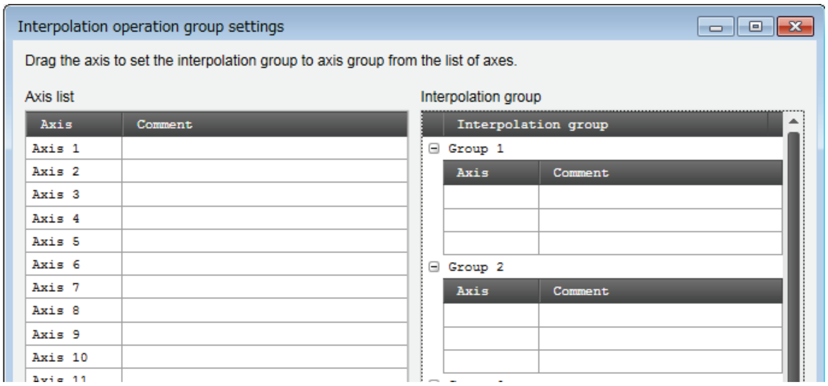
The "Axis settings" dialog box is displayed.



(This is the 16-axis type. For the 32-axis and 64-axis types, see p.4-9.)

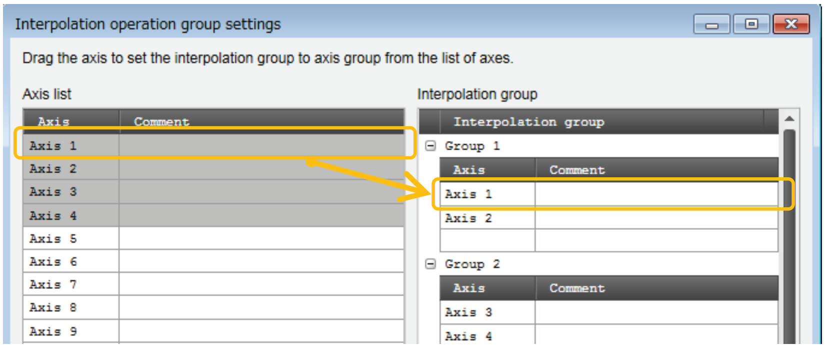
4. Select the axes to be used, and press the [OK] button.

The dialog box for the interpolation operation group setting is displayed. When you do not set the interpolation operation, go to step 6.



5. Drag the line to be allocated for interpolation to the interpolation group field.

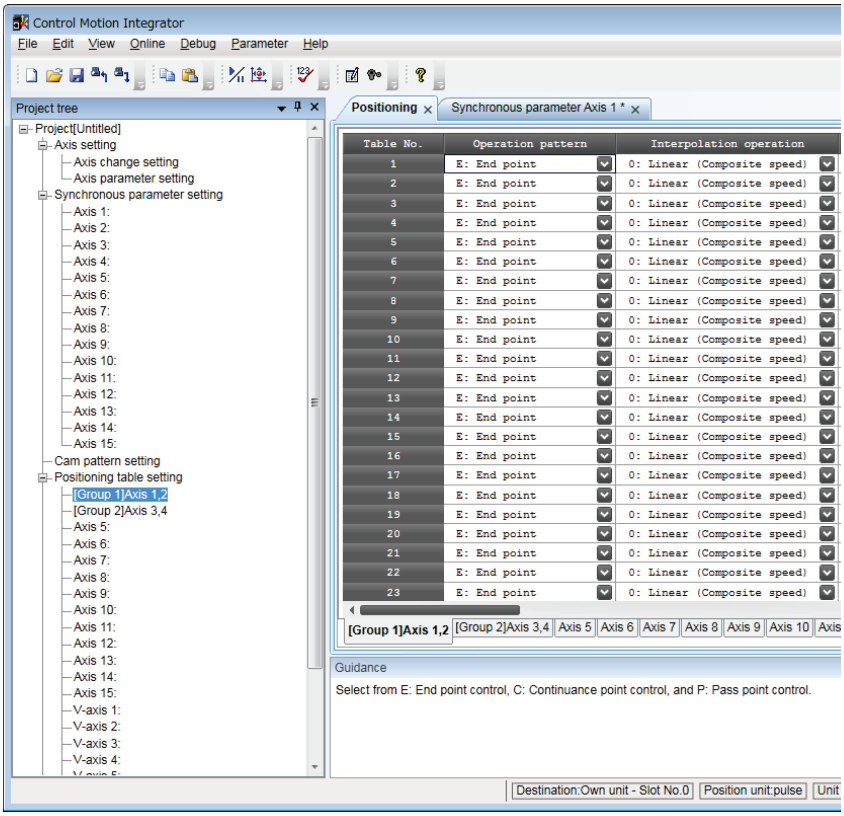
The following picture shows the allocations of "axes 1 and 2" to "group 1" and "axes 3 and 4" to "group 2" of interpolation groups. When removing the axes from the interpolation groups, right-click on the target axis in the "Interpolation group" field and execute "Clear".



6. Press the [OK] button.

7. Confirm the change and press the [Yes] button.

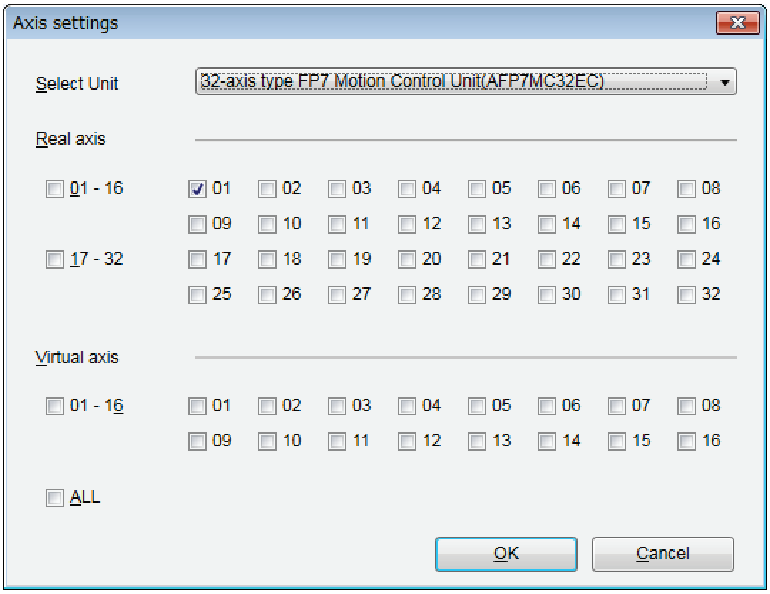
The data table is created in accordance with the setting content. The corresponding axis numbers are also displayed in the project tree.



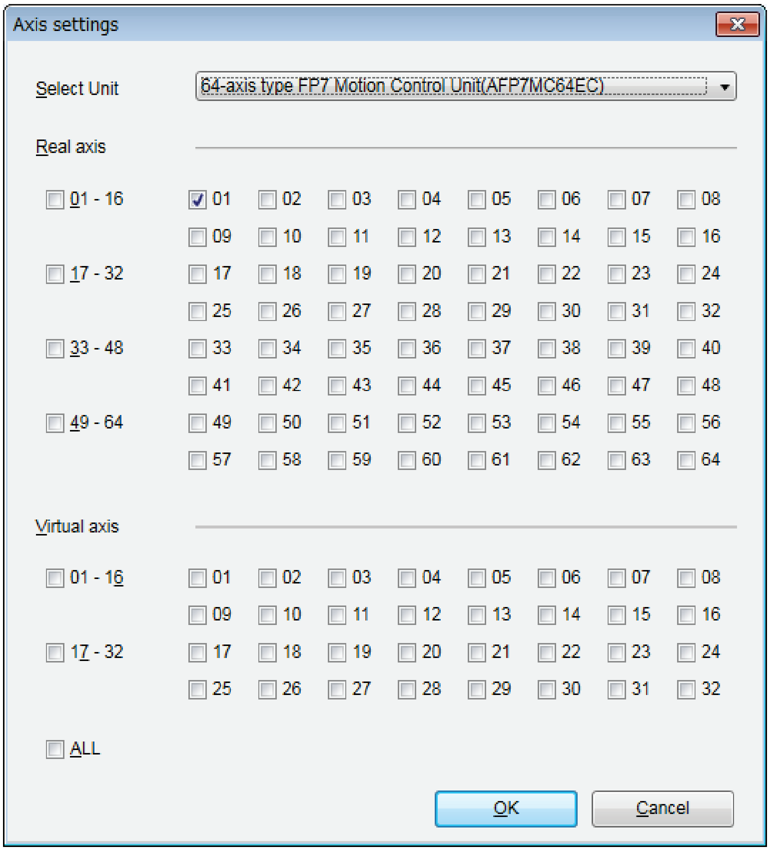
◆ KEY POINTS

- **When setting interpolation groups, setting items of the movement amount and interpolation opration are added to the data table, and the group numbers are displayed.**
- **Closing the window with the X mark during editing displays a confirmation message. Press the [Yes] button to cancel and finish the operation.**

■ Axis settings dialog box (For MC32EC)



■ Axis settings dialog box (For MC64EC)



4.4 Setting of Network Configuration

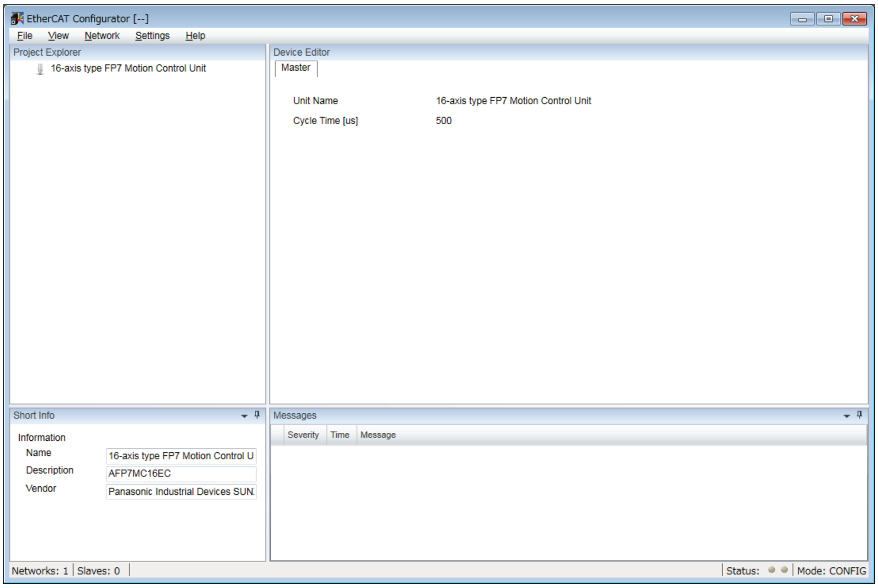
4.4.1 Registration of Slaves (Offline)

Slaves connected to FP7 MC Unit are registered using the EtherCAT communication setting menu "EtherCAT Configurator" of CMI. The following procedure is explained on the condition that CMI has already started.

◆ **PROCEDURE**

1. **Select "Parameter" > "EtherCAT communication setting" from the menu bar.**

   The "EtherCAT Configurator" window is displayed.

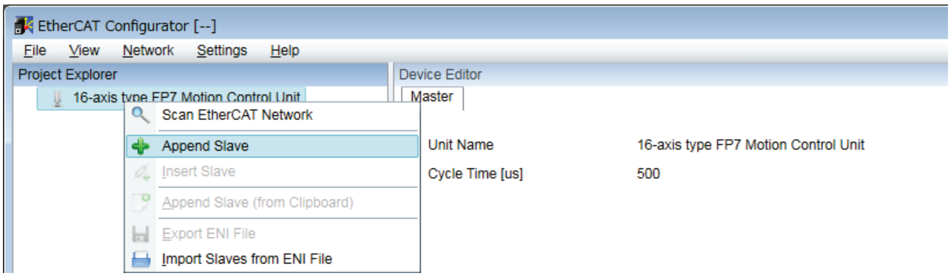


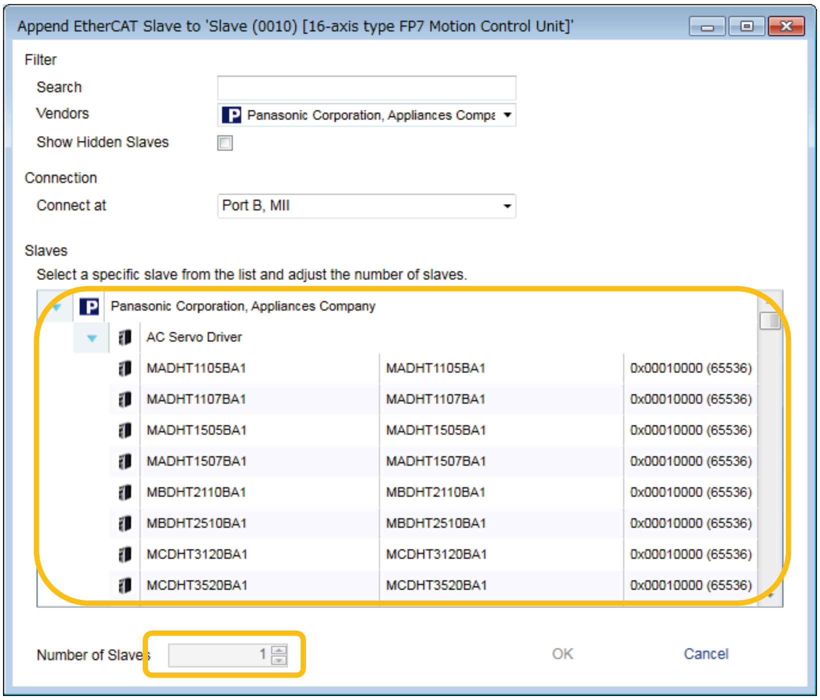
2. **Right-click on "FP7 Motion Control Unit" in the project explorer.**

   The context menu is displayed.

3. **Select "Append Slave" from the context menu.**

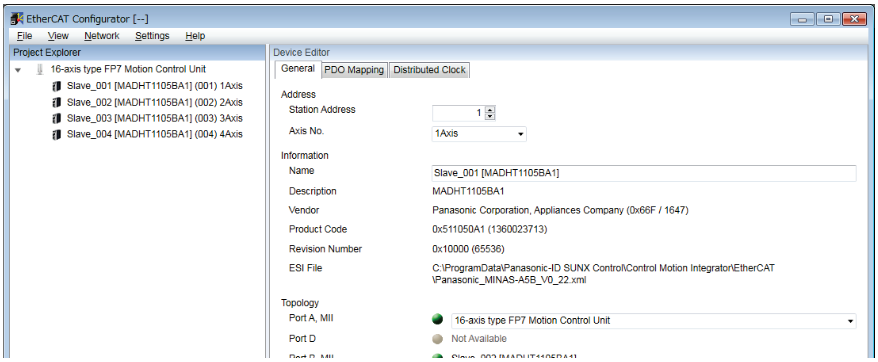
   The dialog box for selecting slaves is displayed.





4. **Select slaves (servo amplifier form) to be used from the list.**
5. **Input the number of slaves, and press the [OK] button.**

   The registration state of the slaves (A5B) connected to FP7 MC Unit is displayed in the project explorer. The list shows the slaves in the connection order from the unit connected to FP7 MC Unit first.



6. **When there are multiple types of slaves (servo amplifier form), repeat steps 2 to 5.**

4.4.2 Registration of Slaves (Online)

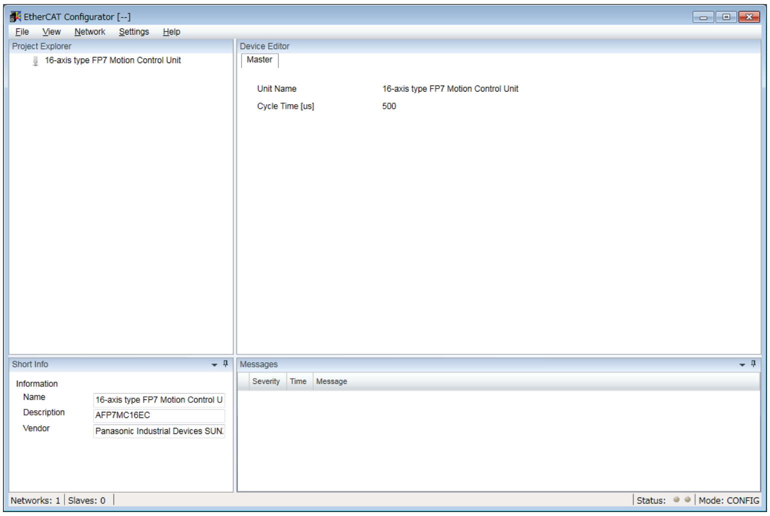
In FP7 MC Unit, the configuration of slaves connected to the network can be read and registered in online mode. The following procedure is explained on the condition that CMI has already started.

◆ **PROCEDURE**

1. **Turn on the power supplies of all servo amplifiers A5B connected to the network.**
2. **Turn on the power of the FP7 MC system.**

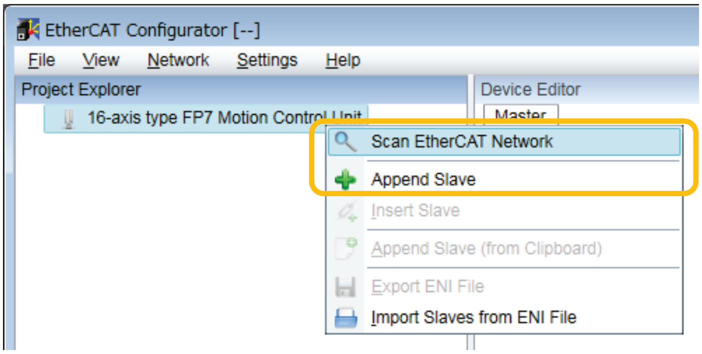
   The "EC L/A" LED of FP7 MC Unit turns on or blinks after the execution of EtherCAT communication between FP7 MC Unit and servo amplifiers A5B.
3. **Select "Parameter" > "EtherCAT communication setting" from the menu bar.**

   The "EtherCAT Configurator" window is displayed.



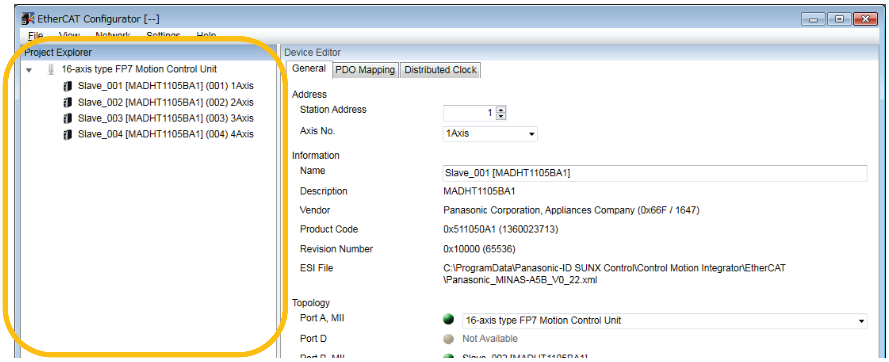
4. **Right-click on "FP7 Motion Control Unit" in the project explorer.**

   The context menu is displayed.



5. Select "Scan EtherCAT Network" from the context menu.

FP7 MC Unit executes scanning the network. The information on the servo amplifiers A5B connected to FP7 MC Unit is displayed in the project explorer in the connection order.



◆ **KEY POINTS**

- **It takes approximately 10 seconds for one axis to complete the scanning of EtherCAT network.**
- **"Scan EtherCAT network" can be executed when the "EC L/A" LED on FP7 MC Unit is lit or blinking. Possible situations are as follows.**

■ Unit state and network scanning operation

LEDs of FP7 MC Unit			Possible case and confirmation method	Network scanning
EC L/A	EC RUN	ERR		
ON	OFF	ON	"Network configuration verify error" occurs. In this case, even when the ERR LED is lit, the network scanning can be executed. This error also occurs when using FP7 MC Unit for the first time as the information on the network configuration is not downloaded to FP7 MC Unit.	Executable
Blinking	ON	ON	"Network configuration verify error" may occur as the rotary switch on Servo Amplifier A5B is not set to "00". Set the rotary switch to "00" and restart the power supply.	Not executable
ON Blinking	ON	OFF	The situation that the network configuration information has been downloaded and the number of connected servo amplifiers matches is possible. The network scanning can be executed.	Executable

4.4.3 Setting of Station Addresses and Axis Numbers

Once the information on devices connected to the network is displayed in the project explorer of EtherCAT Configurator, set the station addresses and axis numbers of servo amplifiers A5B.erCAT Configurator, set the station addresses and axis numbers of servo amplifiers A5B.

■ Explanation of terms

Name	Setting range	Description
Station address	1-192	ID of a slave used on the EtherCAT network. In the technical data of Servo Amplifier A5B, it is expressed as station alias (node ID).
Axis number	1-16 1-32 1-64	It is linked with various functions set for each axis in CMI such as axis parameter setting, positioning table setting, and synchronous parameter setting.
		The start requests and flags used in user porgrams are determined based on the "axis numbers" set in CMI. User programs are created using FPWIN GR7.

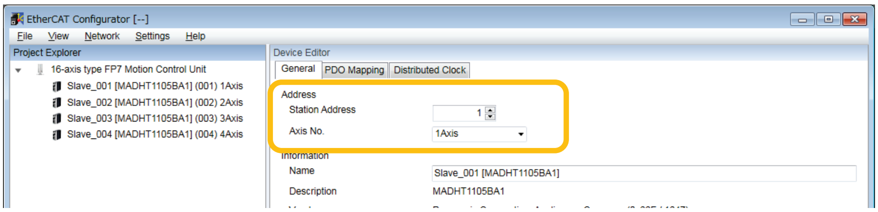
■ Procedure

The following procedure is explained on the condition that slaves have already been registered in CMI.

◆ **PROCEDURE**

1. Select an arbitrary slave (servo amplifier) in the project explorer.

The slave information is displayed on the "General" tab in the "Device Editor" window.



2. Input "Station Address" and "Axis No.".

◆ **KEY POINTS**

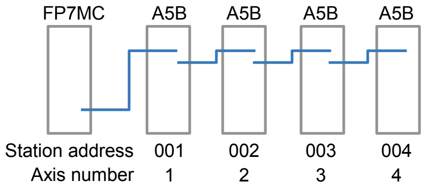
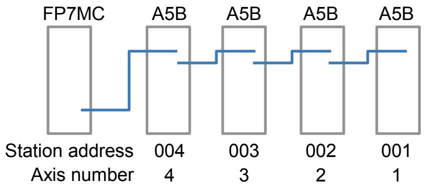
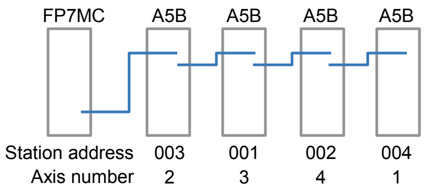
- **When a station address is overlapped, an error message is displayed on EtherCAT Configurator of CMI.**

- **When "Not use" is displayed in the project explorer, no "Axis no." is set. Change the used axis setting as necessary. When there is "Not use", an error occurs at the time of download.**

- **When the number of axes specified in the used axis setting is more than the number of slave axes registered in the project explorer, the download is executed, however, "network configuration error" occurs when the power supplies of servo amplifier and FP7 MC Unit turn off and on.**

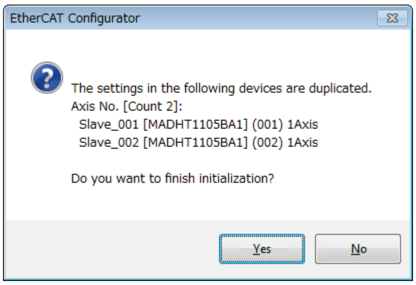
■ Setting example

Although station addresses and axis numbers can be set arbitrarily, it is recommended to set the same numbers to facilitate the management. By default, station addresses are allocated in the connection order.

<table>
<tr><th>No.</th><th>Display of project explorer</th><th>Configuration of devices</th></tr>
<tr><td>①</td><td>Project Explorer
16-axis type FP7 Motion Control Unit
Slave_001 [MADHT1105BA1] (001) 1Axis
Slave_002 [MADHT1105BA1] (002) 2Axis
Slave_003 [MADHT1105BA1] (003) 3Axis
Slave_004 [MADHT1105BA1] (004) 4Axis</td><td>This shows the state the station addresses are the same as axis numbers, and set in the connection order.

</td></tr>
<tr><td>②</td><td>Project Explorer
16-axis type FP7 Motion Control Unit
Slave_001 [MADHT1105BA1] (004) 4Axis
Slave_002 [MADHT1105BA1] (003) 3Axis
Slave_003 [MADHT1105BA1] (002) 2Axis
Slave_004 [MADHT1105BA1] (001) 1Axis</td><td>This shows the state the station addresses are the same as axis numbers, and set in the reverse order of the connection.

</td></tr>
<tr><td>③</td><td>Project Explorer
16-axis type FP7 Motion Control Unit
Slave_001 [MADHT1105BA1] (003) 2Axis
Slave_002 [MADHT1105BA1] (001) 3Axis
Slave_003 [MADHT1105BA1] (002) 4Axis
Slave_004 [MADHT1105BA1] (004) 1Axis</td><td>The station addresses do not match the axis numbers.

</td></tr>
</table>

◆ **KEY POINTS**

- **When closing EtherCAT Configurator of CMI, an error message is displayed if station addresses or axis numbers are duplicated.**



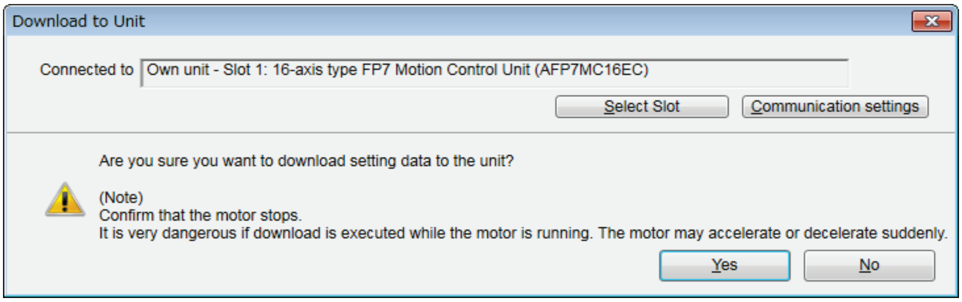
4.4.4 Download to FP7 MC Unit

Check the configuration of devices connected to the network, and download setting information to FP7 MC Unit after finishing the setting of station addresses and axis numbers. The following procedure is explained on the condition that CMI has already started.

◆ PROCEDURE

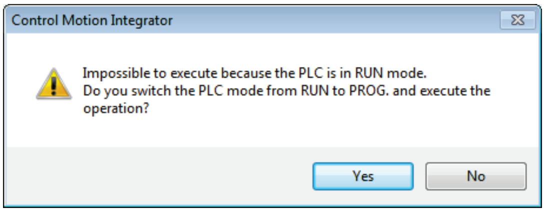
1. **Select "File" > "Download to Unit" from the menu bar.**

   A message confirming the target unit is displayed.



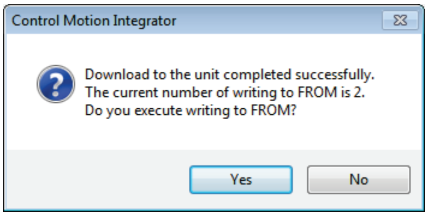
2. **Confirm the message, and press the [Yes] button.**

   When the CPU is in RUN mode, the following message is displayed.



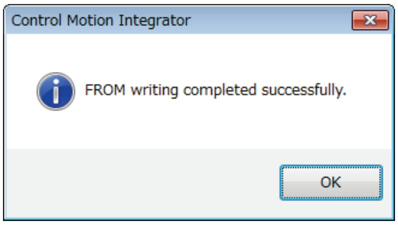
3. **Select a unit to which the setting data is downloaded, and press the "Yes" button.**

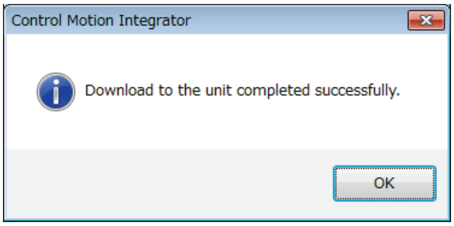
   A message confirming whether to execute the writing to FROM is displayed.



4. Press the [Yes] button to write data to the FROM in the unit, and press the [No] button not to perform the writing.

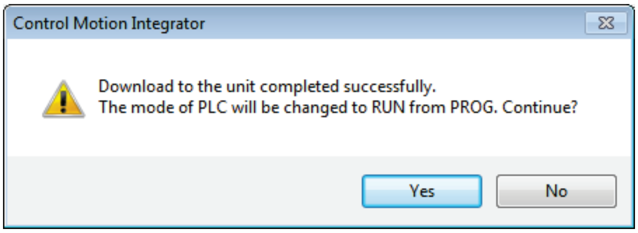
When the processing is finished, the following message is displayed.





5. Press the [OK] button.

The message for confirming the mode switching of the CPU unit is displayed.



6. Press the [Yes] or [No] button.

◆ **KEY POINTS**

- **Executitng "Writing to FROM" writes set parameters to the FROM in FP7 MC Unit. When the power turns on again, the parameters are read to the unit memory (RAM) from the FROM.**
- **When "Write to FROM" is not executed, the set parameters are temporarily written to the unit memory (RAM) in the unit and used as data during operation. However, when the power turns on again, it is overwritten by the parameters written into the FROM.**
- **It is also possible to execute "Online" > "Write to FROM" on CMI.**
- **"Write to FROM" can also be executed by turning on the FROM write request (Y3) of user programs. However, we recommend using differential execution with this instruction to prevent the writing from being executed continuously.**

◆ **NOTES**

- **Writing to FROM can be performed up to 10000 times. Do not write data to FROM more than 10000 times.**

4.4.5 Restarting Power Supplies and Checking Communication State

Download the parameters set by CMI to FP7 MC Unit, and then restart the power supplies for the system (Unit and Servo Amplifier). The setting is reflected and the communication is started.

◆ **PROCEDURE**

1. **Turn off the power supplies of FP7 MC Unit and Servo Amplifier A5B.**
2. **Turn on the power supply of Servo Amplifier A5B.**
3. **Turn on the power of FP7 MC Unit.**

   EtherCAT communication is started between Servo Amplifier A5B and FP7 MC Unit. Once the communication is executed and the link is established properly, the both "EC RUN" LEDs turn on.
4. **Confirm that no error occurs.**

   When an error occurs, the ERR LED on FP7 MC Unit turns on.

◆ **KEY POINTS**

- **The connection state of the network can be checked by monitorng the unit memories. The informatin on abnormal slaves is stored in the unit memories (UM 0012E-UM 00139).**
- **When the configuration is different from the network configuration set by CMI, an error occurs.**
- **The participation wait time for the nodes (slaves) connected to the EtherCAT network can be set in the "MC common setting" menu of CMI after the power-on of FP7 MC Unit.**

■ Unit memories (Slave tables)

Slave no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-16	UM 000FE	Registered slave table	H0	Turns on bits corresponding to each station address (slave number) registered in ENI file.	●	-
17-32	UM 000FF					
-	-					
177-192	UM 00109					
1-16	UM 0010A	Network participating slave table	H0	Turns on the bits corresponding to each station address (slave number) in the OP mode out of the slaves participating in the network.	●	-
17-32	UM 0010B					
-	-					
177-192	UM 00115					
1-16	UM 00122	Normal slave table	H0	Turns on bits corresponding to each station address (slave number) in the OP mode out of the slaves registered in ENI file and participating in the network.	●	-
17-32	UM 00123					
-	-					
177-192	UM 0012D					
1-16	UM 0012E	Abnormal slave table	H0	Turns on bits corresponding to each station address (slave number) in any modes other than the OP mode out of the slaves registered in ENI file and participating in the network.	●	-
17-32	UM 0012F					
-	-					
177-192	UM 00139					

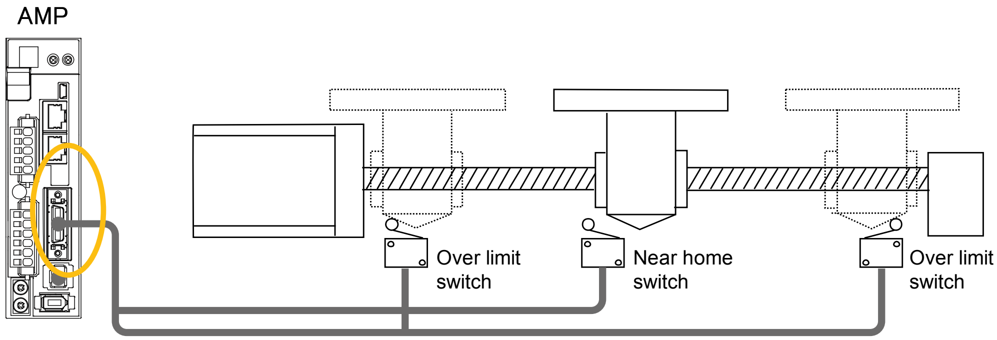
(Note 1): Sixteen slave numbers are allocated to each area (1 word).

bit no.	15		8	7		0
Slave no.	16	• • • • •	9	8	• • • • •	1
	32	• • • • •	25	24	• • • • •	17
	48	• • • • •	41	40	• • • • •	33
	64	• • • • •	57	56	• • • • •	49
	80	• • • • •	73	72	• • • • •	65
	96	• • • • •	89	88	• • • • •	81
	112	• • • • •	105	104	• • • • •	97
	128	• • • • •	121	120	• • • • •	113
	144	• • • • •	137	136	• • • • •	129
	160	• • • • •	153	152	• • • • •	145
	176	• • • • •	169	168	• • • • •	161
	192	• • • • •	185	184	• • • • •	177

4.5 Connection of Limit and Near Home Switches

4.5.1 Connection of Input Signals

For the system which uses the over limit switches and near home switch, connect them to the I/O connector (X4) of Servo Amplifier A5B.



■ **I/O connector (X4): Allocation of functions at the factory setting**

X4 connector		Function at the factory setting			Application on the FP7 MC Unit side
Name	**Pin no.**	**Signal name**	**Code**	**Logic**	
SI1	5	General-purpose monitor input 5	SI-MON5	A contact	It can be only monitored by the unit memories..
SI2	7	CW over-travel inhibit input	POT	B contact	Do not allocate POT or NOT.
SI3	8	CCW over-travel inhibit input	NOT	B contact	
SI4	9	Near home input	HOME	A contact	It is used as a near home input.
SI5	10	External lutch input 1	EXT1	A contact	It can be only monitored by the unit memories..
SI6	11	External lutch input 2	EXT2	A contact	
SI7	12	General-purpose monitor input 3	SI-MON3	A contact	It is used as limit +.
SI8	13	General-purpose monitor input 4	SI-MON4	A contact	It is used as limit -.

(Note 1): The above table shows the allocation before shipment. It varies according to the setting of PANATERM.

◆ **KEY POINTS**

- **When using FP7 MC Unit in combination with Servo Amplifier A5B, the general-purpose inputs (SI-MON3 and SI-MON4) are used as limit inputs. For using the general-purpose monitor inputs (SI-MON3 and SI-MON4) as limit inputs, the setting of the limit switch should be set to "A: Enabled" in the "Axis parameter setting" menu of CMI.**
- **The over-travel inhibit inputs (POT, NOT) cannot be used as the limit inputs on the MC Unit side. Do not allocate the over-travel inhibit inputs (POT, NOT) to the I/O connector (X4) of Servo Amplifier A5B.**

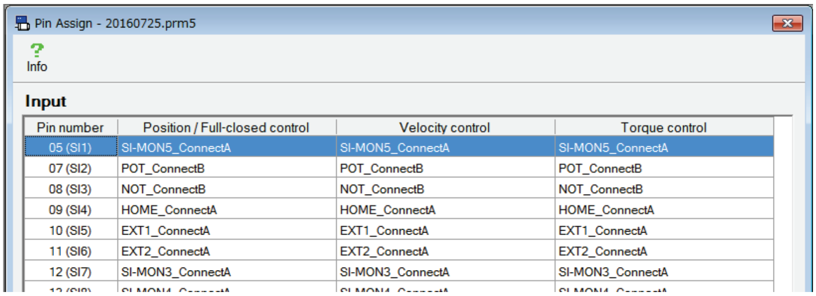
4.5.2 Pin Assignment Setting of Servo Amplifier

The allocation of I/O connector (X4) and input logic is set by PANATERM. The following procedure is explained on the condition that PANATERM has already started.

PROCEDURE

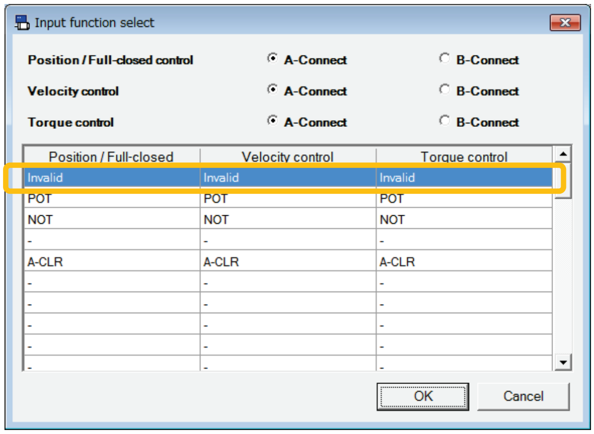
1. **Select "Other" > "Pin Assign" from the toolbar.**

   The "Pin Assign" dialog box is displayed.



2. **Double-click the row "Pin number 07 (SI2)" to which "POT" is allocated.**

   The "Input function select" dialog box is displayed.



3. **Select the row "Invalid", and press the [OK] button.**

   The change result can be confirmed in the "Pin Assign" dialog box.

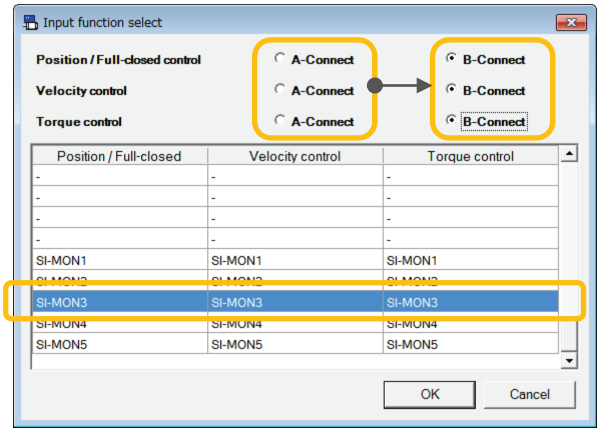
4. **Repeat steps 2 and 3 for "NOT: Pin number 08 (SI3)".**

5. **When changing the input logics of limit and near home switches, go to step 6. When they are not changed, go to step 10.**

6. **Double-click the row in which the general-purpose monitor input "SI-MON3" is allocated.**

   The "Input function select" dialog box is displayed.

7. **Confirm "SI-MON3" is selected, switch the three radio buttons from "A-Connect" to "B-Connect", and press the [OK] button.**



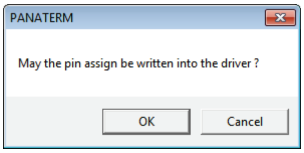
The change result can be confirmed in the "Pin Assign" dialog box.

8. **Repeat the same operations in steps 6 and 7 for "SI-MON4", too.**

9. **When changing the input logic of near home switch, repeat the same operations.**

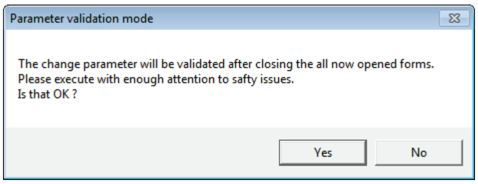
10. **Press the "Apply" button in the "Pin Assign" dialog box.**

A confirmation message is displayed.



11. **Press the [OK] button.**

A confirmation message is displayed.

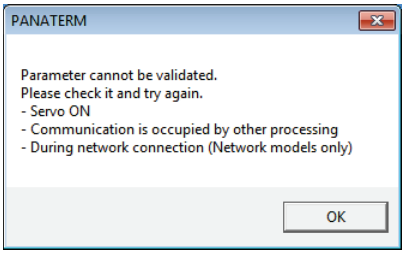


12. **Press the [Yes] button.**

Writing to the EEPROM to the servo amplifier is executed.

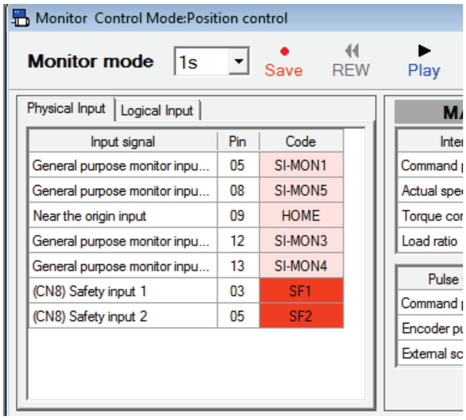
◆ **KEY POINTS**

- **When FP7 MC Unit is being controlled, the following message is displayed.**



4.5.3 Checking Servo Amplifier Input State

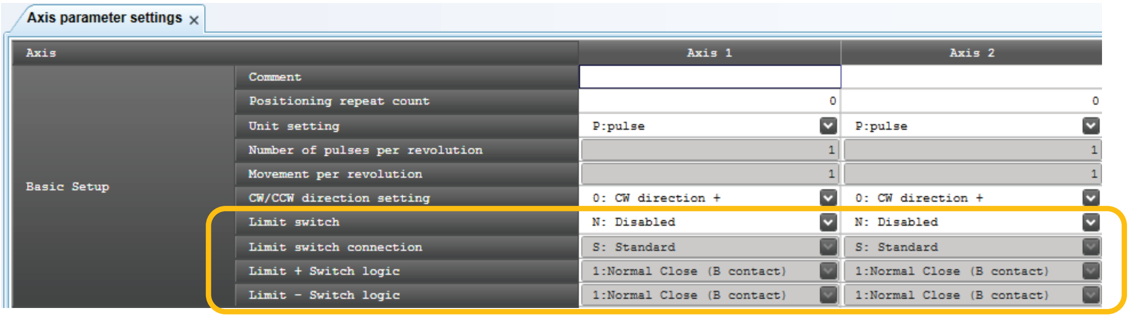
After the completion of the pin assign setting of Servo Amplifier, operate the connected limit inputs and near home inputs forcibly and check the input states. The input states can be checked on PANATERM.



4.5.4 Settings of FP7 MC Unit

To enable the limit function, the axis parameter "Limit input" in CMI should be set to be enabled. Also, the input logic should be confirmed on CMI.

■ Settings related to Limit switch



Parameter name	Default	Description
Limit switch	N: Disabled	When using the limit switch function or the home return function using limit switches, select "A: Enabled". N: Disabled, A: Enabled
Limit switch connection	S: Standard	When the arrangement of the connected "limit switch +" and "limit switch -" is opposite to the input state loaded to the unit, select "R: Reverse connection". S: Standard, R: Reverse connection
Limit + Switch logic	1: Normal Close (B contact)	Select the input logic of the limit swtiches. 0: Normal Open (A contact), 1: Normal Close (B contact)
Limit - Switch logic		

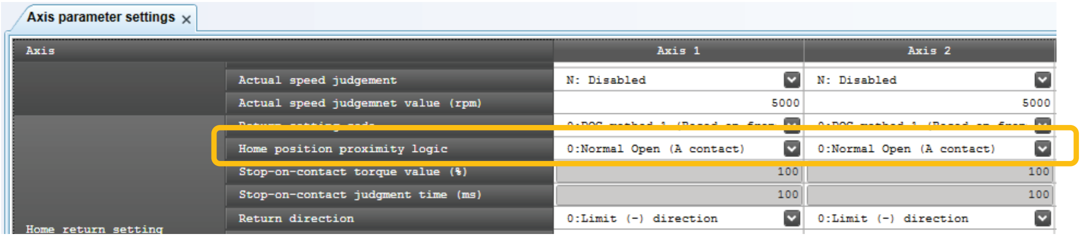
◆ **KEY POINTS**

- **In the system using FP7 MC Unit, limit switches are connected to the general-purpose inputs (SI-MON3 and SI-MON4) of Servo Amplifier A5B. When the "Limit switch" is set to "Enabled" in the above parameter, the state of the general-purpose inputs (SI-MON3 and SI-MON4) of Servo Amplifier A5B is reflected as the limit inputs of FP7 MC Unit.**
- **It is recommended to select "Normal Open (A contact)" for "Limit + Switch logic" and "Limit - Switch logic". The input logic selected on the servo amplifier A5B is reflected as is.**

◆ **REFERENCE**

- **For details of the axis parameter settings, refer to "5.2 Axis Parameter Setting".**

■ Setting of Home position proximity logic



Parameter name	Default	Description
Home position proximity logic	Normal Open (A contact)	The near home input logic is selected. 0: Normal Open (A contact), 1: Normal Close (B contact)

◆ **KEY POINTS**

- **It is recommended to select "Normal Open (A contact)" for "Home position proximity logic". The input logic selected on Servo Amplifier A5B is reflected as is.**

4.5.5 Download to FP7 MC Unit

Once the settings of limit switches and input logic is completed in CMI, download the parameter information to FP7 MC Unit.

◆ **REFERENCE**

- **For details of the downloading method, refer to "4.4.4 Download to FP7 MC Unit".**

4.5.6 Checking Input State

After the completion of the settings, operate the limit inputs and near home inputs connected to the servo amplifier forcibly, checker that they can be monitored on the FP7 MC Unit side.

- They can be monitored by the status monitor or unit memories (input control area).
- The unit memories of FP7 MC Unit can also be monitored when FP7 CPU Unit is in PROG. mode.

4.6 Saving and Managing Files

4.6.1 File Type

The set parameters and positioning table information can be saved or exported in the following four formats.

File name	Extension	Application	Operation
Configurator CMI file	.cmi	The whole parameters of FP7 MC Unit are saved. ● EtherCAT communication parameters ● Setting of positioning parameters ● Setting of positioning tables	Save Open
Project file	.ecc	Project files (EtherCAT communication parameters) created by EtherCAT Configurator in CMI are saved.	Save Open
ENI file	.xml	ENI files created by EtherCAT Configurator in CMI are exported/imported.	Export Import
CSV file	.csv	The whole parameters of FP7 MC Unit are exported in csv format. They can be used for checking parameters.	Export

4.6.2 Saving as CMI Files

Set parameters and positioning table information can be saved and opened on CMI. The saved data can also be reused in multiple units and projects.

◆ **PROCEDURE**

1. Select "File" > "Save As" from the menu bar.

The "Save As" dialog box is displayed.

2. Enter a saving destination and file name, and press [Save] button.

Information on parameters and positioning tables is saved as files with the extension (.cmi).

◆ **KEY POINTS**

- **The files saved by the above operations contain the information on all parameters and positioning tables set on CMI.**

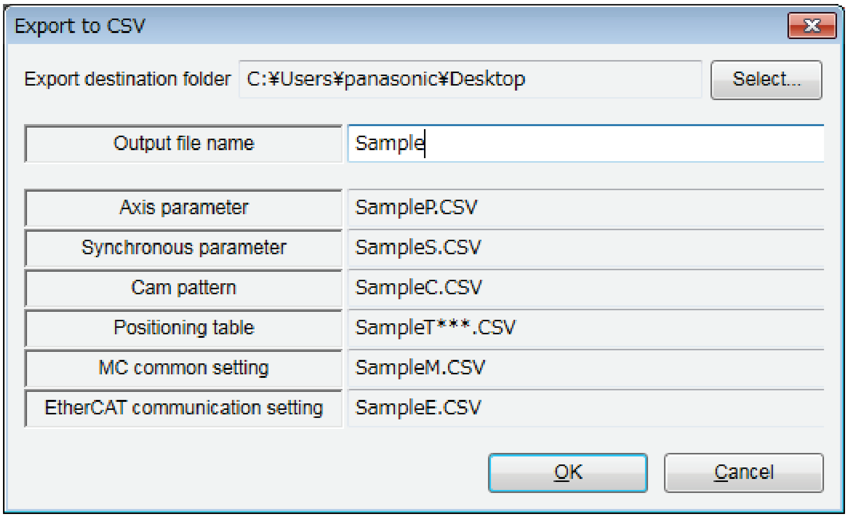
4.6.3 Export to CSV Files

The information on set parameters and positioning tables can be exported in csv format. It is possible to open the csv files and check the settings of each parameter and positioning table..

◆ **PROCEDURE**

1. Select "File" > "Export to CSV" from the menu bar.

The "Export to CSV" dialog box is displayed.



2. Input an output file name, and press the [OK] button.

CSV files with given file names are saved for each parameter.

5

Settings of FP7 MC Unit

5.1 MC Common Settings

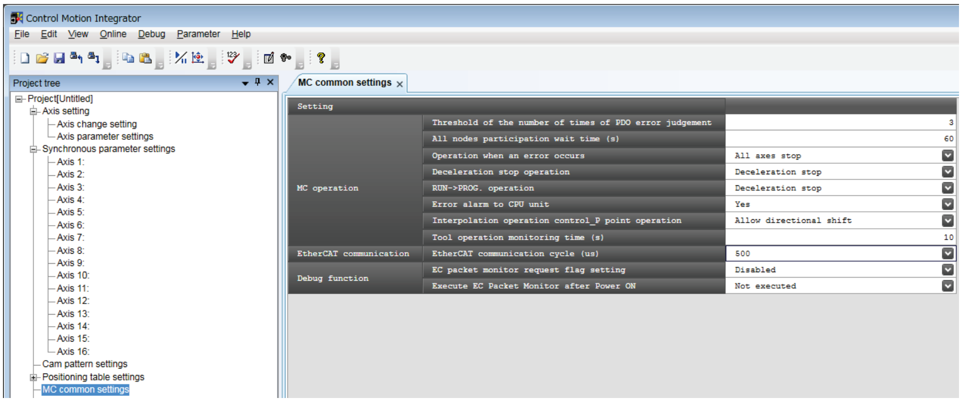
5.1.1 MC Common Settings Dialog Box

In the "MC common settings" dialog box, The EtherCAT communication cycle and the operations when errors occur are set. The following procedure is explained on the condition that CMI has already started.

◆ **PROCEDURE**

1. **Select "Parameter" > "MC common settings" from the menu bar.**

   The "MC common settings" dialog box is displayed.



2. **Set necessary parameters in accordance with the intended use.**

◆ **KEY POINTS**

- **Although the data being edited is held until finishing CMI even when the dialog box is closed with the X mark during the editing, save parameters by executing "File" > "Save As" as necessary.**

5.1.2 MC Common Settings Parameters

The Parameters common to the unit, such as error judgement conditions and operation when errors occur, are set.

■ **MC operation**

Parameter name	Default	Description
Threshold of the number of times of PDO error judgement	3	The EtherCAT communication error judgement threshold is set. When the error occurs for the specified number of times consecutively, it is judged as EtherCAT communication error. Range: 1 to 10 (times)
All nodes participation wait time (s)	60	The participation wait time for slaves connected to EtherCAT network after MC Unit is powered on is set. Error occurs when a node does not participate in the network after the elapse of the specified time. Range: 1 to 240 (s)
Operation when an error occurs	All axes stop	The operation performed when an error occurs in axes (nodes) connected to the network is set. All axes stop: Stops all axes operations. Normal axis operation continuance (Degraded operation): Stops the operation of the axis an error occurred. The operations of normal axes continue.
Deceleration stop operation	Deceleration stop	The function when the deceleration stop request of unit memories (output control area) turns on is set. Deceleration stop / Pause
RUN->PROG. operation	Deceleration stop	The operation when the operation mode of CPU unit changes from RUN to PROG is set. Operation continuance: The operation of each axis continues. Deceleration stop: Each axis decelerates and stops in a specified deceleration stop time in the current control mode. Immediate stop: Each axis decelerates and stops in a specified emergency stop deceleration time.
Error alarm to CPU unit	Yes	The error annunciation method to FP7 MC Unit when an error occurs is set. Yes: Announces errors to the CPU unit. No: Not announce errors to the CPU unit.
Interpolation operation control_P-point operation	Allow directional shift	Set whether or not to allow the shift between the moving direction (vector) to a target point from the operation starting point and the moving direction (vector) to the next target point during the P-point operation of interpolation operation control. Allow directional shift: P-point operation continues even when the moving direction is displaced. Not allow directional shift: Operation is performed by replacing P point with C point when the moving amount shifts.
Tool operation monitoring time (s)	10	The communication timeout period between CMI and FP7 MC Unit is set. Range: 1 to 240 (s)

☛ To the next page

■ EtherCAT communication

Parameter name	Default	Description
EtherCAT communication cycle (μs)	500	Select the EtherCAT communication cycle. 500 / 1000 / 2000 / 4000 (μs)

(Note): Set the EtherCAT communication cycle in accordance with the following contents. The installation condition is the case by our measurement condition.

Control method	No. of used axes	Setting value
Single axis control Interpolation control	Up to 16 axes	From 500 [μs]
	Up to 32 axes	From 1000 [μs]
	Up to 64 axes	From 2000 [μs]
Synchronous control	Up to 16 axes	From 1000 [μs]
	Up to 32 axes	From 2000 [μs]
	Up to 64 axes	From 4000 [μs]

■ Debug function

Parameter name	Default	Description	
EC packet monitor request flag setting	Disabled	The operation of packet monitor request flag of EC(EtherCAT) communication is set.	
		Disabled	Packet monitor is not executed when the EC packet monitor request flag turns ON.
		Enabled	Packet monitor is executed when the EC packet monitor request flag turns ON.
Execute EC Packet Monitor after Power ON	Not executed	The operation of the EC (EtherCAT) packet monitor when FP7 MC Unit is powered on is set.	
		Not executed	EC packet monitoring is not executed after the power turns on.
		Executed	EC packet monitoring is executed after the power turns on.

◆ **REFERENCE**

- **For details of "EC packet monitor" function, refer to "13.9 EC Packet Monitor Function".**

5.2 Axis Parameter Settings

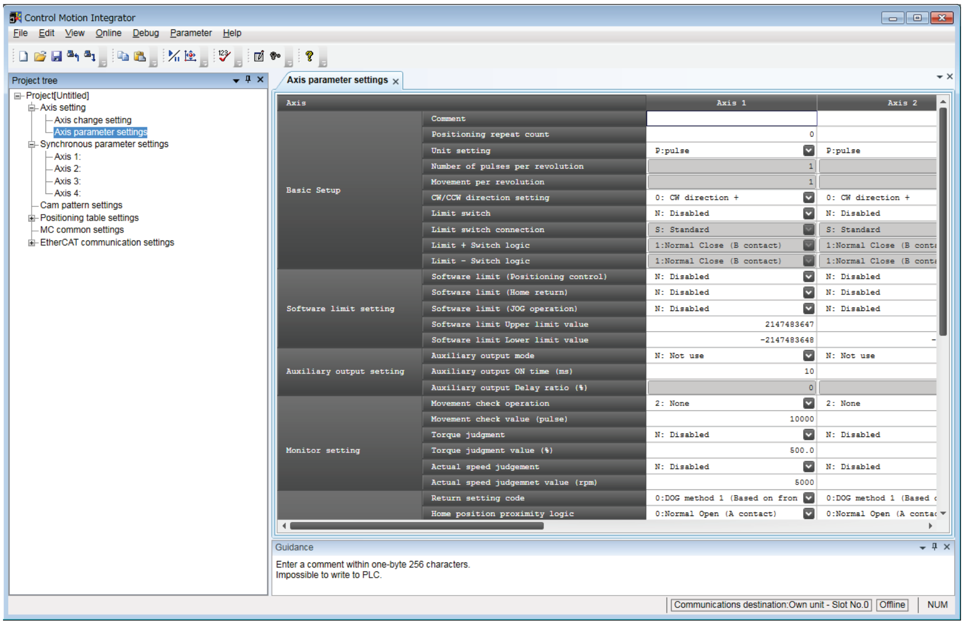
5.2.1 Setting by CMI

The parameters common to each axis, such as the motor rotation direction and the logics of home input and limit input, are set by CMI. The following procedure is explained on the condition that CMI has already started.

◆ PROCEDURE

1. **Select "Parameter" > "Axis parameter settings" from the menu bar.**

   The "Axis parameter settings" dialog box is displayed.



2. **Set necessary parameters in accordance with the intended use.**
3. **Select "File" > "Save As" from the menu bar.**
4. **Enter an arbitrary file name, and press the [Save] button.**

◆ KEY POINTS

- **Although the data being edited is held until finishing CMI even when the dialog box is closed with the X mark during the editing, save parameters by executing "File" > "Save As".**

5.2.2 Axis Parameters (Basic Setup)

■ Basic setup

Parameter name	Default	Description
Comment	Blank	Arbitrary comments can be input. However, they cannot be written into the unit.
Positioning repeat count	0	The number of repetitions of positioning control is set. Range: 0 to 255 (times)
Unit setting	P：pulse	The units for specifying position command values and speed command values are set. P: pulse M: μm [Min 0.1], M: μm [Min 1] I: inch [Min 0.00001 inches]、I: inch [Min 0.0001 inches] D: degree [Min 0.1], D: degree [Min 1]
Number of pulses per revolution	1	Only when the unit is set to um, inch, or degree, the pulse number and movement amount per rotation are set.
Movement per revolution	1	
CW/CCW direction setting	0: CW direction +	0: CW direction +: Set the direction that an elapsed value is + as CW. 1: CCW direction +: Set the direction that an elapsed value is + as CCW.
Limit switch	N: Disabled	When using the home return function using the limit switches or using the limit stop function, select "A: Enabled". N: Disabled, A: Enabled
Limit switch connection	S: Standard	When the arrangement of the connected "limit +" and "limit -" is opposite to the input state loaded to the unit, select "R: Reverse connection". S: Standard, R: Reverse connection
Limit + Switch logic	1: Normal Close (B contact)	Select the input logic of the limit swtiches. 0: Normal Open (A contact), 1: Normal Close (B contact)
Limit - Switch logic		

◆ **KEY POINTS**

- **In FP7 MC Unit, CW refers to the rotating direction with a count increase and CCW refers to the direction with a count decrease. Therefore, limit input in the CW direction is limit + input and that in the CCW direction is limit -.**
- **In the system using FP7 MC Unit, limit switches are connected to the general-purpose inputs (SI-MON3 and SI-MON4) of Servo Amplifier A5B. When the "Limit switch" is set to "Enabled" in the above parameter, the state of the general-purpose inputs (SI-MON3 and SI-MON4) of Servo Amplifier A5B is reflected as the limit inputs of FP7 MC Unit.**
- **It is recommended to select "Normal Open (A contact)" for "Limit + Switch logic" and "Limit - Switch logic". The input logic selected on the servo amplifier A5B side is reflected as is.**

5.2.3 Axis Parameters (Options)

These parameters are set according the used functions.

■ Software limit setting

Parameter name	Default	Description
Software limit (Positioning control)	N: Disabled	Select whether to enable or disable the software limit when executing the positioning control, home return or JOG operation. N: Disabled, A: Enabled
Software limit (Home return)	N: Disabled	
Software limit (JOG operation)	N: Disabled	
Software limit Upper limit value	2147483647	Set the upper or lower limit of the software limit.
Software limit Lower limit value	-2147483648	

■ Auxiliary output setting

Parameter name	Default	Description
Auxiliary output mode	N: Not use	Select the operation mode of auxiliary output contact and auxiliary output code. N: Not use, W: With mode, D: Delay mode
Auxiliary output ON time (ms)	10	Set the time period that auxiliary output contact is ON. Range: 0 to 255 ms
Auxiliary output Delay ratio (%)	0	When using the delay mode for the auxiliary output, specify the ratio to output. Range: 0 to 100 %

■ Monitor setting

Parameter name	Default	Description
Movement check operation	2: None	Select the operation when exceeding the movement amount automatic check threshold. 0: Error, 1: Warning, 2: None
Movement check value (pulse)	10000	Set the threshold for the movement amount automatic check operation. Range: 0 to 65535 pulses
Monitor error - Torque judgment	N: Disabled	Select the operation of FP7 MC Unit when the torque value of the amplifier is monitored and exceeds the judgement value. N: Disabled, E: Enabled (Error), W: Enabled (Warning)
Monitor error - Torque judgment value (%)	500.0	Set the torque judgement value. Range: 0 to 500.0 (%)
Monitor error - Actual speed judgement	N: Disabled	Select the operation of FP7 MC Unit when the actual speed of the amplifier is monitored and exceeds the judgement value. N: Disabled, E: Enabled (Error), W: Enabled (Warning)
Monitor error - Actual speed judgement value (rpm)	5000	Set the actual speed judgement value. Range: 0 to 5000 rpm

◆ **REFERENCE**

- **For details of each function of software limit, auxiliary output and monitor setting, refer to "13 Supplementary Functions".**

5.2.4 Axis Parameters (Operation)

Common parameters to each axis related to operations are set.

■ Home return setting

Parameter name	Default	Description
Return setting code	0: DOG method 1	Select the pattern of home return. 0:DOGmethod 1 (Based on front end + Z phase) 1: DOG method 2 (Based on front end) 2: DOG method 3 (Based on back end + Z phase) 9: DOG method 4 (Based on back end) 3: Limit method 1 (Limit signal + Z phase) 4: Limit method 2 (Limit signal) 5: Z-phase method 6: Stop-on-contact method 1 7: Stop-on-contact method 2 (Stop-on-contact + Z phase) 8: Data set method
Home position proximity logic	Normal Open (A contact)	Select the near home input logic. Normal Open (A contact) 1: Normal Close (B contact)
Stop-on-cotnact torque value (%)	100	This parameter is used for selecting the stop-on-contact method as the home return method. It is regarded as a criterion for judging the home return once the torque value of the servo amplifier exceeded this set value by the stop-on-contact. Range: 0.0 to 500.0 (%)
Stop-on-contact judgment time (ms)	100	This parameter is used for selecting the stop-on-contact method as the home return method. When using the stop-on-contact method, it is regarded as a criterion for judging the home return once this set time has passed after the torque value of the servo amplifier exceeded the stop-on-contact torque value. Range: 0 to 10000 (ms)
Return direction	0: Limit (-) direction	Select the operation direction of home return. 0: Elapsed value decreasing direction (Limit - direction) 1: Elapsed value increasing direction (Limit "+" direction)
Return acceleration time (ms)	100	Set the acceleration time when performing the home return. Range: 0 to 10000 (ms)
Return deceleration time (ms)	100	Set the deceleration time when performing the home return. Range: 0 to 10000 (ms)
Return target speed	1000	Set the target speed when performing the home return. Range: 1 to 32767000
Return creep speed	100	Set the creep speed to search the home position in the home return operation. Range: 1 to 32767000
Home coordinates	0	Set the home coordinates to be set after the completion of the home return. Range: -2147483648 to +2147483647

◆ **KEY POINTS**

- **It is recommended to select "Normal Open (A contact)" for "Home position proximity logic". The input logic selected on Servo Amplifier A5B is reflected as is.**

■ JOG operation setting

Parameter name	Default	Description
Acceleration/deceleration pattern setting	0: Linear acceleration/ deceleration	Select the acceleration/deceleration pattern when performing the JOG operation. 0: Linear acceleration/deceleration 1: S-shaped acceleration/deceleration
JOG acceleration time (ms)	100	Set the acceleration time when performing the JOG operation. Range: 0 to 10000 (ms)
JOG deceleration time (ms)	100	Set the deceleration time when performing the JOG operation. Range: 0 to 10000 (ms)
JOG target speed	1000	Set the target speed for performing the JOG operation. Range: 1 to 32767000
JOG operation - Inching movement	1	Set the movement amount when starting JOG inching operation. Range: 1 to 2147483647

■ Stop function setting

Parameter name	Default	Description
Emergency stop deceleration time (ms)	100	Set the deceleration time at the time of emergency stop. Range: 0 to 10000 (ms)
Limit stop deceleration time (ms)	100	Set the deceleration time at the time of limit stop. Range: 0 to 10000 (ms)
Error stop deceleration time (ms)	100	Set the deceleration time at the time of error stop. Range: 0 to 10000 (ms)

■ J-point operation setting

Parameter name	Default	Description
Operation setting code	0: Linear acceleration/ deceleration	Select the acceleration/deceleration pattern when performing the J-point control 0: Linear acceleration/deceleration 1: S-shaped acceleration/deceleration
Acceleration time (ms)	100	Sets the acceleration time when performing the J-point control. Range: 0 to 10000 (ms)
Deceleration time (ms)	100	Sets the deceleration time when performing the J-point control. Range: 0 to 10000 (ms)
Target speed	1000	Set the target speed when performing the J-point control. Range: 1 to 32767000

◆ REFERENCE

- **For details of the home return operation, refer to "11 Manual Operation (Home Return)".**
- **For details of the JOG operation, refer to "10 Manual Operation (JOG Operation)".**
- **For details of the stop functions, refer to "12 Stop Functions".**
- **For details of the J-point control, refer to "8.1.5 Setting and Operation of J-point Control".**

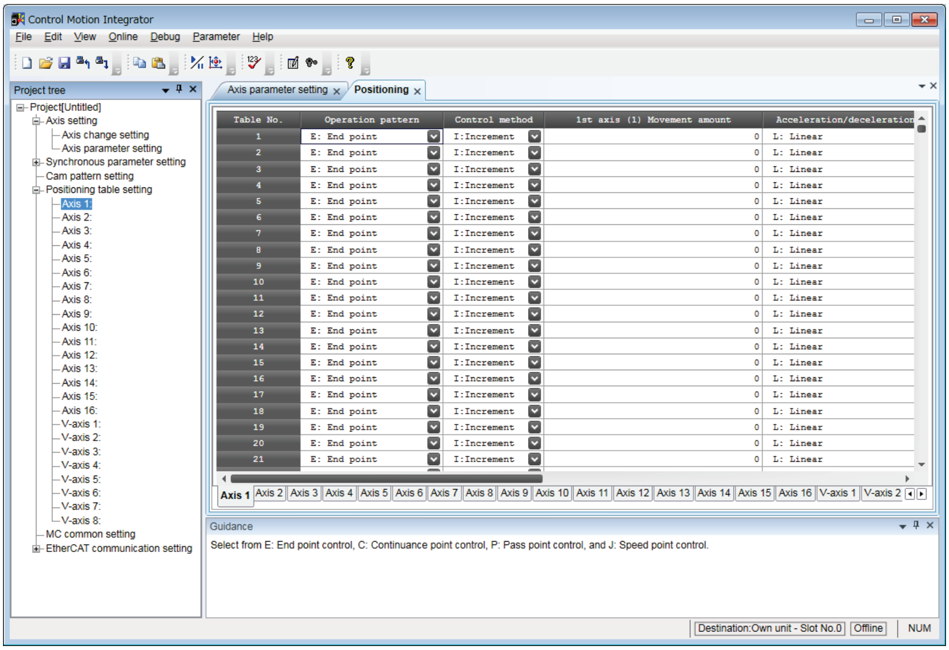
5.3 Positioning Table Setting

5.3.1 Construction of Positioning Tables

Positioning tables are assigned using CMI. The following procedure is explained on the condition that CMI has already started.

■ Positioning table setting screen of CMI

- Sheets are divided for each axis, and 1000 tables ranging no. 1 to no. 1000 can be set.
- By double-cliking an arbitrary axis of the project tree in CMI, the positioning data table opens.
- When setting the interpolcation control, the cell for "Interpolation operation" as a selection item is added between Operation pattern and Control method. Also, the input cells for Movement amount and Auxiliary point are added according to the number of axes.



In the above example, the real axes 1 to 16 and virtual axes 1 to 8 are displayed.

◆ **REFERENCE**

- **For details of each control, refer to "8 Automatic Operation (Position Control)".**

■ Setting items (Common)

Parameter name	Default	Description
Operation pattern	E: End point	Select one from the following operation patterns. E: End point, C: Continuance point, P: Pass point, J: Speed point
Control method	I: Increment	Select the control method. I: Increment, A: Absolute
1st axis (n) Movement amount	0	Input the movement amount (position command value). The movement amount depends on the unit system specified in the parameter settings. Axis numbers are displayed in (L). Range: -2147483648 to 2147483647
Acceleration/ deceleration type	L: Linear	Select the acceleration/deceleration method. L: Linear, S: S shape
Acceleration time (ms)	100	Set the acceleration time. Range: 1 to 10000 (ms)
Deceleration time (ms)	100	Set the deceleration time. Range: 1 to 10000 (ms)
Target speed	1000	Set the target speed. Range: 1 to 32767000 Unit: pps, μm/s, inch/s, rev/s
Dwell time [ms]	0	Set the time from the completion of the positioning instruction in theE-point control until the positioning done flag turns ON. For the C-point control, it is the wait time between each table. For the P-point control, the dwell time is ignored.
Auxiliary output	0	Set the auxiliary output code. When the auxiliary output is set to be enabled in the parameter settings, the auxiliary output code specified here is output.
Comment	-	Arbitrary comments can be input for each table. However, they cannot be written into the unit.

■ Setting items (Additional items for 2-axis interpolation)

Parameter name	Default	Description
Interpolation operation	0: Linear (Composite speed)	Select one from the following operation patterns. 0: Linear (Composite speed), 1: Linear (Long axis speed), S: Circular (Center piont/CW direction), T: Circular (Center point/CCW direction), U: Circular (Pass point).
1st axis (L) Movement amount	0	Input the movement amount (position command value). The auxiliary point is input for hte circular interpolation. The axis numbers allocated to interpolation groups are displayed in (L) and (m) in the ascending order from the smaller number.
1st axis (L) Auxiliary point	0	
2nd axis (m) Movement amount	0	
2nd axis (m) Auxiliary point	0	

■ Setting items (Additional items for 3-axis interpolation)

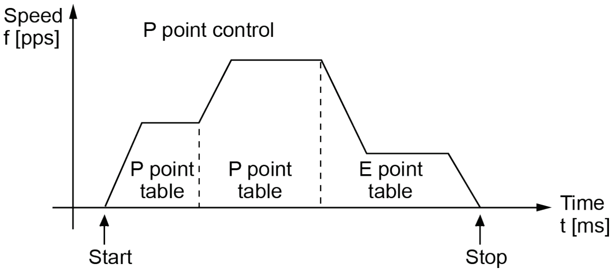
Parameter name	Default	Description
Interpolation operation	0: Linear (Composite speed)	Select one from the following operation patterns. 0: Linear (Composite speed), 1: Linear (Long axis speed), A: Spiral (Center point/ CW direction/1st axis movement), B: Spiral (Center point/CCW direction/1st axis movement), C: Spiral (Center point/CW direction/2nd axis movement), D: Sprial (Center point/CCW direction/2nd axis movement), E: Spiral (Center pont/CW direction/3rd axis movement), F: Spiral (Center point/CCW direction/3rd axis movement), L: Spiral (Pass point/1st axis movement), M: Spiral (Pass pont/2nd axis movement), N: Spiral (Pass point/3rd axis movement)
1st axis (L) Movement amount	0	Input the movement amount (position command value). The auxiliary point is input for hte spiral interpolation. The axis numbers allocated to interpolation groups are displayed in (L), (m) and (n) in the ascending order from the smaller number.
1st axis (L) Auxiliary point	0	
2nd axis (m) Movement amount	0	
2nd axis (m) Auxiliary point	0	
3rd axis (n) Movement amount	0	
3rd axis (n) Auxiliary point	0	

5.3.2 Operation Patterns and Tables

- Use a number of tables if the positioning patterns consist of P-point control (pass point control), C-point control (continuance point control), and J-point control (JOG positioning control).
- In these types of control, the tables are created continuously on CMI, and "E-point control" is selected for the operation pattern for the last table.
- Start requests are made by specifying the starting data table numbers for each control in user programs.

Example) When performing three-speed positioning control by P-point control (speed change control)

Create three positioning tables, and select "E:End point" for the last table. Also, start requests are made by specifying the starting table numbers in user programs.



Positioning*

Table No.	Operation pattern	Control method	1st axis (1) Movement amount	Acceleration/deceleration type
1	E: End point	I:Increment	50000	L: Linear
2	E: End point	I:Increment	100000	L: Linear
3	E: End point	I:Increment	30000	L: Linear

◆ **REFERENCE**

- **For details of each control, refer to "8 Automatic Operation (Position Control)".**

5.4 Synchronous Parameter and Cam Pattern Settings

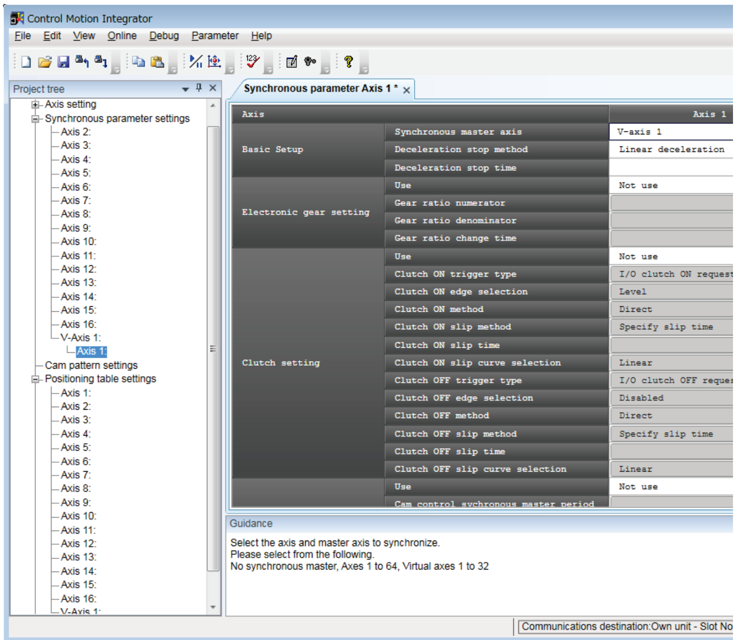
5.4.1 Synchronous Parameter Settings

Parameters required for the synchronous control are assigned using CMI. The following procedure is explained on the condition that CMI has already started.

◆ **PROCEDURE**

1. Select and double-click the axis for setting the parameters from the project tree.

The synchronous parameter dialog box is displayed.



2. Set necessary parameters in accordance with the intended use.

◆ **REFERENCE**

- **For details of the methods of setting parameters related to synchronous control, refer to "9 Automatic Operation (Synchronous Control)".**

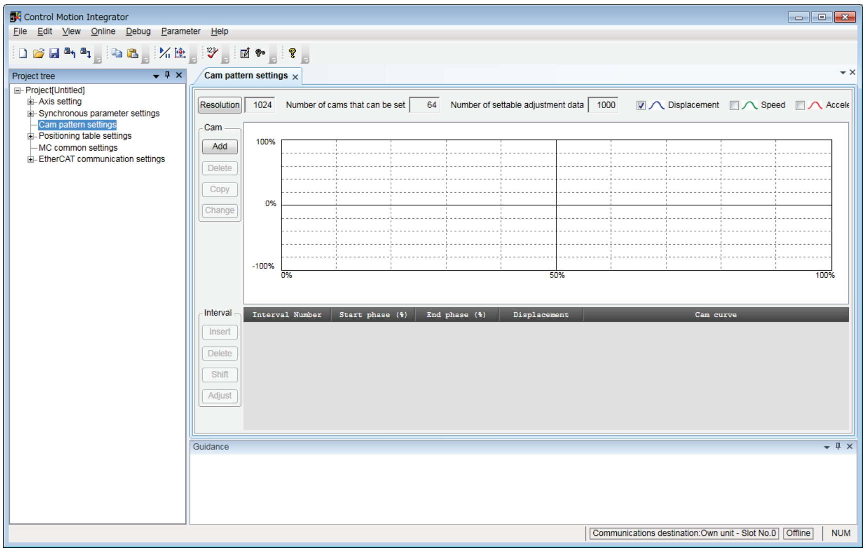
5.4.2 Cam Pattern Setting

Make electronic cam settings in the case of using an electronic cam. Necessary parameters are assigned using CMI. The following procedure is explained on the condition that CMI has already started.

◆ **PROCEDURE**

1. Select "Parameter" > "Cam pattern setting" from the menu bar.

The cam pattern setting dialog box is displayed.



2. Set necessary parameters in accordance with the intended use.

◆ **KEY POINTS**

- **The saved parameter information can be read on CMI.**
- **In the case of synchronous control, it also operates according to the parameters specified in "5.2 Axis Parameter Setting".**

5.5 Confirmation of Setting Contents

5.5.1 Check on Parameter Data

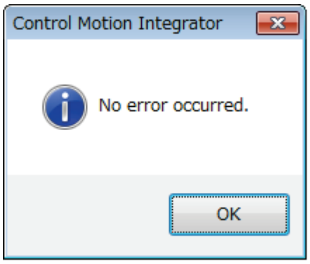
The following procedure is explained on the condition that CMI has already started.

◆ **PROCEDURE**

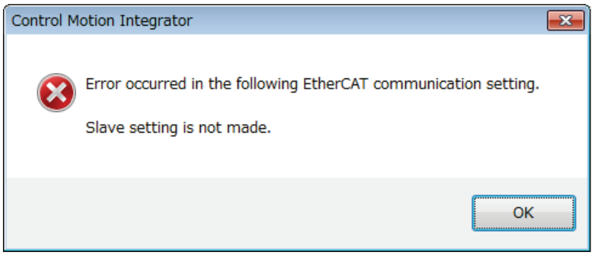
1. **Select "Debug" > "Check parameters and data values" from the menu bar.**

   A message box is displayed to show the check result.

(In normal state)



(In abnormal state)



2. **Press the [OK] button.**

   The screen returns to the editing screen of CMI.

5.5.2 Comparison of Parameter Information

The following items can be verified using CMI.

- Verifying the data being edited with saved cmi files
- Verifying the data being edited with the unit memory (RAM) data in the unit

The following procedure is explained on the condition that CMI has already started.

◆ **PROCEDURE**

1. **Select "Debug" > "Compare" > "File" or "Unit" from the menu bar.**

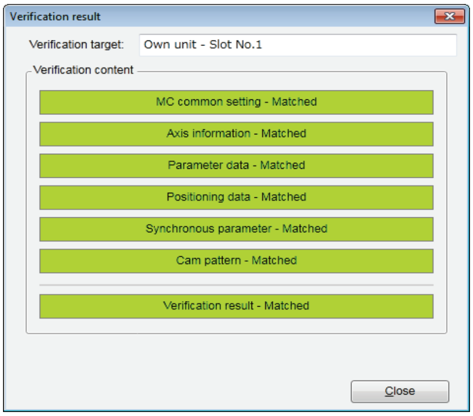
   When "File" is selected, the "Select verification file" dialog box is displayed.

   When "Unit" is selected, the "Verify - Unit selection" dialog box is displayed.

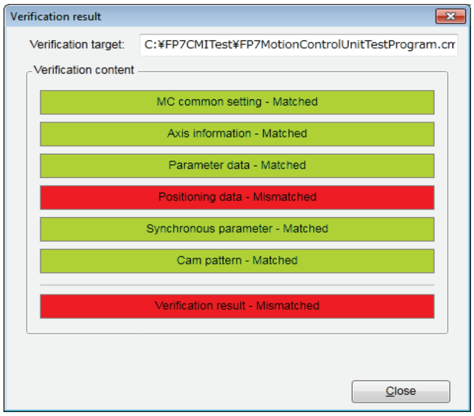
2. **Select a target (file or unit) to be verified, and press the [OK] button.**

   The verification result is displayed.

(In normal state)



(In abnormal state)



3. Press the [Close] button.

The screen returns to the editing screen of CMI.

◆ **KEY POINTS**

- **When selecting "Unit" for the verification target, the contents of the unit memories (RAM) in the unit are verified. The contents of the FROM in the unit may not match the contents of the unit memories (RAM).**

5.6 Transfer of Parameters

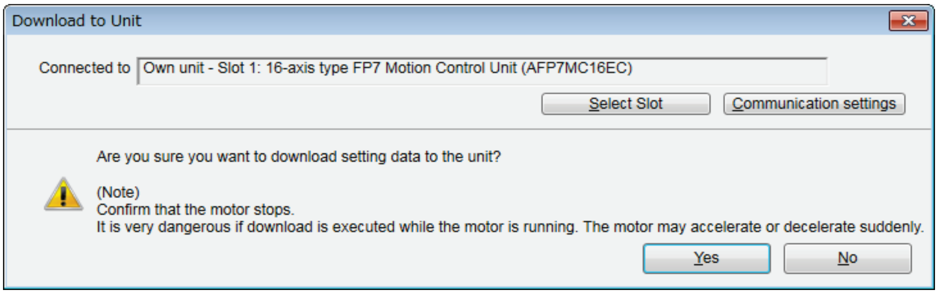
5.6.1 Writing Parameters to Unit

The set parameter information is downloaded to the memory of FP7 MC Unit. The following procedure is explained on the condition that CMI has already started.

◆ **PROCEDURE**

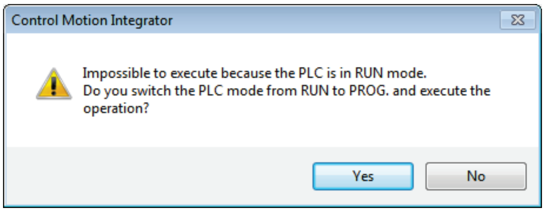
1. Select "File" > "Download to Unit" from the menu bar.

A confirmation message is displayed.



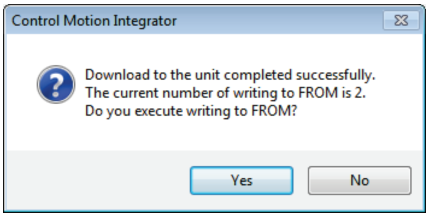
2. Confirm the message, and press the [Yes] button.

When the CPU is in RUN mode, the following message is displayed.



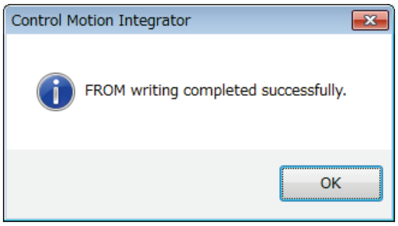
3. Select a unit to which the setting data is downloaded, and press the [Yes] button.

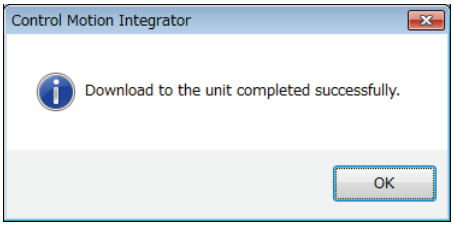
The FROM confirmation message is displayed.



4. **Press the [Yes] button to write data to the FROM in the unit, and press the [No] button not to perform the writing.**

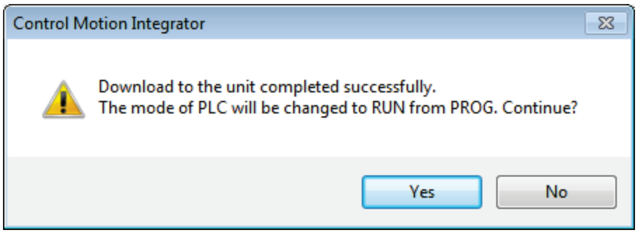
   When the processing is finished, the following message is displayed.





5. **Press the [OK] button.**

   The message for confirming the mode switching of the CPU unit is displayed.



6. **Press the [Yes] or [No] button.**

◆ KEY POINTS

- **Executiing "Writing to FROM" writes set parameters to the FROM in FP7 MC Unit. When the power turns on again, the parameters are read into the unit memory (RAM) from the FROM.**
- **When "Write to FROM" is not executed, the set parameters are temporarily written to the unit memories (RAM) in the unit and used as data during operations. However, when the power turns on again, they are overwritten by the parameters written into the FROM.**
- **It is also possible to execute "Online" > "Write to FROM" on CMI.**
- **"Write to FROM" can also be executed by turning on the FROM write request (Y3) of user programs. However, we recommend using differential execution with this instruction to prevent the writing from being executed continuously.**

◆ NOTES

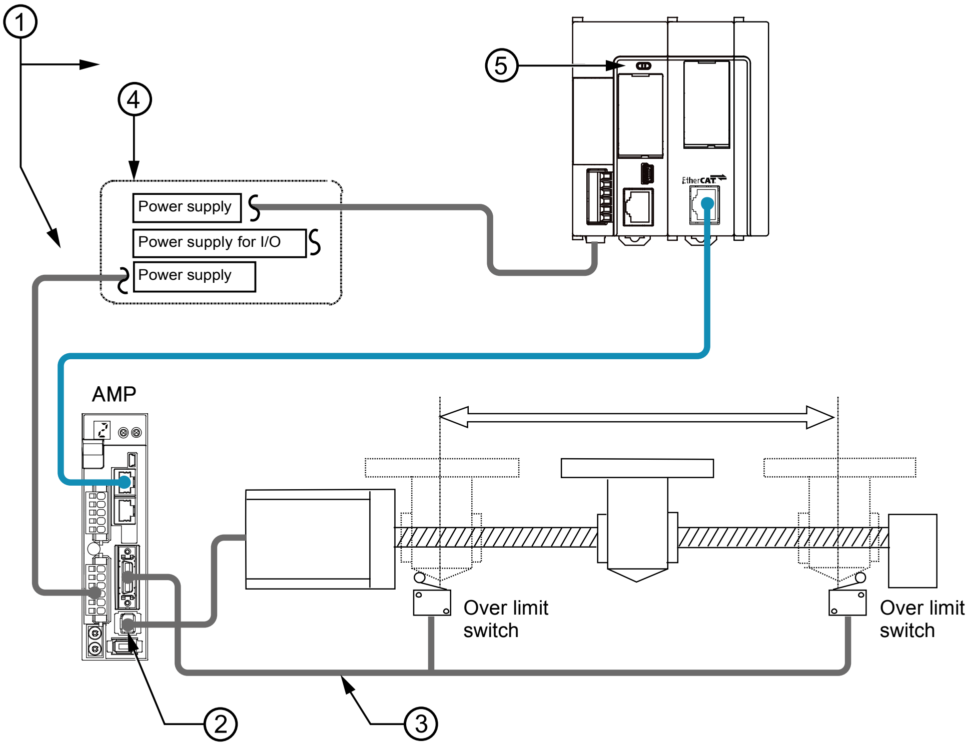
- **Writing to FROM can be performed up to 10000 times. Do not write data to FROM more than 10000 times.**

6

Data Transfer to MC Unit and Test Operation

6.1 Before Turning On the Power

System configuration example



■ Items to check before turning on the power

No.	Item	Description
①	Checking connections to the various devices	Check to make sure the various devices have been connected as indicated by the design.
②	Checking the servo amplifier	Check the wiring of servo amplifier and parameter settings.
③	Checking the installation of the safety circuit	Check the connection between the servo amplifier and over limit switches. Check the installation condition of the over limit switches. Check if the limit input can be monitored on PLC.
④	Checking the procedure settings for turning ON the power supplies	Check to make sure settings have been entered so that power supplies are turned on according to the procedure outlined in the section "Procedure for Turning On the Power" on the next page.
⑤	Setting configuration data	Check if the parameters and positioning data are configured in MC Unit as designed.
	Checking the CPU mode selection switch	Set the CPU unit to PROG. mode. Setting it in RUN mode can cause inadvertent operation.
	Checking user programs	Create programs to turn off the start request of each operation when switching the mode to RUN mode. If they are on, they may activate improperly.

6.2 Procedure for Turning On the Power

6.2.1 Procedure for Turning On the Power

When turning on the power to the system incorporating the unit, consider the nature and states of any external devices connected to the system, and take sufficient care so that turning on the power will not initiate unexpected movements.

◆ PROCEDURE

1. **Turn on the power supplies for the input and output devices connected to the PLC.**
2. **Turn on the power supply for the servo amplifier.**
3. **Turn ON the power supply for the PLC.**

6.2.2 Procedure for Turning Off the Power

◆ PROCEDURE

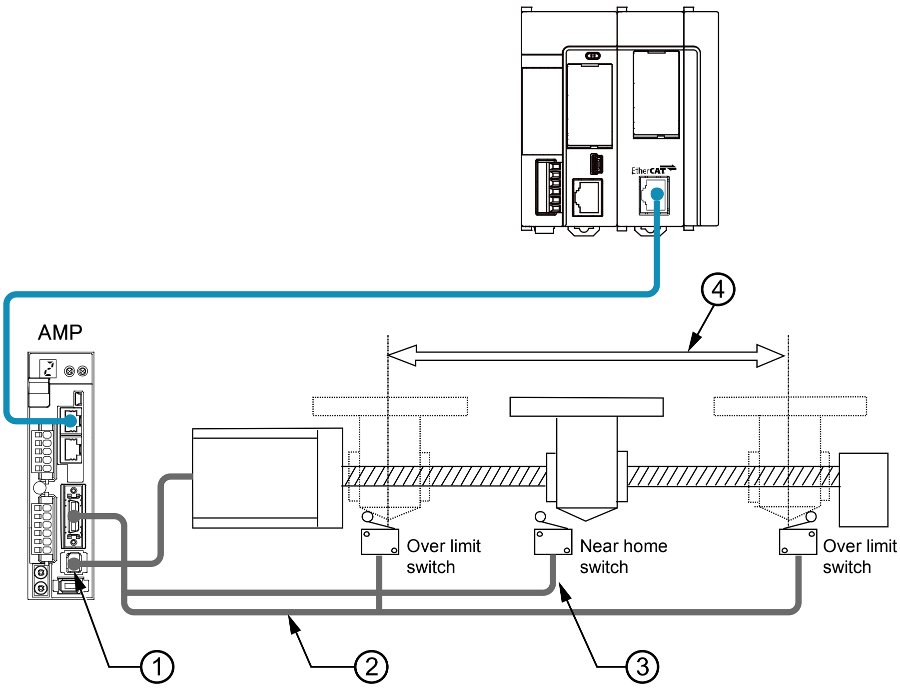
1. **Check to make sure the rotation of the motor has stopped, and then turn off the power supply for the PLC.**
2. **Turn off the power supply for the servo amplifier.**
3. **Turn off the power supplies for the input and output devices connected to the PLC.**

6.3 Checking While the Power is ON

6.3.1 Items to Check When the Power is ON

System configuration example

Check each item in the following four major steps.



■ Items to check after turning on the power

No.	Item	Description
①	Checking the communication state	Check if the communication between P7 MC Unit and Servo Amplifier is performed properly.
②	Checking the safety circuit by the PLC unit	Check the connection between the servo amplifier and over limit switches. Check the installation condition of the over limit switch. Check if the over limit switch is loaded as the limit input of FP7 MC Unit and activated properly by performing JOG operation.
③	Checking the near home input	Check the connection between the servo amplifier and near home input. Check the installation condition of the near home input. Check if the near home input is loaded as the near home input of FP7 MC Unit and activated properly by performing JOG operation or home return operation.
④	Checking the rotation, moving direction, and moving distance.	Check the rotation, moving direction and moving distance by performing JOG operation or positioning operation.

6.3.2 Checking Network Communication State

Procedure 1

Turn on the powers of the servo amplifier and FP7 MC Unit in this order, and check if no error occurs.

Procedure 2

If an error occurs, check if the settings agree with the actual network configuration on CMI.

Points to check

After turning on FP7 MC Unit, the time until slaves participate in the network can be confirmed and changed in the axis parameter setting menu of CMI.

6.3.3 Checking the safety circuit by the PLC unit

Procedure 1

Check if the input of the over limit switches connected to the servo amplifier is loaded to the unit by operating them forcibly.

Points to check

Check if the limit setting is Enabled, input logic is correct in the parameter setting menu of CMI.

Procedure 2

Check if the limit stop is activated at the time of limit input by the tool operation function of CMI or performing the JOG operation with a program.

Procedure 3

Using the JOG operation, check if the over limit switch is functioning properly.

■ **Operation at Over limit input (Limit is Enabled)**

Condition	Direction	Limit status	Operation
When JOG operation is started	Forward	Over limit input (+): ON	Not executable, Error occurs.
		Over limit input (-): ON	Executable
	Reverse	Over limit input (+): ON	Executable
		Over limit input (-): ON	Not executable, Error occurs.
During JOG operation	Forward	Over limit input (+): ON	Limit stops, Error occurs.
	Reverse	Over limit input (-): ON	Limit stops, Error occurs.

6.3.4 Checking the Operation of Near Home Switch

Procedure 1

Check if the near home input is loaded as an input signal on the PLC properly by operating the input forcibly.

Procedure 2

Start the home return by the tool operation function of CMI or inputting the home return program, and check if the operation transits to the deceleration operation by the near home input.

Points to check

The logic of near home input depends on the settings of Servo Amplifier and FP7 MC Unit.

Procedure 3

Check if the home stop position shifts by repeating the JOG and home return operations.

Procedure 4

If the home stopping position is shifted, change the position of near home input or reduce the home return speed.

6.3.5 Checking Rotating and Moving Directions and Moving Distance

Procedure 1

Execute the JOG operation to confirm the rotating direction and moving direction of the motor. Use the tool operation function of CMI and perform the JOG operation.

Points to check

The rotating direction is determined according to the installation of the ball screw or the "CW/CCW direction setting" of the axis parameter.

Procedure 2

Check if the moving distance is that as designed by performing the JOG operation or positioning operation.

Points to check

The moving distance is determined according to the pitch of the ball screw, deceleration gear ratio or setting movement amount of the positioning data.

6.4 Monitor Function of CMI

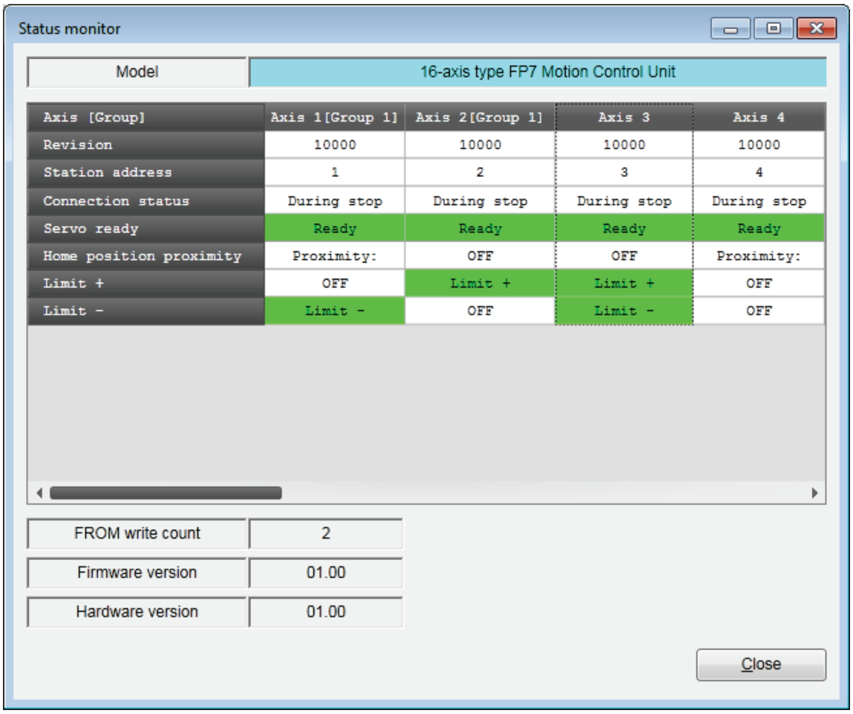
6.4.1 Status Monitor

- The connection state of each axis and input state of external terminals can be monitored.
- The following procedure is explained on the condition that CMI has already started.

◆ **PROCEDURE**

1. Select "Online" > "Status Monitor" from the menu bar.

The status monitor dialog box is displayed.



■ Monitoring item

Item	Description	Related page
Revision	Indicates the revision number of Servo Amplifier A5B.	
Station address	Indicates the station address of Servo Amplifier A5B allocated to each axis.	
Connection status	Indicates the connection status of each axis. Not connected / During stop / During operation / Warning occurs / Error occurs	
Servo ready	Indicates the servo ready status on the servo amplifier side. Ready (Green): Indicates that the servo is ready. Off (White): Indicates the servo is off.	
Home position proximity	Indicates the status of the near home input (HOME). Near home (Green): Indicates the input is valid. Off (White): Indicates the input is invalid.	
Limit +	Indicates the status of the limit input. Monitored signals vary according to the settings of "Axis parameter settings" of FP7 MC Unit. Limit + (Green) or limit - (Green): Indicates the input is enabled. Off (White): Indicates the input is disabled.	
Limit -		
FROM write count	Indicates the number of times of writing to FROM in FP7 MC Unit. Writing can be performed up to 10000 times.	
Firmware version	Indicates the firmware version of FP7 MC Unit.	
Hardware version	Indicates the hardware version of FP7 MC Unit.	

◆ KEY POINTS

- **The input logics of the near home, limit + and limit - depend on the settings of Servo Amplifier A5B and FP7 MC Unit.**
- **The target limit inputs to be monitored vary according to the settings of axis parameters as below. Confirm them with CMI.**

Parameter name	Selection	Description
Axis parameters - Basic setup - Limit switch	N: Disabled	Indicates the POT/NOT status of Servo Amplifier A5B. Limit +: POT (CW over-travel inhibit input) Limit -: NOT (CCW over-travel inhibit input)
	A: Enabled	Indicates the SI-MON3/SI-MON4 status of Servo Amplifier A5B. Limit +: SI-MON3 (General-purpose monitor input 3) Limit -: SI-MON4 (General-purpose monitor input 4)

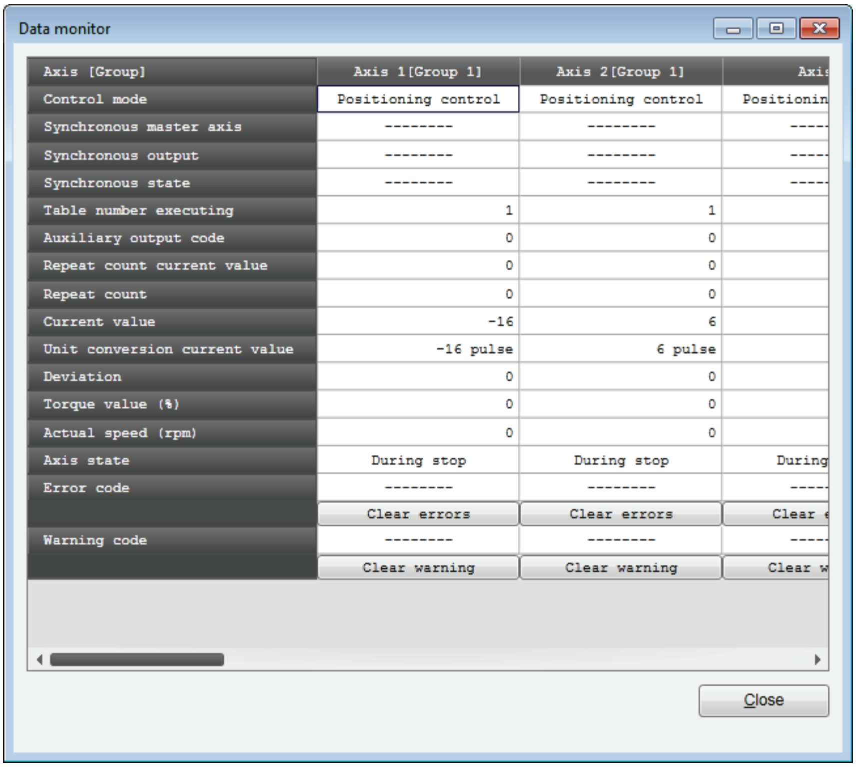
6.4.2 Data Monitor

The operating state can be monitored.

◆ **PROCEDURE**

1. Select "Online" > "Data Monitor" from the menu bar.

The data monitor dialog box is displayed.



◆ **KEY POINTS**

- **If a recoverable error occurs in FP7 MC Unit, click the [Clear errors] button to clear the error.**
- **If a warning occurs in FP7 MC Unit, click [Clear warning] to clear the warning.**
- **The difference between the value of the position specified in FP7 MC and the value of the position fed back from Servo Amplifier A5B is calculated on the FP7 MC Unit side as a deviation. This value is not the same as the value of the deviation counter of the servo amplifier.**

■ Monitoring item

Item	Description	Related page
Control mode	Displays the control mode. Positioning control / J-point control / Home return / JOG operation	
Synchronous master axis	When an axis has been set as master axis, "Master" is displayed. When an axis has been set as slave axis, the master axis which this axis follows is displayed. Example) When the second axis has been set as a slave axis for the master of first axis, "1 axis" is displayed in the column of 2 axis. For axes that are not used for the synchronous control, "--------" is displayed.	9.2 Settings for Master and Slave Axes
Synchronous output	Displays the functions of synchronous operation that have been set for slave axes. Gear, Clutch, Cam Gear+Clutch, Gear+Cam, Clutch+Cam Gear+Clutch+Cam For axes that are not used for the master axes and synchronous control, "--------" is displayed.	9.1 Synchronous Control
Synchronous state	Displays the states (synchronous/asynchronous) that have been set for each axis.	
Table number executing	Displays the table number that the positioning data is being executed or has been executed.	
Auxiliary output code	When the auxiliary output function is enabled, output code is output within the range of 0 to 65535.	13.3 Auxiliary Output Code and Auxiliary Output Contact
Repeat count current value	Displays the current value of the repeat count.	8.3 Repeat Function
Repeat count	When setting to repeat operations, the repeat count is displayed (0 to 255). When this function is not set, the repeat count is "0".	
Current value (pulse)	Displays the current value of FP7 MC Unit. It will return to "0" on the completion of home return.	13.4 Current Value Update 13.5 Home Coordinates
Unit conversion current value	Displays the unit-converted current value of FP7 MC Unit. It will return to "0" on the completion of home return. When the home coordinate has been set, it will be preset to the home coordinate on the completion of home return.	
Deviation	The difference value between the value of the position specified in FP7 MC Unit and the value of the position fed back from the amplifier is stored. In the case of virtual axes, "------" is displayed.	
Torque value (%)	Displays the current value of the torque value.	
Actual speed (rpm)	Displays the current value of the actual speed.	
Axis state	Displays "During operation" or "During stop". Displays "Error occurs" when an error occurs.	
Error code	Displays the latest error code when an error has occurred. Pressing the "Clear errors" button clears errors.	
Warning code	Displays the latest warning code when a warning has occurred. Pressing the "Clear warning" button clears warnings.	

6.5 Tool Operation Function of CMI

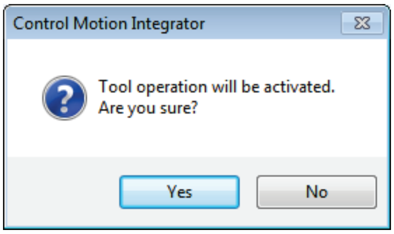
6.5.1 Tool Operation Function

You can perform commissioning with CMI before actually starting user programs. The following procedure is explained on the condition that CMI has already started.

◆ **PROCEDURE**

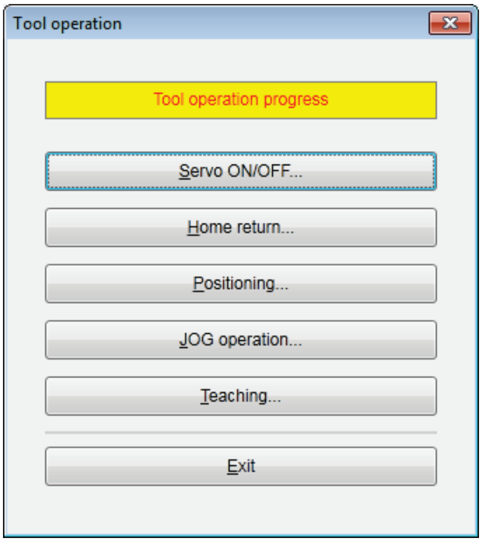
1. **Select "Online" > "Tool Operation" from the menu bar.**

   A confirmation message is displayed.



2. **Press the [Yes] button.**

   The "Tool operation" dialog box is displayed.



■ Type of tool operation

Item	Description
Serve ON/OFF	Specify the servo ON/OFF setting for each axis.
Home return	A home return is performed to the home of the machine coordinates according to the specified parameter.
Positioning	Moves from the start table number according to the set contents of the positioning table.
JOG operation	The specified axis can be moved to the specified direction at the specified speed while the operation command is on.
Teaching	Controls the axis manually like JOG operation, and reflects the resulting positioning address on the data editing screen.

◆ KEY POINTS

- **The unit cannot go into the tool operation while the unit is operated with a user program.**
- **Operation requests using unit memories (output control area) are disabled during the tool operation.**
- **If any communication error occurs during the tool operation, FP7 MC Unit will detect the error and stop automatically. Also, if the previous tool operation does not finish properly due to any error such as communication error, the tool operation mode will be cancelled forcibly when the next tool operation starts. Exit the operation once, and start the tool operation again.**

6.5.2 Serve ON/OFF with Tool Operation Function

The following procedure is explained on the condition that CMI has already started.

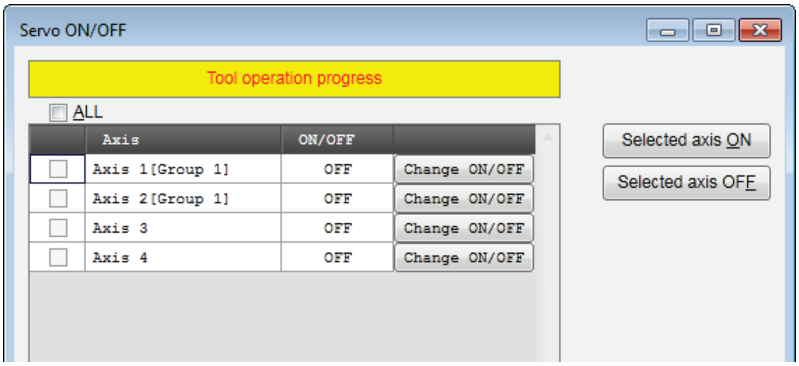
◆ **PROCEDURE**

1 Select "Online" > "Tool Operation" from the menu bar.

The "Tool operation" dialog box is displayed.

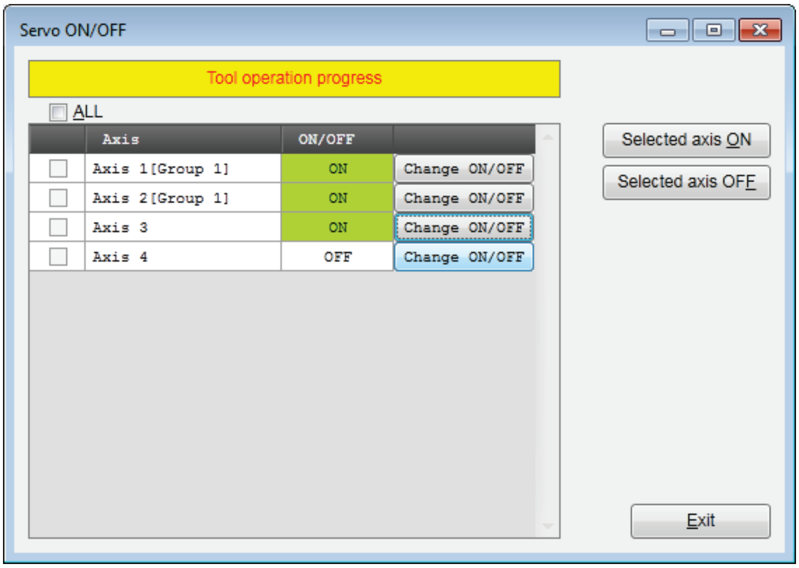
2. Select "Servo ON/OFF" in the "Tool operation" dialog box.

The "Servo ON/OFF" dialog box is displayed.



3. Select a desired axis, and press the [Change ON/OFF] button.

The state is switched between servo lock and servo free.



4. Confirm the servo ON/OFF states of arbitrary axes, and press the "Exit" button.

This returns to the "Tool operation" dialog box.

◆ **KEY POINTS**

- **If the servo ON/OFF has been controlled using user programs, the servo-lock or servo-free state before the start of the tool operation is kept and the operation shifts to the tool operation.**
- **The servo-lock or servo-free state before the completion will be kept even after finishing the tool operation mode.**

6.5.3 JOG Operation with Tool Operation Function

- You can perform commissioning with CMI before actually starting user programs.
- The following procedure is explained on the condition that CMI has already started.

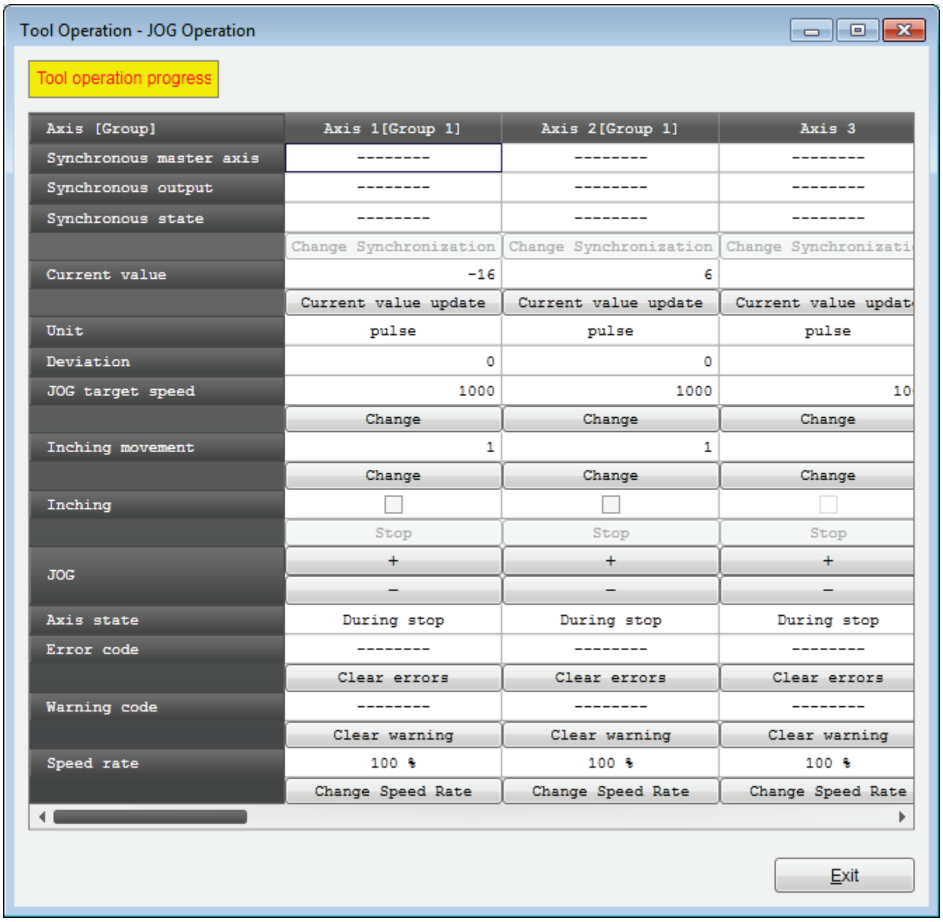
◆ **PROCEDURE**

1. **Select "Online" > "Tool Operation" from the menu bar.**

   The "Tool operation" dialog box is displayed.

2. **Select "JOG operation" from the tool operation dialog box.**

   The "Tool operation - JOG operation" dialog box is displayed.



3. **Press [+] or [-] button in the JOG field.**

   The JOG operation is executed.

4. **Press [Exit] button to terminate the JOG operation.**

◆ **KEY POINTS**

- **If a recoverable error occurs in FP7 MC Unit, click the [Clear errors] button to clear the error.**
- **If a warning occurs in FP7 MC Unit, click [Warning clear] to clear the warning.**

■ Items of dialog box

Item	Description	Related page
Synchronous master axis	When an axis has been set as master axis, "Master" is displayed. When an axis has been set as slave axis, the master axis which this axis follows is displayed. Example) When the second axis has been set as a slave axis for the master of first axis, "1 axis" is displayed in the column of 2 axis. For axes that are not used for the synchronous control, [- - - - - -] is displayed.	9.2 Settings for Master and Slave Axes
Synchronous output	The functions of synchronous operation that have been set for slave axes are displayed. Gear, Clutch, Cam Gear+Clutch, Gear+Cam, Clutch+Cam Gear+Clutch+Cam For axes that are not used for the master axes and synchronous control, [- - - - - -] is displayed.	9.1 Synchronous Control
Synchronous state	The states (synchronous/asynchronous) that have been set for each axis are displayed. Pressing the "Change synchronization" button switches the state between Synchronous and Asynchronous.	
Current value	Displays the current value after the unit system conversion. Click [Current value update] to display the dialog for inputting value to change the preset value.	13.4 Current Value Update
Unit	The units of position for each axis specified in the parameter settings are displayed.	
Deviation (pulses)	The difference value between the value of the position specified in FP7 MC Unit and the value of the position fed back from the amplifier is stored. For virtual axes, [- - - - - -] is always displayed.	
JOG target speed	Monitors and displays the target speed in the JOG operation. Click [Change] to change the target speed for the JOG operation.	10.1 Setting and Operation of Home Return 10.3 Setting and Operation of JOG Inching Operation
Inching movement	The inching movement amount is set.	
Inching	Check the box for performing the inching operation.	
JOG [+]	Click [+] to perform the forward rotation of the JOG operation.	
JOG [-]	Click [-] to perform the reverse rotation of the JOG operation.	
Axis state	Displays "During operation" or "During stop". Displays "Error occurs" when an error occurs. Displays "Warning occurs" when a warning occurs.	
Error code	Displays the latest error code when an error has occurred. Pressing the "Clear errors" button clears errors.	
Warning code	Displays the latest warning code when a warning has occurred. Pressing the "Clear warning" button clears warnings.	
Speed rate	The target speed of the JOG operation specified in the parameter settings for each axis is regarded as 100%, and the operation is executed in the specified speed rate. Clicking [Change Speed Rate] shows the dialog for inputting the value.	

6.5.4 Home Return by Tool Operation Function

- When the power is turned on, the coordinates of FP7 MC Unit do not coincide with those of the machine position. Execute a home return before starting positioning.
- You can perform commissioning with CMI before actually starting user programs.
- The following procedure is explained on the condition that CMI has already started.

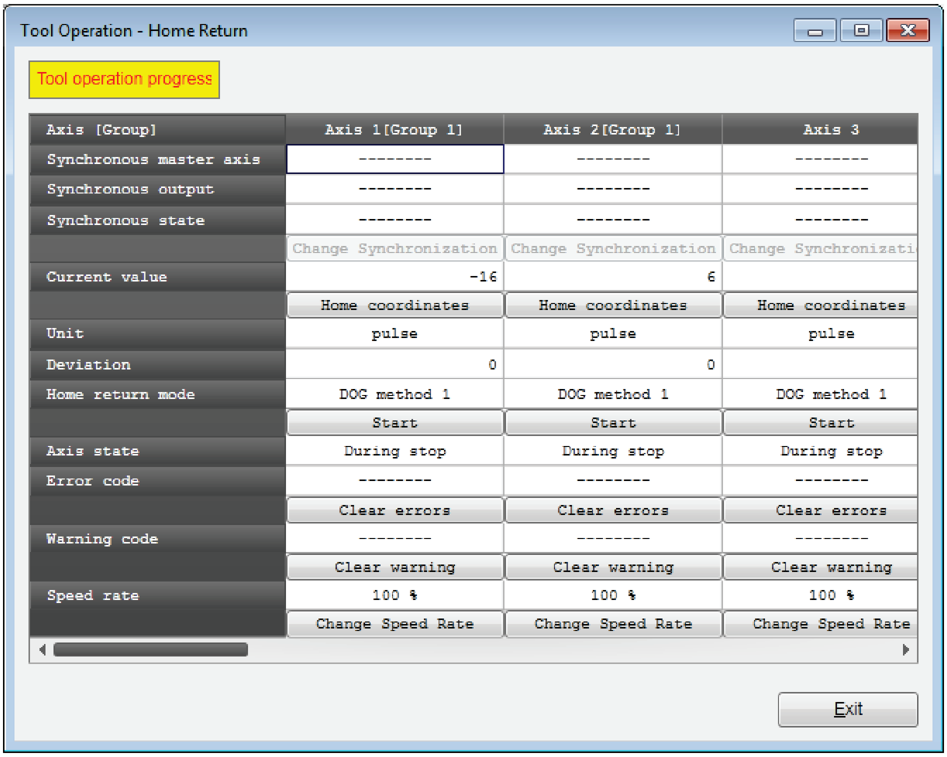
◆ **PROCEDURE**

1. Select "Online" > "Tool Operation" from the menu bar.

The "Tool operation" dialog box is displayed.

2. Select "Home Return" from the tool operation dialog box.

The "Tool operation - Home return " dialog box is displayed.



3. Click [Start] for the axis to execute the home return.

Execute the home return operation.

4. Press [Exit] button to terminate the home return operation.

◆ **KEY POINTS**

- **If a recoverable error occurs in FP7 MC Unit, click the [Clear errors] button to clear the error.**
- **If a warning occurs in FP7 MC Unit, click [Warning clear] to clear the warning.**
- **This dialog box cannot be closed during the operation.**

■ Items of dialog box

Item	Description	Related page
Synchronous master axis	When an axis has been set as master axis, "Master" is displayed. When an axis has been set as slave axis, the master axis which this axis follows is displayed. Example) When the second axis has been set as a slave axis for the master of first axis, "Axis 1" is displayed in the column of Axis 2. For axes that are not used for the synchronous control, [- - - - - -] is displayed.	9.2 Settings for Master and Slave Axes
Synchronous output	The functions of synchronous operation that have been set for slave axes are dipslayed. Gear, Clutch, Cam Gear+Clutch, Gear+Cam, Clutch+Cam Gear+Clutch+Cam For axes that are not used for the master axes and synchronous control, [- - - - - -] is displayed.	9.1 Synchronous Control
Synchronous state	The states (synchronous/asynchronous) that have been set for each axis are displayed. Pressing the "Change synchronization" button switches the state between Synchronous and Asynchronous.	
Current value	Displays the current value after the unit system conversion. Click [Home position coordinate] to display the dialog box for inputting value to change the value after home return.	13.5 Home Coordinates
Unit	The units of position for each axis specified in the parameter settings are displayed.	
Deviation (pulses)	The difference value between the value of the position specified in FP7 MC Unit and the value of the position fed back from the amplifier is stored. For virtual axes, [- - - - - -] is always displayed.	
Home return mode	Displays the content of the home return setting code registered in the positioning setting data.	
Start/Stop	Executes the operation to start/stop the home return. - Click [Start] to execute the home return operation. The button name changes to [Stop]. - Click [Stop] to execute the deceleration stop operation. The button name changes to [Start].	
Axis state	Displays "During operation" or "During stop". Displays "Error occurs" when an error occurs. Displays "Warning occurs" when a warning occurs.	
Error code	Displays the latest error code when an error has occurred. Pressing the "Clear errors" button clears errors.	
Warning code	Displays the latest warning code when a warning has occurred. Pressing the "Clear warning" button clears warnings.	
Speed rate	The target speed of the home return specified in the parameter settings for each axis is regarded as 100%, and the operation is executed in the specified speed rate. Clicking [Change Speed Rate] shows the dialog for inputting the value.	

6.5.5 Positioning by Tool Operation Function

Specifying a starting table number enables to check if positioning from the starting table operates properly.

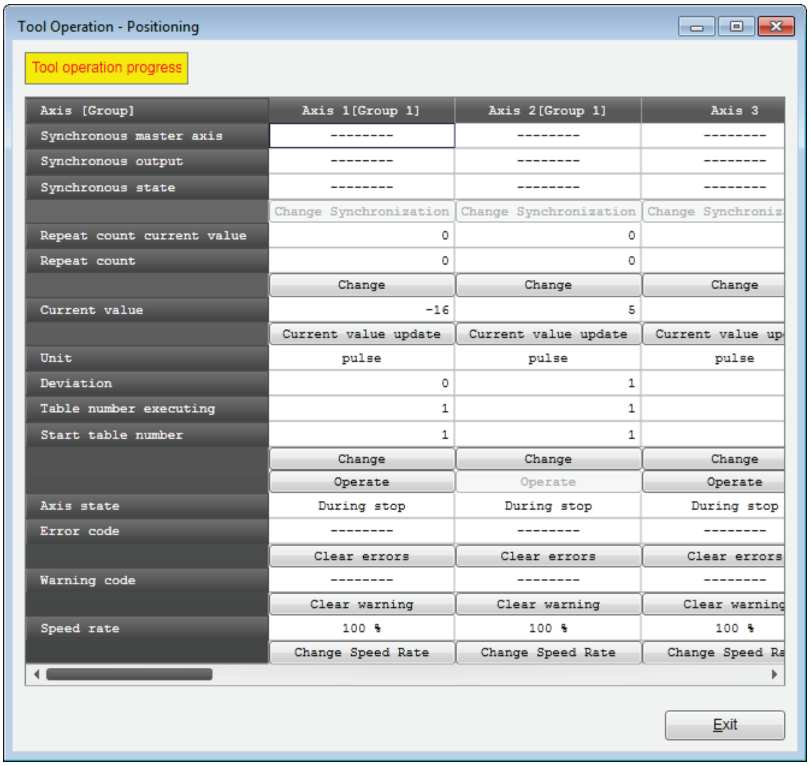
◆ **PROCEDURE**

1. **Select "Online" > "Tool Operation" from the menu bar.**

   The "Tool operation" dialog box is displayed.

2. **Select "Positioning" from the tool operation dialog box.**

   The "Tool operation - Positioning" dialog box is displayed.



3. **Press the [Change] button under the target start table number field.**

   The starting table no. setting dialog box is displayed.

4. **Input a starting table number.**

5. **Press the [Operate] button.**

   Positioning starts from the specified start table number.

6. **Press [Exit] button to terminate the positioning operation.**

■ Items of dialog box

Item	Description	Related page
Synchronous master axis	When an axis has been set as master axis, "Master" is displayed. When an axis has been set as slave axis, the master axis which this axis follows is displayed. Example) When the second axis has been set as a slave axis for the master of first axis, "Axis 1" is displayed in the column of Axis 2. For axes that are not used for the synchronous control, [- - - - - -] is displayed.	9.2 Settings for Master and Slave Axes
Synchronous output	The functions of synchronous operation that have been set for slave axes are dipslayed. Gear, Clutch, Cam Gear+Clutch, Gear+Cam, Clutch+Cam Gear+Clutch+Cam For axes that are not used for the master axes and synchronous control, [- - - - - -] is displayed.	9.1 Synchronous Control
Synchronous state	The states (synchronous/asynchronous) that have been set for each axis are displayed. Pressing the "Change synchronization" button switches the state between Synchronous and Asynchronous.	
Repeat count current value	Displays the current value of the repeat count.	8.3 Repeat Function
Repeat count	Displays the setting value of the repeat count.	
Current value	Displays the current value after the unit system conversion. Click [Current value update] to display the dialog for inputting value to update the current value.	13.4 Current Value Update
Unit	The units of position for each axis specified in the parameter settings are displayed.	
Deviation (pulse)	The difference value between the value of the position specified in FP7 MC Unit and the value of the position fed back from the amplifier is stored. For virtual axes, [- - - - - -] is always displayed.	
Table number executing	Displays the table number during the operation or when it completes.	
Start table number	The starting table number for the positioning control. Click [Change] to change the starting table number.	
Operate/Stop	Execute the operation to start/stop the home return. - Click [Operate] to execute the positioning operation. The button name changes to [Stop]. - Click [Stop] to execute the deceleration stop operation. The button name changes to [Operate].	
Axis state	Displays "During operation" or "During stop". Displays "Error occurs" when an error occurs. Displays "Warning occurs" when a warning occurs.	
Error code	Displays the latest error code when an error has occurred. Pressing the "Clear errors" button clears errors.	
Warning code	Displays the latest warning code when a warning has occurred. Pressing the "Clear warning" button clears warnings.	
Speed rate	The target speed specified in the parameter settings for each axis is regarded as 100%, and the operation is executed in the specified speed rate. Clicking [Change Speed Rate] shows the dialog for inputting the value.	

◆ **KEY POINTS**

- **Even in the tool operation, the unit operates in accordance with the data of the positioning table downloaded to FP7 MC Unit. The operations after the starting table number vary depending on operation patterns.**
- **If a recoverable error occurs in FP7 MC Unit, click the [Clear errors] button to clear the error.**
- **If a warning occurs in FP7 MC Unit, click [Clear warning] to clear the warning.**
- **The positioning operation of an interpolation group starts and stops the axis with the smallest number in the group. In the case of the tool operation function, the "Operate" buttons other than that for the smallest axis number cannot be pressed**
- **This dialog box cannot be closed during the operation.**
- **When conditions are changed during the tool operation, the operation continues by updating the unit memories temporarily, however, the changes are not reflected in the configuration data written in the FROM within FP7 MC Unit. Therefore, when the power is turned on again, the unit is booted based on the cofniguration data written in the FROM within FP7 MC Unit.**

6.5.6 Teaching by Tool Operation Function

Activate each axis manually by the tool operation, and register the positioning addresses where each axis stops as the point data.

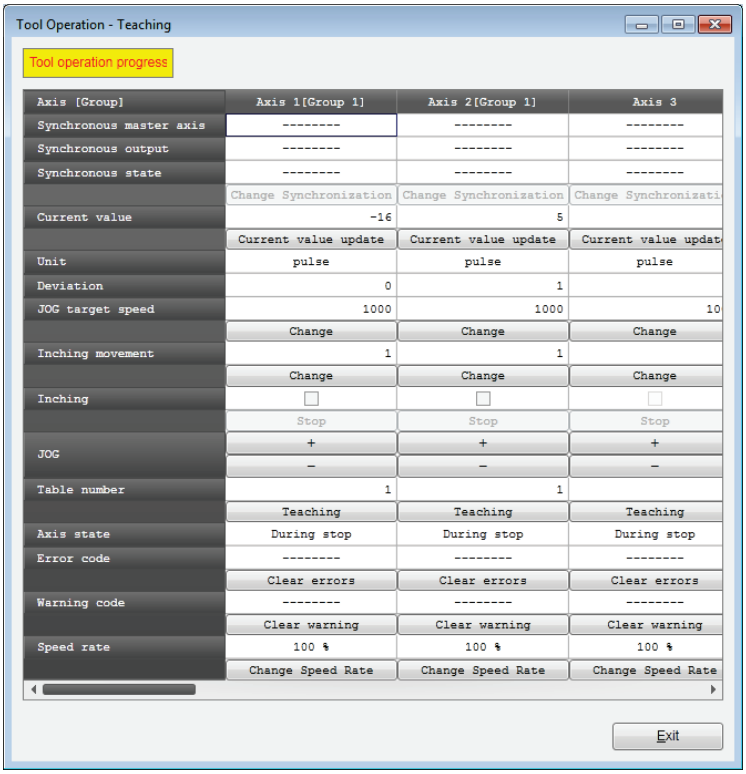
◆ **PROCEDURE**

1. **Select "Online" > "Tool Operation" from the menu bar.**

   The "Tool operation" dialog box is displayed.

2. **Select "Teaching" from the tool operation dialog box.**

   The "Tool operation - Teaching" dialog box is displayed.



3. **Stop at the positioning point by the JOG operation.**
4. **Press the [Teaching] button.**
5. **Input the table number where the desired positioning information is registered, and click the [OK] button.**

   The current value is registered for the amount of movement of the table number specified. Also, if the axis that the teaching operation is performed is an interpolation axis, the current value is registered for the movement amount of the equivalent coordinate in the interpolation group.

6. **Press [Exit] button to terminate the teaching operation.**

■ Items of dialog box

Item	Description	Related page
Synchronous master axis	When an axis has been set as master axis, "Master" is displayed. When an axis has been set as slave axis, the master axis which this axis follows is displayed. Example) When the second axis has been set as a slave axis for the master of first axis, "Axis 1" is displayed in the column of Axis 2. For axes that are not used for the synchronous control, [- - - - - -] is displayed.	9.2 Settings for Master and Slave Axes
Synchronous output	The functions of synchronous operation that have been set for slave axes are dipslayed. Gear, Clutch, Cam Gear+Clutch, Gear+Cam, Clutch+Cam Gear+Clutch+Cam For axes that are not used for the master axes and synchronous control, [- - - - - -] is displayed.	9.1 Synchronous Control
Synchronous state	The states (synchronous/asynchronous) that have been set for each axis are displayed. Pressing the "Change synchronization" button switches the state between Synchronous and Asynchronous.	
Current value	Displays the current value after the unit system conversion. Click [Current value update] to display the dialog for inputting value to change the preset value.	13.4 Current Value Update
Unit	The units of position for each axis specified in the parameter settings are displayed.	
Deviation (pulses)	The difference value between the value of the position specified in FP7 MC Unit and the value of the position fed back from the amplifier is stored. For virtual axes, [- - - - - -] is always displayed.	
JOG target speed	Monitors and displays the target speed in the JOG operation. Click [Change] to change the target speed for the JOG operation.	10.1 Setting and Operation of Home Return
JOG [+]	Click [+] to perform the forward rotation of the JOG operation.	
JOG [-]	Click [-] to perform the reverse rotation of the JOG operation.	
Table number	Displays the table number to perform the teaching. Click [Teaching] to change the table number for the teaching and register the current value.	
Axis state	Displays "During operation" or "During stop". Displays "Error occurs" when an error occurs. Displays "Warning occurs" when a warning occurs.	
Error code	Displays the latest error code when an error has occurred. Pressing the "Clear errors" button clears errors.	
Warning code	Displays the latest warning code when a warning has occurred. Pressing the "Clear warnings" button clears warnings.	
Speed rate	The target speed of the JOG operation specified in the parameter settings for each axis is regarded as 100%, and the operation is executed in the specified speed rate. Clicking [Change Speed Rate] shows the dialog for inputting the value.	

◆ **KEY POINTS**

- **If a recoverable error occurs in FP7 MC Unit, click the [Clear errors] button to clear the error.**
- **If a warning occurs in FP7 MC Unit, click [Clear warning] to clear the warning.**
- **The control method for the table number that the teaching operation was performed is automatically changed to “Absolute”.**
- **The result of the teaching becomes effective once the tool operation quits and the setting data is downloaded to FP7 MC Unit.**
- **This dialog box cannot be closed during the operation.**

7

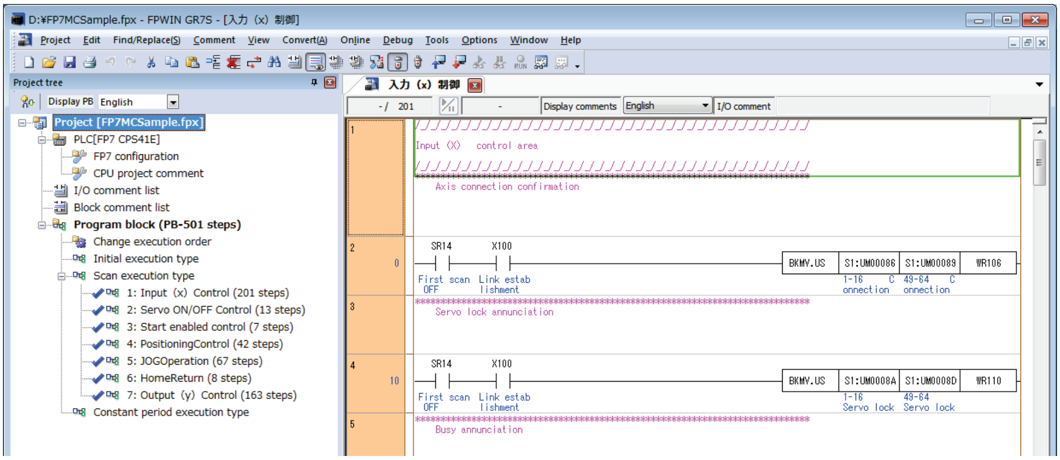
Creation of User Programs

7.1 How to Create User Programs

7.1.1 Basic Configuration of Program

The user programs which control FP7 MC Unit are created by the tool software "FPWIN GR7".

- To support the multi-axis control through network, for FP7 MC Unit, main input and output signals required for the control are allocated to the unit memories (input control area/output control area).
- For various controls, the processes of reading flags from unit memories (input control area) and wriitng operation results to unit memories (output control area) are created as programs.
- As exceptions, the "link establishment flag (X0)" for storing the link establishment of network and "system stop request (Y0)" for stopping the whole system are allocated to the area of I/O signals (XY).

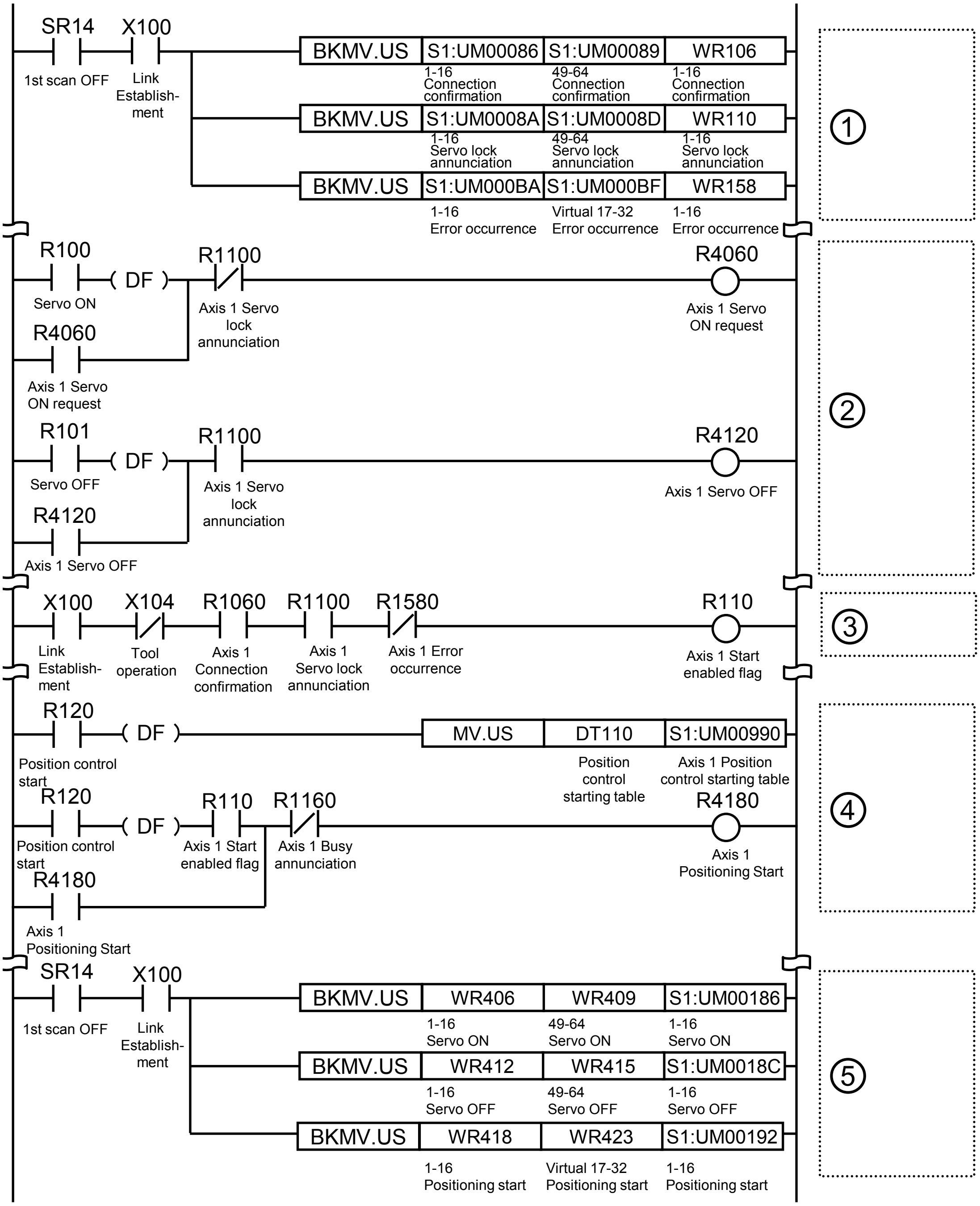


■ Configuration of program

	Item	Description
①	Reading from unit memories UM (input control area)	Reads information required for confirming states from the unit memories (input control area) to an arbitrary operation memories (such as internal relay area WR). Example) Connection confirmation flag, servo lock annunciation flag, busy flag, error annunciation flag
②	Servo control	Ouputs the requests for the servo ON and servo OFF controls to the operation memories (such as internal relay area WR).
③	Start enabled control	Checks the states of read flags if each control (such as position control, JOG operation, home return) can be started, and outputs the start enabled states to internal relays.
④	Various control programs (such as position control, JOG operation, home return)	Checks the results of start enabled controls, and outputs the start requests for position control, JOG operation or home return to the operation memories (such as internal relays).
⑤	Writing to unit memories UM (output control area)	Writes the results of the operation memories (such as internal relay area) in which the above operation results are reflected to the unit memories (output control area). Example) Startup of positioning, JOG operation, or home return, stop control

■ Program example

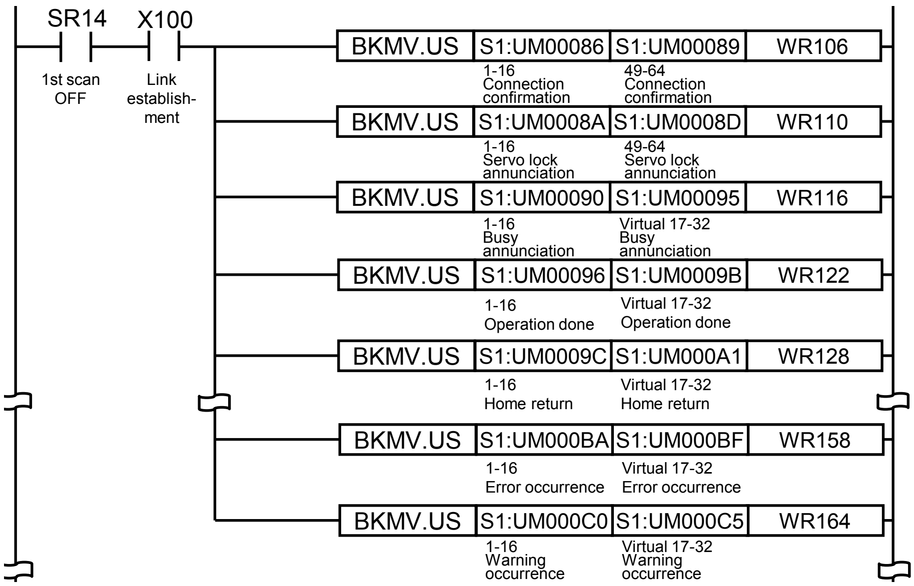
The following program is simplified to show the whole configuration. The reading data from the input control area is inserted in the beginning of the program, and the writing data to the output control area is inserted at the end of the program.



7.2 Overview of Programs

7.2.1 Reading Data From Input Control Area

- The reading program from the unit memories (input control area) reads and stores flags in the operation memories such as internal relays to enable them to be treated easily in consecutive control programs.
- Most flags are allocated to 1-word (16-bit) unit memory for 16 axes. As for the limit inputs, 2 bits (+ and - sides) are required for 1 axis, therefore, flags for 8 axes are allocated to 1-word (16-bit) unit memory.

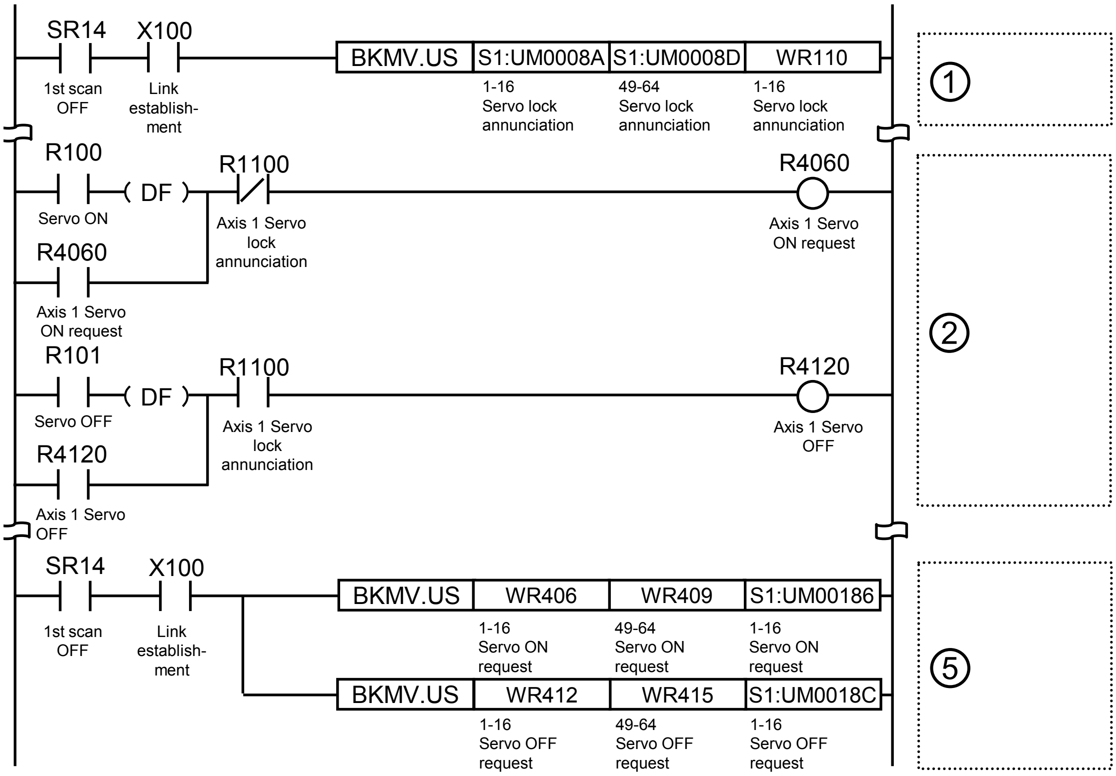


◆ **REFERENCE**

- **For details of the configuration and contents of input control area, refer to "15.4.1 Configuration of Input Control Area" and "15.4.3 List of Input Control Area Functions".**

7.2.2 Servo ON/OFF Control Program

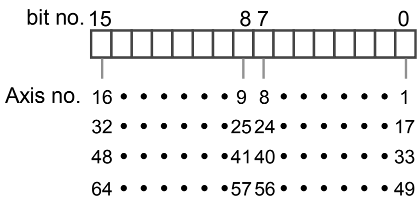
- The servo ON/OFF is controlled by writing requests into the unit memories (output control area).
- Create a program to turn on each bit of the unit memories allocated to the servo ON request signal or servo OFF request signal. The part of the following ② indicates the control program of axis no. 1.



■ Allocation of unit memories

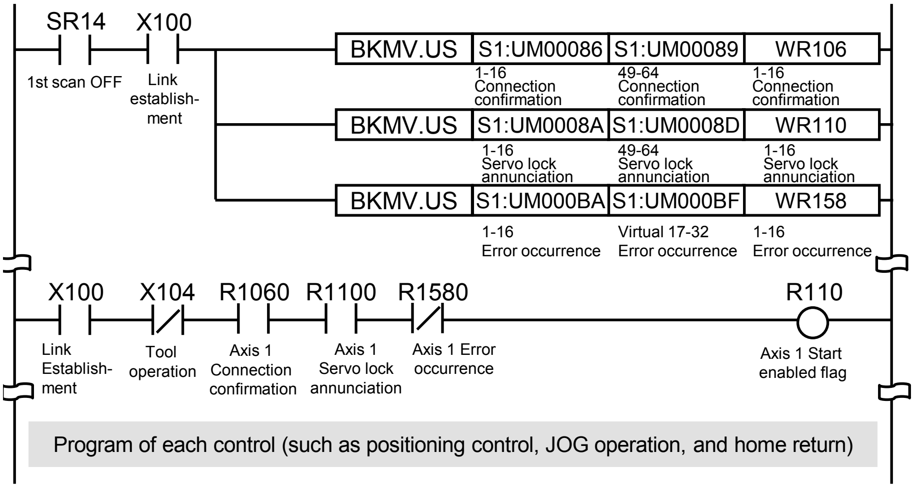
Signal name	Real axis				Virtual axis	
	Axes 1-16	Axes 17-32	Axes 33-48	Axes 49-64	Axes 1-16	Axes 17-32
Servo lock annunciation	UM0018A	UM0018B	UM0018C	UM0018D	-	-
Servo ON request	UM00186	UM00187	UM00188	UM00189		
Servo OFF request	UM0018C	UM0018D	UM0018E	UM0018F	-	-

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word) in the above table.



7.2.3 Start Enabled Program

- The start enabled control program is inserted to check flags read from the unit memories (input control area) to confirm if each consecutive control (such as position control, JOG operation and home return) can be started.
- Collected start conditions are output as arbitrary start enabled flags (internal relays).



7.2.4 Each Control Programs

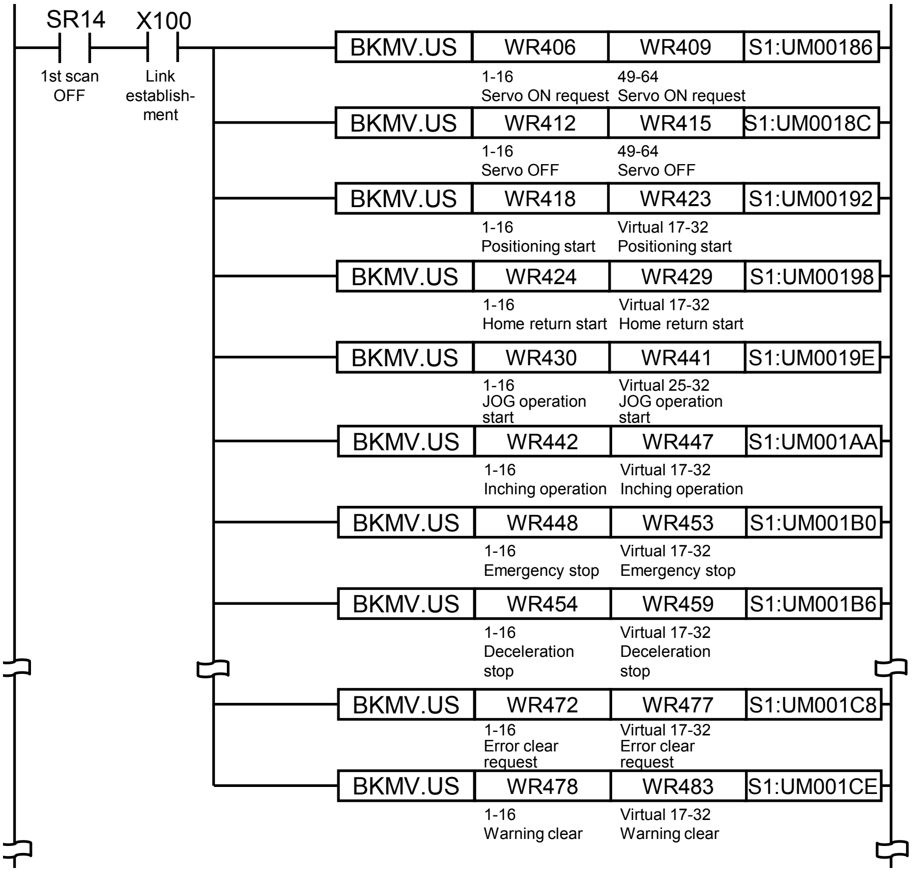
Each control programs (such as position control, JOG operation and home return) operates the start requests which require the output result of the above start enabled program.

◆ **REFERENCE**

- **For details of poritioning control programs, refer to "8.4.1 Sample Programs (E-point, C-point and C-point Controls)".**
- **For details of JOG operation programs, refer to "10.4.1 Sample Program (JOG Operation)".**
- **For details of home return programs, refer to "11.3.1Sample Program (Home Return)".**

7.2.5 Writing Data to Output Control Area

- The values of the operation memories (such as WR) in which the results operated in each control program are reflected are written to the unit memories (output control area).
- Most flags are allocated to 1-word (16-bit) unit memory for 16 axes. As for JOG operation, 2 bits (forward anc reverse) are required for 1 axis, therefore, flags for 8 axes are allocated to 1-word (16-bit) unit memory.



◆ **REFERENCE**

- **For details of the configuration and contents of output control area, refer to "15.4.2 Configuration of Output Control Area" and "15.4.4 List of Output Control Area Function".**

7.3 Precautions On Programming

7.3.1 Turning Off Power Supply Clears Contents in Unit Memories

- Data in unit memories are cleared when the power is turned off.
- When the powe is turned on again, data is preset in the parameters saved in the FROM within FP7 MC Unit.

7.3.2 Operation Cannot be Switched Once One Operation Has Started

- If any of the startup requests for position control, synchronous control, JOG operation and home return turns ON and the operation is initiated, this operation cannto be switched to another operation even if another request turns on.
- Busy flags corresponding to each axis turn on during operation. Insert them as interlock signals for each start request on user programs.
- The stop operations (system stop, limit stop, emergency stop and deceleration stop) are preferentially activated even in other operations.

7.3.3 Operation When PLC Mode Changes From RUN To PROG.

The operation when the mode of the CPU unit changes from RUN to PROG. varies depending on the setting of "RUN > PROG operation" of "MC common setting".

8

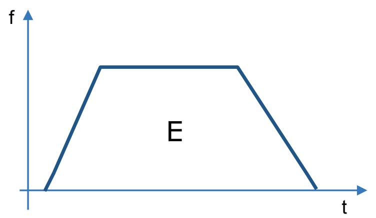
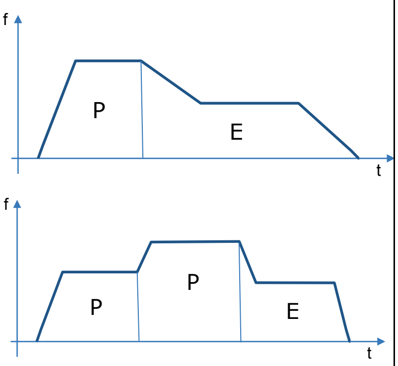
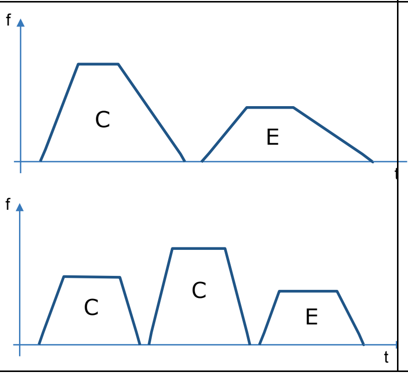
Automatic Operation (Position Control)

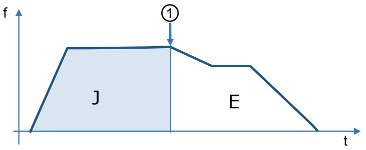
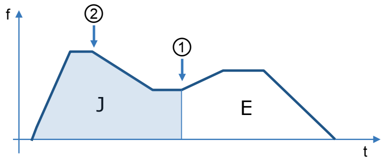
8.1 Basic Operation

8.1.1 Patterns of Position Control

- The automatic operation is an operation mode to be perform a position control. For the position control, there are a single axis control and an interpolation control that starts and stops multiple axes simultaneously.
- For the operaions of position controls, there are E-point, P-point and C-point controls which are performed regardless of single axis control or interpolation axis control. Also, there is J-point control which is activated only by the single axis control. The operation patterns of each control are as follows.

■ **Operation pattern**

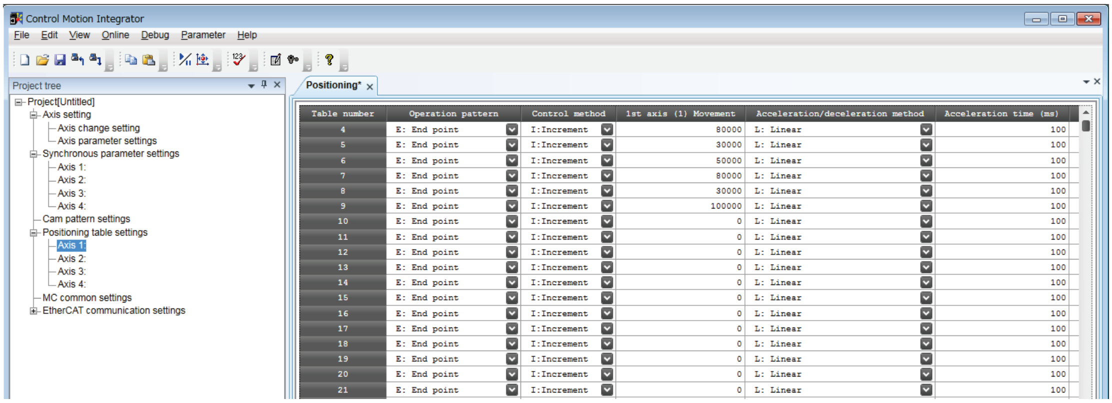
Name	Time chart	Operation and application	Repeat	Inter-pola-tion
E-point control		● This is a method of control which is initiated up to an end point, and is called “E-point control˝. ● This method is used for a single-speed acceleration/deceleration.	●	●
P-point control		● This refers to control which passes through a “Pass Point”, and is called “P-point control”. ● This method is used for performing acceleration/deceleration by two-speed control or more. ● After the P-point control is performed for a specified movement amount, it shifts to the E-point control. ● The last table should be set to E: End point.	●	●
C-point control		● This refers to control which passes through a “Continuance Point”, and is called "C-point control”. ● This method is used for performing two successive single-speed positioning control with different target speeds or acceleration/deceleration times. ● The time taken until the operation shifts to the next table is specified as a dwell time. ● The last table should be set to E: End point.	●	●

<table>
<tr><th>Name</th><th>Time chart</th><th>Operation and application</th><th>Repeat</th><th>Inter-pola-tion</th></tr>
<tr><td rowspan="2">J-point control</td><td>No speed change
</td><td rowspan="2">● This refers to control which passes through a speed point “JOG Operation Point”, and is called "J-point control”.
● After the start, it is controlled at specified speeds.
● Once the J-point positioning request turns on, the positioning control (E-point control) starts.
● When the J-point speed change request is set, the speed changes.
<table><tr><td>①</td><td>J-point positioning start request</td></tr><tr><td>②</td><td>J-point speed change contact</td></tr></table>● The last table should be set to E: End point.</td><td rowspan="2">—</td><td rowspan="2">—</td></tr>
<tr><td>Speed changes
</td></tr>
</table>

■ Selection of operation patterns

The positioning operation mode is selected in the "Positioning table setting" menu of CMI.

- For the E-point control, input settings in one row.
- For P-point, C-point and J-point controls, input settings to make the last table to be the E-point control in combination.

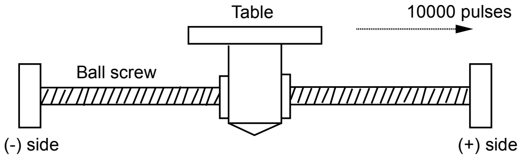


■ Settings of J-point control

- Set the positioning unit to increment mode to implement P-point control, C-point control, or E-point control with positions specified after J-point control is implemented.
- For changing the speed during the J-point control, set the acceleration/deceleraiton time and target speed when the speed is changed in the "Axis parameter" menu of CMI.

8.1.2 Setting and Operation of E-point Control

In the following example, a single-speed acceleration/deceleration control is performed by a single-axis control.

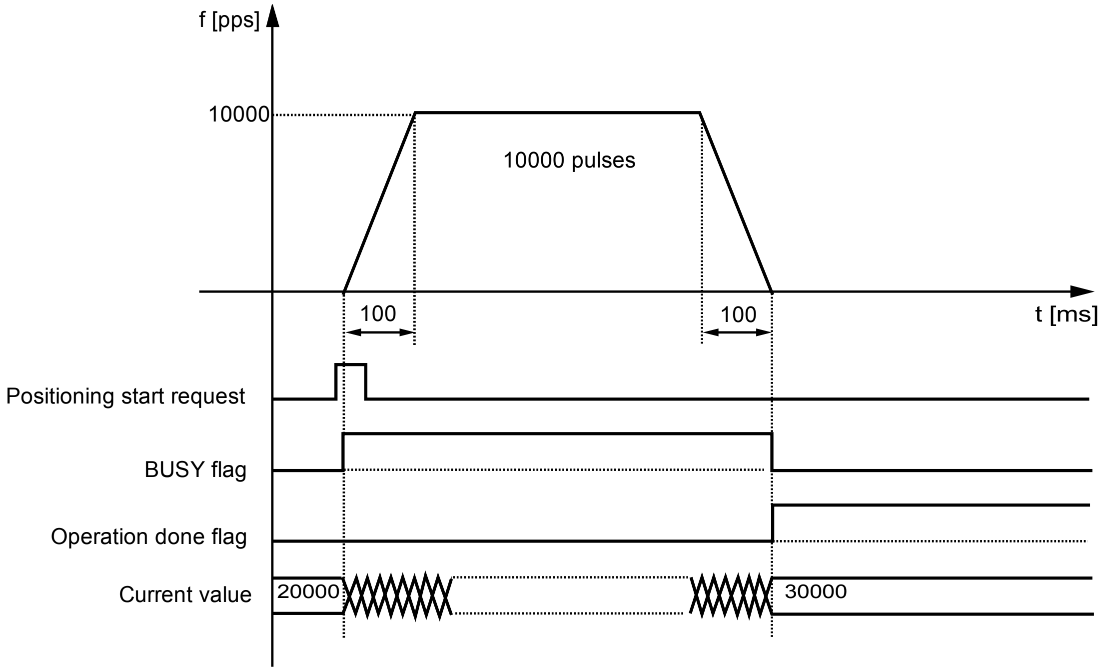


■ Settings

Item	Setting example
Operation pattern	E: End point
Control method	I: Increment
1st axis (L) movement amount	10000 pulses
Acceleration/deceleration type	L: Linear
Acceleration time (ms)	100 ms
Deceleration time (ms)	100 ms
Target speed	10000 pps

(Note): The (L) in the above table is an axis number.

■ Operation diagram



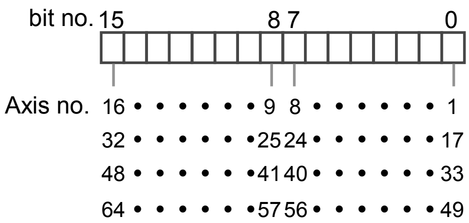
■ Operation of input control/output control signals

- When a positioning start request (corresponding bit allocated to UM00192 to UM00197) turns ON by a user program, the positioning control will start. The positioning start request will be enabled at the edge where it turns ON.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a requested operation is being controlled, will turn ON when the positioning control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

■ Allocation of unit memories

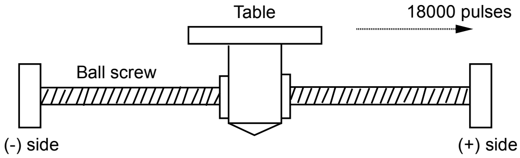
Signal name	Real axis				Virtual axis	
	Axes 1-16	Axes 17-32	Axes 33-48	Axes 49-64	Axes 1-16	Axes 17-32
Positioning start request	UM00192	UM00193	UM00194	UM00195	UM00196	UM00197
Busy flag	UM00090	UM00091	UM00092	UM00093	UM00094	UM00095
Operation done flag	UM00096	UM00097	UM00098	UM00099	UM0009A	UM0009B

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word) in the above table. When the value of each bit is 1, it turns on. When the value of each bits is 0, it turns off.



8.1.3 Setting and Operation of P-point Control

In the following example, a three-speed acceleration/deceleration control is performed by a single-axis control.

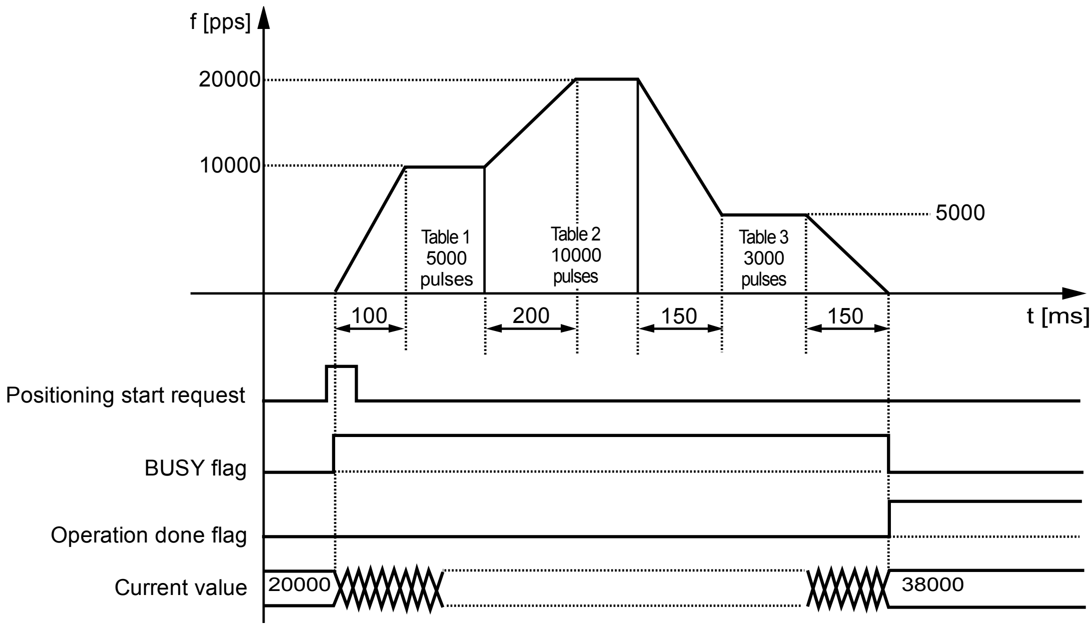


■ Settings

Item	Setting example		
	Table 1	**Table 2**	**Table 3**
Operation pattern	P: Pass point	P: Pass point	E: End point
Control method	I: Increment	I: Increment	I: Increment
1st axis (L) movement amount	5000 pulses	10000 pulses	3000 pulses
Acceleration/deceleration type	L: Linear	L: Linear	L: Linear
Acceleration time (ms)	100 ms	200 ms	30 ms
Deceleration time (ms)	10 ms	20 ms	150 ms
Target speed	10000 pps	20000 pps	5000 pps

(Note): The (L) in the above table is an axis number.

■ Operation diagram



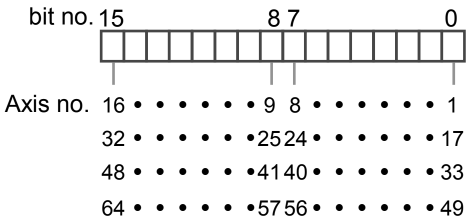
■ Operation of input control/output control signals

- When a positioning start request (corresponding bit allocated to UM00192 to UM00197) turns ON by a user program, the positioning control will start. The positioning start request will be enabled at the edge where it turns ON.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a requested operation is being controlled, will turn ON when the positioning control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

■ Allocation of unit memories

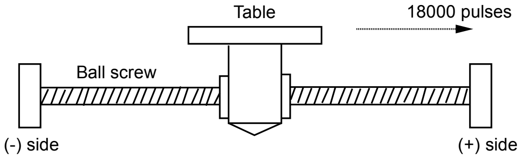
Signal name	Real axis				Virtual axis	
	Axes 1-16	Axes 17-32	Axes 33-48	Axes 49-64	Axes 1-16	Axes 17-32
Positioning start request	UM00192	UM00193	UM00194	UM00195	UM00196	UM00197
Busy flag	UM00090	UM00091	UM00092	UM00093	UM00094	UM00095
Operation done flag	UM00096	UM00097	UM00098	UM00099	UM0009A	UM0009B

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word) in the above table. When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



8.1.4 Setting and Operation of C-point Control

In the following example, three successive acceleration/deceleration control is performed by a single-axis control.

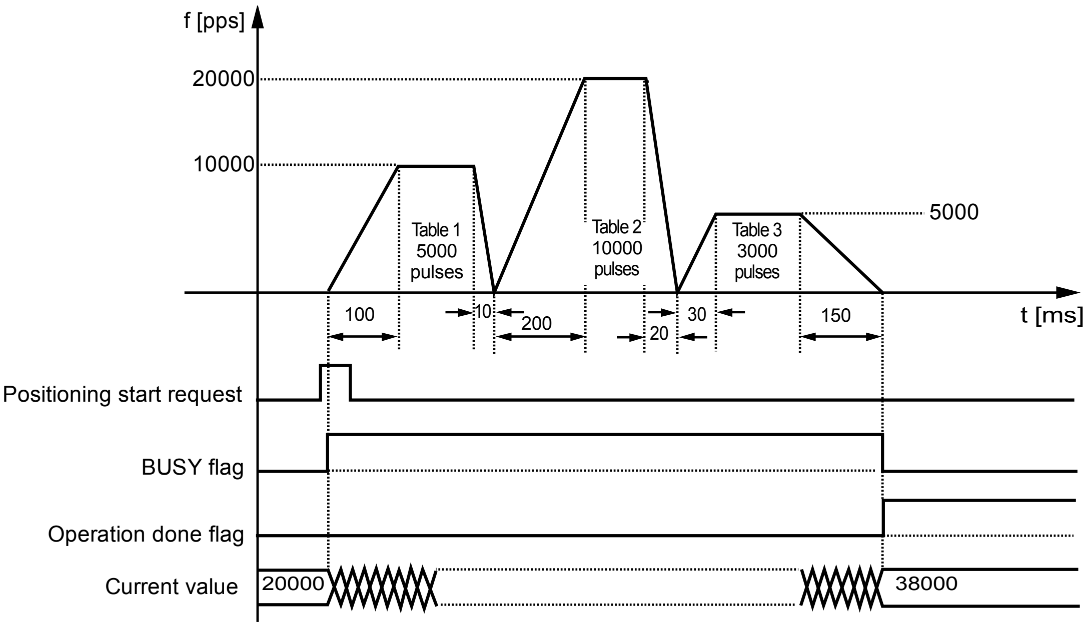


■ Settings

Item	Setting example		
	Table 1	**Table 2**	**Table 3**
Operation pattern	C: Continuance point	C: Continuance point	E: End point
Control method	I: Increment	I: Increment	I: Increment
1st axis (L) movement amount	5000 pulses	10000 pulses	3000 pulses
Acceleration/deceleration type	L: Linear	L: Linear	L: Linear
Acceleration time (ms)	100 ms	200 ms	30 ms
Deceleration time (ms)	10 ms	20 ms	150 ms
Target speed	10000 pps	20000 pps	5000 pps

(Note): The (L) in the above table is an axis number.

■ Operation diagram



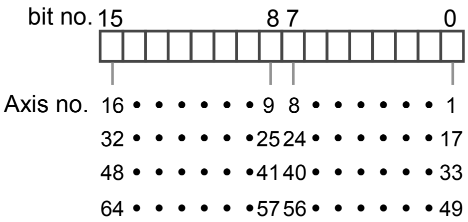
■ Operation of input control/output control signals

- When a positioning start request (corresponding bit allocated to UM00192 to UM00197) turns ON by a user program, the positioning control will start. The positioning start request will be enabled at the edge where it turns ON.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a requested operation is being controlled, will turn ON when the positioning control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

■ Allocation of unit memories

Signal name	Real axis				Virtual axis	
	Axes 1-16	Axes 17-32	Axes 33-48	Axes 49-64	Axes 1-16	Axes 17-32
Positioning start request	UM00192	UM00193	UM00194	UM00195	UM00196	UM00197
Busy flag	UM00090	UM00091	UM00092	UM00093	UM00094	UM00095
Operation done flag	UM00096	UM00097	UM00098	UM00099	UM0009A	UM0009B

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word) in the above table. When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



8.1.5 Setting and Operation of J-point Control

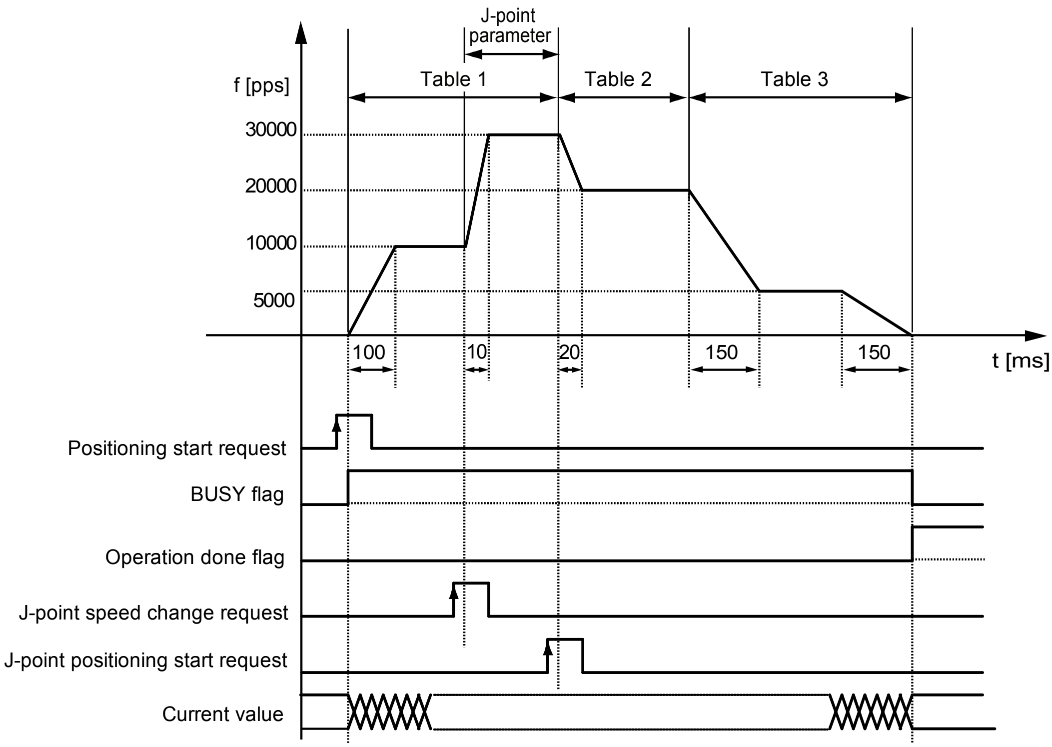
In the following example, a J-point control is performed by a single-axis control. The unit operates at the target speed and J-point target speed until the J-point positioning start request turns ON, and will start the position control when the J-point positioning start request turns ON.

■ Settings

Item	Setting example			
	Table 1	J point axis parameter setting	Table 2	Table 3
Operation pattern	J: Speed point	—	P: Pass point	E: End point
Control method	I: Increment	—	I: Increment	I: Increment
1st axis (L) movement amount	5000 pulses	—	10000 pulses	3000 pulses
Acceleration/deceleration type	L: Linear	—	L: Linear	L: Linear
Acceleration time (ms)	100 ms	—	200 ms	30 ms
Deceleration time (ms)	10 ms	—	20 ms	150 ms
Target speed	10000 pps	—	20000 pps	5000 pps
J-point operation setting code	—	Linear acceleration/ deceleration	—	—
J-point acceleration time (ms)	—	10 ms	—	—
J-point deceleration time (ms)	—	10 ms	—	—
J-point target speed	—	30000 pps	—	—

(Note): The (L) in the above table is an axis number.。

■ Operation diagram



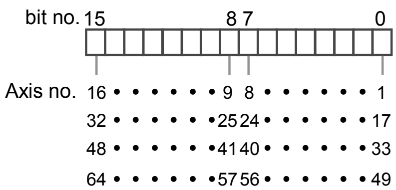
■ Operation of input control/output control signals

- When a positioning start request (corresponding bit allocated to UM00192 to UM00197) turns ON by a user program, the positioning control will start. The positioning start request will be enabled at the edge where it turns ON.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a requested operation is being controlled, will turn ON when the positioning control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.
- When a J-point speed change request (corresponding bit allocated to UM001BC to UM001C1) turns ON, the target speed will change. The speed change request will be enabled at the edge where it turns ON.
- When a J-point positioning start request (corresponding bit allocated to UM001C2 to UM001C7) turns ON, the next positioning control will start.

■ Allocation of unit memories

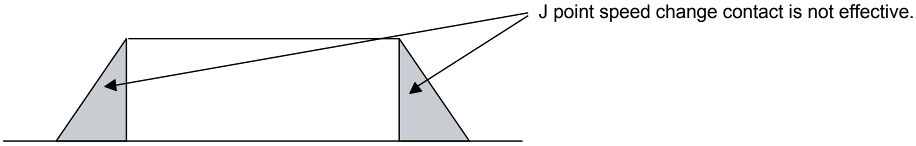
Signal name	Real axis				Virtual axis	
	Axes 1-16	Axes 17-32	Axes 33-48	Axes 49-64	Axes 1-16	Axes 17-32
Positioning start request	UM00192	UM00193	UM00194	UM00195	UM00196	UM00197
Busy flag	UM00090	UM00091	UM00092	UM00093	UM00094	UM00095
Operation done flag	UM00096	UM00097	UM00098	UM00099	UM0009A	UM0009B
J-point speed change request	UM001BC	UM001BD	UM001BE	UM001BF	UM001C0	UM001C1
J-point positioning start request	UM001C2	UM001C3	UM001C4	UM001C5	UM001C6	UM001C7

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word) in the above table. When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



■ Behaviors when the speed change request turns ON while the positioning unit is accelerating or decelerating the speed

A speed change is possible during J-point control, but impossible during acceleration or deceleration. A speed change will be made after the unit goes to constant speed when the speed change signal turns ON during acceleration or deceleration. Be sure to input the amount of movement for positioning with a value that can secure a target constant-speed area.



8.2 Interpolation Control

8.2.1 Type of Interpolation Control (Two-axis Interpolation)

- The following types and operation specification methods are available for the 2-axis interpolation.
- The axes in the relation of an interpolation are called 1st axis and 2nd axis for the 2-axis interpolation. Also, the 1st axis and 2nd axis are automatically allocated from the smalles axis number in axcending order.

■ Type and operation specification method

Type	Operation specification method	Necessary data
2-axis linear interpolation control	Composite speed	Composite speed of 1st axis and 2nd axis
	Long axis speed	Speed of long axis (Axis of which moving distance is long)
2-axis circular interpolation control	Center point/CW direction	Coordinates of 1st axis and 2nd axis of center point
	Center point/CCW direction	Coordinates of 1st axis and 2nd axis of center point
	Pass point	Coordinates of 1st axis and 2nd axis of pass point on arc

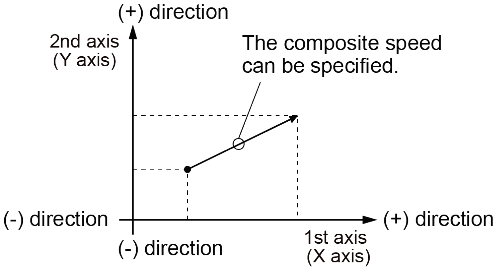
■ Positioning table and operation characteristics

- When specifying the long axis speed method, the composite speed is faster than the long axis speed.
- In the case of the center point specification, the coordinate of the center point on arc is specified as the data of 1st-axis (X-axis) auxiliary point and 2nd-axis (Y-axis) auxiliary point of positioning data. Also, in the case of the pass point specification, the coordinate of the pass point on arc is specified as the data of 1st-axis (X-axis) auxiliary point and 2nd-axis (Y-axis) auxiliary point of positioning data
- When the control method is increment, for the both center point and pass point, the increment coordinate from the start point is specified.
- When the start point and the operation done point is the same, it performs one circular operation when using the center point method. However, when using the pass point method, an error occurs.
- In case of the pass point method, when the start point, pass point and operation done pont exsit in the same straight line, an arc is not comprised, and an error occurs.
- In each interpolation control, the E-point control which uses one table, P-point control and C-point control which uses multiple tables can be combined arbitrarily as positioning data. For the P-point and C-point controls, the last table should be set as an end point.

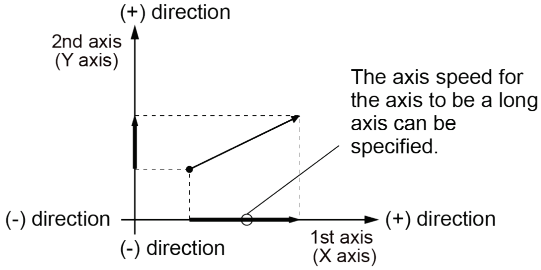
◆ **REFERENCE**

- **For details of E-point, P-point, and C-point controls, refer to "8.1.1 Patterns of Position Control".**

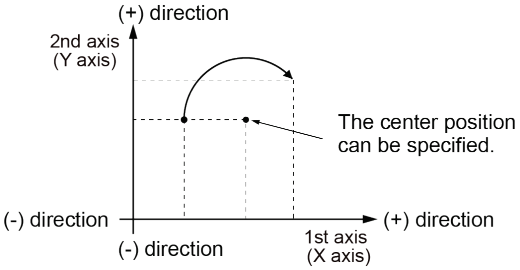
2-axis linear interpolation
(Composite speed specification)



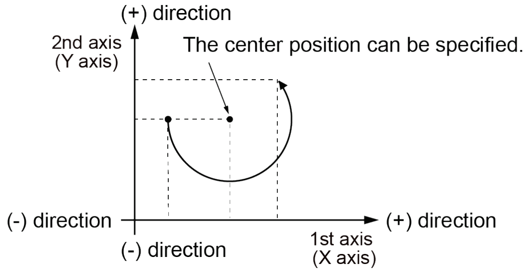
2-axis linear interpolation
(Long axis speed specification)



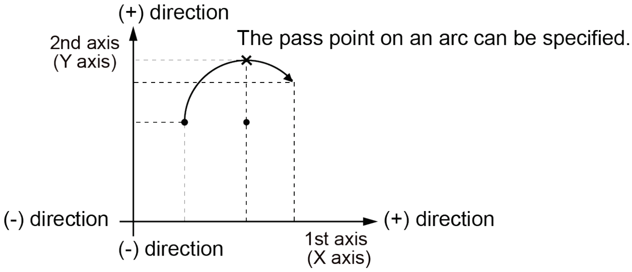
2-axis circular interpolation
(Center point specification/CW direction)



2-axis circular interpolation
(Center point specification/CCW direction)



2-axis circular interpolation
(Pass point specification)



8.2.2 Type of Interpolation Control (Three-axis Interpolation)

- The following types and operation specification methods are available for the 3-axis interpolation.
- The axes in the relation of an interpolation are called 1st axis, 2nd axis and 3rd axis for the 3-axis interpolation. Also, the 1st, 2nd and 3rd axes are automatically allocated from the smallest axis number in ascending order.

■ Type and operation specification method

Type	Operation specification method	Necessary data
3-axis linear interpolation control	Composite speed	Composite speed of 1st, 2nd and 3rd axes
	Long axis speed	Speed of long axis (Axis of which moving distance is long)
3-axis spiral interpolation control	Center point/CW direction/1st axis movement	Coordinates of 2nd and 3rd axes of center point
	Center point/CCW direction/1st axis movement	Coordinates of 2nd and 3rd axes of center point
	Center point/CW direction/2nd axis movement	Coordinates of 1st and 3rd axes of center point
	Center point/CCW direction/2nd axis movement	Coordinates of 1st and 3rd axes of center point
	Center point/CW direction/3rd axis movement	Coordinates of 1st and 2nd axes of center point
	Center point/CCW direction/3rd axis movement	Coordinates of 1st and 2nd axes of center point
	Pass point/1st axis movement	Coordinates of 2nd and 3rd axes of pass point on arc
	Pass point/2nd axis movement	Coordinates of 1st and 3rd axes of pass point on arc
	Pass point/3rd axis movement	Coordinates of 1st axis and 2nd axis of pass point on arc

■ Positioning table and operation characteristics

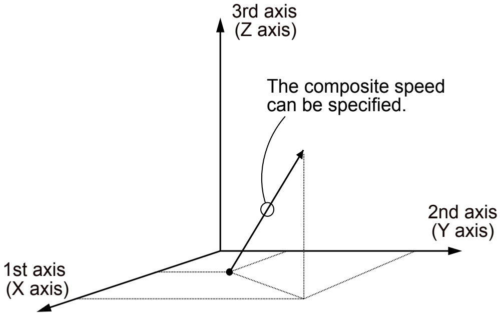
- When specifying the long axis speed method, the composite speed is faster than the long axis speed.
- In the case of the center point specification, the coordinates of the center point for two axes which draw an arc is specified as the data of 1st-axis (X-axis) auxiliary point and 2nd-axis (Y-axis) auxiliary point of positioning data. Also, in the case of the pass point specification, the coordinate of the pass point on arc is specified as the data of 1st-axis (X-axis) auxiliary point and 2nd-axis (Y-axis) auxiliary point of positioning data
- When the control method is increment, for the both center point and pass point, the increment coordinate from the start point is specified.
- When the start point and the operation done point is the same, it performs one circular operation when using the center point method. However, when using the pass point method, an error occurs.
- In case of the pass point method, when the start point, pass point and operation done point exist in the same straight line, an arc is not comprised, and an error occurs.

- In each interpolation control, the E-point control which uses one table, P-point control and C-point control which uses multiple tables can be combined arbitrarily as positioning data. For the P-point and C-point controls, the last table should be set as an end point.

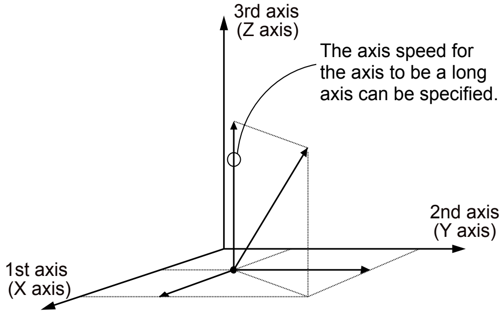
◆ REFERENCE

- **For details of the position control patterns, refer to "8.1.1 Patterns of Position Control".**

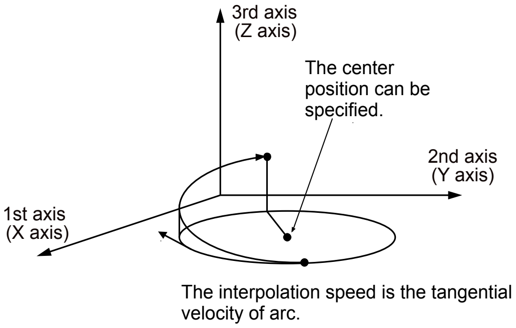
3-axis linear interpolation
(Composite speed specification)



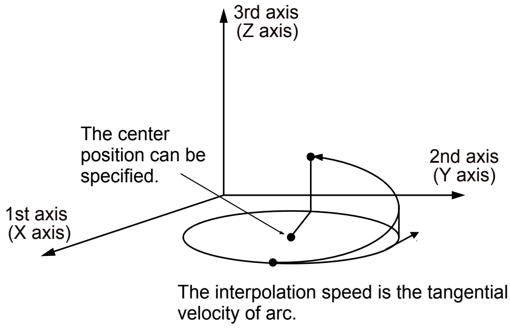
3-axis linear interpolation
(Long axis speed specification)



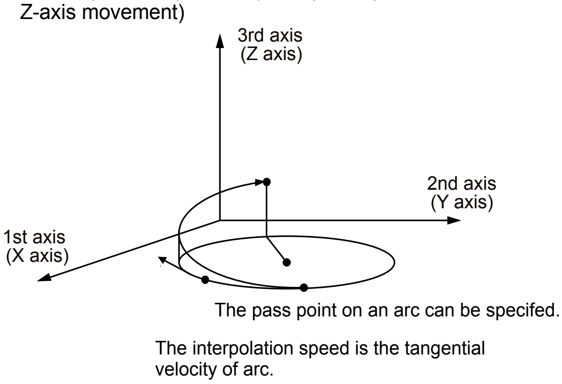
3-axis spiral interpolation (Center point specification/
CW direction/Z-axis movement)



3-axis spiral interpolation (Center point specification/
CCW direction/Z-axis movement)



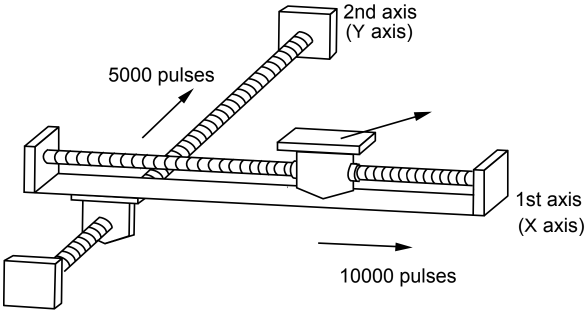
3-axis spiral interpolation (Pass point specification/
Z-axis movement)



(Note): The following explanatory drawings for 3-axis spiral interpolation control show the cases that an arc is drawn with the 1st axis (X-axis) and 2nd axis (Y-axis) and moves toward the 3rd axis (Z-axis).

8.2.3 Setting and Operation of Two-Axis Linear Interpolation

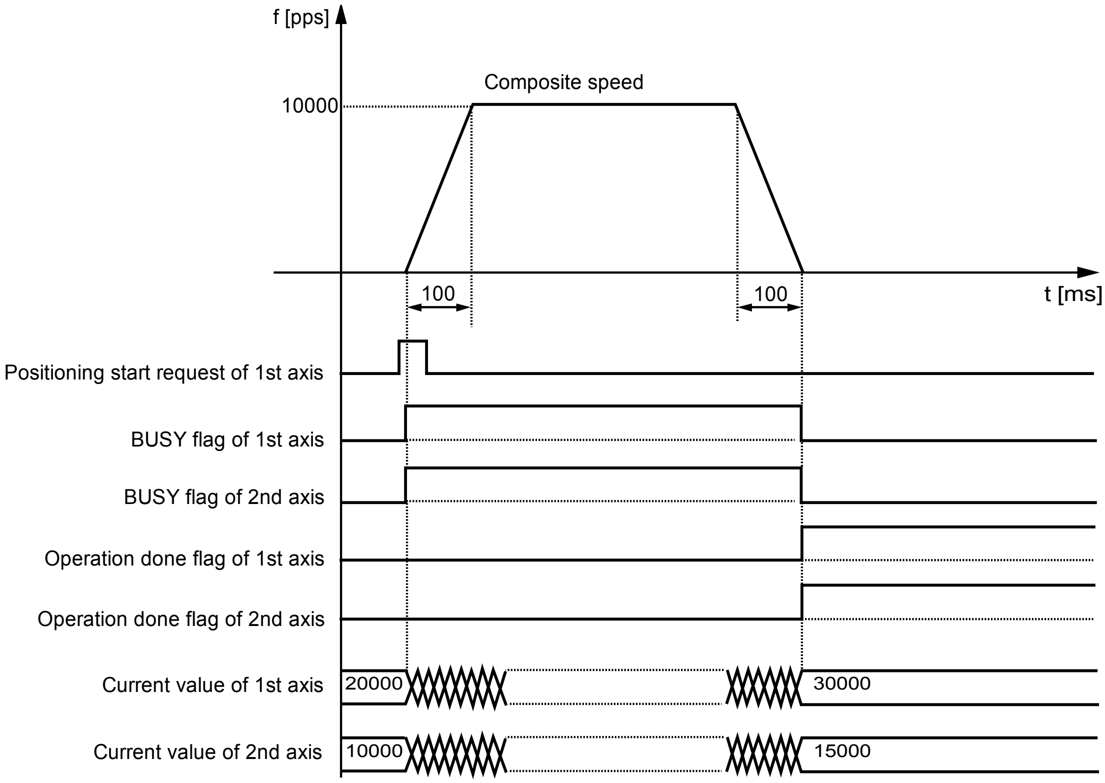
In the following example, a 2-axis linear interpolation control is performed by a composite speed.



■ Settings

Item	Setting example	Remarks
Operation pattern	E: End point	
Interpolation operation	0: Linear (Composite speed)	
Control method	I: Increment	
1st axis (L) movement amount	10000 pulses	Axis numbers are put in (L) and (m). The values of auxiliary points are invalid for the linear interpolation.
1st axis (L) Auxiliary point	0 pulse	
2nd axis (m) Movement amount	5000 pulses	
2nd axis (m) Auxiliary point	0 pulse	
Acceleration/deceleration type	L: Linear	
Acceleration time (ms)	100 ms	
Deceleration time (ms)	100 ms	
Interpolation speed	10000 pps	

■ Operation diagram

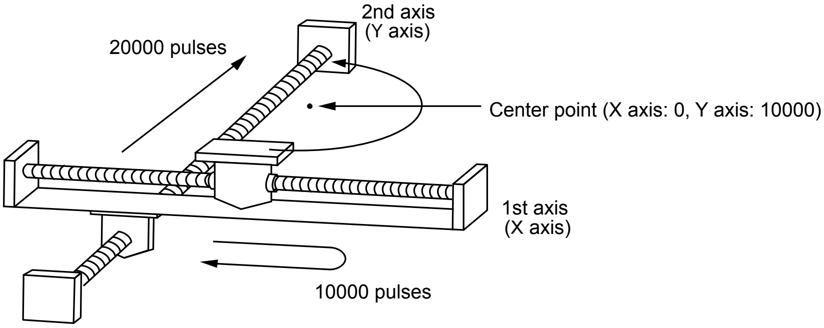


■ Operation of input control/output control signals

- When a positioning start request (corresponding bit allocated to UM00192 to UM00197) turns ON by a user program, the positioning control will start. The positioning start request will be enabled at the edge where it turns ON. In the interpolation control, turn ON the positioning start request of the smallest axis number in the same interpolation group.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a motor is running, will turn ON when the positioning control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

8.2.4 Setting and Operation of Two-Axis Circular Interpolation

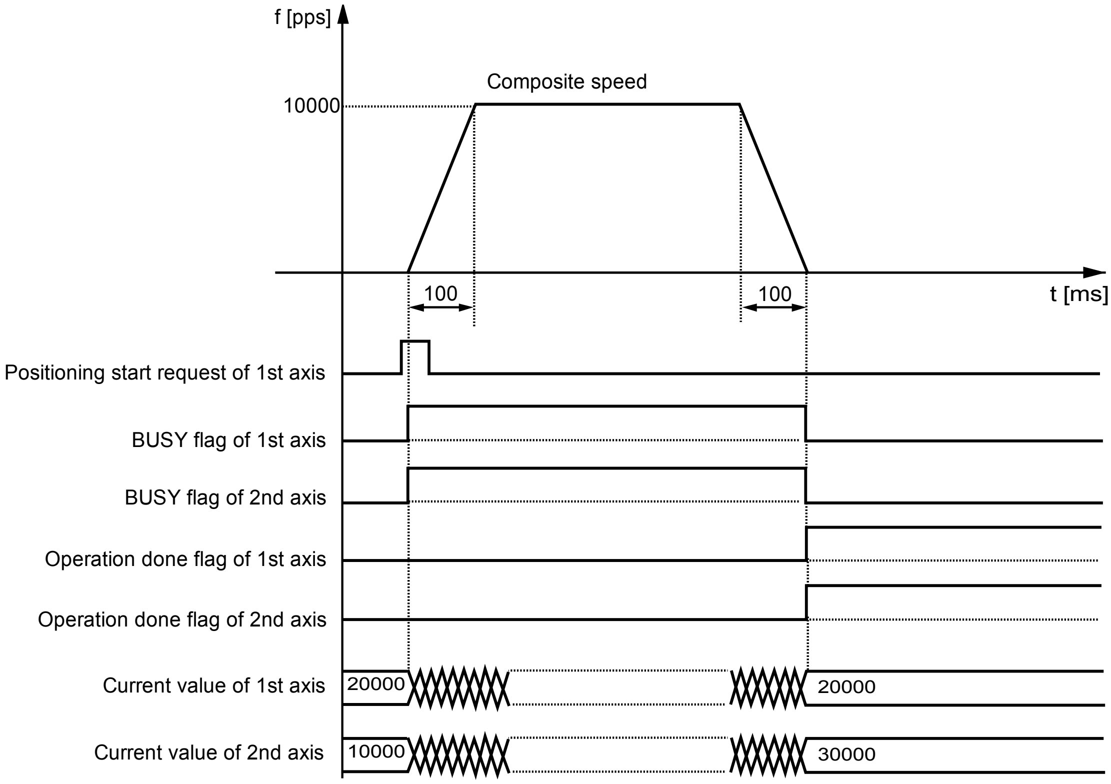
In the following example, a 2-axis circular interpolation control is performed by specifying the center point.



■ **Settings**

Item	Setting example	Remarks
Operation pattern	E: End point	
Interpolation operation	S: Circular (Pass point/CW direction)	
Control method	I: Increment	
1st axis (L) movement amount	0 pulse	Axis numbers are put in (L) and (m). For the auxiliary points, specify the coordinate (0, 10000) to be the center of an arc.
1st axis (L) Auxiliary point	0 pulse	
2nd axis (m) Movement amount	20000 pulses	
2nd axis (m) Auxiliary point	10000 pulses	
Acceleration/deceleration type	L: Linear	
Acceleration time (ms)	100 ms	
Deceleration time (ms)	100 ms	
Interpolation speed	10000 pps	Specify the speed of a tangent of an arc.

■ Operation diagram

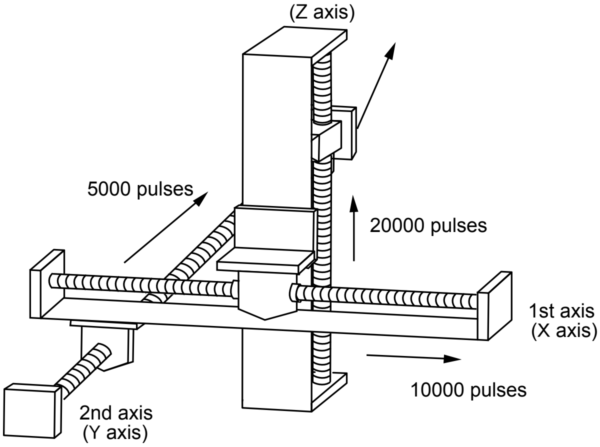


■ Operation of input control/output control signals

- When a positioning start request (corresponding bit allocated to UM00192 to UM00197) turns ON by a user program, the positioning control will start. The positioning start request will be enabled at the edge where it turns ON. In the interpolation control, turn ON the positioning start request of the smallest axis number in the same interpolation group.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a motor is running, will turn ON when the positioning control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

8.2.5 Setting and Operation of Three-Axis Linear Interpolation

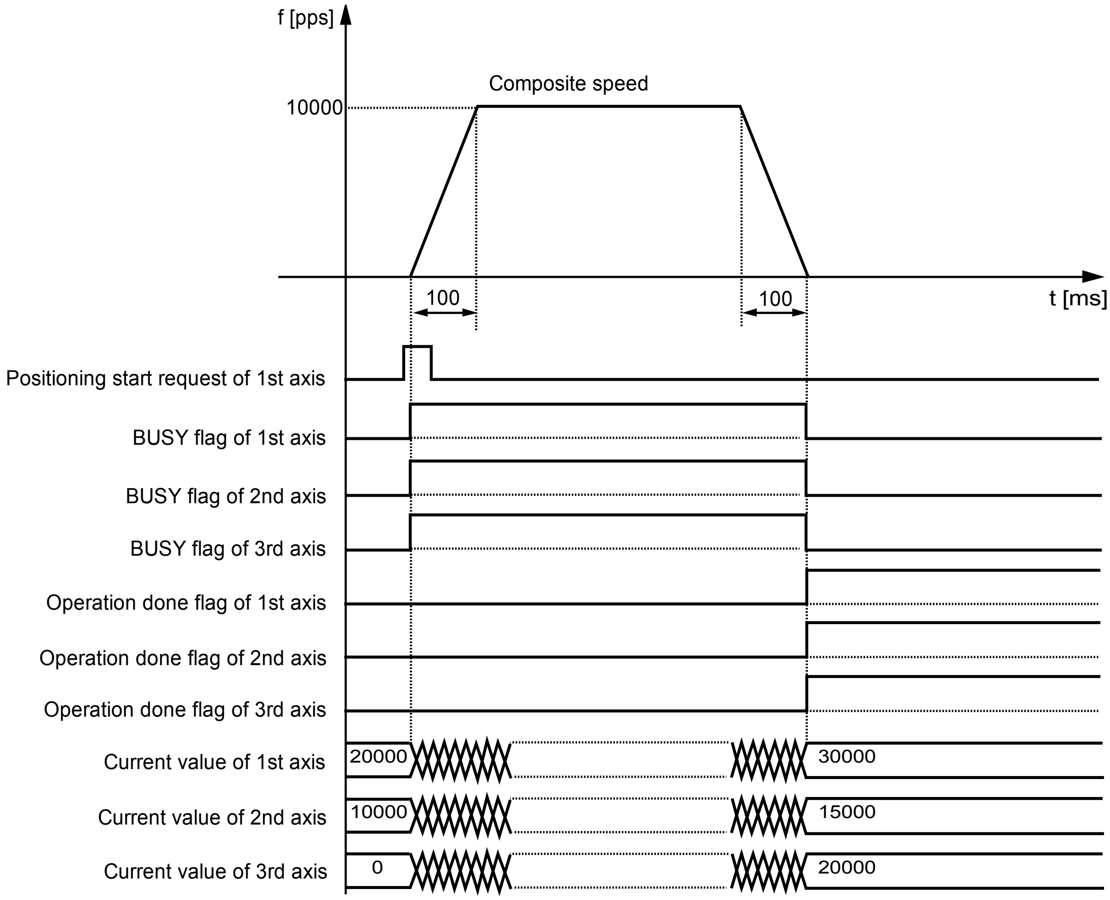
In the following example, a 3-axis linear interpolation control is performed by a composite speed.



■ Settings

Item	Setting example	Remarks
Operation pattern	E: End point	
Interpolation operation	0: Linear (Composite speed)	
Control method	I: Increment	
1st axis (L) movement amount	10000 pulses	Axis numbers are put in (L), (m) and (n). The values of auxiliary points are invalid for the linear interpolation.
1st axis (L) Auxiliary point	0	
2nd axis (m) Movement amount	5000 pulses	
2nd axis (m) Auxiliary point	0	
3rd axis (n) Movement amount	20000 pulses	
3rd axis (n) Auxiliary point	0	
Acceleration/deceleration type	L: Linear	
Acceleration time (ms)	100 ms	
Deceleration time (ms)	100 ms	
Interpolation speed	10000 pps	Specify the speed of a tangent of an arc.

■ Operation diagram

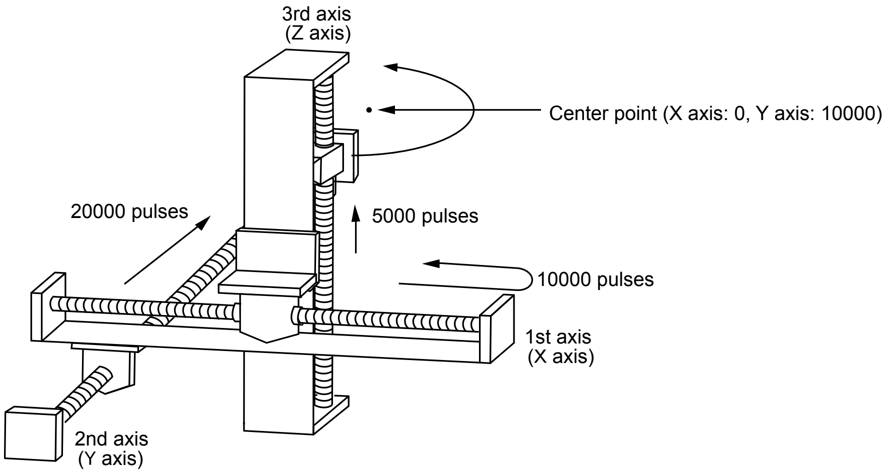


■ Operation of input control/output control signals

- When a positioning start request (corresponding bit allocated to UM00192 to UM00197) turns ON by a user program, the positioning control will start. The positioning start request will be enabled at the edge where it turns ON. In the interpolation control, turn ON the positioning start request of the smallest axis number in the same interpolation group.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a motor is running, will turn ON when the positioning control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

8.2.6 Setting and Operation of Three-Axis Spiral Interpolation

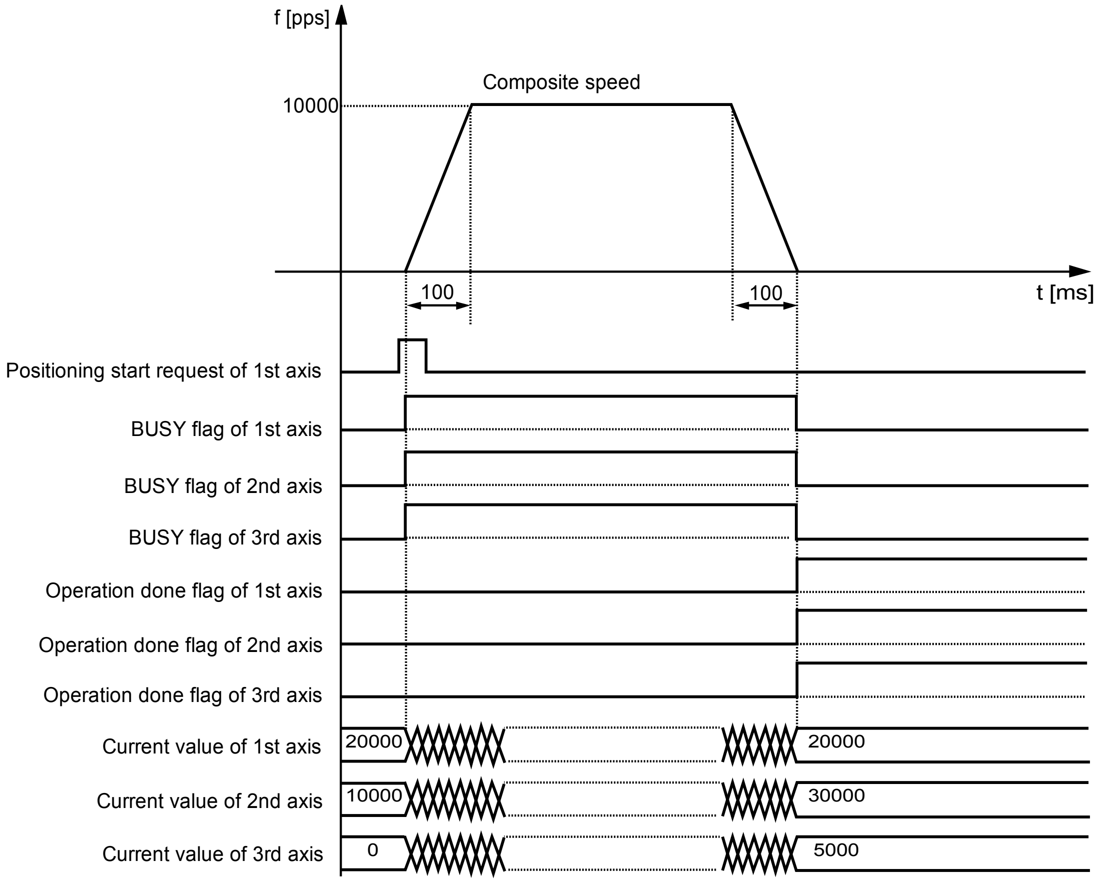
In the following example, an arc is drawn with the 1st axis (X-axis) and 2nd axis (Y-axis), and a 3-axis spiral interpolation control is performed with 3rd axis (Z-axis) movement.



■ **Settings**

Item	Setting example	Remarks
Operation pattern	E: End point	
Interpolation operation	E: Spiral (Center point/CW direction/3rd axis movemet)	
Control method	I: Increment	
1st axis (L) movement amount	0 pulse	Axis numbers are put in (L) and (m). For the auxiliary points, specify the coordinate (0, 10000) to be the center of an arc.
1st axis (L) Auxiliary point	0 pulse	
2nd axis (m) Movement amount	20000 pulses	
2nd axis (m) Auxiliary point	10000 pulses	
3rd axis (n) Movement amount	5000 pulses	Axis numbers are put in (n). Specify the movement amount of 3rd axis (Z-axis).
3rd axis (n) Auxiliary point	0 pulse	
Acceleration/deceleration type	L: Linear	
Acceleration time (ms)	100 ms	
Deceleration time (ms)	100 ms	
Interpolation speed	10000 pps	

■ Operation diagram



■ Operation of input control/output control signals

- When a positioning start request (corresponding bit allocated to UM00192 to UM00197) turns ON by a user program, the positioning control will start. The positioning start request will be enabled at the edge where it turns ON. In the interpolation control, turn ON the positioning start request of the smallest axis number in the same interpolation group.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a motor is running, will turn ON when the positioning control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

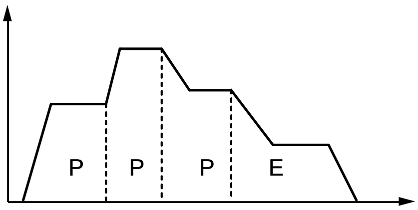
8.3 Repeat Function

8.3.1 Overview of Repeat Operation

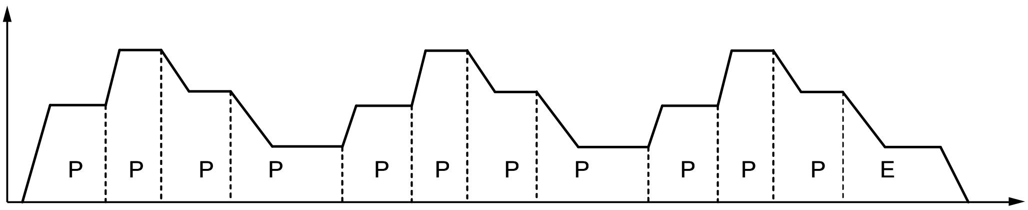
- This function is used to execute continuous positioning control by specifying a repeat count.
- The repeat count is set in the "positioning repeat count area" in the unit memories. The continuous positioning control can be executed in the range of 2 to 254 times or unlimitedly according to the setting.
- The operation from the positioning control starting table to the E-point table is repeated.

■ Overview of positioning repeat function

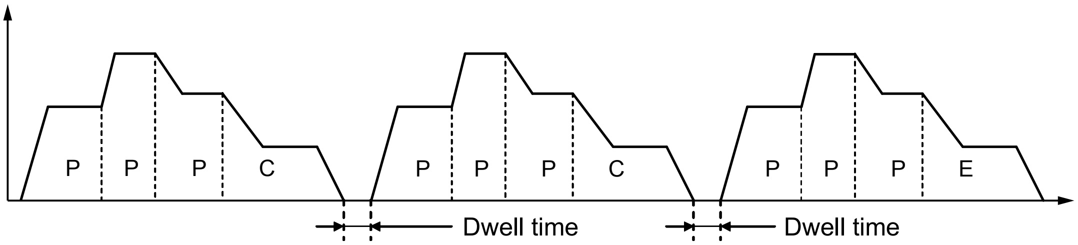
The positioning unit operates as shown below in the case of repeating positioning control three times.



If a dwell time of 0 is set for E-point control, i.e., the end point of positioning control, the unit processes E-point control as P-point control, and finishes the operation after repeating the positioning control three times continuously.



If the dwell time is set to a value other than 0 for E-point control, i.e., the end point of positioning control, the control unit processes E-point control as C-point control, and executes the positioning control after stopping for the specified dwell time (ms). The positioning unit finishes the operation after repeating the positioning control three times.



■ Setting area for positioning repeat count (Unit memories)

Axis no.	Unit memory no. (Hex)	Name	Default	Description
Axis 1	UM 009F0	Positioning repeat count	U0	Stores the number of times for repeating the operation starting from the positioning control starting table number until the E point.
Axis 2	UM 009F1			
Axis 64	UM 00A2F			
Virtual axis 1	UM 00A30			
	-			
Virtual axis 32	UM 00A4F			

Value	Operation
0 or 1	Execute only once.
2-254	Execute for a specified number of times.
255	Execute unlimitedly until performing the stop operation.

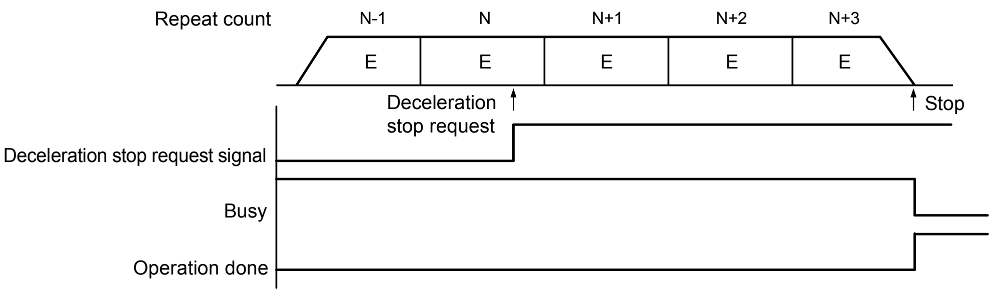
(Note 1): As for the unit memories in which "positioning repeat count" is set, 1-word area is allocated for each axis.

8.3.2 Stop Operation During Repeat Operation

The unit operates as follows when the deceleration stop is executed during the repeat operation.

■ When repeating E-point control

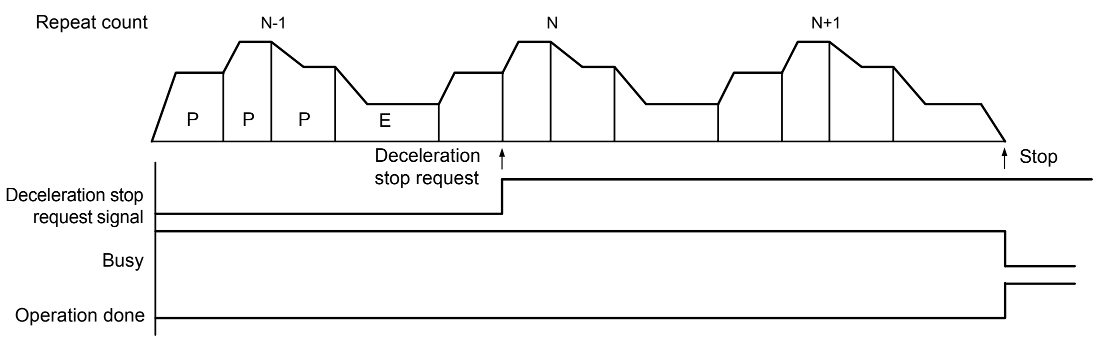
When the unit detects a deceleration stop, it stops the operation after repeating the positioning control N+3 times.



(Note): The above figure shows the case that the dwell time is 0 ms.

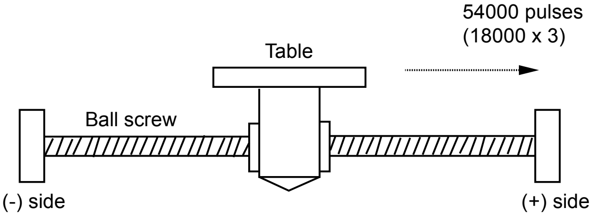
■ When executing multiple positioning tables continuously

When the unit detects a deceleration stop, it stops the operation after repeating the positioning control N+2 times (when the number of tables is 2) or N+1 times (when the number of tables is 3 or more).



8.3.3 Setting and Operation of Repeat

In the following example, the positioning control with three tables (P + P + E points) is repeated three times by a single axis control.

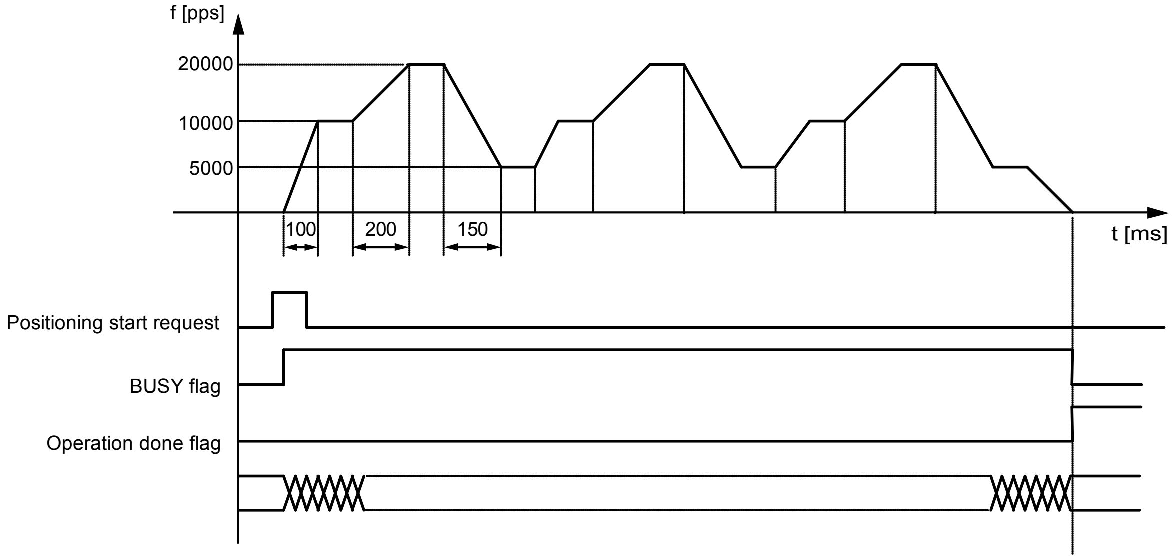


■ Settings

Item	Setting example		
	Table 1	**Table 2**	**Table 3**
Operation pattern	P: Pass point	P: Pass point	E: End point
Control method	I: Increment	I: Increment	I: Increment
1st axis (L) movement amount	5000 pulses	10000 pulses	3000 pulses
Acceleration/deceleration type	L: Linear	L: Linear	L: Linear
Acceleration time (ms)	100 ms	200 ms	30 ms
Deceleration time (ms)	10 ms	20 ms	150 ms
Target speed	10000 pps	20000 pps	5000 pps
Dwell time	0 ms	0 ms	0 ms
Positioning repeat count	3 (Write in the setting area of unit memories.)		

(Note): The (L) in the above table is an axis number.

■ Operation diagram



(Note): The above figure shows the case that the dwell time is 0.

■ Operation of input control/output control signals

- When a positioning start request (corresponding bit allocated to UM00192 to UM00197) turns ON by a user program, the positioning control will start. The positioning start request will be enabled at the edge where it turns ON.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a motor is running, will turn ON when the positioning control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

8.4 Sample Programs

8.4.1 Sample Programs (E-point, C-point and C-point Controls)

The operation for starting the positioning operation is mainly divided into five steps on a user program.

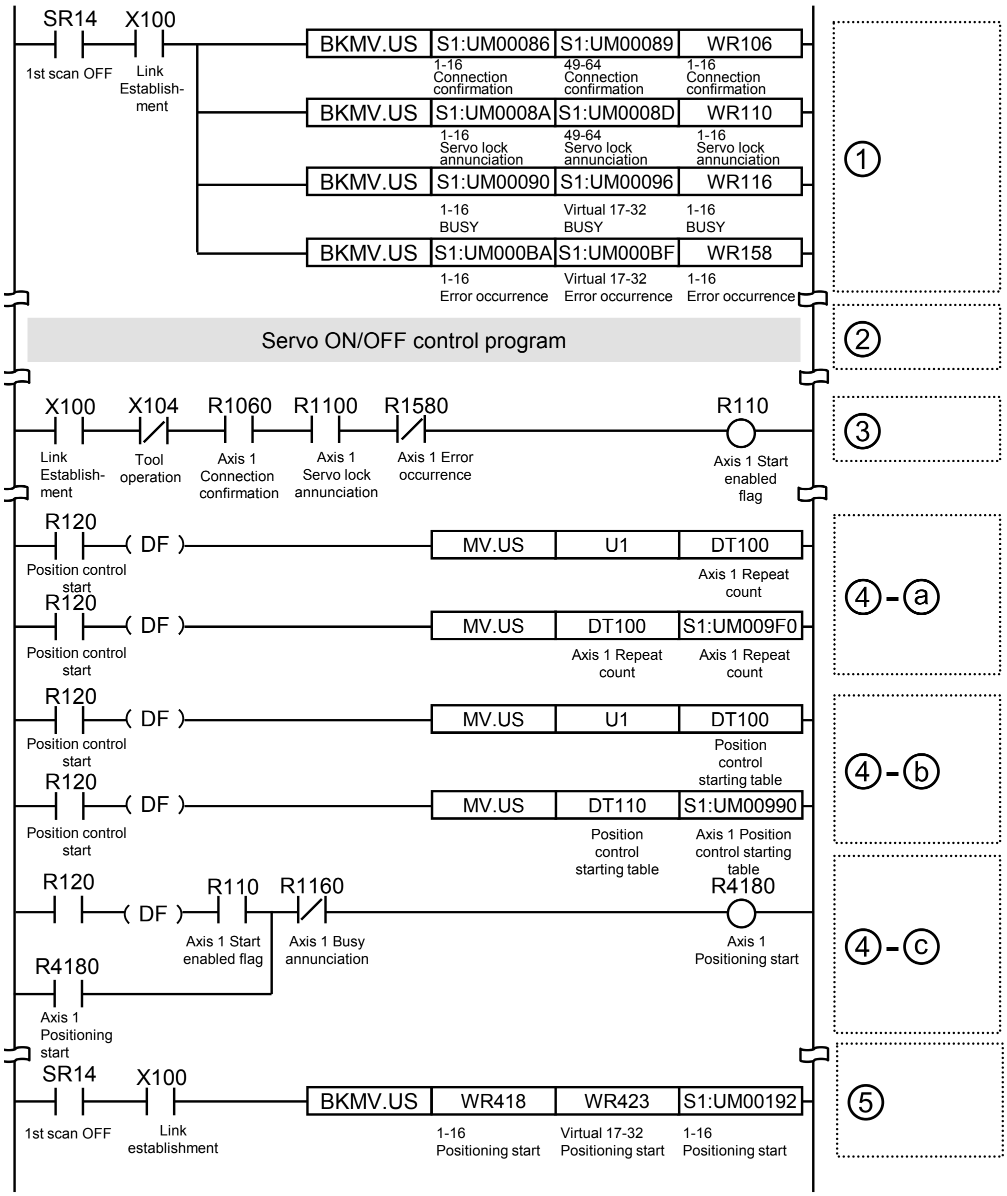
- Read flags stored in the unit memories (input control area).
- Control the servo ON/OFF.
- Check the condition if the control of each axis can be started.
- Set positioning table numbers, check the conditions, and start the positioning operation.
- Write operation results in the unit memories (output control area).

(Note): The sample program on the next page is for activating the positioning operation with the table number 1 of the axis number 1 for the FP7 MC Unit installed in the slot number 1. To simplify the explanation, the part related to the positioning operation is extracted.

■ Contents of sample program

Mark		Description
①		Read flags indicating states from the input control area of the unit memories (UM) to arbitrary areas (WR). Read flags such as connection confirmation flag, servo lock confirmation flag, busy flag, and error flag.
②		Servo ON/OFF control program
③		Check required conditions and replace it with the start enabled flag (R110) in the program.
④		Positioning operation start program
	ⓐ	Set the repeat count as necessary.
	ⓑ	Specify positioning table numbers.
	ⓒ	Start the positioning operation.
⑤		Write flags to the output control area of the unit memoires (UM) from arbitrary area (WR) where the start conditions are written. Start the positioning operation.

■ Sample program



8.4.2 Precautions on Programming

■ Precautions on programming

- If any value such as a movement amount, acceleration time, deceleration time or target speed is out of the specified range, a setting value error will occur when the position control starts.
- Unit memory numbers allocated to flags and start requests vary depending on axis numbers.
- A specified slot number varies depending on the installation position of the unit.

■ Operation at Over limit input (Limit is Enabled)

Condition	Direction	Limit status	Operation
When each control starts	Forward	Over limit input (+): ON	Not executable, Error occurs.
		Over limit input (-): ON	Not executable, Error occurs.
	Reverse	Over limit input (+): ON	Not executable, Error occurs.
		Over limit input (-): ON	Not executable, Error occurs.
When each control is performed	Forward	Over limit input (+): ON	Deceleration stop, Limit error occurs.
	Reverse	Over limit input (-): ON	Deceleration stop, Limit error occurs.

8.5 Rewriting Positioning Data by User Programs

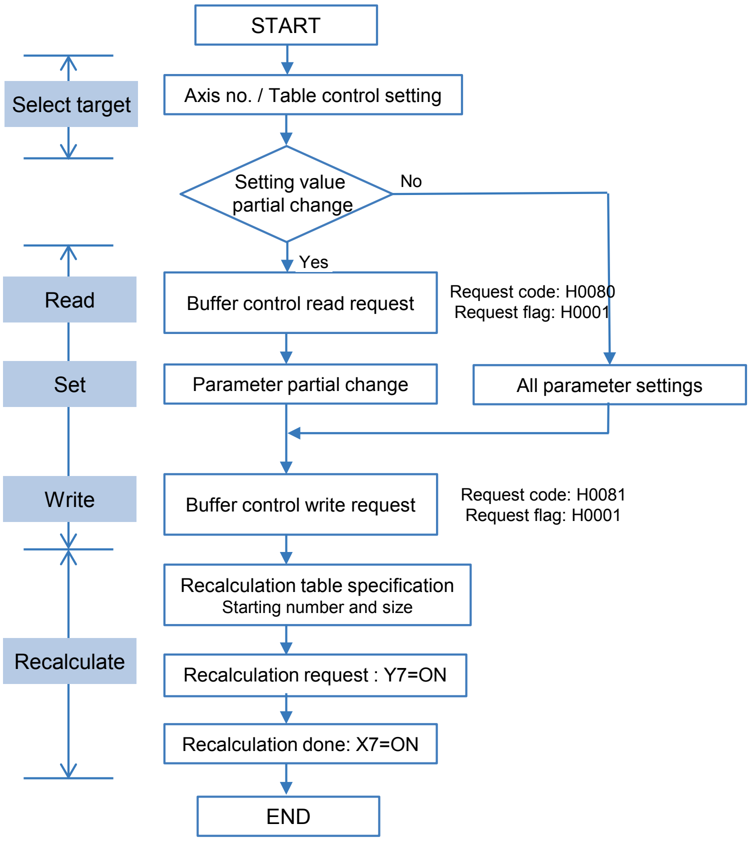
8.5.1 Overview of Function

- Positioning data set by CMI is downloaded to the FROM of FP7 MC Unit.
- The positioning data stored in the FROM is transferred to the system area of FP7 MC Unit when the power is turned on. The system area cannot be directly accessed using user programs.
- When positioning data (such as movement amount or target speed) varies according to operation results, the positioning data should be rewritten using user programs.
- In the system area of FP7 MC Unit, the positioning data for 32 words x 1000 tables x 96 axes (64 real axes + virtual axes) are stored.
- When rewriting positioning data using user programs, the data is read and written from/to the system area through the 24 buffer areas allocated to the unit memories.
- The data that can be read or written in a single operation using a user program is data for 32 words x Max. 500 tables x 1 axis.

8.5.2 Procedure of Rewriting

The following flowchart shows the flow of the operation required in a user program.

- For reading and writing, the operations to be executed (read, write) and targets (axis number, table number, table size) are specified in the buffer control area of the unit memories.
- By executing "Recalculation" after the operation, the positioning data stored in the system area of FP7 MC Unit is updated. Once the "Recalculation" is completed, the positioning operation can be started for the rewrtten positioning data.



■ Recalculation

Recalculation is necessary after rewriting positioning data using user porgrams. The procedure of recalculation is as follows. When recalculation is not performed, the operation is executed with the positioning table before rewriting.

1. Change the positioning table in the unit memories.
2. Turn on the recalculation request (Y4) in the I/O area.
3. Confirm that the recalculation done flag (X7) in the I/O area is on. (Confirm that the recalculation process is completed.)

(Note): I/O numbers of the recalculation request (Y7) and recalculation done flag (X7) vary according to the value of the "Starting word number" allocated to the unit.

8.5.3 Sample Program (Rewritign Positioning Tables)

The operation for rewriting positioning tables using a user program is mainly divided into five steps.

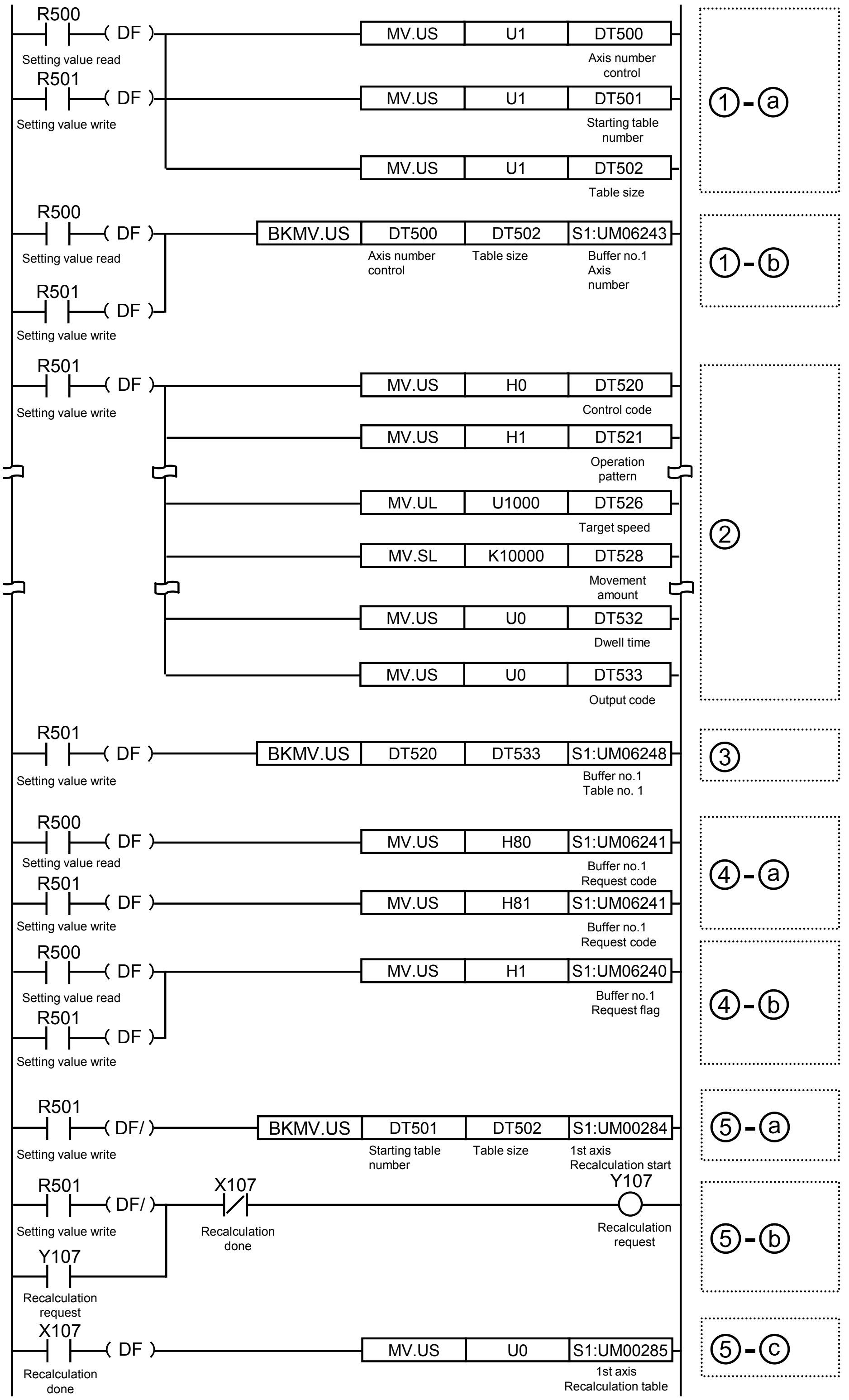
- Specify the axis number, table number and table size to rewrite the positioning table.
- Set the positioning data to be rewritten.
- Set the positioning data in the positioning data setting area in buffers.
- Execute reading or writing the data in accordance with the requests stored in buffers.
- Execute recalculation.

(Note): The sample program on the next page is for rewriting the positioning data of one table from the table number 1 of the axis number 1 for the FP7 MC Unit installed in the slot number 1.

■ Contents of sample program

Mark		Description
①		Set the axis number, table number and table size to be rewritten.
	ⓐ	Set the axis number, table number and table size.
	ⓑ	Set the axis number, table number and table size in the unit memory (control area for buffer control).
②		Set the positioning data (14 words) to be rewriten in an arbitrary area.
②		Set the positioning data in the unit memory (positioning data setting area in the buffer).
④		Execute reading and writing the data in accordance with the requests stored in the buffer.
	ⓐ	Specify reading or writing in the unit memory (control area for buffer control).
	ⓑ	Set request flags in the unit memory (control area for buffer control).
⑤		Execute recalculation.
	ⓐ	Set the table number and table size to be recalculated in the unit memory (setting parameter control area).
	ⓑ	Request recalculation until it is completes.
	ⓒ	Reset the recalculation table size stored in the unit memory (setting parameter control area) to zero.

■ Program example



9

Automatic Operation (Synchronous Control)

9.1 Synchronous Control

9.1.1 Overview of Synchronous Control

■ What is synchronous control?

In the synchronous control, by operating a reference axis (master axis), the axes (slave axes) interlocking (synchronizing) with the master axis are activated. The advantages of using the synchronous control are as follows.

1. Ease of setting

A number of related axes can be operated with ease by designing the operation of the axes based on the master axis.

2. Ensuring operational safety

If an axis comes to a stop for some reason while the positioning unit is in synchronous control, all the relevant axes under synchronous control will come to a stop. Therefore, you can easily increase the safety of the positioning unit.

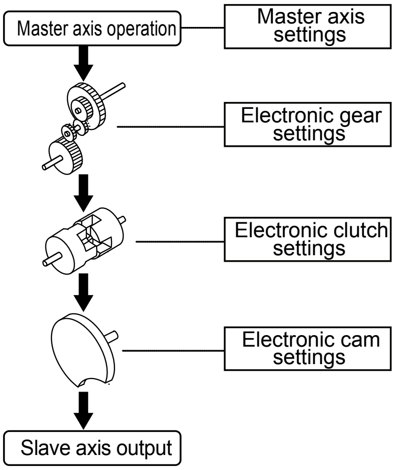
■ Functions of control output

The synchronous control provides the following functions. These functions are executed in order, and the slave axes operate according to the operation result of each function.

Function	Overview
Electronic gear	The number of pulses multiplied by the preset electronic gear ratio is output according to the operation of the master axis.
Electronic clutch	The operation of the slave axes can be separated from the operation of the master axis by disengaging the clutch.
Electronic cam	A function to output pulses according to the preset cam pattern. Calculates the operation phase of the master axis and outputs cam pulses according to the phase. The cam pattern is set by CMI.

■ Execution order of synchronous control and setting procedures

The following section provides information on the outline of functions achieved by synchronous control and setting procedures for the functions.



Make master axis settings for each operating axis.
Each operating axis will work as a slave axis if master axis settir are made for the operating axis.

Select the use or non-use of the electronic gear. Various electro gear settings are required if the electronic gear is used.

Select the use or non-use of the electronic clutch. Various electronic cutch settings are required if the electronic gear is use

Select the use or non-use of the electronic cam. Various electroı cam settings are required if the electronic gear is used.
In addition, electronic cam pattern settings are required in the ca of using the electronic cam.

9.2 Settings for Master and Slave Axes

9.2.1 Selection of Master Axis and Settings

The master axis serves as a reference for synchronization control. Start and stop requests for various operations are made to the master axis under synchronous control. It is possible to select one of the following master axes.

■ Types of master axis

Master axis type	Description
Real axis	Use one of them if the master axis needs to be an object of control as well. If a real axis is used as the master axis, the rest of the real axes can be used as slave axes.
Virtual axis	It is a virtual axis controlled within FP7 MC Unit. The virtual axis can be used only as the master axis. Real axes can be used effectively by using the virtual axis.

■ Types of master axis and restrictions

Operation mode		Usable axis		Remarks
		Real axis	Virtual axis	
Home return		○	△	Virtual axes are available only for "Data set" method".
JOG operation		○	○	
Positioning	Single axis	○	○	
	Interpolation	○	○	Available in any of the following combinations. Real axis + Real axis Virtual axis + Real axis Virtual axis + Virtual axis
Stop function	System stop Emergency stop Deceleration stop	○	○	
	Limit stop	○	△	For virtual axes, only the stop by softwrae limit is available.
	Error stop	○	○	

◆ **KEY POINTS**

- **While the unit is in synchronous control, slave axes set to use the master axis operate only in synchronization with the master axis, i.e., the slave axes cannot operate independently.**

9.2.2 Selection of Slave Axes and Settings

■ Selection of slave axes

- Axes that can be used as slave axes are real axes. Virtual axes can be used only as the master axis.
- When "Synchronous master axis" is selected in the synchronous parameter dialog box of CMI, the corresponding axis operates as a slave axis for the specified master axis.
- Axes set as slave axes operate in synchronization with the master axis. Slave axes cannot be controlled independently during synchronization.

■ Settings for slave axes

Slave axes operate in synchronization with the master axis. Set the following items, however, for each individual slave axis.

- Unit setting
- Pulse number per rotation
- Movement amount per rotation

9.2.3 Unit Type and Number of Axes

FP7 MC Unit model number	Number of usable axes	
	Real axis	Virtual axis
AFP7MC16EC	Max. 16 axes	Max. 8 axes
AFP7MC32EC	Max. 32 axes	Max. 16 axes
AFP7MC64EC	Max. 64 axes	Max. 32 axes

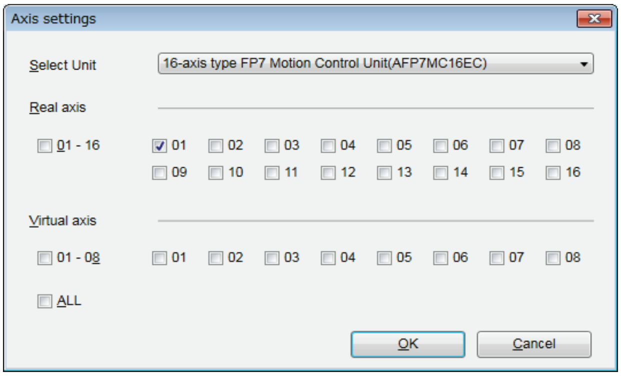
9.2.4 Setting by CMI

Master and slave axes are allocated using CMI. The following procedure is explained on the condition that CMI has already started. In the following example, AFP7MC16EC (16-real axes, 8-virtual axes) type is used, and the axis 1 is allocated to the master and the axes 2 and 3 are allocated to slave axes.

◆ **PROCEDURE**

1. **Select "File" > "New" from the menu bar of CMI.**

   The Axis settings dialog box is displayed.

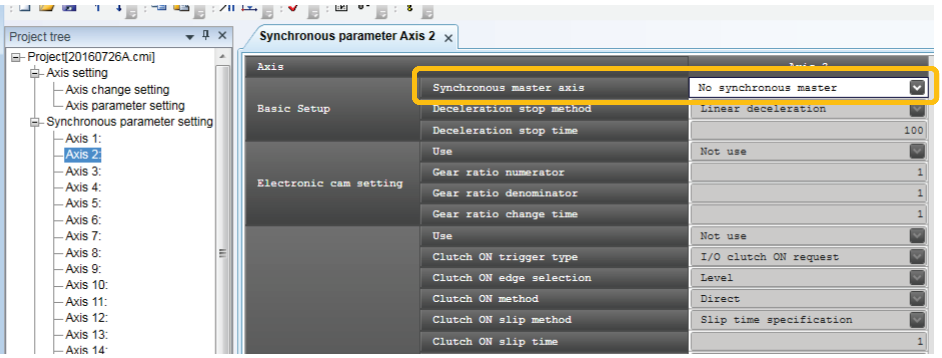


2. **Select an interpolation group, and press the [OK] button.**

   For performing the synchronous control, only the master axis can be selected for the interpolation group.

3. **Select "Parameter" > "Synchronous parameter settings" > "Axis 2" from the menu bar.**

   The "Synchronous parameter Axis 2" window opens.



4. **Select "Axis 1" from the drop-down list of "Basic setup" > "Synchronous master axis".**

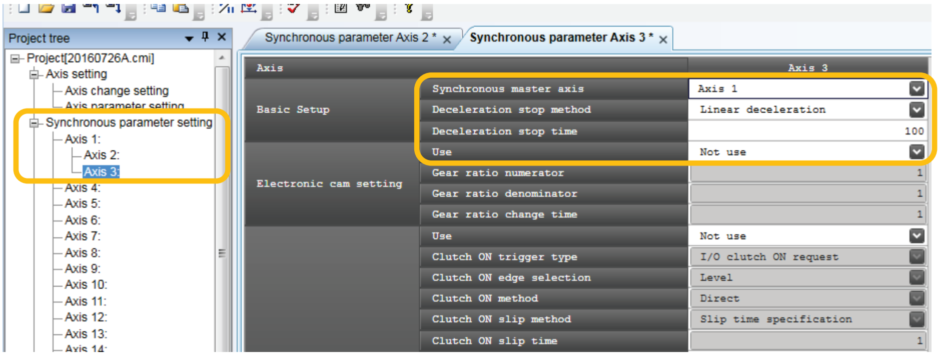
   The hierarchy of "Axis 2" in the project tree is changed. Also, the items in the electronic gear, electronic clutch and electronic cam settings of "Synchronous parameter Axis 2" become available.

5. Select "Parameter" > "Synchronous parameter settings" > "Axis 3" from the menu bar.

The "Synchronous parameter Axis 3" window opens.

6. Select "Axis 1" from the drop-down list of "Basic setup" > "Synchronous master axis".

The hierarchy of "Axis 3" in the project tree is changed. Also, the items in the electronic gear, electronic clutch and electronic cam settings of "Synchronous parameter Axis 3" become available.



9.3 Start and Cancel of Synchronous Control

9.3.1 Start and Cancel of Synchronous Control

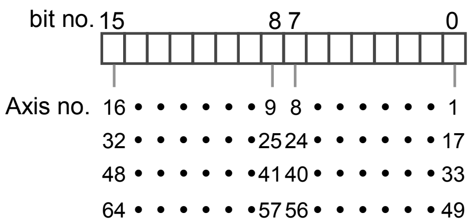
■ Start and cancel operations

- The synchronous control can be temporarily canceled by turning on "Synchronous cancel request" in the output control area of unit memories.
- It is possible to operate any slave axes individually while the synchronous state is canceled.
- The synchronous control can be started again with the sync cancel request signal turned OFF.

■ Synchronous cancel request/annunciation signals

Signal name	Real axis				Virtual axis	
	Axes 1-16	**Axes 17-32**	**Axes 33-48**	**Axes 49-64**	**Axes 1-16**	**Axes 17-32**
Synchronous cancel request Corresponding bit ON: Synchronization is canceled. Corresponding bit OFF: Synchronization is executed	UM001DA	UM001DB	UM001DC	UM001DD	UM001DE	UM001DF
Synchronous cancel active annunciation Corresponding bit ON: Synchronization is being canceled. Corresponding bit OFF: Synchronization is being processed.	UM000CC	UM000CD	UM000CE	UM000CF	UM000D1	UM000D2

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word).



■ Operations while synchronous control is performed/canceled

<table>
<tr><th colspan="2" rowspan="2">Operation mode</th><th colspan="2">Operation during synchronization</th><th>Operation while synchronization is being canceled</th></tr>
<tr><th>When requesting operation for master axis</th><th>When requesting operation for slave axis</th><th>When requesting operation for master/slave axis</th></tr>
<tr><td colspan="2">Home return</td><td>Home return operation is performed on the master axis.
Hoe return operation is not performed on slave axes. Synchronous operation is performed in synchronization with output from the master axis.
For performing home return operation on slave axes, cancel the synchronous operation.</td><td rowspan="4">The slave axes do not operate in response to operation requests.</td><td>Regardless of master or slave axes, home return operation is performed only on the axes are so requested.</td></tr>
<tr><td colspan="2">JOG operation</td><td rowspan="2">The slave axes operate in synchronization with the operation request of the master axis.</td><td rowspan="2">Regardless of master or slave axes, JOG operation is performed only on the axes are so requested.</td></tr>
<tr><td rowspan="2">Positioning</td><td>Single axis</td></tr>
<tr><td>Interpolation</td><td>Interpolation is executed upon request if the master axis is the start axis of interpolation.
The slave axes operate in synchronization with the master axis.</td><td>Interpolation is executed upon request if the requested axis is the start axis of interpolation.</td></tr>
<tr><td rowspan="5">Stop function</td><td>System stop</td><td colspan="3">All the axes come to a stop regardless of the synchronization settings.</td></tr>
<tr><td>Emergency stop</td><td rowspan="2">The master axis comes to a stop upon request.
The slave axes come to a stop in synchronization with the master axis.</td><td rowspan="2">Only axes requested come to a stop.
The master axis and other slave set on the same master axis continue operating.</td><td rowspan="2">Only axes requested come to a stop.
(All the target axes in interpolation operation come to a stop.)</td></tr>
<tr><td>Deceleration stop</td></tr>
<tr><td>Limit stop</td><td colspan="2" rowspan="2">The master axis and all the slave axes come to a stop.</td><td>Only axes resulting in a limit error come to a stop.</td></tr>
<tr><td>Error stop</td><td>Only axes resulting in an error come to a stop.</td></tr>
</table>

9.3.2 Precautions When Canceling or Starting Synchronous Control

■ Precautions when canceling synchronous control

- The synchronous control can be canceled during the master operation, however, slave axes will stop immediately.
- It is recommended to cancel the synchronous control after stopping slave axes using the clutch function.
- When the synchronous control is canceled, flags related to the synchronous control (synchronous slave gear ratio change state notification, synchronous slave clutch connection state notification) will turn off.

■ Conditions for starting synchronous control

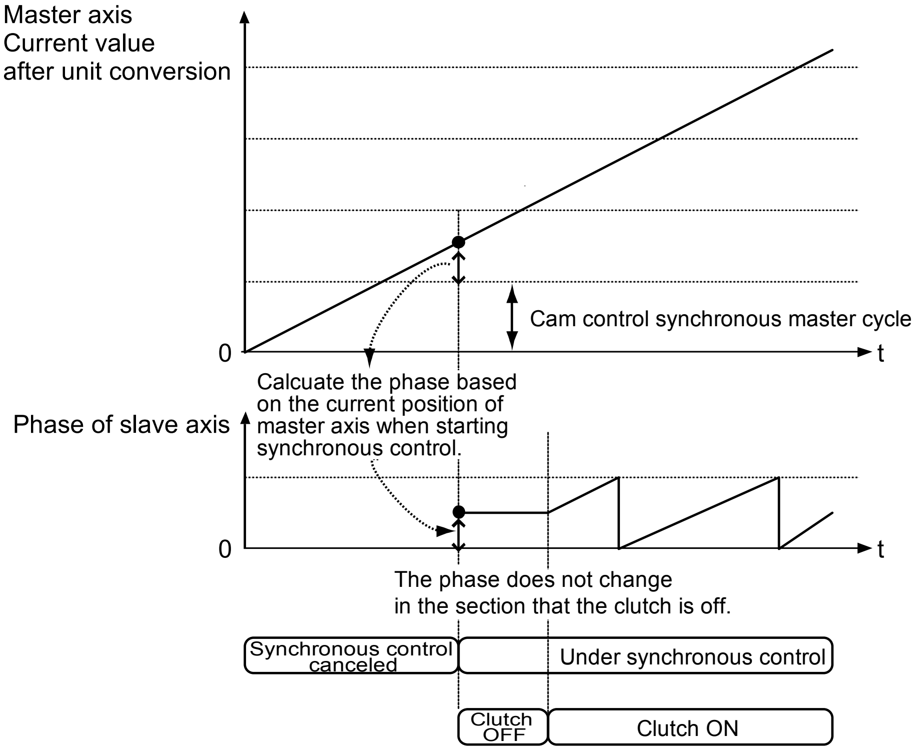
Only when the following conditions are met, the synchronous control can be started.

- Slave axes stop.
- No stop request for slave axes is generated.
- No error occurs in slave axes.

When these conditions are not met, the unit does not become the synchronous state and the synchronous control cancel active annumciation relay does not turn off. If the synchronous cancel request kept off while the conditions are not met, the synchronous control will start once the condition to start the synchronous control is met.

■ Phase when starting synchronous control

It is calculated from the "current value after unit conversion" of master axis and the "cam control synchronous master axis cycle" of synchronous parameter. The remainder obtained by dividing "current value after unit conversion" by "cam control synchronous master axis cycle" is used as a phase.

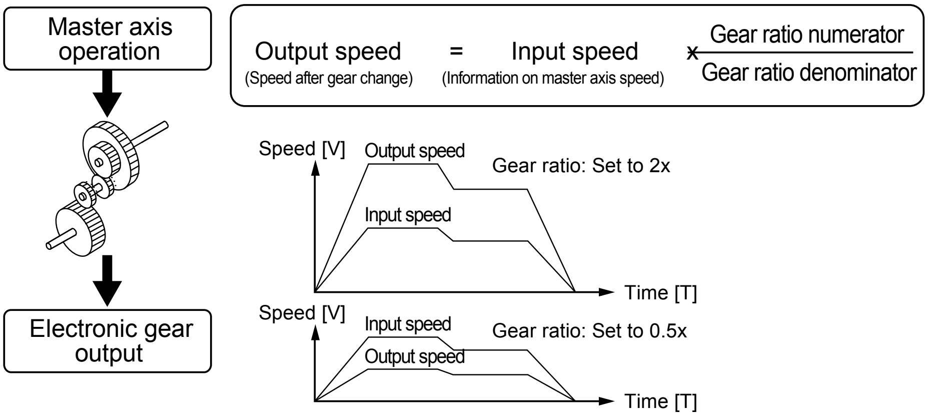


9.4 Electronic Gear Function

9.4.1 Overview of Electronic Gear Function

■ Electronic gear function

The electronic gear function operates the positioning unit at the speed of the master axis multiplied by a preset gear ratio.



■ Cautions when using the electronic gear function

The use of the electronic gear function makes it possible to set the salve axes to a desired speed relative to the master axis.

Movement amount of slave axes
= Movement amount of master axis x (gear ratio numerator/Gear ratio denominator)
* On the condition that the gear ratios are constant

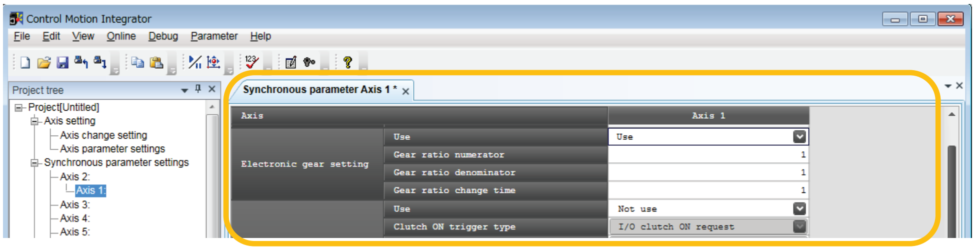
Do not use the electronic gear function if the movement amount of the master axis needs to coincide with that of the slave axes.

◆ **NOTES**

- **Keep in mind that the slave axes may come to a sudden stop if an emergency stop or deceleration stop is executed while make a gear ratio change.**

9.4.2 Types and Contents of Setting Parameters

For using the electronic gear, set the following parameters in the "Synchronous parameter settings" menu.



Parameter name	Default	Description
Electronic gear setting - Use	Not use	Select the operation of the electronic gear function. Use / Not use The gear ratio of the electronic gear is set to 1:1 if the electronic gear is not used, and the operation of the master axis is input as it is into the electronic clutch.
Gear ratio numerator	1	Determines the gear ratio of the electronic gear. Electronic gear ratio is determined by the following formula. Output speed of electronic gear = Operating speed of master axis x (Gear ratio numerator/Gear ratio denominator)
Gear ratio denominator	1	
Gear ratio change time	1	The time required to change the current gear ratio to a new gear ratio if the new gear ratio is set for the electronic gear in operation.

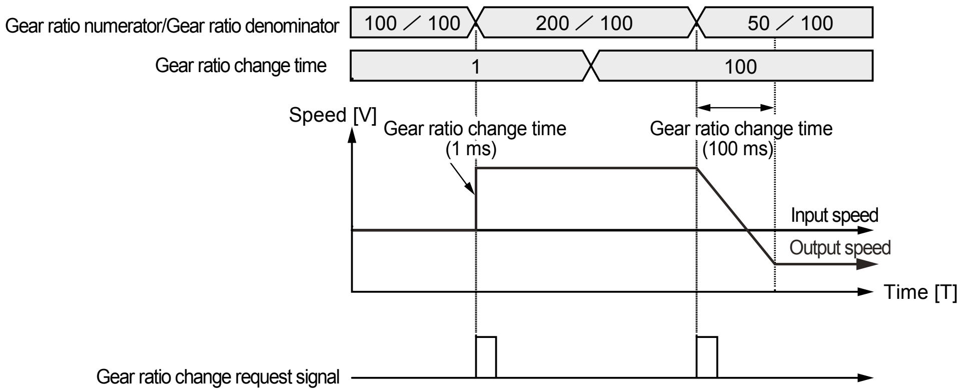
◆ **KEY POINTS**

- **The gear ratio of the electronic gear is set to 1:1 when selecting "Not use" for the electronic gear, and the operation of the master axis is input as it is into the electronic clutch.**

9.4.3 Gear Ratio Changes while in Operation

■ Precautions for gear ratio changes while the positioning unit is in operation

- If the gear ratio is changed with a new gear ratio while the electronic gear is in operation, the new gear ratio will be effective with an elapse of a preset gear change time.
- If the gear ratio change time is 1, the gear ratio will be changed at an acceleration/deceleration time of 0.
- Acceleration or deceleration during the gear ratio change results in linear acceleration or deceleration. S-shaped acceleration or deceleration cannot be used.



■ Programming method

Follow the procedure below and write a user program in the case of changing the gear ratio while the positioning unit is in operation.

1. Gear ratio change

- Change the gear ratio numerator and denominator of the electronic gear in the setting area for the electronic gear.
- The gear ratio at the time of starting the unit is set for this area. It is recommended to save the initial gear ratio before change so that the initial gear ratio can be reused with ease.

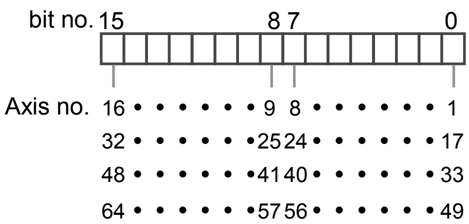
1. Gear ratio change request

- Turn ON an I/O signal (electronic gear ratio change request) for the target axis allocated to the unit.
- This signal becomes enabled by the "edge type" operation. Starts the gear ratio change triggered by the gear ratio change request signal turned ON.
- Turn OFF the gear ratio change request signal after changing the gear ratio.

■ Gear ratio change request signal

Signal name	Real axis				Virtual axis	
	Axes 1-16	**Axes 17-32**	**Axes 33-48**	**Axes 49-64**	**Axes 1-16**	**Axes 17-32**
Slave axis gear ratio change request	UM001E0	UM001E1	UM001E2	UM001E3	UM001E4	UM001E5
Slave axis gear ratio change state annunciation	UM001D2	UM001D3	UM001D4	UM001D5	UM001D6	UM001D7

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word). When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



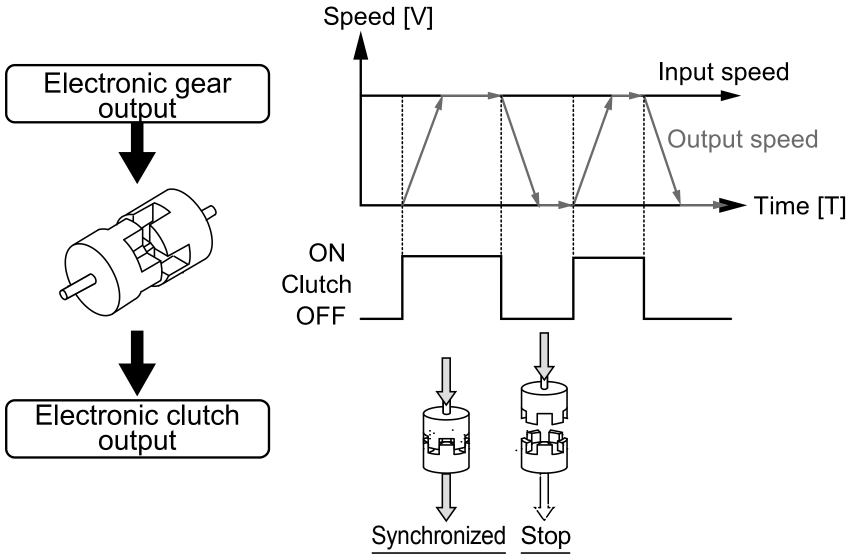
◆ **REFERENCE**

- **For details of the gear ratio setting area, refer to "15.8.1 Configuration of Synchronous Control Setting Area".**

9.5 Electronic Clutch Function

9.5.1 What is Electronic Clutch Function?

The electronic clutch function is used to engage or disengage the clutch for output from the electronic gear. When the electronic clutch is disengaged, the master axis is separated from the slave axes and the slave axes not in synchronization with the master axis come to a stop. When the electronic clutch is engaged, the master axis and slave axes operate in synchronization.



◆ **NOTES**

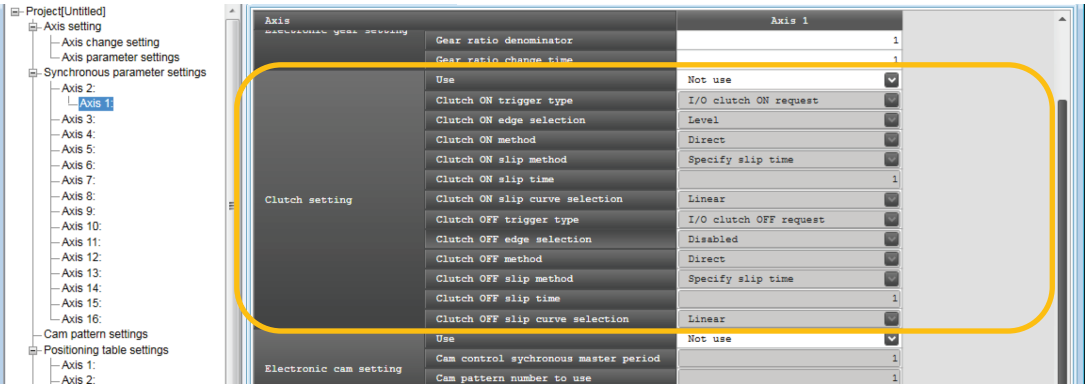
- **Keep in mind that the slave axes may come to a sudden stop if the clutch is disengaged while making a gear ratio change.**

◆ **KEY POINTS**

- **The electronic clutch is by default disengaged. Be sure to engage the electronic clutch in response to the operation.**

9.5.2 Types and Contents of Setting Parameters

For using the electronic clutch, set the following parameters in the "Synchronous parameter settings" menu.



Parameter name	Description
Clutch setting - Use	Select the operation of the electronic clutch function. Use / Not use
Clutch ON trigger type	Set an I/O clutch ON request as a trigger to be detected.
Clutch ON edge selection	Select "Level", "Leading edge" or "Trailing edge" for the method of detecting trigger signals.
Clutch ON method	Select "Direct" or "Slip" for the engagement of the clutch.
Clutch ON slip method	Select "Slip time specification".
Clutch ON slip time	If "Slip" is selected, set the slip time. Range: 1 to 10000 ms
Clutch ON slip curve selection	Select "Linear".
Clutch OFF trigger type	Select "I/O clutch OFF request" as a trigger to be detected.
Clutch OFF edge selection	Select "Disabled", "Leading edge" or "Trailing edge" for the method of detecting trigger signals.
Clutch OFF method	Select "Direct" or "Slip" for the engagement of the clutch.
Clutch OFF slip time	If "Slip" is selected, set the slip time.。 Range: 1 to 10000 ms
Clutch OFF slip curve selection	Select "Linear".

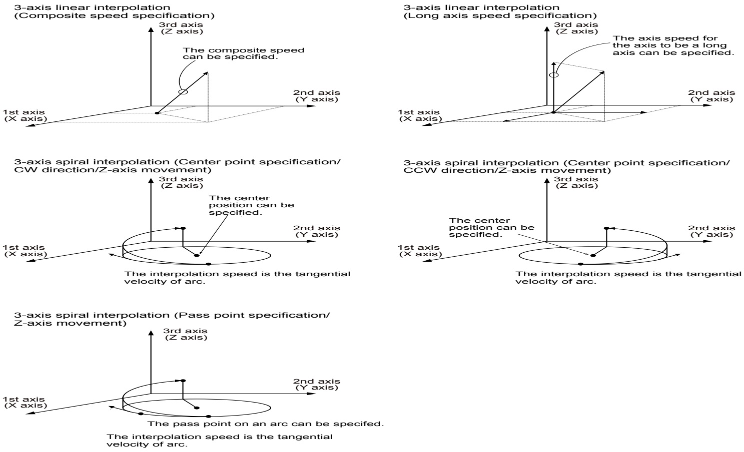
(Note 1): "Clutch OFF trigger type" is selectable when "Clutch ON trigger type" is set to "Leading edge" or "Trailing edge".

◆ **KEY POINTS**

- **The electronic clutch is always engaged when setting the electronic clutch setting to "Not use", and output data from the electronic gear is input as it is into the electronic cam. At that time, the master axis always operates in synchronization with the slave axes.**

9.5.3 Trigger Types for Electronic Clutch

The electronic clutch is connected (ON) or disconnected (OFF) by controlling the ON request or OFF request in the output control area of the unit memories using user programs.

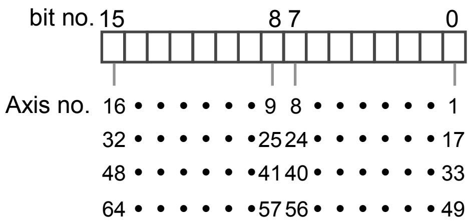


(Note): The above shows an example of the direct method selected for the engagement of the clutch.

■ Clutch request signal

Signal name	Real axis				Virtual axis	
	Axes 1-16	**Axes 17-32**	**Axes 33-48**	**Axes 49-64**	**Axes 1-16**	**Axes 17-32**
Slave axis clutch ON request	UM001E6	UM001E7	UM001E8	UM001E9	UM001EA	UM001EB
Slave axis clutch OFF request	UM001EC	UM001ED	UM001EE	UM001EF	UM001F0	UM001F1
Slave axis clutch operation annunciation	UM001D8	UM001D9	UM001DA	UM001DB	UM001DC	UM001DD

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word). When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



■ Edge selection

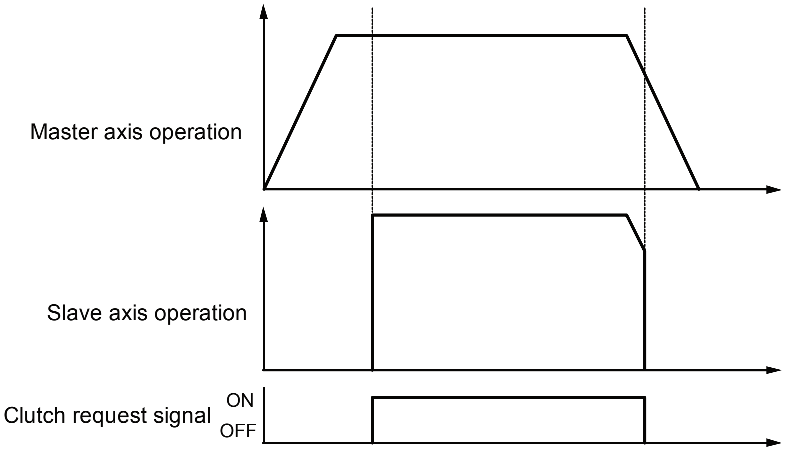
Edge selection	Operation
Level	The clutch operation is switched by turning on or off the slave axis clutch ON request. The slave axis clutch OFF request signal is not used. When the edge selection is level, the slave clutch OFF request is disabled.
Leading edge	The clutch turns ON by the leading edge of the slave clutch ON request. Also, the clutch turns OFF by the leading edge of the slave clutch OFF request.
Trailing edge	The clutch turns on by the trailing edge of the slave clutch ON request. Also, the clutch turns OFF by the trailing edge of the slave clutch OFF request.

9.5.4 Engagement Method of Electronic Clutch

The electronic clutch function engages the clutch to start operating the slave axes and disengages the clutch to stop operating the slave axes, the acceleration or deceleration of the slave axes can be set as shown below.

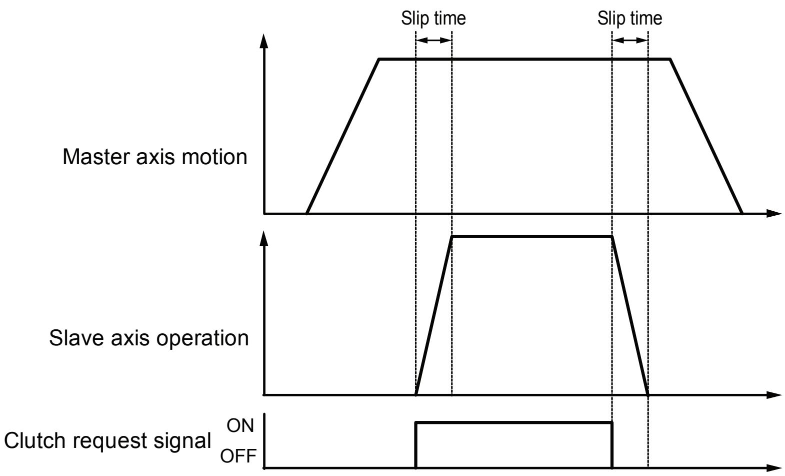
■ **Direct method**

This method detects the engagement or disengagement of the clutch to adjust the operating speed of the master axis to coincide with that of the slave axes. In the direct method, the speed of the slave axes with the clutch engaged or disengaged coincides with the operating speed of the master axis with the acceleration and deceleration time set to 0.



■ **Slip method**

This method detects the engagement or disengagement of the clutch and set the slip time to acceleration time and deceleration time so that the operating speed of the slave axes to follow the operation speed of the master axis. Linear acceleration and deceleration will apply.

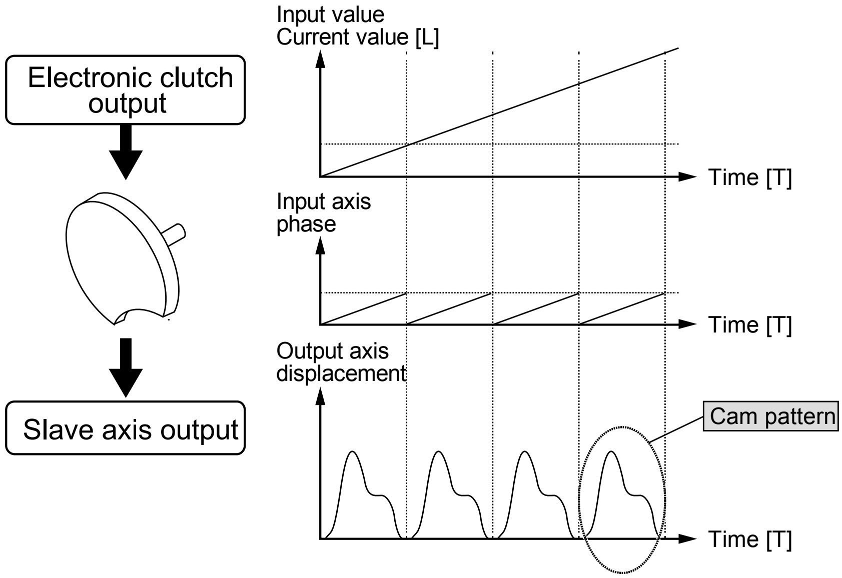


9.6 Electronic Cam Function

9.6.1 Overview of Electronic Cam Function

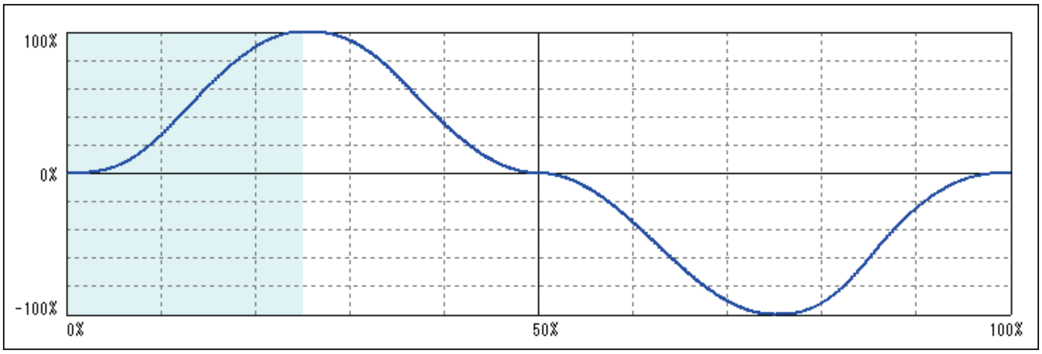
■ What is Electronic cam function?

The electronic cam function uses a preset cam pattern, determines the movement amount of the slave axes according to the operation of the master axis (phase information) and cam pattern, and outputs the movement amount.



■ Cam pattern

The cam pattern uses one rotation of the master axis as an operation reference, based on which the displacement of the slave axes in each phase (rotation angle) is defined. The cam pattern is defined with the phase (rotation angle) of the master axis on the X-axis and the displacement on the Y-axis in percent. The cam pattern is set in the "Cam pattern setting" menu of CMI.

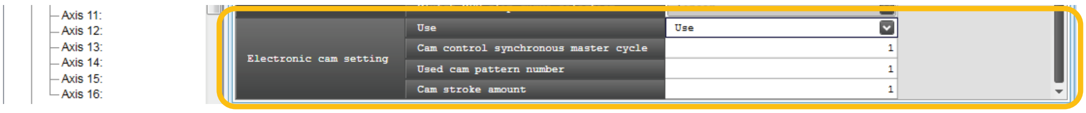


■ Cam pattern specifications

Setting item	Specifications			
Resolution	1024, 2048, 4096, 8192, 16384, 32768			
No. of cam patterns		AFP7MC16EC	AFP7MC32EC	AFP7MC64EC
	Resolutions of 1024, 2048, 4096, and 8192:	64	128	256
	Resolution of 16384:	32	64	128
	Resolution of 32768:	16	32	64
Section setting	100%/cycle, 20 sections max.			
Displacement setting	100% setting			
Cam curve	Constant speed / Constant acceleration / Simple harmonic / Cycloid /Modified trapezoid / Modified sine / Modified constant speed / Asymmetric cycloid / Asymmetric modified trapezoid / Trapecloid / One-dwell cycloid, m=1 / One-dwell cycloid, m=2/3 / One-dwell modified trapezoid, m=1 / One dwell modified trapezoid, Ferguson / One-dwell modified trapezoid, m=2/3 / One-dwell modified sine / One-dwell trapecloid / No-dwell modified trapezoid / No-dwell constant speed / NC2 curve			
Adjustment function	Function to adjust the displacement of desired point data: Max. 1,000 points (in units of cam data)			
Shift function	Phase shift in created cam data: 0 to 100%			
Display	Displacement / Speed / Acceleration / Jerk The display can be changed arbitrarily by the check box of CMI.			

9.6.2 Types and Contents of Setting Parameters

For using the electronic cam, set the following parameters in the "Synchronous parameter settings" menu.



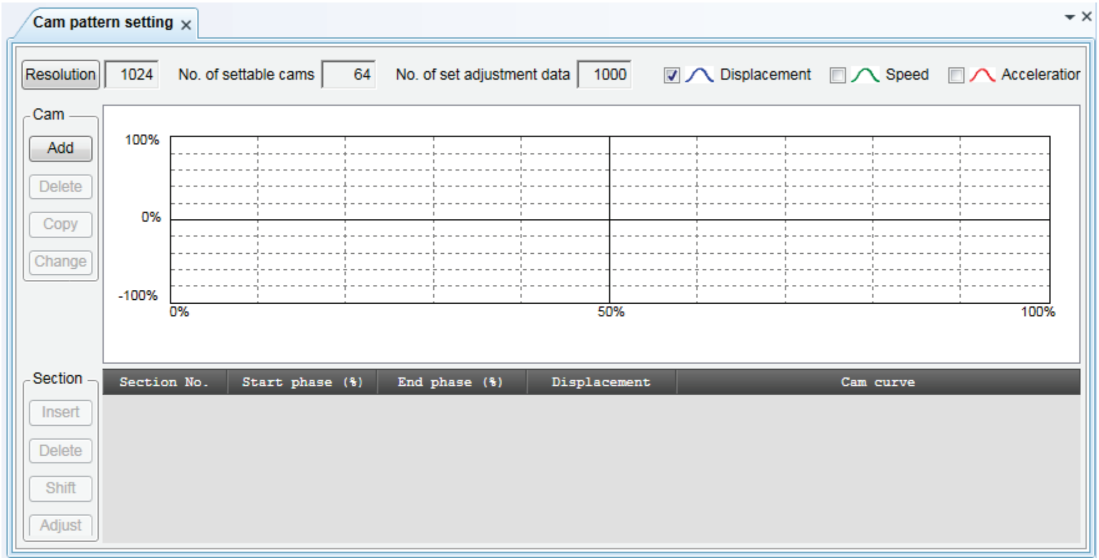
Parameter name	Default	Description
Electronic cam setting - Use	Not use	Select the operation of the electronic cam. When selecting "Not use", the electronic cam function does not operate and the output from the electronic clutch is output. Use / Not use
Cam control synchronous master cycle	1	Set the number of pulses corresponding to the all phases of the cam pattern used (one-rotation data on the master axis). Range: 1 to 2147483647
Used cam pattern number	1	Specify the cam pattern number to be used from cam patterns created. Range: 1 to 256
Cam stroke amount	1	Set the number of pulses corresponding to the total displacement (100%) of the cam pattern to use. Range: 1 to 2147483647

9.6.3 Cam Pattern Setting Method

The following procedure is explained on the condition that CMI has already started.

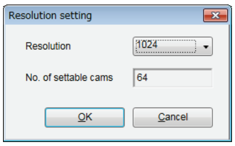
■ Starting Cam Pattern Setting Screen

Select "Parameter" > "Cam pattern setting" from the menu bar. The cam patter setting screen is displayed. A blank screen is displayed for a new file, and settings of cam pattern 1 is displayed when data already exists.



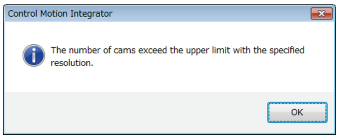
■ Resolution setting

Press the [Resolution] button on the Cam Pattern screen. The Resolution Settings screen will be displayed. Select the desired resolution and press the [OK] button.



◆ **KEY POINTS**

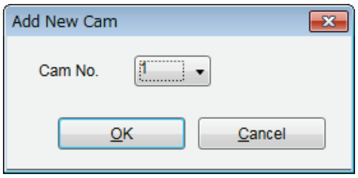
- **The resolution is valid for all cam patterns. You cannot set a different resolution per cam pattern.**
- **The number of cam patterns available varies with each resolution. The current resolution cannot be changed to a new resolution if the number of cam patterns already set exceeds the number of cam patterns available for the new resolution. Delete the cam pattern and change the resolution.**



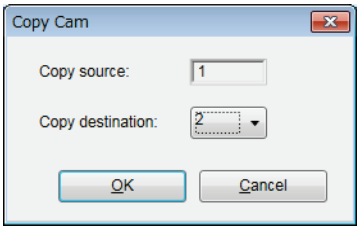
■ Making/duplicating new cam pattern

The Cam No. Selection screen is displayed by pressing the [Add] button from the Cam field.

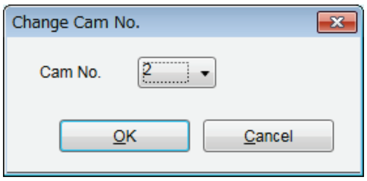
Select the desired can number and press the [OK] button.



Cam patterns can be copied. Press the "Copy" button and select the cam pattern numbers of copy destination and copy source.



For changing the cam number, press the "Change" button and select a cam number after the change.



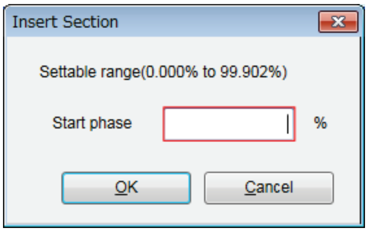
Note) Cam pattern numbers that have been already set cannot be set.

■ Cam pattern setting

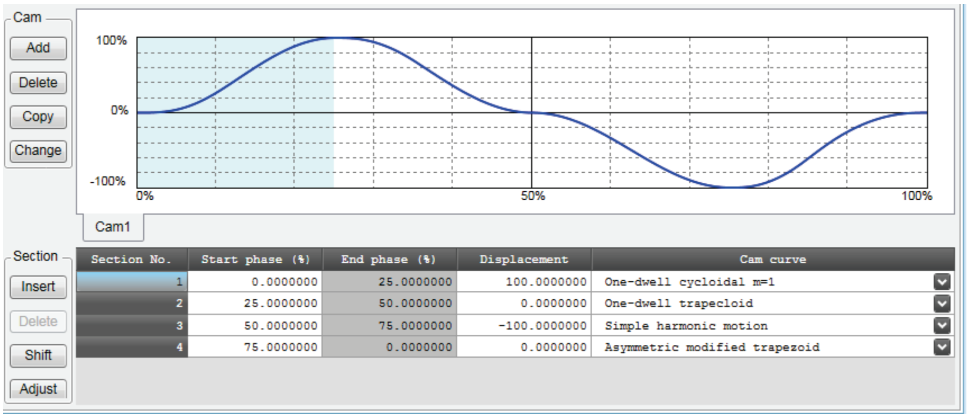
Press the "Insert" button from the "Section" field. Set the start phase, and press the [OK] button.

In the default condition, only one section whose phase is 0 to 100% can be set for the cam pattern.

By setting the start phase, the above section is divided into multiple sections.



The background of the selected sections is displayed in white, and the background of the unselected sections is displayed in gray.



◆ **NOTES**

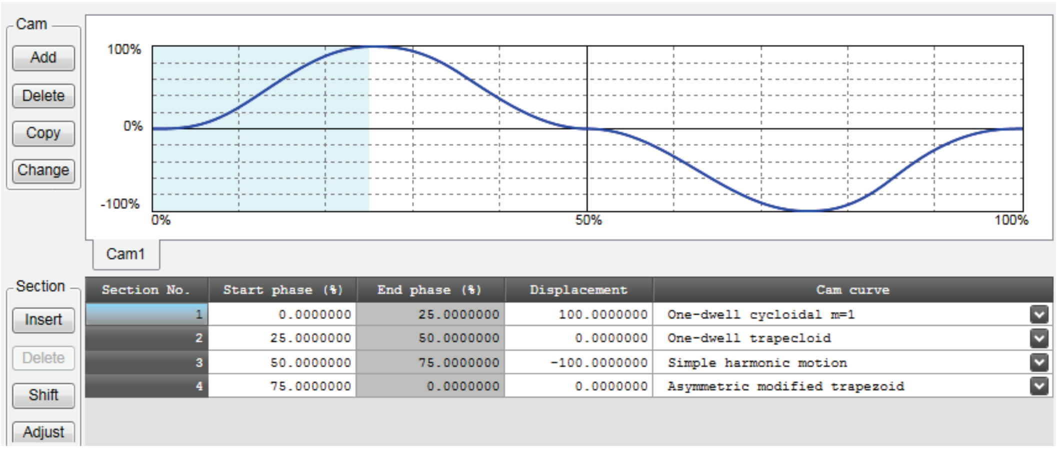
The start phase may not be a specified phase value due to the relation with resolution.

■ Edit of cam table

Data of created cam tables is edited.

Set the following items in each set section;
- Start phase (%)
- Displacement (%)
- Cam curve

The cam curve changes according to the settings.



◆ **KEY POINTS**

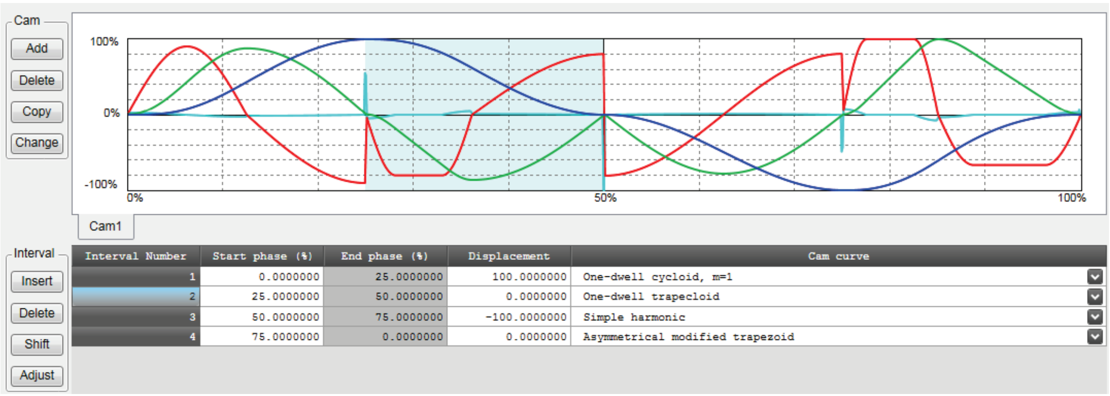
- **The end phase cannot be set. The end phase is automatically changed when changing the start phase.**
- **Do not make a rapid change in displacement for the set cam curve. In the case of rapid displacement, a motor may not be able to follow the output.**
- **Also, set the 0% and 100% of the phase to be the same displacement.**

■ Confirmation of cam table

Confirm the set cam table (cam curve). In the synchronous control, slave axes operate following the cam curve. Therefore, a motor may not be able to follow the output if the change in the cam curve is rapid. For the change in the cam curve, not only the information on displacement but also the information such as acceleration information is important. In the cam table setting screen, the following information except displacement can be displayed.

Display item	Description
Displacement	This is set in the cam table.
Speed	The operation speed of the cam table with a set displacement amount is displayed. Also , the display is displayed by relative values.
Acceleration	Accelerations at each phase are displayed. Care is necessary in the area where acceleration largely changes as a rapid change in the speed occurs.
Jerk	It is obtained by differentiating an accleration by a time. It indicates a rate of change of acceleration.

Each display item can be set by checking the following check boxes in the cam table setting screen. Refer to each display items, and change the cam table settings.



■ Adjustment of cam table

There is a function to finely adjust the data of set cam curves in the cam table setting screen. Rapid change can be lessened by performing find adjustment of the set cam data using the adjustment function. To perform adjustment, select a section number to be adjusted and press the [Adjust] button. The adjustment screen is displayed. The adjustment screen shows the table of the part corresponding to the specified section number among sections divided by the resolution that all sections (0 to 100%) are set.

Cam curve adjustment

Phase	Control	Displacemen
25.0000000	256	100.0000000
25.0976563	257	99.9999387
25.1953125	258	99.9995099
25.2929688	259	99.9983468
25.3906250	260	99.9960847
25.4882813	261	99.9923611
25.5859375	262	99.9868175
25.6835938	263	99.9790995
25.7812500	264	99.9688580
25.8789063	265	99.9557498
25.9765625	266	99.9394391
26.0742188	267	99.9195972
26.1718750	268	99.8959044
26.2695313	269	99.8680499
26.3671875	270	99.8357333
26.4648438	271	99.7986647
26.5625000	272	99.7565656
26.6601563	273	99.7091698
26.7578125	274	99.6562238
26.8554688	275	99.5974875
26.9531250	276	99.5327346
27.0507813	277	99.4617534
27.1484375	278	99.3843472
27.2460938	279	99.3003349
27.3437500	280	99.2095511
27.4414063	281	99.1118468
27.5390625	282	99.0070898

Clear Adjustment | OK | Cancel

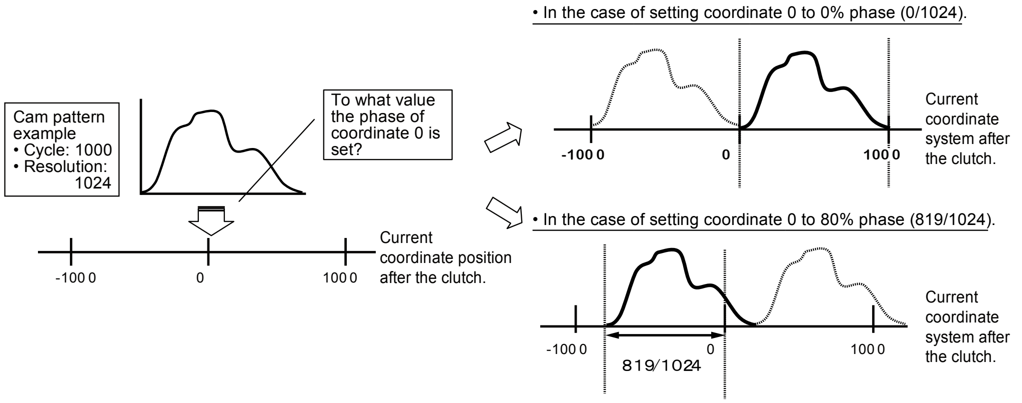
Select the data of a phase (control point) you want to adjust and change the displacement data. Select "OK" to reflect the adjustment. Select "Clear Adjustment" to clear the set adjustment data. The cam curve of the section number that the adjustment was executed is displayed in red so that it can be identified.

Interval Number	Start phase (%)	End phase (%)	Displacement	Cam curve
1	0.0000000	25.0000000	100.0000000	One-dwell cycloid, m=1
2	25.0000000	50.0000000	0.0000000	One-dwell trapecloid
3	50.0000000	75.0000000	-100.0000000	Simple harmonic
4	75.0000000	0.0000000	0.0000000	Asymmetrical modified trapezoid

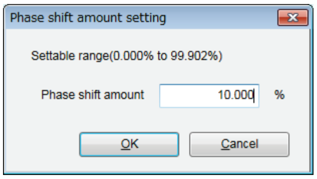
■ Shift of cam table

Although created cam patterns are defined for the phases of 0 to 100%, phases used as a reference for created cam patterns may be different in actual operations. The shift of cam table is a function to set the phase of the position of current value coordinate system 0 to be a percentage of a created cam pattern.

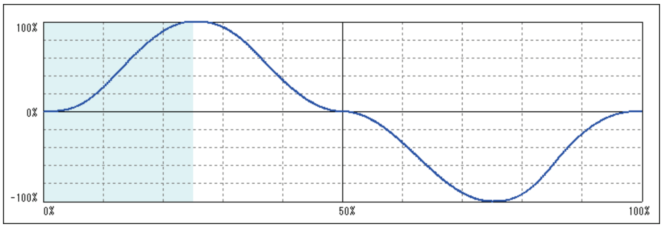
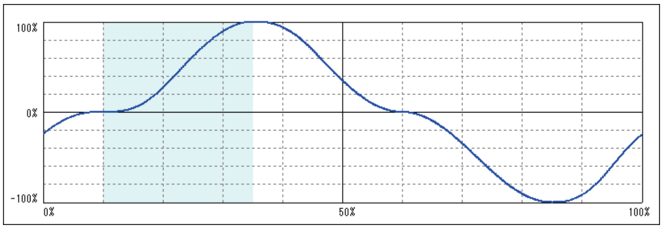
Image of shifting electronic cam



Select Shift from "Section", and set a shift amount.



The created cam pattern is shifted by 10% and the display is updated.

Before change	
After change	

■ Storage of cam table

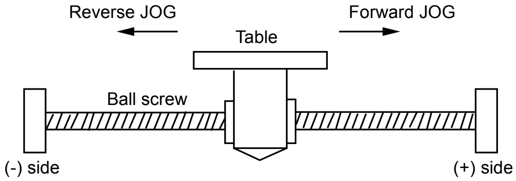
The created cam table is stored as a file together with other parameter data set by CMI.

10

Manual Operation (JOG Operation)

10.1 Setting and Operation of Home Return

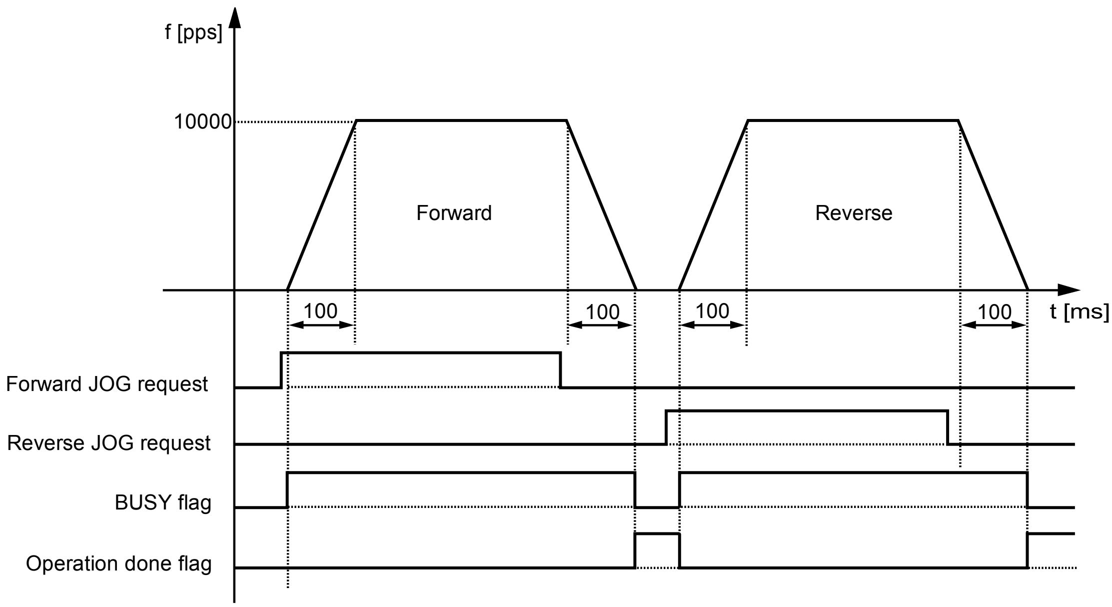
In this example, a forward or reverse operation is performed in the JOG operation.



■ Settings

Item	Setting example
Acceleration/deceleration pattern	0: Linear acceleration/deceleration
Acceleration time (ms)	100 ms
Deceleration time (ms)	100 ms
Target speed	10000 pps

■ Operation diagram



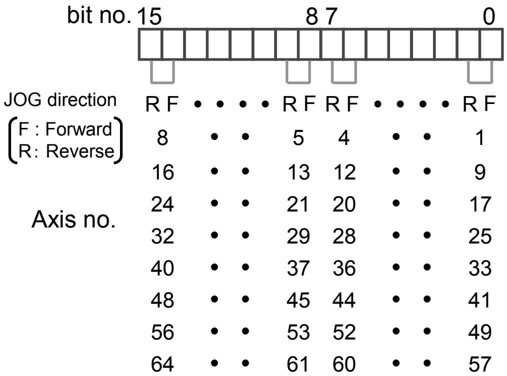
■ Operation of input control/output control signals

- When a JOG operation forward or reverse request (corresponding bit allocated to UM0019E to UM001A9) is ON by a user program, the JOG operation control is performed.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a requested operation is being controlled, will turn ON when the JOG operation control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

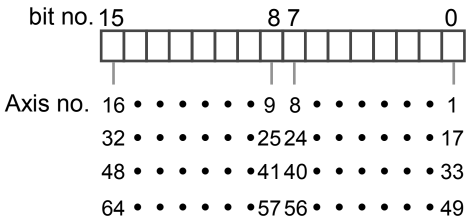
■ Allocation of unit memories

Signal name	Real axis				Virtual axis	
	Axes 1-16	Axes 17-32	Axes 33-48	Axes 49-64	Axes 1-16	Axes 17-32
JOG operation forward/reverse request (Note 1)	UM0019E (Axes 1 to 8)	UM000A0 (Axes 17 to 24)	UM000A2 (Axes 33 to 40)	UM000A4 (Axes 49 to 56)	UM000A6 (Axes 1 to 8)	UM000A8 (Axes 17 to 24)
	UM0019F (Axes 9 to 16)	UM000A1 (Axes 25 to 32)	UM000A3 (Axes 41 to 48)	UM000A5 (Axes 57 to 64)	UM000A7 (Axes 9 to 16)	UM000A9 (Axes 25 to 32)
Busy flag (Note 2)	UM00090	UM00091	UM00092	UM00093	UM00094	UM00095
Operation done flag (Note 2)	UM00096	UM00097	UM00098	UM00099	UM0009A	UM0009B

(Note 1): Request flags for 8 axes are allocated to each unit memory (1 word). When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



(Note 2): Flags or request signals for 16 axes are allocated to each unit memory (1 word). When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



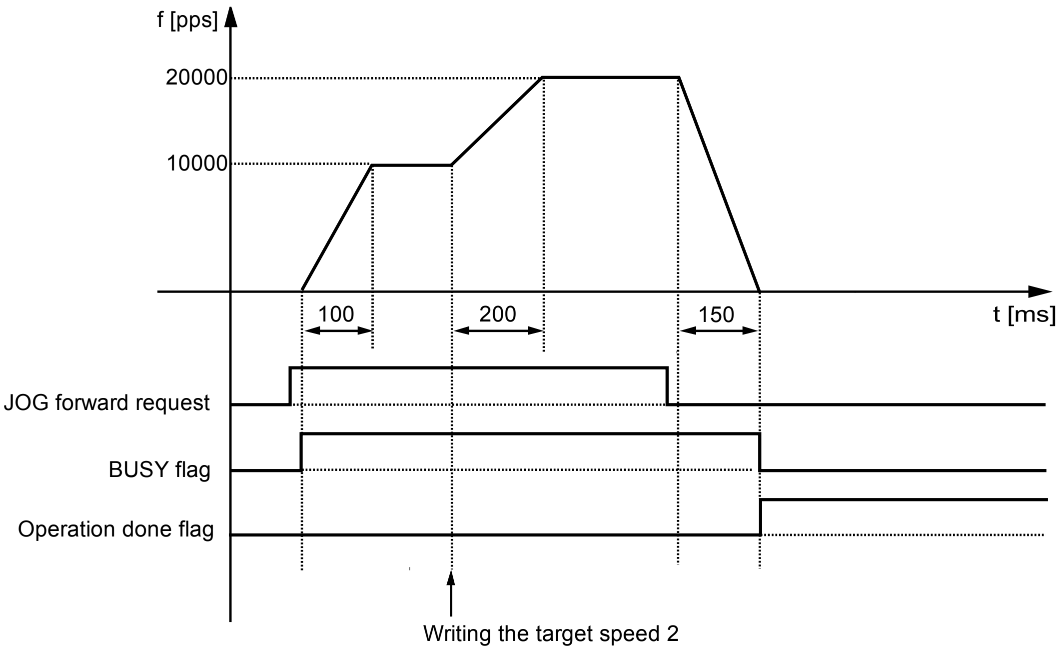
10.2 Changing Speed During JOG Operation

The target speed can be changed during the JOG operation.

■ Settings

Item	Setting example	
Acceleration/deceleration pattern	0: Linear acceleration/deceleration	
Acceleration time 1 (ms)	100 ms	
Deceleration time 1 (ms)	50 ms	
Target speed 1	10000 pps	
Target speed 2	20000 pps	Write a set value for the target speed after the speed change in the unit memory on a program.

■ Operation diagram



◆ **KEY POINTS**

- **Only in the case of "JOG operation (Infinite rotation)", the speed during the JOG operation can be changed. It cannot be changed in the case of "JOG operation inching operation".**
- **The acceleration time and deceleration time when changing the target speed are the same as the values at the startup.**

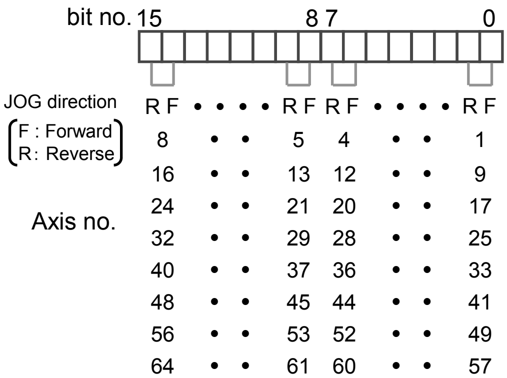
■ Operation of input control/output control signals

- When a JOG operation forward or reverse request (corresponding bit allocated to UM0019E to UM001A9) is ON by a user program, the JOG operation control is performed.
- The speed is changed by rewriting "JOG operation target speed" in the parameter setting area of unit memories (for axis 1: UM0326C-UM0326D) using a user program during the JOG operation.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a requested operation is being controlled, will turn ON when the JOG operation control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

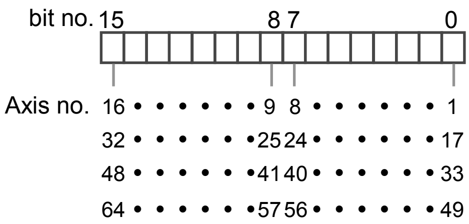
■ Allocation of unit memories

Signal name	Real axis				Virtual axis	
	Axes 1-16	**Axes 17-32**	**Axes 33-48**	**Axes 49-64**	**Axes 1-16**	**Axes 17-32**
JOG operation forward/reverse request (Note 1)	UM0019E (Axes 1-8)	UM000A0 (Axes 17-24)	UM000A2 (Axes 33-40)	UM000A4 (Axes 49-56)	UM000A6 (Axes 1-8)	UM000A8 (Axes 17-24)
	UM0019F (Axes 9-16)	UM000A1 (Axes 25-32)	UM000A3 (Axes 41-48)	UM000A5 (Axes 57-64)	UM000A7 (Axes 9-16)	UM000A9 (Axes 25-32)
Busy flag (Note 2)	UM00090	UM00091	UM00092	UM00093	UM00094	UM00095
Operation done flag (Note 2)	UM00096	UM00097	UM00098	UM00099	UM0009A	UM0009B

(Note 1): Request flags for 8 axes are allocated to each unit memory (1 word). When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.

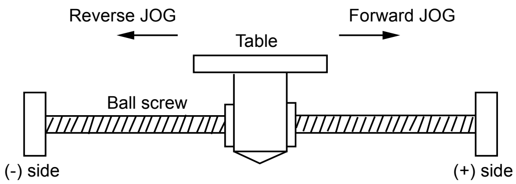


(Note 2): Flags or request signals for 16 axes are allocated to each unit memory (1 word). When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



10.3 Setting and Operation of JOG Inching Operation

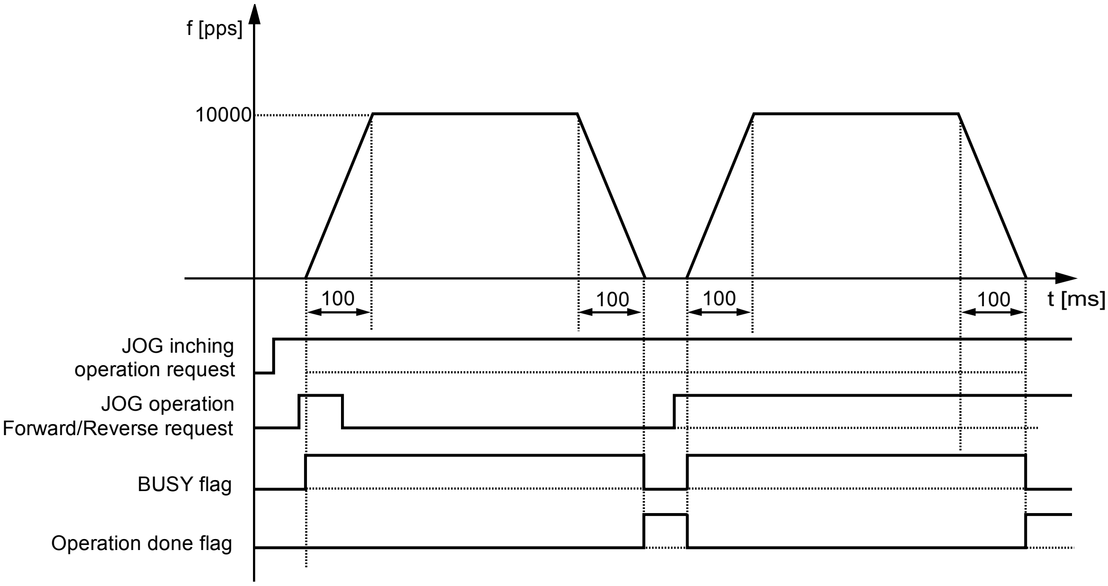
In this example, a forward or reverse operation is performed in the JOG operation by the inching operation.



■ Settings

Item	Setting example
Acceleration/deceleration pattern	0: Linear acceleration/deceleration
Acceleration time (ms)	100 ms
Deceleration time (ms)	100 ms
Target speed	10000 pps
JOG inching movement amount	10000 pulses

■ Operation diagram



◆ **KEY POINTS**

- **The inching operation starts at the leading edge of the JOG forward/reverse request. Also, when the request signal is short, it operates until the pulse set for "inching movement amount" is output.**

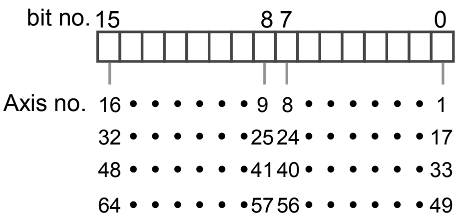
■ Operation of input control/output control signals

- When a JOG inching request (corresponding bit allocated to UM001AA to UM001AF) is ON by a user program and a JOG operation forward or reverse request (corresponding bit allocated to UM0019E to UM001A) turns ON, the JOG inching operation will be performed. The JOG inching operation starts when the edge of the JOG operation forward or reverse request changes to ON from OFF.
- A busy flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a requested operation is being controlled, will turn ON when the JOG inching operation control starts, and it will turn OFF when the operation completes.
- An operation done flag (corresponding bit allocated to UM00096 to UM0009B), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

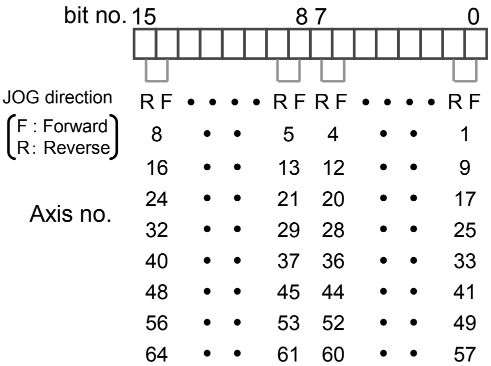
■ Allocation of unit memories

Signal name	Real axis				Virtual axis	
	Axes 1-16	Axes 17-32	Axes 33-48	Axes 49-64	Axes 1-16	Axes 17-32
JOG inching operation request (Note 1)	UM001AA	UM001AB	UM001AC	UM001AD	UM001AE	UM001AF
JOG operation forward/reverse request (Note 2)	UM0019E (Axes 1-8)	UM000A0 (Axes 17-24)	UM000A2 (Axes 33-40)	UM000A4 (Axes 49-56)	UM000A6 (Axes 1-8)	UM000A8 (Axes 17-24)
	UM0019F (Axes 9-16)	UM000A1 (Axes 25-32)	UM000A3 (Axes 41-48)	UM000A5 (Axes 57-64)	UM000A7 (Axes 9-16)	UM000A9 (Axes 25-32)
Busy flag (Note 1)	UM00090	UM00091	UM00092	UM00093	UM00094	UM00095
Operation done flag (Note 1)	UM00096	UM00097	UM00098	UM00099	UM0009A	UM0009B

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word). When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



(Note 2): Request flags for 8 axes are allocated to each unit memory (1 word).When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



10.4 Sample Programs

10.4.1 Sample Program (JOG Operation)

The operation for starting the JOG operation is mainly divided into five steps on a user program.

- Read flags stored in the unit memories (input control area).
- Control the servo ON/OFF.
- Check the state if the control of each axis can be started.
- Set the condition for the JOG operation (option), confirm the required start condition and start the JOG operation.
- Write operation results in the unit memories (output control area).

(Note): The sample program on the next page is for activating the JOG operation of the axis number 1 for the FP7 MC Unit installed in the slot number 1. To simplify the explanation, the part related to the JOG operation is extracted.

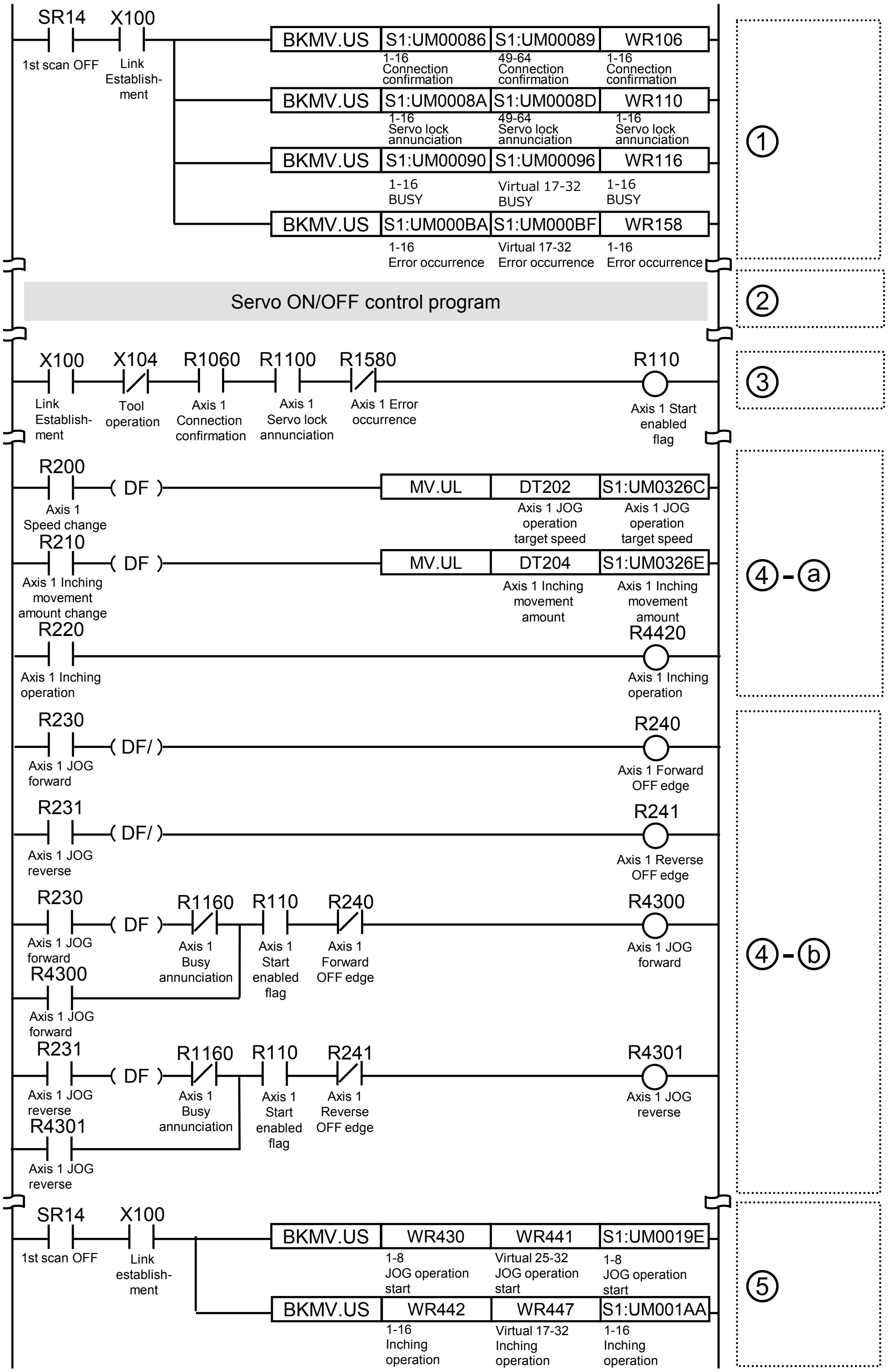
■ Contents of sample program

Mark		Description
①		Read flags indicating states from the input control area of the unit memories (UM) to arbitrary areas (WR). Read flags such as connection confirmation flag, servo lock confirmation flag, busy flag, and error flag.
②		Servo ON/OFF control program
③		Check required conditions and replace it with the start enabled flag (R110) in the program.
④		JOG operation program
	ⓐ	Set the following operations as necessary. Changing the speed during the JOG operation, setting and switching the JOG inching operation.
	ⓑ	Start the JOG operation (forward), start JOG operation (reverse).
⑤		Write flags to the output control area of the unit memoires (UM) from arbitrary area (WR) where the start conditions are written. JOG operation start, JOG inching operation.

◆ **KEY POINTS**

- **In the case of "JOG operation (Infinite rotation)", the unit operates by the level signals of "JOG forward/reverse request".**
- **The "JOG inching operation" starts at the leading edge of the "JOG forware/reverse request".**
- **It is possible to switch between "JOG operation (Infinite rotation)" and "JOG inching operation" by turning ON/OFF the corresponding bit to the "JOG inching operation request" area in the unit memories.**

■ Sample program



10.4.2 Precautions on Programming

■ Precautions on programming

- If any value such as a movement amount, acceleration time, deceleration time or target speed is out of the specified range, a setting value error will occur at the time of startup.
- Unit memory numbers allocated to flags and start requests vary depending on axis numbers.
- The specified slot number varies depending on the installation position of the unit.

■ Operation at Over limit input (Limit is valid)

Condition	Direction	Limit status	Operation
When JOG operation is started	Forward	Over limit input (+): ON	Not executable, Error occurs.
		Over limit input (-): ON	Executable
	Reverse	Over limit input (+): ON	Executable
		Over limit input (-): ON	Not executable, Error occurs.
During JOG operation	Forward	Over limit input (+): ON	Deceleration stop, Limit error occurs.
	Reverse	Over limit input (-): ON	Deceleration stop, Limit error occurs.

11

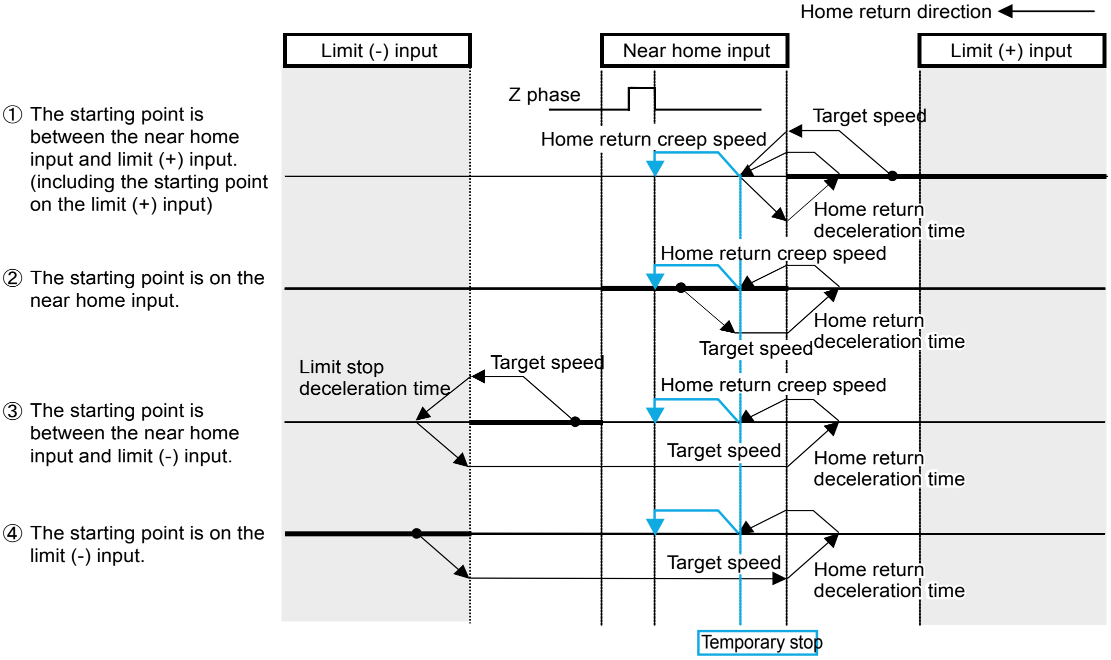
Manual Operation (Home Return)

11.1 Types of Home Return

■ DOG method 1 (Based on front end + Z phase)

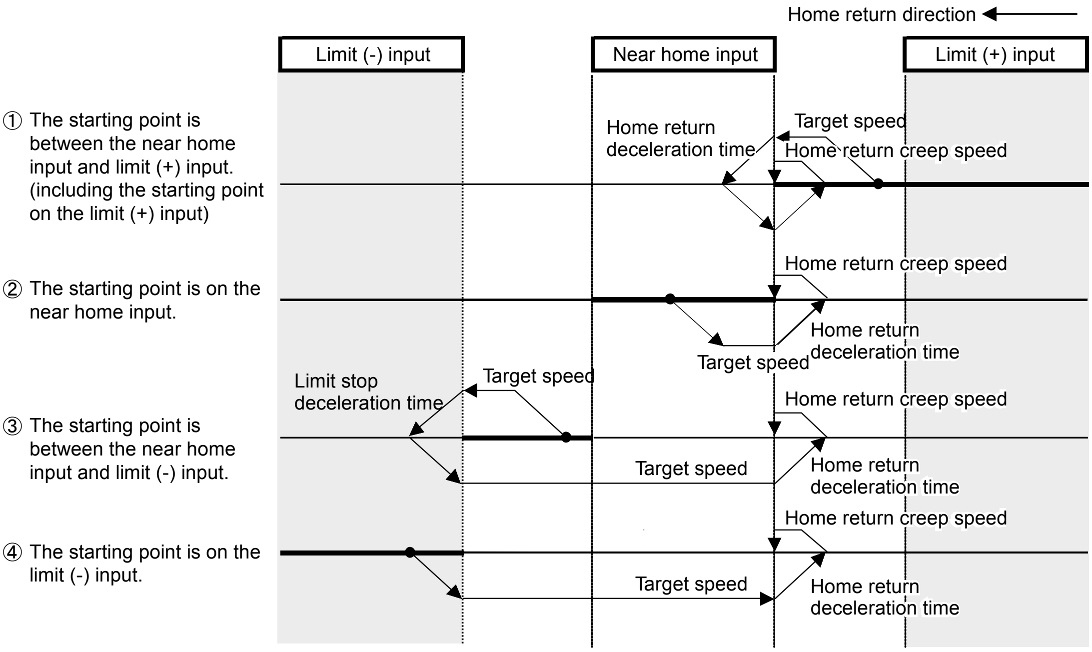
- The leading edge of the first home position (Z phase) is set as a home position after the detection of the leading edge of a near home input (HOME).
- In the case of the DOG method 1, the operation stops once after the detection of the leading edge of a near home input (HOME) as the home return positioning control mode (Method33/34) of Servo Amplifier A5B is used. The home position is searched at a home return creep speed again, and the operation stops when the leading edge of the first home position (Z phase) is detected.

(Note): The home return positioning control mode (Method33/34) of Servo Amplifier A5B is a mode to detect an index pulse as a home position. The home return direction of Method33 is the - direction, and that of Method 34 is the + direction.



■ DOG method 2 (Based on front end)

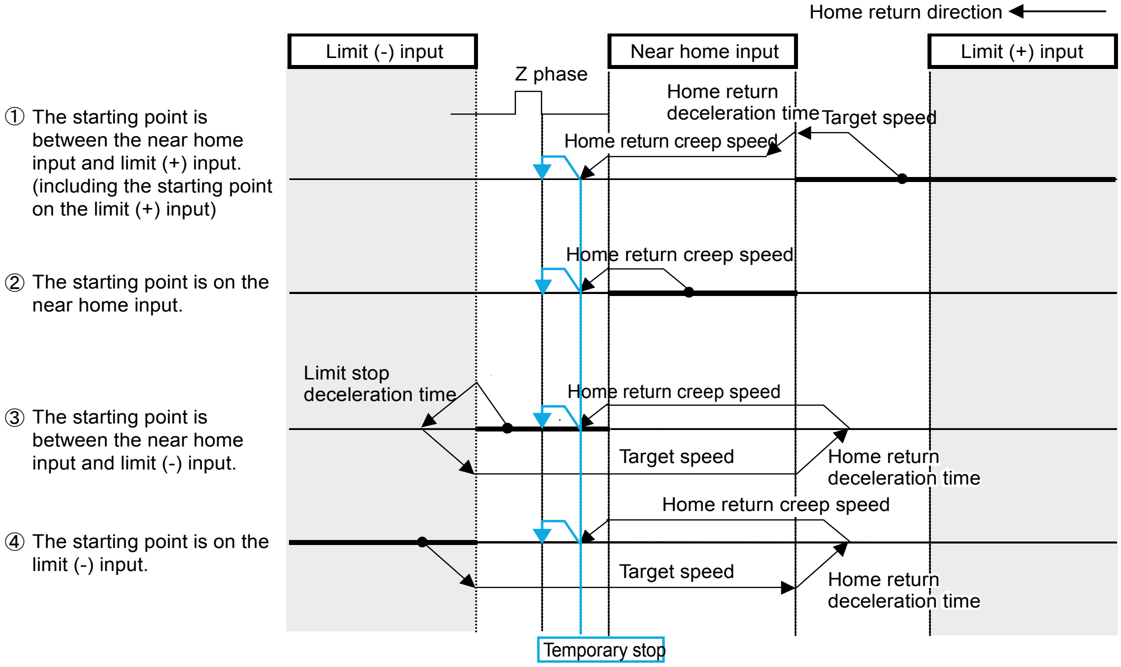
- The leading edge of a near home input (HOME) is detected and it is set as a home position.
- After the leading edge of a near home input (HOME) is detected, the deceleration stop is performed in the home return deceleration time. After reversing, the near home input (HOME) is searched at a home return creep speed, and the operation stops at a detected position.



■ DOG method 3 (Based on back end + Z phase)

- The leading edge of the first home position (Z phase) in the home return direction set as a home position after the detection of a trailing edge (back end) of the near home input (HOME).
- In the case of the DOG method 3, the operation stops once after the detection of the trailing edge of a near home input (HOME) as the home return positioning control mode (Method33/34) of Servo Amplifier A5B is used. The home position is searched at a home return creep speed again, and the operation stops when the leading edge of the first home position (Z phase) is detected.

(Note): The home return positioning control mode (Method33/34) of Servo Amplifier A5B is a mode to detect an index pulse as a home position. The home return direction of Method33 is the - direction, and that of Method 34 is the + direction.



■ DOG method 4 (Based on back end)

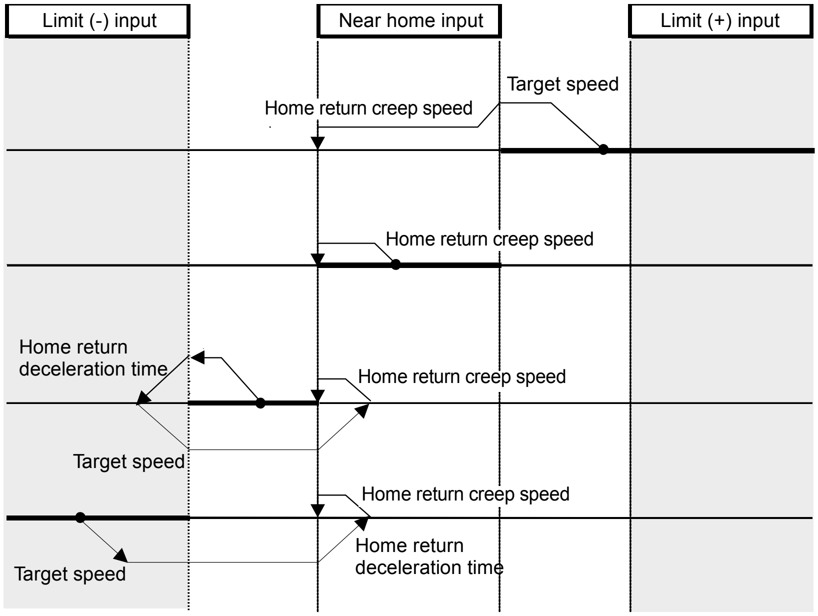
- The trailing edge of a near home input (HOME) is detected and it is set as a home position.
- After the trailing edge of a near home input (HOME) is detected, the deceleration stop is performed in the home return deceleration time. After reversing, the near home input (HOME) is searched at a home return creep speed, and the operation stops at a detected position.

① The starting point is between the near home input and limit (+) input. (including the starting point on the limit (+) input)

② The starting point is on the near home input.

③ The starting point is between the near home input and limit (-) input.

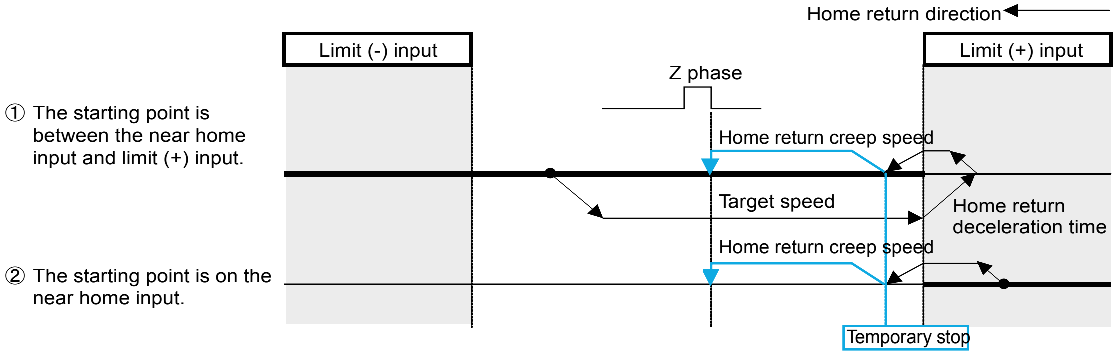
④ The starting point is on the limit (-) input.



■ Limit method 1 (Limit signal + Z phase)

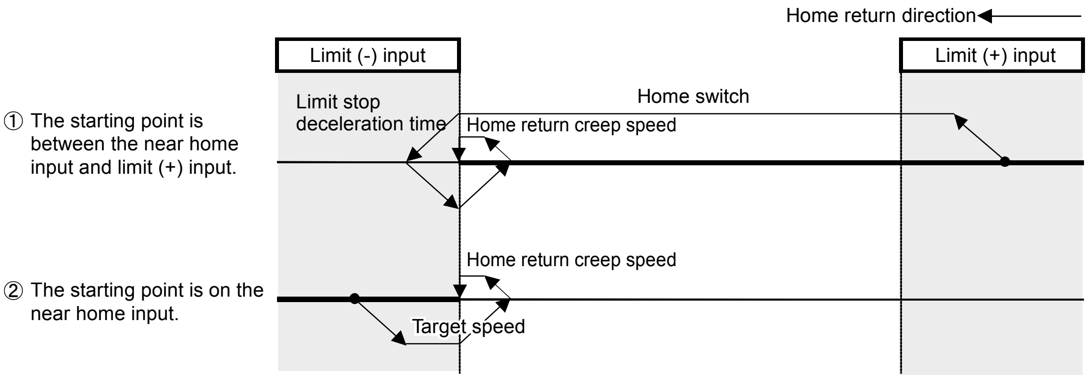
- Reverses after detecting the leading edge of the limit switch on the opposite side of the home return direction. After that, the operation stops at the first leading edge of the home position (Z phase). It is set as a home position.
- In the case of the limit method 1, the operation stops once in the home return deceleration time after the detection of the trailing edge of the limit input as the home return positioning control mode (Method33/34) of Servo Amplifier A5B is used. The home position is searched at a home return creep speed again, and the operation stops when the leading edge of the first home position (Z phase) is detected.

(Note): The home return positioning control mode (Method33/34) of Servo Amplifier A5B is a mode to detect an index pulse as a home position. The home return direction of Method33 is the - direction, and that of Method 34 is the + direction.



■ Limit method 2 (Limit signal)

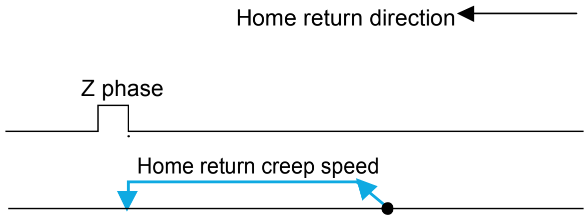
- Detects the leading edge of the limit switch in the home return direction and stops. It is set as a home position.



■ Z phase method

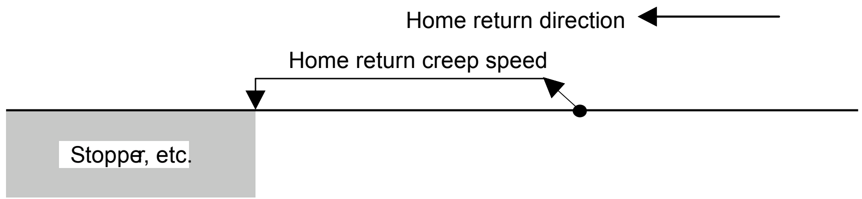
The home position is searched at a home return creep speed from the current position, and the operation stops when the leading edge of the first home position (Z phase) is detected. For the Z phase method, the home return positioning control mode (Method33/34) of Servo Amplifier A5B is used.

(Note): The home return positioning control mode (Method33/34) of Servo Amplifier A5B is a mode to detect an index pulse as a home position. The home return direction of Method33 is the - direction, and that of Method 34 is the + direction.



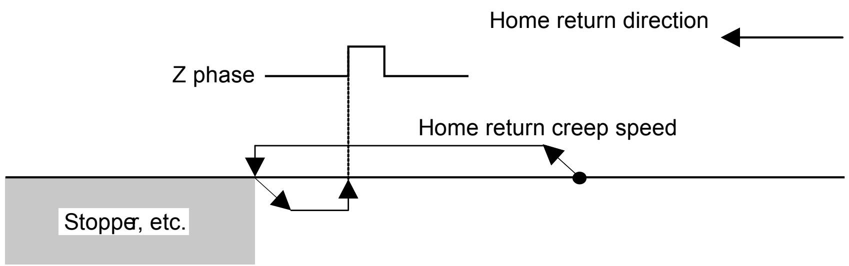
■ Stop-on-contact Method 1

Stops by a mechanical stopping mechanism such as a stopper. A position when the stop-on-contact time (ms) elapses at a torque value larger than "Stop-on-contact torque value (%)" set in the axis parameter of CMI is regarded as a home position.



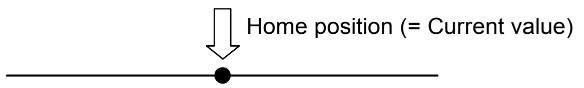
■ Stop-on-contact method 2 (Stop-on-contact + Z phase)

Performs the reverse operation after the stop by a stopper and stops at the position where the first home position (Z phase) is detected although the operation is similar to the stop-on-contact method. This position is set as a home position.



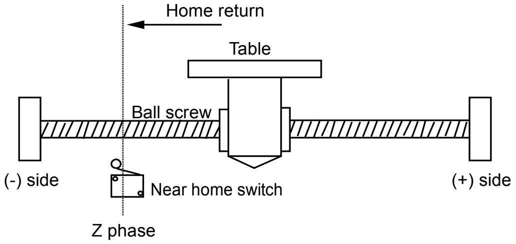
■ Data set method

The current value is set as a home position.



11.2 Operation of Home Return

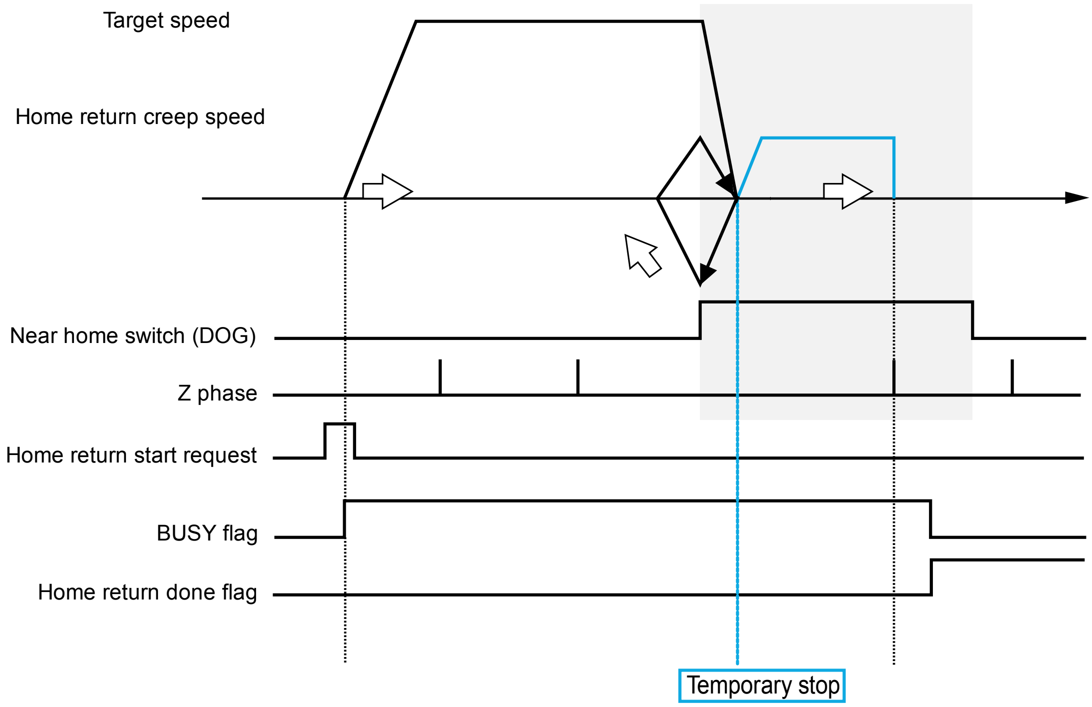
In this example, the leading edge of the first home position (Z phase) is set as a home position after the detection of the leading edge of a near home input (DOG).



■ Settings

Item	Setting example
Return setting code	0: DOG method 1
Return direction	0: Limit (-) direction
Acceleration time (ms)	100 ms
Deceleration time (ms)	100 ms
Target speed	10000 pps
Return creep speed	1000 pps

■ Operation diagram



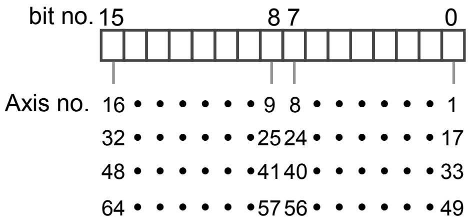
■ Operation of input control/output control signals

- When the home return request (corresponding bit allocated to UM00198 to UM0019D) turns ON by a user program, the home return will start. The home return request will be enabled at the edge where the contact turns ON.
- The BUSY flag (corresponding bit allocated to UM00090 to UM00095), which indicates that a requested operation is being controlled, will turn ON when the control starts, and it will turn OFF when the operation completes.
- The home return done annunciation flag (corresponding bit allocated to UM0009C to UM000A1), which indicates the completion of operation, will turn ON when the current operation is completed, and it will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

■ Allocation of unit memories

Signal name	Real axis				Virtual axis	
	Axes 1-16	Axes 17-32	Axes 33-48	Axes 49-64	Axes 1-16	Axes 17-32
Request home return	UM00198	UM00199	UM0019A	UM0019B	UM0019C	UM0019D
Busy flag	UM00090	UM00091	UM00092	UM00093	UM00094	UM00095
Home return done annunciation flag	UM0009C	UM0009D	UM0009E	UM0009F	UM000A0	UM000A1

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word) in the above table. When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



◆ KEY POINTS

- **In the case of the DOG method 1, the operation stops once after the detection of the leading edge of a near home input (HOME) as the home return positioning control mode (Method33/34) of Servo Amplifier A5B is used. The home position is searched at a home return creep speed again, and the operation stops when the leading edge of the first home position (Z phase) is detected.**

11.3 Sample Programs

11.3.1 Sample Program (Home Return)

The operation for starting the JOG operation is mainly divided into five steps on a user program.

- Read flags stored in the unit memories (input control area).
- Control the servo ON/OFF.
- Check the condition if the control of each axis can be started.
- Confirm the condition and start the home return.
- Write operation results in the unit memories (output control area).

(Note): The sample program on the next page is for activating the home return of the axis number 1 for the FP7 MC Unit installed in the slot number 1. To simplify the explanation, the part related to the home return operation is extracted.

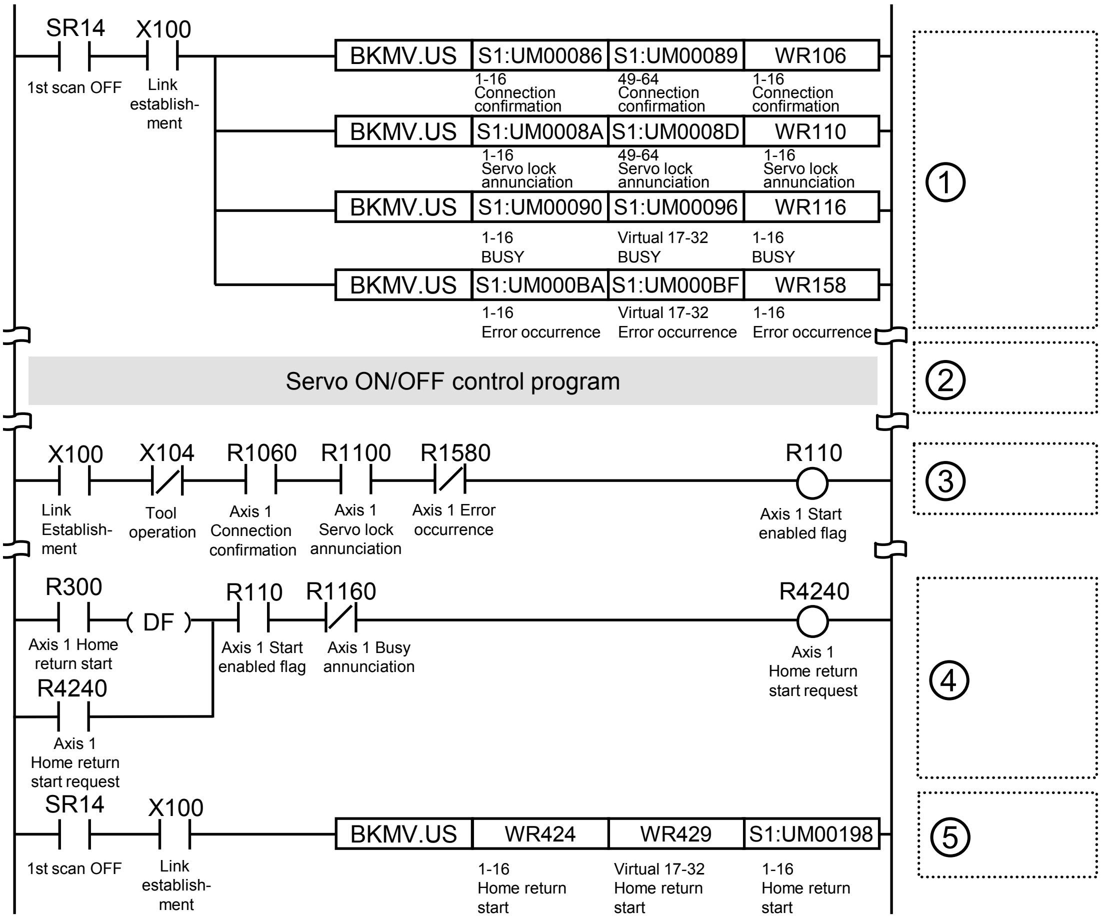
■ Contents of sample program

Mark	Description
①	Read flags indicating states from the input control area of the unit memories (UM) to arbitrary areas (WR). Read flags such as connection confirmation flag, servo lock confirmation flag, busy flag, and error flag.
②	Servo ON/OFF control program
③	Check required conditions and replace it with the start enabled flag (R110) in the program.
④	Home return start program.
⑤	Write flags to the output control area of the unit memoires (UM) from arbitrary area (WR) where the start conditions are written. Home return start

◆ **KEY POINTS**

- **Parameters related to the home return operation are set in the axis parameter of CMI. Refer to “5.2.4 Axis Parameters (Operation)”.**

■ Sample program



11.3.2 Precautions on Programming

■ Precautions on programming

- If any value such as an acceleration time, deceleration time or target speed is out of the specified range, a setting value error occurs at the time of start.
- Unit memory numbers allocated to flags and start requests vary depending on axis numbers.
- The specified slot number varies depending on the installation position of the unit.

■ Operation at over limit input (Limit is valid)

Condition	Direction	Limit status	Operation
When Home return operation is executed	Forward	Over limit input (+): ON	Executable
		Over limit input (-): ON	Executable
	Reverse	Over limit input (+): ON	Executable
		Over limit input (-): ON	Executable
During Home return operation	Forward	Over limit input (+): ON	Automatic reverse operaiton
	Reverse	Over limit input (-): ON	Automatic reverse operaiton

12

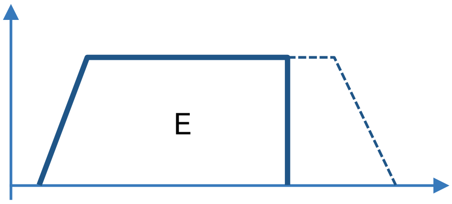
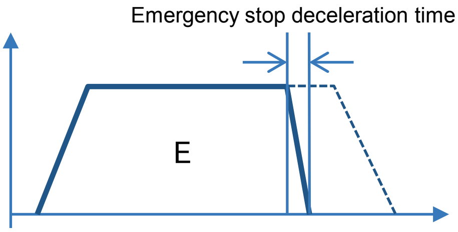
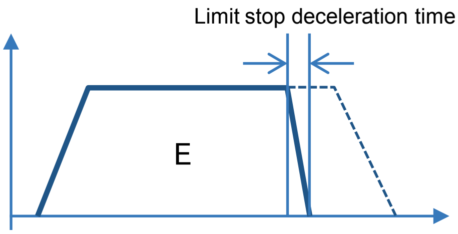
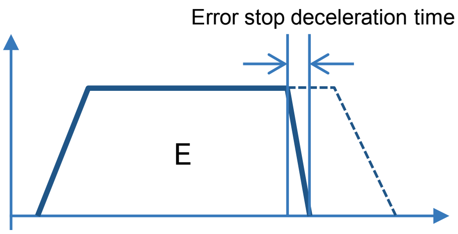
Stop Functions

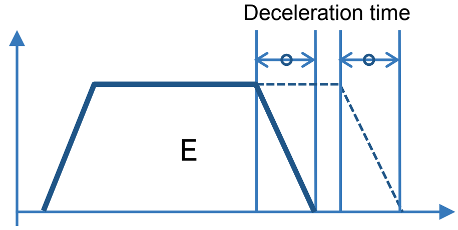
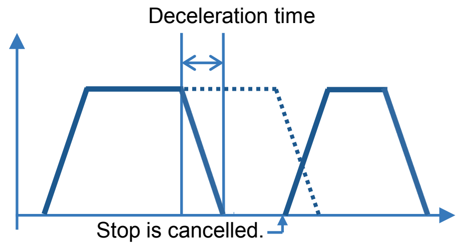
12.1 Type of Stop Functions

12.1.1 Type of Stop Operations

- The following seven stop operations are available.
- The system stop, emergency stop, deceleration stop, and pause will be effective when allocated request signals turn ON by user programs.
- The limit stop, software limit stop, and error stop will be effective when corresponding conditions are established.

■ Type of stop operations

Name	Time chart	Occurrence condition and operation
System stop		● Once a system stop request (Y0) turns ON, an active operation will stop and the operation of all axes will stop. ● Stops in the deceleration time of 1 ms.
Emergency stop		● When an emergency stop request (corresponding bit allocated to UM001B0 to UM001B5) turns ON, an active operation will stop and the operation of corresponding axes will stop. ● Performs a deceleration stop in the "emergency stop deceleration time" specified in the positioning parameter.
Limit stop		● Once a limit + input and limit - input turns ON, an active operation will stop and the operation of corresponding axes will stop. "Limit switch" under "Axis parameter settings" > "Basic setup" should be set to "A: Enabled". ● Performs a deceleration stop in the "limit stop deceleration time" specified in the positioning parameter.
Software limit stop		● When the software limit function is effective, an active operation will stop and the corresponding axes will stop when it exceeds the range of the software limit. ● Performs a deceleration stop in the "limit stop deceleration time" specified in the positioning parameter.
Error stop		● When a unit error occurs, the operation of corresponding axes (all axes or axis in which the error occurs) will stop. ● Target axes vary depending on the selection of the parameter "MC operation" > "Operation when an error occurs". ● Performs a deceleration stop in the "error stop deceleration time" specified in the positioning parameter.

Name	Time chart	Occurrence condition and operation
Deceleration stop (Note 1)		● When a deceleration stop request (corresponding bit allocated to UM001B6 to UM001BB) turns ON, an active operation will stop and the operation of corresponding axes will stop. ● Performs a deceleration stop in the deceleration time specified for the active positioning operation.
Pause (Note 1)		● When a deceleration stop request (corresponding bit allocated to UM001B6 to UM001BB) turns ON, an active operation will stop and the operation of corresponding axes will stop. ● Performs a deceleration stop in the deceleration time specified for the active positioning operation. ● Once a deceleration stop signal turns OFF, the deceleration stop will be canceled and the stopped control will restart.

(Note 1): The deceleration stop and pause operations are switched by the "MC common setting" parameter.

■ Allocation of I/O Numbers

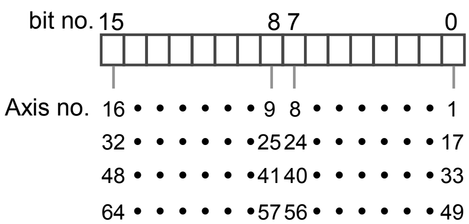
Signal name	I/O number
System stop	Y0

(Note 1): The I/O numbers in the above table show relative addresses based on the base word number. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.

■ Allocation of unit memories

Signal name	Real axis				Virtual axis	
	Axes 1-16	Axes 17-32	Axes 33-48	Axes 49-64	Axes 1-16	Axes 17-32
Emergency stop	UM001B0	UM001B1	UM001B2	UM001B3	UM001B4	UM001B5
Deceleration stop	UM001B6	UM001B7	UM001B8	UM001B9	UM001BA	UM001BB

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word) in the above table. When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



12.1.2 Characteristics of Pause Function

- The pause function is a function to temporarily stop the control in operation. The pause function is used by switching between the pause and deceleration stop functions.
- The pause function is used to perform the deceleration stop in the deceleration time of an active control when a deceleration stop request (corresponding bit allocated to UM001B6 to UM001BB) turns ON. After that, the stopped state will be kept while the deceleration stop request is on, and the control in the stopped state will be restarted when the deceleration stop request turns off.

◆ **KEY POINTS**

- **The deceleration stop cannot be executed when using the pause function. Use the emergency stop function to execute the stop operation when using the pause function.**
- **The pause function is available only when performing the automatic operation (positioning control). During a manual operation (JOG operation/home return), it is the same operation as a deceleraiton stop.**
- **The pause function keeps the stopped state as well as other stop functions when a deceleration stop request signal is on. If executing the emergency stop or system stop in paused state, the pause will be cancelled and the state will change to the one of the emergency stop or system stop.**

12.1.3 Stop Operation During Interpolation Control

- For executing the emergency stop, deceleration stop, or pause, turn on a request corresponding to the smallest axis number in an interpolation group.
- In the case of limit stop, software limit stop or error stop, the stop operation will start once a corresponding condition is established on one of axes in an interpolation group.

12.1.4 Stop Operation During Synchronous Control

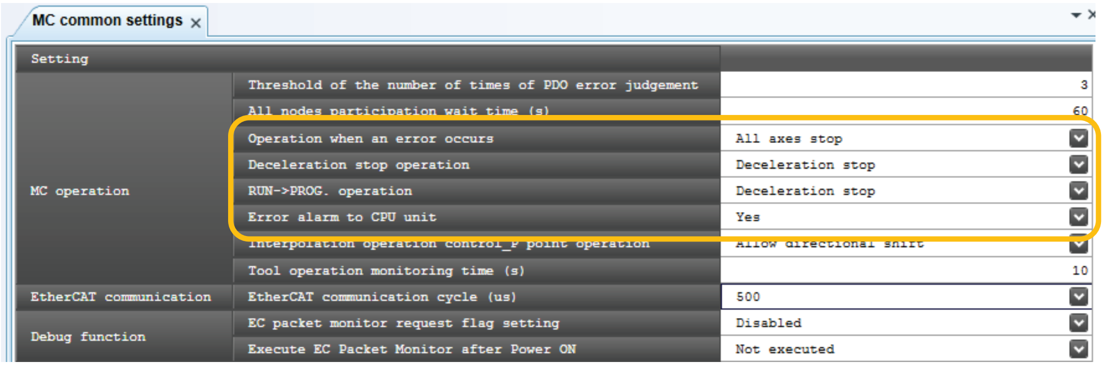
◆ **REFERENCE**

- **For details of the stop operation during synchronous control, refer to "9.2 Settings for Master and Slave Axes" and "9.3 Start and Cancel of Synchronous Control".**

12.2 Settings Related to Stop Function

12.2.1 MC Common Settings

- An operation when an error occurs is specified in the "MC common settings" dialog box.
- Specify the items in "Parameter" > "MC common settings" of CMI.



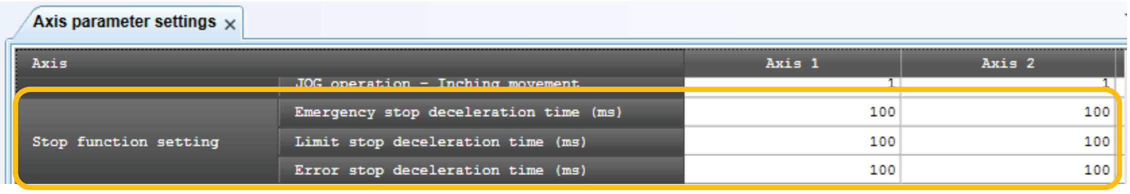
Parameter name	Default	Description	
Operation when an error occurs	All axes stop	Set the operation performed when an error occurs in axes (nodes) connected to the network.	
		All axes stop	All axes operations stop. (Note 1)
		Normal axis operation continuance	The operation of the axis an error occurred stops. The operations of normal axes continue.
Deceleration stop operation	Deceleration stop	Deceleration stop / Pause	
RUN->PROG. operation	Operation continuance	Set the operation when the operation mode of CPU unit changes from RUN to PROG.	
		Operation continuance	The operation of each axis continues.
		Deceleration stop	Each axis decelerates and stops in a specified deceleration stop time in the current control mode.
		Immediate stop	Each axis decelerates and stops in a specified emergency stop deceleration time.
Error alarm to CPU unit	Yes	Set the method of notifying errors to the CPU unit. The operation mode of the CPU unit when an error occurs is set from "CPU configuration" - "Unit error" in FPWIN GR7.	
		Yes	Announces errors to the CPU unit.
		No	Not announce errors to the CPU unit.

(Note 1): When setting "All axes stop", normal axes will stop once when an error occurs in the JOG/inching operation, however, if the JOG operation request is ON after they stopped, the JOG/inching operation will start again. Create a user program to use the error annunciation flag as an interlock signal to stop the JOG/inching operation.

12.2.2 Axis Parameter

The time of a stop operation is specified in the axis parameter setting menu.

Specify the items in "Parameter" > "Axis parameter" > "Stop function setting" of CMI.



Item	Default	Description
Emergency stop deceleration time	100 ms	Set the deceleration time at the time of emergency stop. 0 to 10000 ms
Limit stop deceleration time	100 ms	Set the deceleration time at the time of limit stop and software limit stop. 0 to 10000 ms
Error stop deceleration time	100 ms	Set the deceleration time at the time of error stop. 0 to 10000 ms

12.3 Operation During Stop

■ Operation during stop

- The stop request for the system stop is performed by an output signal (Y0) in the I/O area. The stop requests for the emergency stop, deceleration stop and pause are performed by the bits allocated to the unit memories (UM) area).
- The stopped state is held while each request signal is on until each of them turns off. Any operation cannot be activated in the stopped state. It is also the same in the cases of limit stop, software limit stop and error stop.

■ Priority of stop operations

- When stop control requests are made simultaneously, the stop operations are executed according to the following priority.

(1) System stop > (2) Error stop > (3) Software limit stop > (4) Limit stop > (5) Emergency stop > (6) Pause > (7) Deceleration stop

■ Dwell time setting

- The dwell time setting is invalid in the stop operations regardless of operation patterns.
- However, the dwell time setting is valid in the positioning operation after a pause.

■ Flag processing

- In the case of system stop, the busy flag turns off and the operation done flag turns on.
- In the cases of emergency stop, limit stop, software limit stop, error stop and deceleration stop, the busy flag turns off and the operation done flag turns on after the completion of deceleration.

■ Current value coordinate

- Even in a stop operation, the current value coordinate area is always updated.
- After the emergency stop, limit stop, software limit stop, error stop, deceleration stop or pause, deceleration is performed in each specified deceleration time, and values at the time of stop are stored.
- In the case of system stop, the value at the time of stop is stored.

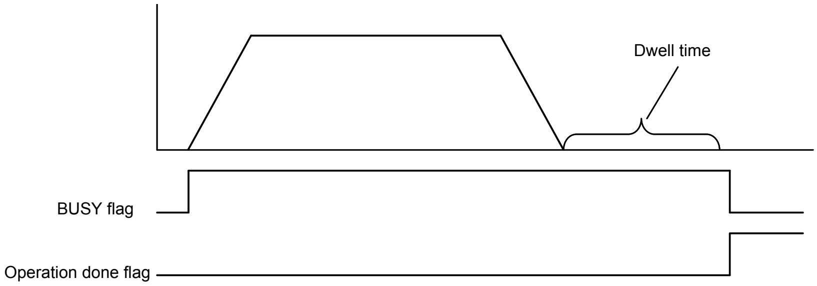
13
Supplementary Functions

13.1 Dwell Time

The time taken until the next operation after the completion of an executed positioning table in the automatic operation is called dwell time.

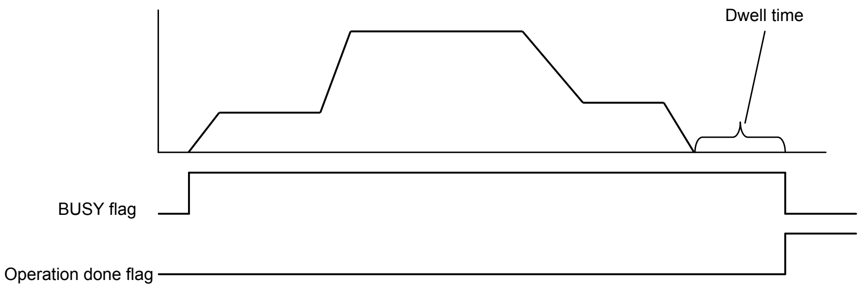
■ For E-point control

The dwell time is the time taken from the completion of the position command until the operation done flag turns on.



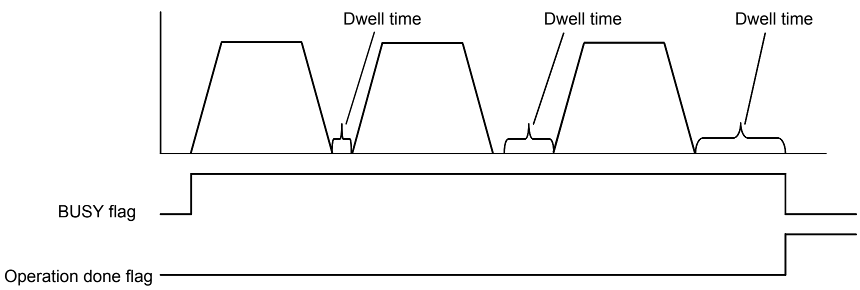
■ For P-point control

In the P-point control, the positioning table operates consecutively, therefore, the dwell time is ignored. For the last table (E point), as well as the E-point control, the dwell time is the time taken from the completion of the position command until the operation done flag turns on.



■ For C-point control

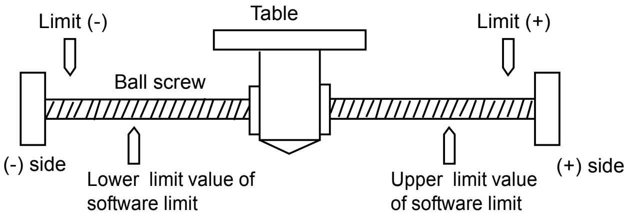
The dwell time is the waiting time for executing the next table from the completion of the positioning talble (deceleraiton stop). For the last table (E point), as well as the E-point control, the dwell time is the time taken from the completion of the position command until the operation done flag turns on.



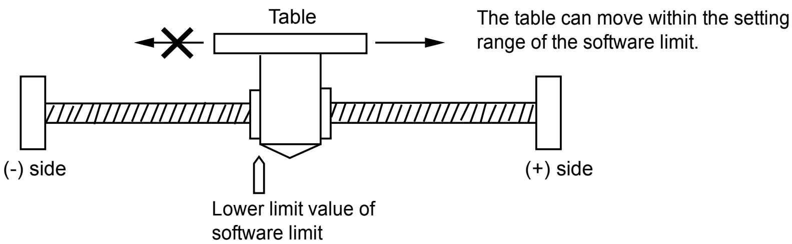
13.2 Software Limit

The system is designed to mechanically set the limit (+) and limit (-) to restrict the moving range of a motor.

Separately from the mechanical limits (+) and (-), the software limit is a function to add the limits on software for the absolute coordinate managed within the unit. As the software limit is a function for the protection of motors and servo amplifiers, it is recommended to set them to the values within the range of the mechanical limits (+) and (-) as below.



When exceeding the setting range of the software limit (upper and lower limit values), an error occurs, and the deceleration stop is executed. It is necessary to clear the error and move the motor into the range of the software limit using an operation such as JOG operation after the stop.



Whether the software limit is set to be available or not can be specified individually for the positioning control, JOG operation and home return each. For example, it is possible to set the limit software to be invalid only when returning to the current value.

13.3 Auxiliary Output Code and Auxiliary Output Contact

The auxiliary output contact is a function to inform about which table's operation is performing when the automatic operation (E-point control, C-point control, P-point control, J-point control) is executed.

The auxiliary output contact and the auxiliary output code can be used by setting the parameter “auxiliary output mode” of each axis to the With or Delay mode.

■ Auxiliary output contact

The With mode and Delay mode are available for the operations of auxiliary output contacts.

Auxiliary output mode	Operation
With mode	At the same time that the automatic operation starts, the auxiliary contact flag of a corresponding axis allocated to the I/O area turns on.
Delay mode	The auxiliary contact flag of a corresponding axis allocated to the I/O area turns on according to the ratio (%) of the positioning movement amount of automatic operation. The setting of the ratio of turning on the flag in the delay mode is set in the auxiliary output delay ratio area in the unit memories. However, when the automatic operation is set to the J-point control, the operation is the same as that in the with mode.

Also, the ON time of an auxiliary contact flag can be specified in the ms unit.

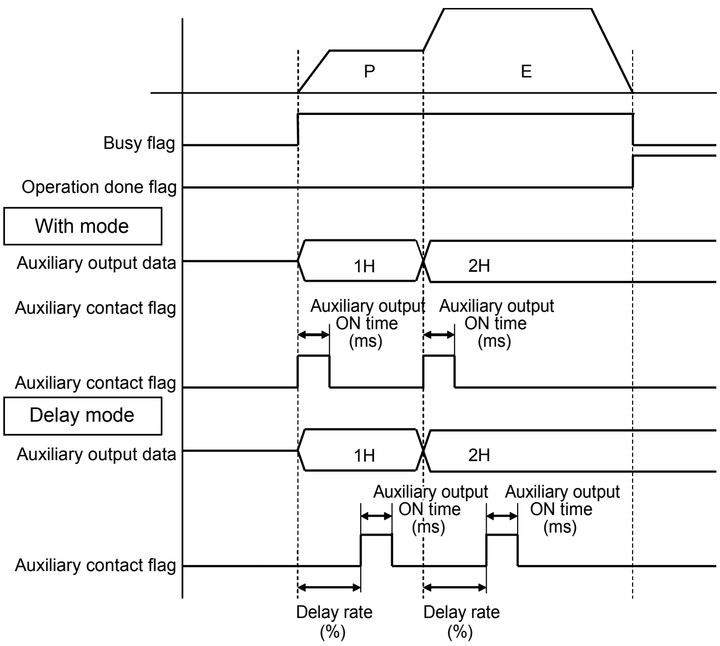
◆ **KEY POINTS**

In the case of the J-point control, the operation in the delay mode is the same as that in the with mode.

■ Auxiliary output data

The auxiliary output data (1 word) can be set for each table of the positioning data. The content of the process currently carried out can be confirmed by setting the auxiliary output.

The values in the auxiliary output data are held until the next positioning table is executed. Also, the auxiliary output data that was output just before the completion of the automatic operation is held.



◆ **KEY POINTS**

Auxiliary output data is stored at the same time that the positioning operation starts regardless of the type of the auxiliary output mode (with mode or delay mode).

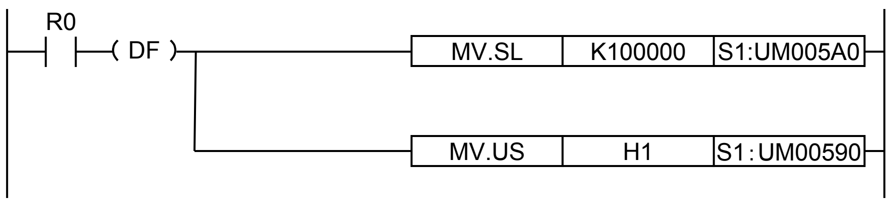
13.4 Current Value Update

The current value update is a function to set the "current value after unit conversion" stored in the unit memories within FP7 MC Unit to an arbitrary value.

- A value is set in the current value update coordinate area (UM005A0 to UM0065F) in the unit memories as a current value using a user program.
- The "current value after unit conversion" of each axis information area is changed to the specified current value by turning on the bit of a target axis in the current value update request flag area (UM00590 to UM00595).

■ Program example

The following figure shows a program to preset an arbitrary value "K100000" in the current value update area in the unit memories and update the value for the current value after unit conversion of 1st axis.



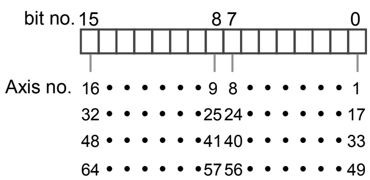
◆ **KEY POINTS**

- **The "current value after unit conversion" area in the unit memories is updated by the "current value update" function. Values in the "AMP current value" area are not updated.**
- **An integer equivalent to the current value after unit conversion is set to the unit memory.**
  Example) When the unit is um (0.1 um), set to "10000" for making it be 1000.0 um.

■ Current value update data area (Unit memories)

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>Axes 1-16</td><td>UM 00590</td><td rowspan="6">Current value update request</td><td rowspan="6">H0</td><td rowspan="6">Only when the corresponding bit for each axis changes to 1 from 0, the current value coordinate controlled by FP7 MC Unit are changed to the the current value update coordinate. Afther the change, FP7 MC Unit clears the corresponding bits to 0 automatically.
<table>
<tr><th>bit</th><th>Name</th><th>Descirption</th></tr>
<tr><td>0</td><td>Axis 1+16n: Current value update request</td><td rowspan="16">0: No change
1: Update the current value after unit conversion of a target axis</td></tr>
<tr><td>1</td><td>Axis 2+16n: Current value update request</td></tr>
<tr><td>2</td><td>Axis 3+16n: Current value update request</td></tr>
<tr><td>3</td><td>Axis 4+16n: Current value update request</td></tr>
<tr><td>4</td><td>Axis 5+16n: Current value update request</td></tr>
<tr><td>5</td><td>Axis 6+16n: Current value update request</td></tr>
<tr><td>6</td><td>Axis 7+16n: Current value update request</td></tr>
<tr><td>7</td><td>Axis 8+16n: Current value update request</td></tr>
<tr><td>8</td><td>Axis 9+16n: Current value update request</td></tr>
<tr><td>9</td><td>Axis 10+16n: Current value update request</td></tr>
<tr><td>10</td><td>Axis 11+16n: Current value update request</td></tr>
<tr><td>11</td><td>Axis 12+16n: Current value update request</td></tr>
<tr><td>12</td><td>Axis 13+16n: Current value update request</td></tr>
<tr><td>13</td><td>Axis 14+16n: Current value update request</td></tr>
<tr><td>14</td><td>Axis 15+16n: Current value update request</td></tr>
<tr><td>15</td><td>Axis 16+16n: Current value update request</td></tr>
</table>
</td></tr>
<tr><td>Axes 17-32</td><td>UM 00591</td></tr>
<tr><td>Axes 33-48</td><td>UM 00592</td></tr>
<tr><td>Axes 49-64</td><td>UM 00593</td></tr>
<tr><td>Virtual axes 1-16</td><td>UM 00594</td></tr>
<tr><td>Virtual axes 17-32</td><td>UM 00595</td></tr>
<tr><td>Axis 1</td><td>UM 005A0 - UM 005A1</td><td rowspan="6">Current value update coordinate</td><td rowspan="6">K0</td><td rowspan="6">Stores the coordinate value to be preset as the current value after unit conversion.
Range: -2147483648 to +2147483647
An integer equivalent to the current value after unit conversion is set to the unit memories.
Example) When the unit is um (0.1 um), set to "10000" for making it be 1,000.0 um.</td></tr>
<tr><td>Axis 2</td><td>UM 005A2 - UM 005A3</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Virtual axis 1</td><td>UM 00620 - UM 00621</td></tr>
<tr><td></td><td>-</td></tr>
<tr><td>Virtual axis 32</td><td>UM 0065E - UM 0065F</td></tr>
</table>

(Note 1): Request signals for 16 axes are allocated to each area (1 word) of current value update request. When the value of each bit is 1, it turns on. When the value is 0, it turns off.



(Note 2): As for the unit memory in which the current value update coordinate is set, 2-word area is allocated for each axis.

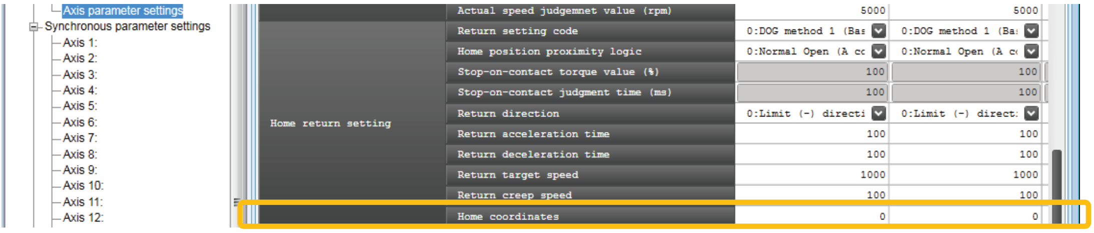
13.5 Home Coordinates

The home coordinates is a function to set the coordinates after the home return processing to arbitrary values.

- The coordinates after the home return processing can be set in the "Axis parameter setting" dialog box of CMI or user programs.
- Set coordinates become the home coordinates by executing the home return for target axes.

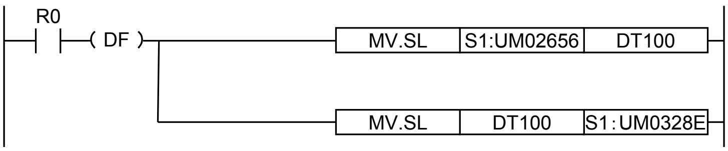
■ Setting of home coordinates

The home coordinates can be set for each axis in the "Axis parameter setting" dialog box of CMI.



■ Program example

The following figure shows a program to read the current value after system conversion of the 1st axis and set it as home coordinates.



■ Home coordinates area (Unit memories)

Axis no.	Unit memory no.(Hex)	Name	Default	Description
Axis 1	UM 0328E - UM 0328F	Home coordinates	K0	Stores the home coordinates to be set on completion of home return. Range: -2147483648 to +2147483647 An integer equivalent to the current value after unit conversion is set to the unit memory. Example) When the unit is um (0.1 um), set to "10000" for making it be 1000.0 um.
-	-			
Axis 2	UM 0330E - UM 0330F			
-	-			
Axis 64	UM 0526E - UM 0526F			
-	-			
Virtual axis 1	UM 0528E - UM 0528F			
-	-			
Virtual axis 32	UM 0620E - UM 0620F			

(Note 1): As for the unit memories in which the home coordinates are set, 2-word area is allocated for each axis.

(Note 2): The difference between the unit memory number of the target axis number and the unit memory number of the adjacent axis number is H20 (for 32 words).

◆ **KEY POINTS**

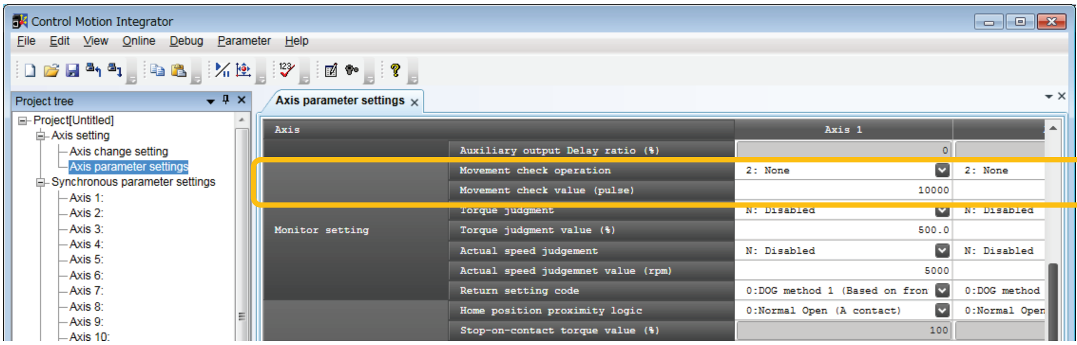
- **An integer equivalent to the current value after unit conversion is set for home coordinates.**
  Example) When the unit is um (0.1 um), set to "10000" for making it be 1000.0 um.

13.6 Movement Amount Automatic Check

This is a function to monitor the position deviation calculated in FP7 MC Unit and generate an error or warning on the FP7 MC Unit side when it exceeds a set judgement value.

- The movement amount automatic check is set in the "Axis parameter setting" menu of CMI. Judgement values can be set by respective axes.
- when an error occurs, the operation will stop in the "error stop deceleration time, and cannot be executed until the error is cleared.When a warning occurs, only the occurrence of warning will be informed, and the operation will continue.

■ Parameter setting by CMI



Parameter name	Default	Description
Movement check operation	2: None	Select the operation when exceeding the movement amount automatic check threshold. 0: Error, 1: Warning, 2: Not check
Movement check value (pulse)	10000	Set the threshold for the movement amount automatic check operation. Range: 0 to 65535 pulse

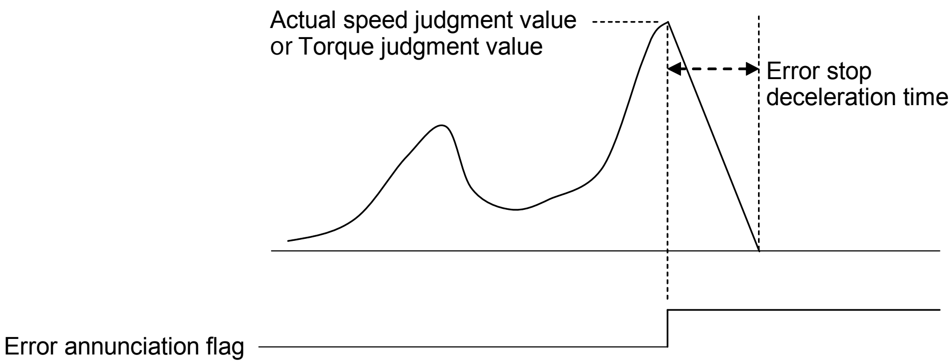
◆ **REFERENCE**

- **For details of errors and warnings, refer to "14 Troubleshooting".**

13.7 Monitor Error (Torque / Actual Speed Judgement)

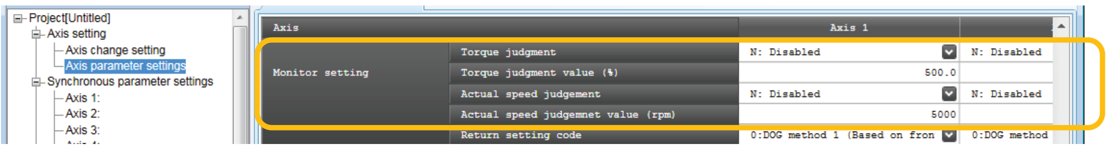
This is a function to monitor the actual speed/torque of servo amplifier and generate an error or warning on the FP7 MC Unit side when it exceeds a set judgement value.

- The monitor error is set in the "Axis parameter setting" dialog box of CMI. Judgement values can be set for torque and actual speed separately by respective axes.
- when an error occurs, the operation will stop in the "error stop deceleration time, and cannot be executed until the error is cleared. When a warning occurs, only the occurrence of warning will be informed, and the operation will continue.



(Note): The above figure shows an operation diagram when error is set.

■ Parameter setting by CMI



Parameter name	Default	Description
Monitor error - Torque judgment	N: Disabled	Select the operation of FP7 MC Unit when the torque value of the amplifier is monitored and exceeds the judgement value. N: Disabled, E: Enabled (Error), W: Enabled (Warning)
Monitor error - Torque judgment value (%)	500.0	Set the torque judgement value. Range: 0 to 500.0 (%)
Monitor error - Actual speed judgement	N: Disabled	Select the operation of FP7 MC Unit when the actual speed of the amplifier is monitored and exceeds the judgement value. N: Disabled, E: Enabled (Error), W: Enabled (Warning)
Monitor error - Actual speed judgement value (rpm)	5000	Set the actual speed judgement value. Range: 0 to 5000 rpm

◆ **REFERENCE**

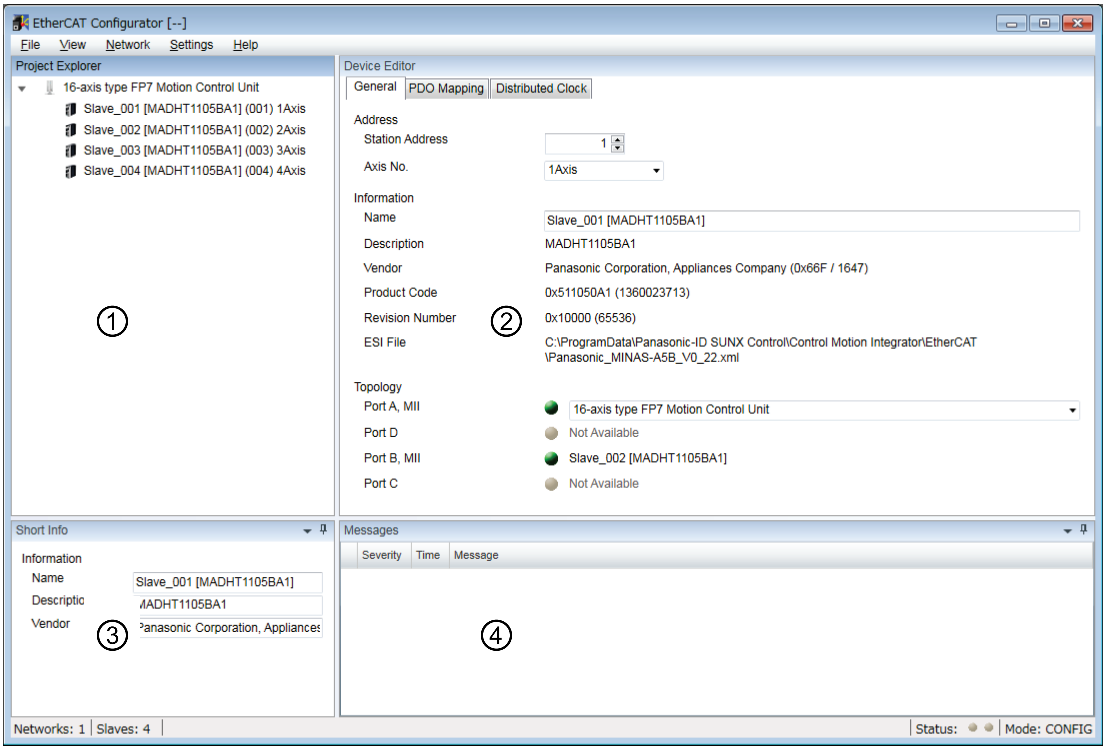
- **For details of errors and warnings, refer to "14 Troubleshooting".**

13.8 EtherCAT Communication Setting

13.8.1 EtherCAT Configurator

EtherCAT Configurator is a menu to configure a system and set parameters of EtherCAT communication on CMI.

■ Configuration of EtherCAT Configurator



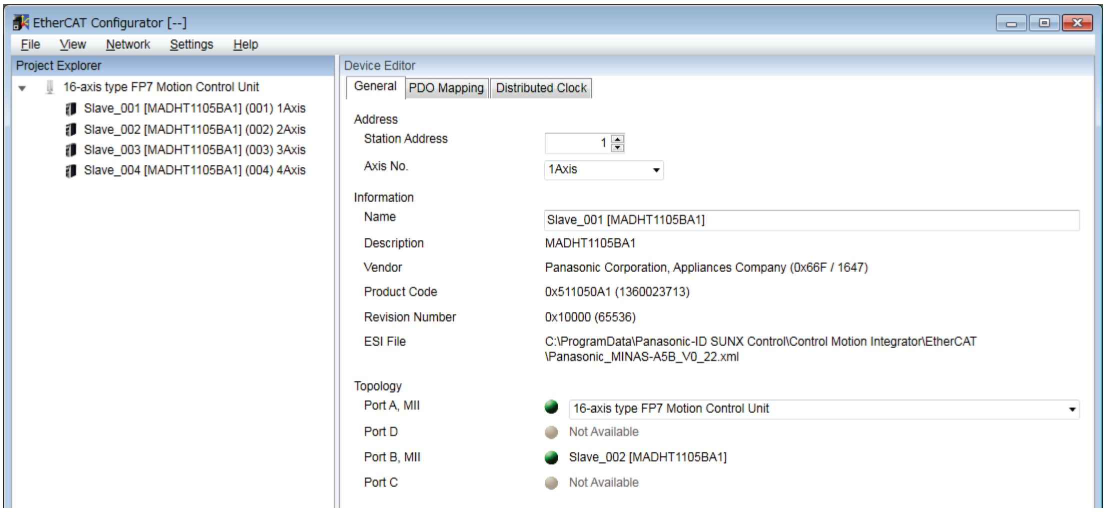
■ Names and functions

No.	Name		Description
①	Project Explorer		Registered slaves (Servo Amplifier A5B) are displayed. The slaves are connected in the connection order from the slave closest to FP7 MC Unit.
②	Device Editor		Three tabs are available.
		General	Addresses are set. Information registered in the ESI file and connection states are displayed.
		PDO Mapping	Information on the PDO map of EtherCAT communication can be monitored.
		Distributed Clocks	The setting state of Distributed Clocks can be monitored.
③	Short Info		The attribute information on slaves can be monitored.
④	Message		Messages are displayed.

13.8.2 Device Editor

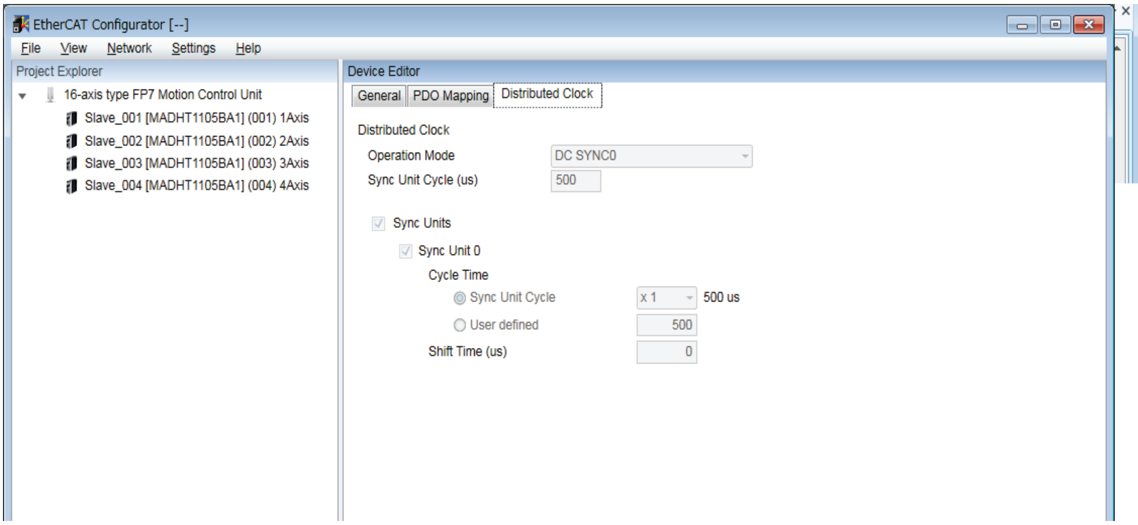
Registered slaves and parameter information can be confirmed in the device editor.

■ "General" tab



The address, axis number settings and information on ESI files and topology are displayed.

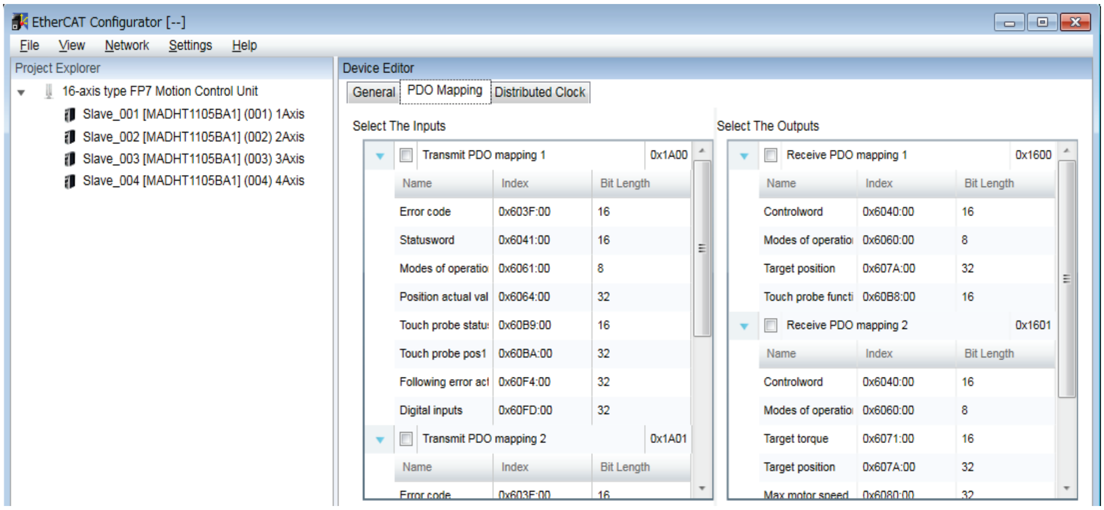
■ "Distributed Clocks" tab



The communication cycle of synchronous unit is "EtherCAT communication cycle". The communication cycle of synchronous unit is set in the "MC common setting" of CMI not in this screen.

13.8.3 Overview of PDO Mapping

PDO (process data object) is data upated for each communication cycle via EtherCAT. "PDO Mapping" can be confirmed in the device editor of CMI "EtherCAT Configurator".



■ PDO mapping tab

Item	Description
Select The Inputs	The maps of (input) data that is sent by Servo Amplifier A5B and received by FP7 MC Unit is displayed. Transmit PDO mapping 1 to Transmit PDO mapping 4 are displayed. Transmit PDO mapping 4 is selected.
Select The Outputs	The maps of data sent (output) by FP7 MC Unit and received by Servo Amplifier A5B are displayed. Receive PDO mapping 1 to Receive PDO mapping 4 are displayed. Receive PDO mapping 4 is selected.

◆ **NOTES**

- **For using FP7 MC Unit in combination with Servo Amplifier A5B, Transmit PDO mapping 4 and Receive PDO mapping 4 is used. Do not change the setting unless the general-purpose output (EXOUT1) is added. Careless changes of PDF mapping may cause malfunction.**

13.8.4 Change of PDO Mapping

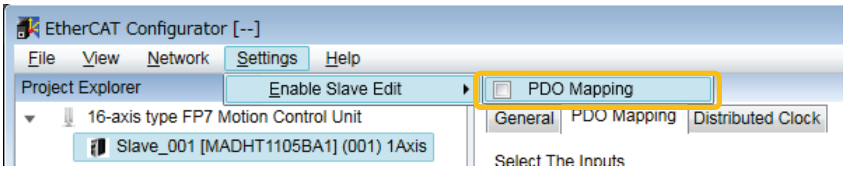
For using the general-purpose output (EXOUT1) of Servo Amplifier, it should be added to the PDO mapping. The following procedure is explained on the condition that servo amplifiers have already been registered in CMI.

◆ **PROCEDURE**

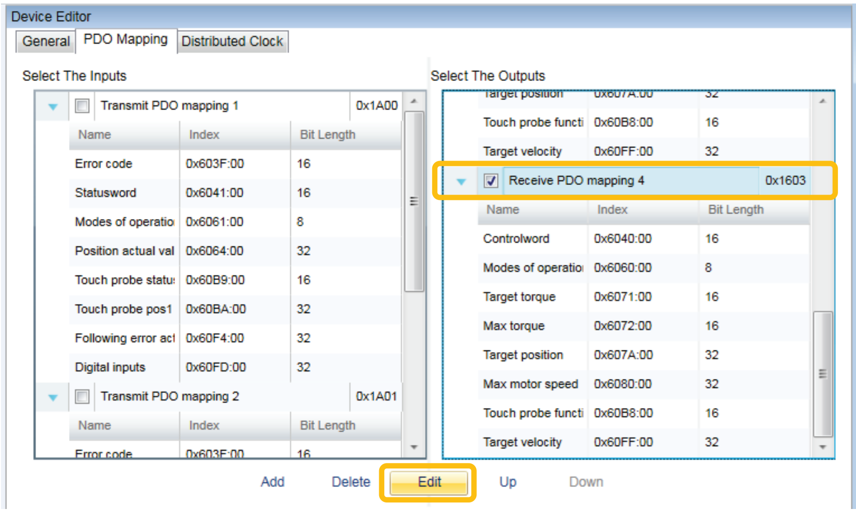
1. Select an arbitrary servo amplifier in the project explorer.

2. Select PDO mapping in the device editor window.

3. Select "Settings" > "Enable Slave Edit" > "PDO Mapping" from the menu bar, and check the checkbox.

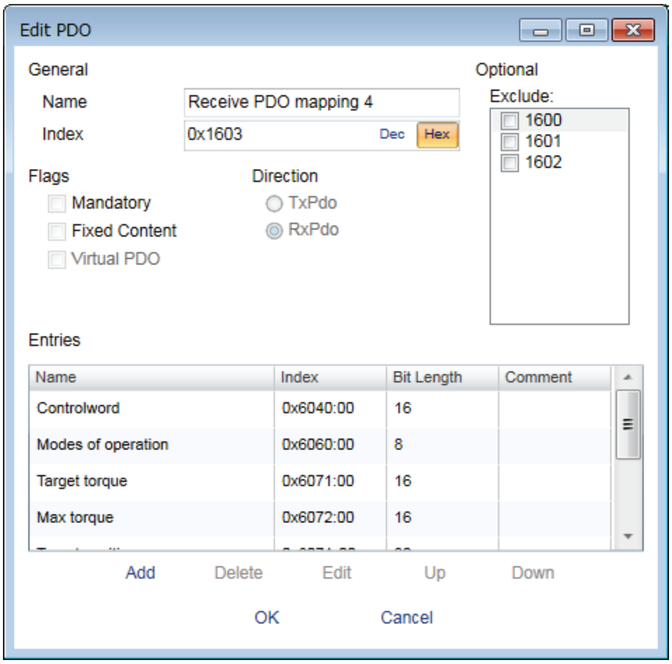


You can now edit the field of PDO map.



4. Select "Receive PDO mapping 4" from the "Select The Outputs" box, and press the "Edit" button.

The "Edit PDO" dialog box is displayed.

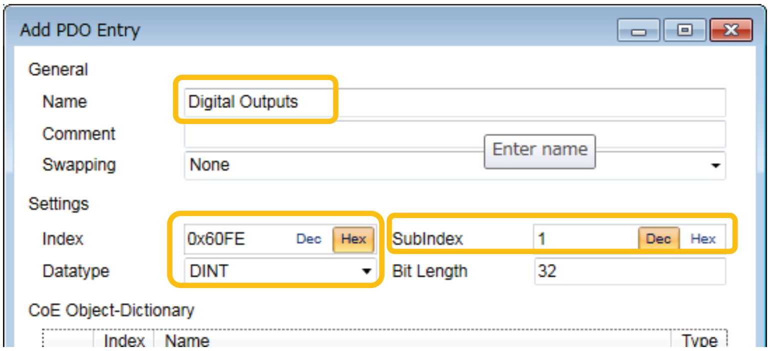


5. **Press the [Add] button.**

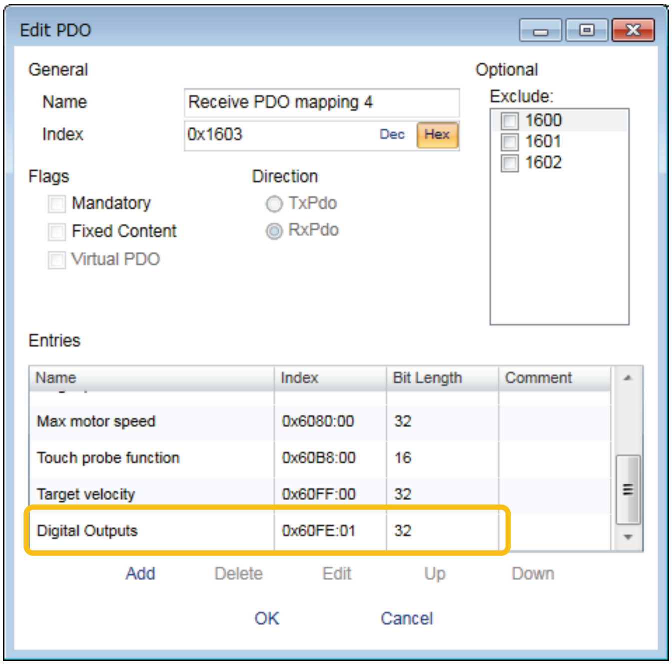
   The "Add PDO" dialog box is displayed.

6. **Input the following items, and press the [OK] button.**

   It returns to the "Edit PDO" dialog box.

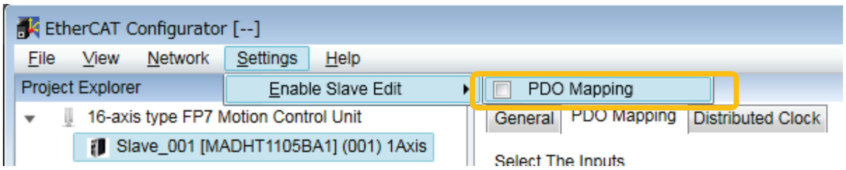


Item		Input content
General	Name	Digital Outputs
Settings	Index	0x60FE
	Sub index	1
	Data type	DINT



7. **Confirm that the added information is displayed, and press the [OK] button.**

8. **Select "Settings" > "Enable Slave Edit" > "PDO Mapping" from the menu bar, and uncheck the checkbox.**



NOTES

- **Carry out the operation of the above procedure 8 to prevent data from being rewritten carelessly after finishing the edit of PDO mapping.**

13.9 EC Packet Monitor Function

13.9.1 Overview of Function

The packet monitor function is a function to store sent or received packet data between the master (FP7 MC Unit) and slaves (Servo Amplifier A5B) as files. Packet data can be confirmed using commercial analyzer software. An SD memory card is required for using the EC packet monitor function.

■ Specifications of FP7 MC Unit

Item	Description
Storage destination	SD memory card inserted in FP7 MC Unit
Packet data file format	TCPDump format (cap)
Packet data file size	Max. 6 Mbytes per file
No. of packets	Max. 3904 packets
Storage timing	EC packet data is stored right after the power is turned on. EC packet data is stored at an arbitrary timing using user programs.

13.9.2 Stored Files

Packet data files are stored in a format such as the following in SD memory cards.

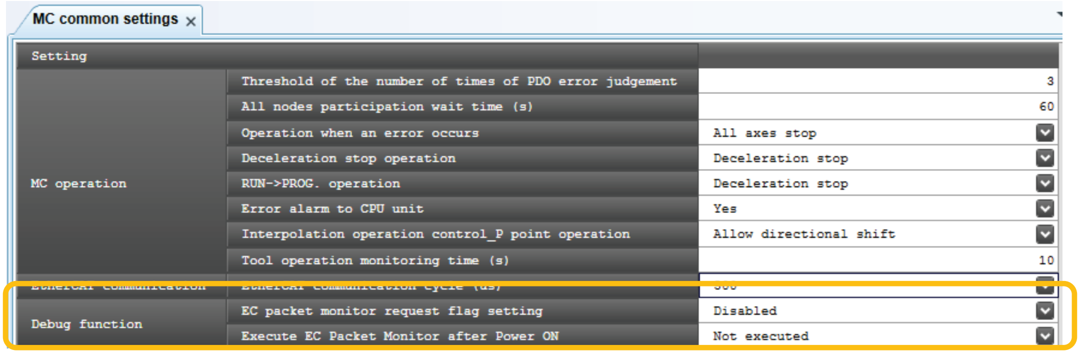
■ Specifications of FP7 MC Unit

Item	Description
Storage destination folder	\ECpacketLog
Stored file	File name: yyyyMMddhhmm-*** yyyy: Year, MM: Month, hh: Hour, mm: Minute, ***: Generation (000-999)

13.9.3 How to Set

For using the packet monitor function, the settings related to the EC packet monitor are configured in CMI.

■ MC common setting dialog box



Item	Default	Description	
EC packet monitor request flag setting	Disabled	Set the operation of packet monitor request flag of EC (EtherCAT) communication.	
		Disabled	Packet monitor is not executed when EC packet monitor request flag turns ON.
		Enabled	Packet monitor is executed when EC packet monitor request flag turns ON.
Execute EC packet monitor after power ON	Not executed	Set whehter or not to execute the EC packet monitor after the power is turned on. Not executed / Executed	

■ Executing by user programs

For executing the packet monitor, turn on the EC packet monitor request (Y1) at an arbitrary timing.

I/O allocation	Target axis	Name	Description
X1	All axes	EC packet monitor active	Turns on when the monitoring of EtherCAT communication packet is executed by the EC packet monitor request (Y1). ON: Monitoring is executed, OFF: Monitoring stops
Y1	All axes	EC packet monitor request	Requests the start of the monitor of EtherCAT communication packet when the EC packet monitor is enabled by "MC common parameter". The packet data is saved in an SD memory card. The monitoring stops when (Y1) turns off. The monitoring also stops, and (X1) turns off when the packet monitor capacity reaches 6 Mbytes or 3904 packets.

13.9.4 How to Execute

The packet monitor is execute in the following procedure.

	Procedure
①	Insert the SD memory card into FP7 MC Unit.
②	Confirm that the EC packet monitor is set with CMI.
③	Turn on the power supply. Confirm.
④	Confirm that the operation monitor LED [SD] is off, and remove the SD memory card.

13.9.5 Handling of SD Memory Card

■ Usable SD memory cards

Use of Panasonic industrial SD memory cards (SLC type) is recommended.
http://panasonic.net/avc/sdcard/industrial_sd/lineup.html

(Note) An operation check has not been conducted for SD memory cards made by other manufacturers.

Printed logo on CPU unit	Usable SD memory cards	
	Card type	Capacity
	SDHC memory card	512 MB to 16 GB

■ Cautions on handling an SD memory card

The data saved in the SD memory card may be lost in the following cases. We assume no responsibility whatsoever for the lost of saved data.

- The user or a third party has misused the SD memory card.
- When the SD memory card was affected by any static electricity or electrical noise.
- The SD memory card was taken out, or the PLC body was powered off, while the card was being accessed.

■ Formatting an SD memory card

In principle, SD memory cards have been formatted by the time of purchase, and no formatting by the user is required. If formatting becomes necessary, download formatting software for SD memory cards on the following website.

"SD Association's website"
https://www.sdcard.org/home/

◆ **NOTES**

- **A file system formatted by PC's standard formatting software does not satisfy the SD memory card specifications. Please use the dedicated formatting software.**
- **It is recommended to save important data in another media for backup. Never remove the card or power off the PLC body while the SD LED on FP7 MC Unit is lit (data is being read from or written into the card). Data may be damaged.**
- **Do not use an SD memory card the memory capacity of which is more than the usable capacity. Data in the card may be damaged.**

14

Troubleshooting

14.1 Errors and Warnings

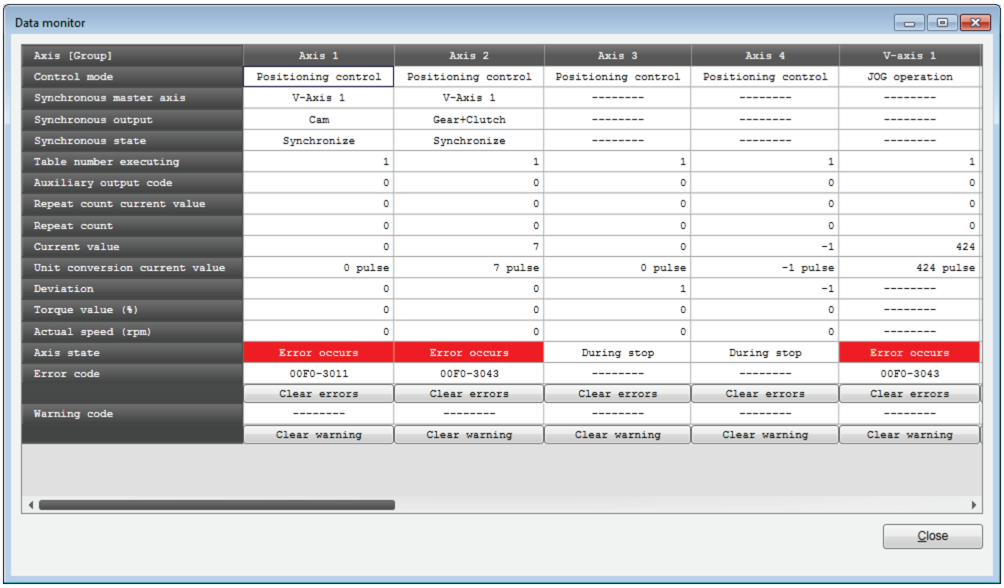
14.1.1 Errors and warnings

When any operational unconformity occurs in FP7 MC Unit, errors or warnings will occur. When errors or warnings occur, the following operations will be performed.

Error	Occurs in any abnormal conditions. When a motor is operating, the operation stops. The motor stopped due to the occurrence of error will not activate until the error clear is executed.
Warning	Occurs when any operational unconformity not abnormal conditions exist. The operation can continue even after the occurrence of warnings, and the motor continues running if the motor is operating.

14.1.2 Checking and Clearing by CMI

It is possible to check and clear errors/warning on an axis-by-axis basis by selecting [Online] > [Data monitor] on the programming tool CMI. Some errors cannot be cleared. Some system errors and communication errors of AMP cannot be cleared by this operation. The power supply of the unit should be restored.



Axis [Group]	Axis 1	Axis 2	Axis 3	Axis 4	V-axis 1
Control mode	Positioning control	Positioning control	Positioning control	Positioning control	JOG operation
Synchronous master axis	V-Axis 1	V-Axis 1	--------	--------	--------
Synchronous output	Cam	Gear+Clutch	--------	--------	--------
Synchronous state	Synchronize	Synchronize	--------	--------	--------
Table number executing	1	1	1	1	1
Auxiliary output code	0	0	0	0	0
Repeat count current value	0	0	0	0	0
Repeat count	0	0	0	0	0
Current value	0	7	0	-1	424
Unit conversion current value	0 pulse	7 pulse	0 pulse	-1 pulse	424 pulse
Deviation	0	0	1	-1	--------
Torque value (%)	0	0	0	0	--------
Actual speed (rpm)	0	0	0	0	--------
Axis state	Error occurs	Error occurs	During stop	During stop	Error occurs
Error code	00F0-3011	00F0-3043	--------	--------	00F0-3043
	Clear errors	Clear errors	Clear errors	Clear errors	Clear errors
Warning code	--------	--------	--------	--------	--------
	Clear warning	Clear warning	Clear warning	Clear warning	Clear warning

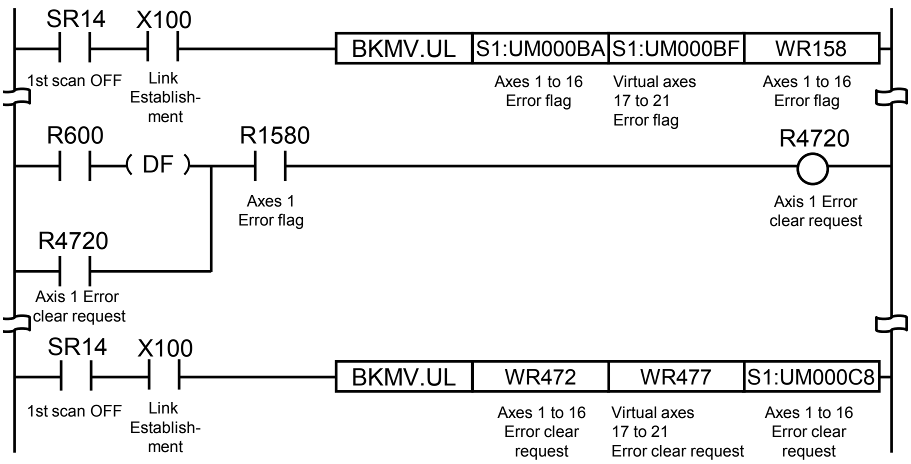
14.1.3 Clearing Errors/Warnings Using User Programs

Errors and warnings can be cleared by turning on the "error clear request" or "warning clear request" allocated to the output control area using user programs.

■ Clearing errors/warnings using unit memories (output control area)

It is possible to clear errors and warnings on an axis-by-axis basis by turning on the error/warning clear request flags allocated to the output control area. Some errors cannot be cleared. Some system errors and communication errors of AMP cannot be cleared by this operation. The power supply of the unit should be restored.

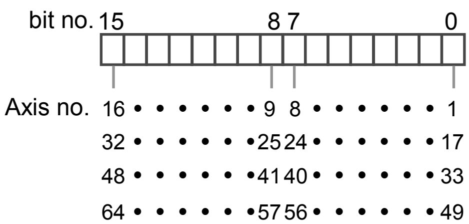
(Example) When clearing the error in the axis no.1 of FP7 MC Unit installed in slot 1



■ Allocation of unit memories (Input control area/Output control area)

Signal name	Real axis				Virtual axis	
	Axes 1-16	Axes 17-32	Axes 33-48	Axes 49-64	Axes 1-16	Axes 17-32
Error annunciation	UM000BA	UM000BB	UM000BC	UM000BD	UM000BE	UM000BF
Warning annunciation	UM000C0	UM000C1	UM000C2	UM000C3	UM000C4	UM000C5
Error clear request	UM001C8	UM001C9	UM001CA	UM001CB	UM001CC	UM001CD
Warning clear request	UM001CE	UM001CF	UM001D0	UM001D1	UM001D2	UM001D3

(Note 1): Flags or request signals for 16 axes are allocated to each unit memory (1 word) in the above table. When the value of each bit is 1, it turns on. When the value of each bit is 0, it turns off.



14.1.4 Error and Warning Logs

FP7 MC Unit has log areas to store error and warning codes in its unit memories.

- Once an error/warning occurs, the error/warning code will be stored in the log area of the axis that the error occurred.
- When an error/warning that is not related to the axes occurs, such as an failure in the unit, the error/warning code will be stored in the log areas of all axes.
- In the data monitor or tool operation dialog box on CMI, only the latest error and warning codes of each axis can be confirmed.
- For referring the error and warning logs for each axis, read the following unit memory from the PLC.

■ Configuration of log areas

Classification	Classification	Function
Error announciation & clear area	Error clear	
	No. of occurrences of errors	The number of occurred errors is stored.
	Error code annunciation buffer 1	Up to eight error codes per axis are stored. Eight-digit hex codes are stored as error codes. The buffer 1 is always the latest code. Error codes are stored in the occurrence order from the buffer 1.

	Error code annunciation buffer 8	
Warning announciation & clear area	Warning clear	
	No. of occurrences of warnings	The number of occurred warnings is stored.
	Warning code annunciation buffer 1	Up to eight warning codes per axis are stored. The buffer 1 is always the latest code. Warning codes are stored in the occurrence order from the buffer 1.

	Warning code annunciation buffer 8	

◆ **REFERENCE**

- **For details of the log areas, refer to "15.5.8 Error Annunciation and Clear Area" and "15.5.9 Warning Annunciation and Clear Area".**

14.2 Error Recovery Process

14.2.1 Overview

The method to recover from error occurrence varies according to the states when errors occur.

Status when an error occurred	**Description**	**Error type**
Recoverable state (Yes)	- After an error occurred, the operating axes stop. - After an error occurred, FP7 MC Unit can recover the error at any time.	All error types
Unrecoverable state (No)	- Error when a critical trouble occurred on the FP7 MC Unit system - When an unrecoverable error occurred, the power supply of the positioning unit should be restored.	System errors AMP communication errors

14.3 Error Code Table

14.3.1 System Errors (From 00F0 1000H

These are the errors that occur due to any failure within FP7 MC Unit. The system errors are defined as the fatal errors for the system.

Error code	Error name	Description	Object	Recovered	Countermeasures
1000H	System runaway	System runaway If the error occurs, the ALARM LED on the unit turns on.	All axes	No	Turn off the power supply and turn it on again. If an error occurs repeatedly, consult your Panasonic representative.
1001H	Hardware error	An error occurred in the hardware test when the power supply turned on.	All axes	No	
1002H	Unit error	Any error occurred in the internal processing.	All axes	No	
1010H	FROM write error	Any error occurred in the execution of writing to FROM. (Write error/Verify error/Erase error)	All axes	Yes	Execute writing to FROM again. If the error occurred repeatedly, please contact us.
1020H	Tool operation abnormal end	Any error occurred in the communication with a PC when executing the tool operaiton on CMI.	All axes	Yes	Check the connection of the cable connecting the PC and PLC. Reboot the PC.
1030H	CPU unit error	ALARM occurred in the CPU unit.	All axes	No	Check the condition of the CPU unit. Turn off the power supply and turn it on again.

(Note 1): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

(Note 2): The power supply must be turned off and on again to recover the errors whose "Recovered" column is "No".

14.3.2 AMP Communication Errors (From 00F0 2000H)

These are the errors occurred in the communication beteween FP7 MC Unit and AMP. They occur when the communication data was judged as abnormal.

Error code	Error name	Description	Object	Recovered	Countermeasures
2020H	AMP station address duplicate error	The AMPs with the same station address exist in the network.	All axes	No	Afer checking the station address settings of AMP, turn off the power supply and turn it on again.
2030H	AMP station address setting error	The AMP with a station address outside the settable range exists.	All axes	No	
2060H	No ENI file	No ENI file exists in FP7 MC Unit.	All axes	No	Download CMI project data.
2061H	Network configuration verify error	The network configuration defined in the ENI file is different from the acutal network configuraiton.	All axes	No	Check whether the configuration matches the connection configuration set on CMI.
2062H	Process data receive timeout error	The PDO (Process data) communication error occurred.	All axes	No	Check the communication cable to see if it is correctly connected. Check the power supply of Servo Amplifier A5B.

(Note 1): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

(Note 2): The power supply must be turned off and on again to recover the errors whose "Recovered" column is "No".

14.3.3 Axis Operation Errors (From 00F0 3000H)

These are the errors occurred while various operations are being executed.

Error code	Error name	Description	Object	Recovered	Countermeasures
3000H	Not servo ready	The axis that servo is not locked was started.	Each axis	Yes	Confirm the servo is locked while each axis is operating
3001H	Servo off detection in operation	The servo became off during the operation being processed.	Each axis	Yes	Turn off the servo on input when the busy flag for the target axis is not on. Check the state of the AMP.
3005H	Main power supply OFF error	The servo on was requested when the main power supply of the AMP was off.	Each axis	Yes	Turn the servo on after the main power supply has been turned on. Check the voltage of the main power supply.
3010H	Limit + signal detection	The input on the plus side of the limit turned on.	Each axis	Yes	Move the motor into the range of the limit by an operation such as the JOG operation. Check the settings of Servo Amplifier and FP7 MC Unit to see if the limit input is correct.
3011H	Limit - signal detection	The input on the minus side of the limit turned on.	Each axis	Yes	
3012H	Limit signal error	Both inputs on the plus and minus sides of the limit turned on.	Each axis	Yes	Check the settings of Servo Amplifier and FP7 MC Unit to see if the limit input is correct.
3020H	Software limit (plus side) detection	The movement amount of the motor exceeded the upper limit of the software limit.	Each axis	Yes	Move the motor into the range of the software limit by an operation such as the JOG operation. Check the setting values of the software limit.
3021H	Software limit (minus side) detection	The movement amount of the motor exceeded the lower limit of the software limit.	Each axis	Yes	
3025H	Command speed operation error	The internal operation of command speed failed due to overflow.	Each axis	Yes	Lower the set speed. Check the settings of the pulse number per rotation and movement amount per rotation.
3030H	Axis operation error	An error occurred in the operation processing of each axis.	Each axis	Yes	Check the setting values and parameters of the positioning unit. If the error occurs repeatedly with the correct set values, consult your Panasonic representative.
3031H	Operation abnormal end	An error occurred in the operation processing of each axis.	Each axis All axes	Yes	If an error occurs repeatedly, consult your Panasonic representative.
3032H	Axis group operation error	The setting of axis group was changed during the operation or when requesting the stop. The setting of axis group is out of the range.	Each axis	Yes	Changing the axis group should be performed when the axes are not in operation. Do not make a stop request, either. Check the axis group settings.

(Note): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

Error code	Error name	Description	Object	Recovered	Countermeasures
3033H	Interpolation operation error	The operation stopped as an error occurred on other interpolation axis during the interpolation operation.	Each axis	Yes	Check the set values for positioning data on interpolation. If the error occurs repeatedly with the correct set values, consult your Panasonic representative.
3035H	Positioning movement amount error	The positioning movement amount has exceeded the upper or lower limit.	Each axis	Yes	Check the set value.
3040H	Synchronous operation group error	The synchronous group was changed during the synchronous operation or when requesting the stop in the synchronous operation. The setting of synchronous group is out of range. An error occurred in the home return of the synchronous operation.	Each axis	Yes	Changing the synchronous group should be performed when the busy flag for the axes to be synchronized is off. Also, it should be performed when various stop requests (system stop, emergency stop, deceleration stop) are off.
3043H	Synchronous operation error	The operation has stopped as an error occurred on another axis while the positioning unit is in synchronous operation.	Each axis	Yes	Check the unit setting of the stopped axis. If the error occurs repeatedly with the correct set values, consult your Panasonic representative.
3046H	Movement automatic check value error	The difference between the command value and feedback value exceeded the movement automatic check value with the movement automatic check function.	Each axis	Yes	Check the operation of the target axes. Check the parameter of the movement amount automatic check function.
3050H	Torque judgment error	The torque value exceeds the setting upper and lower limit values.	Each axis	Yes	Design the system within the range that the torque of the motor does nto exceed the judgment value. Check the torque judgment value.
3051H	Actual speed judgment value error	The actual speed exceeds the setting upper and lower limit values.	Each axis	Yes	Design the system within the range that the actual speed of the motor does nto exceed the judgment value. Check the actual speed jdgement value.
3060H	Home return not executable error	The home return could not be executed as AMP parameter settings and signal input were not correct.	Each axis	Yes	Check the parameters of AMP and signal inputs.

(Note): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

14.3.4 Setting Value Errors (From 00F0 4000H)

These are the errors in the various setting values specified using the positioning setting menu of the programming tool or ladder programs.

Error code	Error name	Description	Object	Recovered	Countermeasures
4000H	Axis group setting error	The settings of axis groups are not correct.	Each axis	Yes	Check the following items in the settings of the axis group and independent axis. - The same axis number has been registered in more than one group. - Four or more axes have been set in one group. - The group is composed of one axis only.
4002H	Unit setting error	The unit system for the axis setting is out of the range.	Each axis	Yes	Check if the unit is one of the followings. pulse, μm, inch, degree
4004H	Pulse number per revolution error	The number of pulses is out of the range.	Each axis	Yes	Check the set value. If the setting value is out of the range, reduce it by the following formula. (Pulse number per rotation) / (Movement amount per rotation)
4005H	Movement per revolution error	The movement amount is out of the range.	Each axis	Yes	
4010H	Software limit setting error	The upper or lower limit value of software limit is out of the range.	Each axis	Yes	Check the set value. If the error occurs repeatedly with the correct set values, consult your Panasonic representative.
4020H	Limit stop deceleration time error	The limit stop deceleration time is out of the range.	Each axis	Yes	
4021H	Error stop deceleration time error	The error stop deceleration time is out of the range.	Each axis	Yes	
4022H	Emergency stop deceleration time error	The emergency stop deceleration time is out of the range.	Each axis	Yes	
4028H	Auxiliary output setting error	The settings of auxiliary output are not correct. A mode other than With mode or Delay mode has been set for the auxiliary output mode. The auxiliary output delay ratio of Delay mode is not in the range of 0 to 100 (%).	Each axis	Yes	
4030H	Synchronous group setting error	The same axis has been set for the synchronous groups 1 and 2. Either master axis or slave axis has not been set. Multiple master axes or slave axes have been set. The same axis has been set for the master and slave axes. - The slave axis has been set to the interpolation group.	Each axis	Yes	

(Note): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

Error code	Error name	Description	Object	Recovered	Countermeasures
4044H	Speed rate error	The stting of th speed rate is out of the range.	Each axis	Yes	
4050H	Startup speed error	The startup speed is out of the range.	Each axis	Yes	
4080H	JOG positioning acceleration/deceleration type error	The acceleration/deceleration method of the JOG positioning is out of the range.	Each axis	Yes	
4081H	JOG positioning operation acceleration time error	The acceleration time of the JOG positioning is out of the range.	Each axis	Yes	
4082H	JOG positioning operation deceleration time error	The deceleration time of the JOG positioning is out of the range.	Each axis	Yes	
4083H	JOG positioning operation target speed error	The target speed of the JOG positioning is out of the range.	Each axis	Yes	
4102H	Home return target speed error	The target speed of the home return is out of the range.	Each axis	Yes	
4105H	Home return acceleration time error	The acceleration time of the home return is out of the range.	Each axis	Yes	
4106H	Home return deceleration time error	The deceleration time of the home return is out of the range.	Each axis	Yes	
4107H	Home return setting code error	The home return setting code is incorrect.	Each axis	Yes	
4110H	Home return creep speed error	The creep speed of the home return is out of the range.	Each axis	Yes	Check the set value. If the error occurs repeatedly with the correct set values, consult your Panasonic representative.
4111H	Home return direction error	The moving direction of the home return is out of the range.	Each axis	Yes	
4112H	Home return limit error	The limit switch is disabled. (It occurs when the home return method is set to the stop-on-contact method 1 or 2.)	Each axis	Yes	
4115H	Home return stop-on-cotnact torque value error	The home return stop-on-contact torque value is out of the range. (It occurs when the home return method is set to the stop-on-contact method 1 or 2.)	Each axis	Yes	
4116H	Home return stop-on-contact judgment time error	The home return stop-on-contact judgment time is out of the range. (It occurs when the home return method is set to the stop-on-contact method 1 or 2.)	Each axis	Yes	
4120H	Home coordinate error	The set home coordinates are out of the range.	Each axis	Yes	
4201H	JOG operation target speed error	The target speed of the JOG operation is out of the range.	Each axis	Yes	
4203H	JOG operation acceleration/deceleration type error	The acceleration/deceleration type of the JOG operation is incorrect.	Each axis	Yes	
4204H	JOG operation acceleration time error	The acceleration time of the JOG operation is out of the range.	Each axis	Yes	
4205H	JOG operation deceleration time error	The deceleration time of the JOG operation is out of the range.	Each axis	Yes	
4206H	Inching movement amount error	The inching movement amount is out of the range.	Each axis	Yes	

(Note): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

Error code	Error name	Description	Object	Recovered	Countermeasures
4250H	Current value update error	The setting value of the current value update is out of the range.	Each axis	Yes	Check the set value. If the error occurs repeatedly with the correct set values, consult your Panasonic representative.
4301H	Absolute/incremental setting error	A value other than the absolute/increment is set for the move method.	Each axis	Yes	
4302H	Dwell time error	The setting value of the dwell time is out of the range.	Each axis	Yes	
4303H	Positioning starting table no. error	The specified table number is 0, or it exceeds the maximum table number.	Each axis	Yes	
4304H	Table setting error	The last table of the positioning setting tables is not point E.	Each axis	Yes	
4400H	Positioning movement amount setting error	The movement amount of the positioning operation is out of the range.	Each axis	Yes	
4401H	Positioning acceleration/deceleration type error	The acceleration/deceleration type of the positioning operation is incorrect.	Each axis	Yes	
4402H	Positioning acceleration time error	The acceleration time of the positioning operation is out of the range.	Each axis	Yes	
4403H	Positioning deceleration time error	The deceleration time of the positionign operation is out of the range.	Each axis	Yes	
4404H	Positioning target speed error	The target speed of the positioning operation is out of the range.	Each axis	Yes	
4500H	Interpolation type error	The setting of the interpolation type is incorrect.	Each axis	Yes	
4504H	Circular interpolation not executable	The parameter of the circular interpolation (such as center point or pass point) is incorrect.	Each axis	Yes	
4505H	Spiral interpolation not executable	The error occurred during the spiral interpolation as the setting value is incorrect.	Each axis	Yes	
4609H	Movement automatic check operation method setting error	The setting for the operation of movement automatic check function is incorrect.	Each axis	Yes	

(Note): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

14.3.5 Synchronous Parameter Setting Errors (From 00F0 5000H)

■ Synchronous parameter: Common errors

Error code	Error name	Description	Object	Recovered	Countermeasures
5000H	Synchronous master setting value error	The setting for the synchronous master axis is incorrect. ⇒Setting error (Value is incorrect.) ⇒Own axis setting	Each axis	Yes	Check the set value. If the error occurs repeatedly with the correct set values, please contact us.
5002H	Synchronous setting disable error	The synchronous setting rquest was made in the following axis setting . - Its own axis (slave axis) is set as the master of another axis. - The master axis is set as the slave axis of another axis. - Its own axis (slave axis) belongs to the interpolation group.	Each axis	Yes	
5006H	Synchronous slave single deceleration stop deceleration time	The setting for the synchronous slave single deceleration stop time is incorrect.	Each axis	Yes	Check the set value. If the error occurs repeatedly with the correct set values, please contact us.

(Note): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

■ Synchronous parameter: Electronic gear related errors

Error code	Error name	Description	Object	Recovered	Countermeasures
5100H	Electronic gear - Gear ratio numerator setting error	The setting for the gear ratio numerator of the electronic gear is incorrect.	Each axis	Yes	Check the set value. If the error occurs repeatedly with the correct set values, please contact us.
5101H	Electronic gear - Gear ratio denominator setting error	The setting for the gear ratio denominator of the electronic gear is incorrect.	Each axis	Yes	
5102H	Electronic gear- Gear ratio change time setting error	The setting for the gear ratio change time of the electronic gear is incorrect.	Each axis	Yes	

(Note): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

■ Synchronous parameter: Electronic clutch related errors

Error code	Error name	Description	Object	Recovered	Countermeasures
5200H	Electronic clutch - Clutch ON trigger type setting error	The setting for the clutch ON trigger type is incorrect.	Each axis	Yes	Check the set value. If the error occurs repeatedly with the correct set values, please contact us.
5201H	Electronic clutch - Clutch ON edge selection setting error	The setting for the clutch ON edge selection is incorrect.	Each axis	Yes	
5203H	Electronic clutch - Clutch OFF trigger type setting error	The setting for the clutch OFF trigger type is incorrect.	Each axis	Yes	
5204H	Electronic clutch - Clutch OFF edge selection setting error	The setting for the clutch OFF edge selection is incorrect.	Each axis	Yes	
5207H	Electronic clutch - Clutch ON method setting error	The setting for the clutch ON method is incorrect.	Each axis	Yes	
5208H	Electronic clutch - Clutch ON slip method setting error	The setting for the clutch ON slip method is incorrect.	Each axis	Yes	
5209H	Electronic clutch - Clutch ON slip time setting error	The setting for the clutch ON slip time is incorrect.	Each axis	Yes	
5210H	Electronic clutch - Clutch ON slip curve selection setting error	The setting for the clutch ON slip curve is incorrect.	Each axis	Yes	
5211H	Electronic clutch - Clutch OFF method setting error	The setting for the clutch OFF method is incorrect.	Each axis	Yes	
5212H	Electronic clutch - Clutch OFF slip method setting error	The setting for the clutch OFF slip method is incorrect.	Each axis	Yes	
5213H	Electronic clutch - Clutch OFF slip time setting error	The setting for the clutch OFF slip time is incorrect.	Each axis	Yes	
5214H	Electronic clutch - Clutch OFF slip curve selection setting error	The setting for the clutch OFF slip curve is incorrect.	Each axis	Yes	

(Note): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

■ Synchronous parameter: Electronic cam related errors

Error code	Error name	Description	Object	Recovered	Countermeasures
5300H	Electronic cam - Cam control synchronous master axis cycle setting error	The setting for the cam control synchronous master axis cycle is incorrect.	Each axis	Yes	Check the set value.。 If the error occurs repeatedly with the correct set values, please contact us.
5301H	Electronic cam - Used cam pattern no. setting error	The used cam pattern number is out of the range. The used cam pattern number is not registered.	Each axis	Yes	
5302H	Electronic cam - Cam stroke amount setting error	The setting for the cam stroke amount is incorrect.	Each axis	Yes	

(Note): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

■ Cam pattern related errors

Error code	Error name	Description	Object	Recovered	Countermeasures
5400H	Cam pattern resolution setting error	The setting for the cam pattern resolution is out of the range.	Each axis	Yes	Check the set value.。 If the error occurs repeatedly with the correct set values, please contact us.
5401H	Cam pattern set number setting error	The cam pattern set number is out of the range.	Each axis	Yes	
5402H	Cam pattern section function setting error	The setting for the cam pattern section function is out of the range.	Each axis	Yes	
5403H	Cam pattern control start position setting error	The setting for the cam pattern control start position is out of the range.	Each axis	Yes	
5404H	Cam pattern start phase setting error	The start phase setting for each section of cam pattern is out of the range.	Each axis	Yes	
5405H	Cam pattern displacement setting error	The displacement for each section of cam pattern is out of the range.	Each axis	Yes	
5406H	Cam pattern cam curve no. setting error	The curve number for each section of cam pattern is out of the range.	Each axis	Yes	
5410H	Adjustment data total no. setting error	The total number of cam pattern adjustment data is out of the range.	Each axis	Yes	
5411H	Adjustment data no. setting error	The number of cam pattern adjustment data is out of the range. (cam pattern unit)	Each axis	Yes	
5413H	Adjustment data control point setting error	The control point of cam pattern adjustment data is out of the range.	Each axis	Yes	
5414H	Out-of-range adjustment data setting error	The adjustment value of cam pattern adjustment data is out of the range.	Each axis	Yes	

(Note): To simplify the displays, only the lower four digits (Hex) of each error code are displayed in the above table.

14.4 Warning Code Table

14.4.1 Unit Warnings (From 00B0 0000H)

These are the warning codes to be given when the warnings occurred in the unit.

Error code	Error name	Description	Object	Recovered	Countermeasures
0008H	SD memory card warning	The SD memory card access error occurred.	All axes	Yes	Check if an SD memory card is inserted correctly.
0010H	Duplicate startup	The same axis was requested to start even though the axis operation has not completed.	Each axis	Yes	The requests for the axes being operated cannot be executed, except the following requests. - System stop request flag (all axes) - Emergency stop request flag (each axis) - Deceleration stop request flag (each axis)
0030H	J-point simultaneous startup warning	“J-point speed change request” and J-point positioning start request” turned ON simultaneously during the JOG positioning operation. The J-pont speed change request turned ON during acceleraiton/deceleration.	Each axis	Yes	When the both requests have been turned on simultaneously, “J-point positioning start request” has a priority, and “J-point speed change request” is ignored. Please program to turn on the J-pont speed change request during turned ON during the constant speed control.
0031H	J-point speed change request warning	The J-point speed change request turned ON when J-point operation is not active.	Each axis	Yes	Check the timing that the J-point speed change request turns ON.
0032H	J-point positioning start request warning	The J-point positioning start request turned ON when J-point operation is not active.	Each axis	Yes	Check the timing that the J-point positioning change request turns ON.
0046H	Movement automatic check warning	The difference between the command value and feedback value exceeded the specified movement automatic check value with the movement automatic check function. This warning occurs when setting the movement automatic check operation to "Warning".	Each axis	Yes	Check the operation of the target axes.
0050H	Torque judgment error	The torque value exceeds the setting upper and lower limit values.	Each axis	Yes	- Design the system within the range that the torque of the motor does nto exceed the judgment value. - Check the torque judgment value.

Error code	Error name	Description	Object	Recovered	Countermeasures
0051H	Actual speed judgment value error	The actual speed exceeds the setting upper and lower limit values.	Each axis	Yes	- Design the system within the range that the actual speed of the motor does nto exceed the judgment value. - Check the actual speed judgement value.
0100H	Synchronous setting change disable warning	The change of the synchronous setting was requested on an operating axis.	Each axis	Yes	Changing the synchronous setting should be performed when the busy flag for the axes to be synchronized is off.

(Note): To simplify the displays, only the lower four digits (Hex) of each warning code are displayed in the above table.

15

Specifications

15.1 Specifications

15.1.1 General Specifications

Items	Description
Operating ambient temperature	0°C to +55°C
Storage ambient temperature	-40°C to +70°C
Operating ambient humidity	10% to 95%RH (at 25°C with no-condensing)
Storage ambient humidity	10% to 95%RH (at 25°C with no-condensing)
Breakdown voltage	Each external connector pin and entire power supply terminals of CPU unit 500 V AC for 1 minute
Insulation resistance	Each external connector pin and entire power supply terminals of CPU unit 100 MΩ min. (at 500 V DC)
Vibration resistance	Conforming to JIS B 3502 and IEC 61131-2 5 to 8.4 Hz, 3.5-mm single amplitude 8.4 to 150 Hz, acceleration of 9.8 m/s2 10 sweeps each in X, Y and Z directions (1 octave/min)
Shock resistance	Conforming to JIS B 3502 and IEC 61131-2 147 m/s2 min in X, Y, and Z directions three times each.
Noise resistance	1,000 V [p-p], pulse width of 50 ns/1 μs (by noise simulator)
Environment	Free from corrosive gases and excessive dust.
EC Directive applicable standard	EMC directive: EN 61131-2
Overvoltage category	Category II or lower
Pollution degree	Pollution degree 2 or lower
Internal current consumption	120 mA or less
Weight	Approx. 150 g

15.1.2 Communication Specifications

Item	Description
Communication standard	IEC 61158 Type12
Physical layer	100BASE-TX (IEEE802.3)
Baud rate	100M bps
Trasmission distance	Max. distance between nodes: 100 m
Topology	Daisy chain (without brach)
Applicable cable	Shielded twisted-pair cable (Category 5e or higher)
Connector	9-pin RJ45 x 1
Communication cycle	0.5ms / 1ms / 2ms / 4ms
No. of connected slaves	Max. 16 / 32 / 64 slaves (according to models)
Coonnected slave	Panasonic AC servo motor A5B series

(Note): Hubs for EtherCAT and Ethernet cannot be used.

15.1.3 Performance Specifications

<table>
<tr><th colspan="5" rowspan="2">Item</th><th colspan="3">Description</th></tr>
<tr><th>AFP7MC16EC</th><th>AFP7MC32EC</th><th>AFP7MC64EC</th></tr>
<tr><td colspan="5">No. of control axes</td><td>Real axis: 16 axes
Virtual axis: 8 axes</td><td>Real axis: 32 axes
Virtual axis: 16 axes</td><td>Real axis: 64 axes
Virtual axis: 32 axes</td></tr>
<tr><td colspan="5">Interpolation control</td><td colspan="3">2-axis linear interpolation, 2-axis circular interpolation, 3-axis linear interpolation, 3-axis spiral interpolation</td></tr>
<tr><td colspan="5">No. of occupied I/O points</td><td colspan="3">Input: 16 points, Output: 16 points</td></tr>
<tr><td rowspan="14">Automatic operation</td><td rowspan="14">Positioning control CPS</td><td colspan="3">Position specification method</td><td colspan="3">Absolute (specified absolute position), Increment (specified relative position)</td></tr>
<tr><td colspan="3">Position specified unit</td><td colspan="3">pulse
μm (select a minimum instruction unit of 0.1 μm or 1 μm)
inch (select a minimum instruction unit of 0.00001 inch or 0.0001 inch)
degree (select a minimum instruction unit of 0.1 degree or 1 degree)</td></tr>
<tr><td colspan="3">Position reference range</td><td colspan="3">pulse: -2147483648~+2147483647 pulse
μm (0.1 μm): -214748364.8~+214748364.7 μm
μm (1 μm): -2147483648~+214748364.8 μm
inch (0.00001 inch): -21474.83648~+21474.83648 inch
inch (0.0001 inch): -214748.3648~+214748.3648 inch
degree (0.1 degree): -214748364.8~+214748364.7 degree
degree (1 degree): -2147483648~+2147483647 degree</td></tr>
<tr><td colspan="3">Speed reference range</td><td colspan="3">pulse: 1 to 32,767,000 pps
μm: 1 to 32,767,000 μm/s
inch: 0.001 to 32,767.000 inch/s
degree: 0.001 to 32,767.000 rev/s</td></tr>
<tr><td colspan="3">Acceleration/deceleration type</td><td colspan="3">Linear acceleration/deceleration
S-shaped acceleration/deceleration</td></tr>
<tr><td colspan="3">Acceleration time</td><td colspan="3">0 to 10,000 ms (adjustable in 1-ms increments)</td></tr>
<tr><td colspan="3">Deceleration time</td><td colspan="3">0 to 10,000 ms (adjustable in 1-ms increments)</td></tr>
<tr><td colspan="3">No. of positioning tables</td><td colspan="3">Each axis: 1000 points</td></tr>
<tr><td rowspan="5">Control method</td><td colspan="2">Independent</td><td colspan="3">PTP control (E- and C-point control)
CP control (P-point control)
JOG positioning control (J-point control)</td></tr>
<tr><td rowspan="2">2-axis interpolation</td><td>Linear interpolation</td><td colspan="3">E-, P-, C-point control; composite speed or long-axis speed specification</td></tr>
<tr><td>Circular interpolation</td><td colspan="3">E-, P-, C-point control; center or passing point specification</td></tr>
<tr><td rowspan="2">3-axis interpolation</td><td>Linear interpolation</td><td colspan="3">E-, P-, C-point control; composite speed or long-axis speed specification</td></tr>
<tr><td>Spiral interpolation</td><td colspan="3">E-, P-, C-point control; center or passing point specification</td></tr>
<tr><td colspan="3">Other functions</td><td colspan="3">Dwell time: 0 to 32,767 ms (Settable by 1 ms), auxiliary output contact, auxiliary output code</td></tr>
</table>

Item			Description		
			AFP7MC16EC	AFP7MC32EC	AFP7MC64EC
Synchronous operation function	Synchronous basic setting	Master axis	Selectable from real axes, virtual axes and pulse inputs.		
		Slave axis	Max. 8 axes/master	Max. 16 axes/master	Max. 32 axes/master
	Electronic gear	Operation setting	Gear ratio setting		
		Operation method	Direct method, acceleration/deceleration methodv		
	Electronic clutch	Clutch ON trigger	Contact input		
		Clutch method	Direct method, linear slide method		
	Electronic cam	Cam curve	Select from 20 types. Multiple curves can be specified within phase (0 to 100%)		
		Resolution	1024, 2048, 4096, 8192, 16384, 32768		
		No. of cam patterns	16 to 64 (According to resolution)	32 to 128 (According to resolution)	64 to 256 (According to resolution)
Manual operation	JOG/Inching operation	Speed reference range	pulse: 1 to 32,767,000 pps μm: 1 to 32,767,000 μm/s inch: 0.001 to 32,767.000 inch/s degree: 0.001 to 32,767.000 rev/s		
		Acceleration/deceleration type	Linear acceleration/deceleration, S acceleration/deceleration		
		Acceleration time	0 to 10,000 ms (adjustable in 1-ms increments)		
		Deceleration time	0~10,000 ms (adjustable in 1-ms increments)		
	Home return	Speed reference range	pulse: 1 to 32,767,000 pps μm: 1 to 32,767,000 μm/s inch: 0.001 to 32,767.000 inch/s degree: 0.001 to 32,767.000 rev/s		
		Acceleration/deceleration type	Linear acceleration/deceleration		
		Acceleration time	0 to 10,000 ms (adjustable in 1-ms increments)		
		Deceleration time	0 to 10,000 ms (adjustable in 1-ms increments)		
		Return method	DOG method (4 types), Limit method (2 types), Z phase method, Stop-on-contact method (2 types), Data set method		
Stop function	Stop operation type		System stop, emergency stop, limit stop, error stop, deceleration stop, pause		
	Stop deceleration time		The system stops when the deceleration time of all axes reaches 1 ms. The deceleration time of emergency stop, limit stop, error stop, deceleration stop and pause is 0 to 10,000 ms. (Settable by 1 ms.)		
Memory backup			The data of communication parameters, positioning parameters and positioning tables is saved in the FROM within FP7 MC Unit (without battery). Guaranteed number of times of writing: Up to 10000 times		
Other functions (Note 1)			General-purpose input: 5 points, General-purpose output: 1 point (Input/output from AMP) Torque monitor, actual speed monitor		

(Note 1): Two points out of five general-purpose inputs are used as limit inputs.

15.2 I/O Allocation

- In FP7 MC Unit, the I/O signals common to each axis are allocated to the I/O numbers in the following table.
- The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.

■ Allocation of I/O numbers (Input)

I/O no.	Target axis	Name	Description
X0	All axes	Link establishment	Announces the establishment of the network link. ON: Link is establised, OFF: Link is stopped
X1	All axes	EC packet monitor active	Turns on when the monitoring of EtherCAT communication packet is executed by the EC packet monitor request (Y1). ON: Monitoring is executed, OFF: Monitoring stops
X2	—	(Reserved for system)	—
X3	All axes	FROM writing active	Announces that data (positioning parameters, positioning tables) in the unit memory is being written in the FROM. ON: Writing is in progress, OFF: Writing is complete (Normal or abnormal end)
X4	All axes	Tool operation	Flag to indicate that the positioning unit is in tool operation. The start-up by a user program (output control area) is not available during the Tool operaiton. If it performs, a warning will occur. ON: Tool operation is being executed, OFF: Tool operation is not executed
X5	All axes	All groups setting done	Makes axis group setting changes in the unit with the axis group setting request contact (Y5) turned ON after making setting changes in the axis group with the program. The contact turns ON upon completion of the setting changes.
X6	—	(Reserved for system)	-
X7	All axes	Recalculation done	Tthe positioning data of the unit memory is restructured by turning on the recalculation request contact (Y7). This contact turns on after the completion of restructuring. If the recalculation request contact (Y7) turns on again, this contact will be off once. Note) It is used only when the positioning data has been rewritten by laddar programs.
X8-XD	—	(Reserved for system)	-
XE	All axes	SD memory card access active	Turns on while accessing an SD memory card. ON: Access in progress, OFF: Access stops
XF	All axes	Initialization done	Indicates that the initial preparation of FP7 MC Unit has been completed by reading the setting data from the FROm in the unit when the power turns on. ON: FP7 MC Unit preparation done, OFF: FP7 MC Unit in preparation

(Note 1): The I/O numbers in the above table show relative addresses based on the base word number. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.
Example) The link establishment flag is X100 for slot number 1 if the starting word is number 10.

■ Allocation of I/O Numbers (Output)

I/O no.	Target axis	Name	Description
Y0	All axes	System stop	Request the system stop. When it turns on, all axes stops with the deceleration time of 1 ms. While this is on, all operation cannot be started.
Y1	All axes	EC packet monitor request	Requests the start of the monitor of EtherCAT communication packet when the EC packet monitor request flag is enabled by "MC common parameter". The packet data is saved in a SD memory card. The monitorint stops when (Y1) turns off. The monitoring also stops, and (X1) turns off when the packet monitor capacity reaches 6 Mbytes or 3904 packets.
Y2	—	—	—
Y3	All axes	FROM write request	Requests the writing of data (parameters, positioning tables) in the unit memory to teh FROM. The FROM writing active flag (X3) is on during the writing, and (X3) turns off on completion of the writing. The writing result is stored in the unit memory (UM283).
Y4	—	(Reserved for system)	—
Y5	All axes	Axis group setting change request	This is used for changing the "Axis group setting" in the unit memory by user programs. Execute the following procedures by user programs. 1) Write data to "Axis group setting area". 2) Turn on "Axis group setting change request (Y5)". 3) After confirming "Axis grup setting done flag (X5)" turns on, turn off (Y5).
Y6	—	(Reserved for system)	—
Y7	All axes	Recalculation request	This is used for changing the "positioning table data" stored in the system area within FP7 MC Unit by user programs. The positioning data after the table number starting the recalculation specified in the unit memory can be restructured and is executable by turning on this signal. Execute the following procedures by user programs. 1) Write data to "positioning table". 2) Turn on "Recalculation request (Y7)". 3) After confirming "Recalculation done flag (X7)" turns on, and turn off (Y7). For details, refer to "8.5 Rewriting Positioning Data by User Programs".
Y8-YF	—	(Reserved for system)	—

(Note 1): The I/O numbers in the above table show relative addresses based on the base word number. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.
Example) The system stop request signal is Y100 for slot number 1 if the starting word is number 10.

15.3 Whole Configuration of Unit Memories

The unit memories of F7 MC Unit are configured as follows. For details of each area, refer to "15.4 to 15.8".

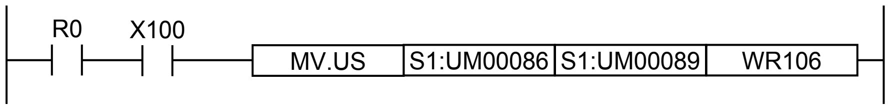
<table>
<tr><th>Name</th><th>Unit memory no. (Hex.)</th><th>No. of occupied words</th><th>Individual name of each area</th></tr>
<tr><td>Reserved area for the system</td><td>UM00000 - UM0007F</td><td>128 words</td><td>Reserved area for the system</td></tr>
<tr><td>Input control area</td><td>UM00080 - UM0017F</td><td>256 words</td><td>Input control area</td></tr>
<tr><td>Output control area</td><td>UM00180 - UM0027F</td><td>256 words</td><td>Output control area</td></tr>
<tr><td rowspan="14">Common area</td><td>UM00280 - UM0037F</td><td>256 words</td><td>Setting parameter control area</td></tr>
<tr><td>UM00380 - UM003FF</td><td>128 words</td><td>Operation speed rate area</td></tr>
<tr><td>UM00400 - UM0048F</td><td>144 words</td><td>Reserved area for the system</td></tr>
<tr><td>UM00490 - UM0058F</td><td>256 words</td><td>Axis group setting area</td></tr>
<tr><td>UM00590 - UM0068F</td><td>256 words</td><td>Current value update data area</td></tr>
<tr><td>UM00690 - UM0098F</td><td>768 words</td><td>Reserved area for the system</td></tr>
<tr><td>UM00990 - UM009EF</td><td>96 words</td><td>Positioning control starting table number setting area</td></tr>
<tr><td>UM009F0 - UM00A4F</td><td>96 words</td><td>Positioning control area</td></tr>
<tr><td>UM00A50 - UM00A8F</td><td>64 words</td><td>Reserved area for the system</td></tr>
<tr><td>UM00A90 - UM0170F</td><td>3200 words</td><td>Error announciation & clear area</td></tr>
<tr><td>UM01710 - UM0238F</td><td>3200 words</td><td>Warning announciation & clear area</td></tr>
<tr><td>UM02390 - UM025CF</td><td>576 words</td><td>Synchronous axis control monitor area
For (6 words for each axis) x (64 real axes + 32 virtual axes)</td></tr>
<tr><td>UM025D0 - UM0260F</td><td>64 words</td><td>Reserved area for the system</td></tr>
<tr><td>Reserved area for the system</td><td>UM02610 - UM0263F</td><td>48 words</td><td>Reserved area for the system</td></tr>
<tr><td>Each axis information monitor area</td><td>UM02640 - UM0323F</td><td>3072 words</td><td>Each axis information monitor area
For (32 words for each axis) x (64 real axes + 32 virtual axes)</td></tr>
<tr><td rowspan="3">Each axis setting area</td><td>UM03240 - UM0623F</td><td>12288 words</td><td>Parameter setting area
For (128 words for each axis) x (64 real axes + 32 virtual axes)</td></tr>
<tr><td rowspan="2">UM06240 - UM63EFF</td><td rowspan="2">384192 words</td><td>No. of buffers: 24
For (16008 words for each buffer) x (24 buffers)</td></tr>
<tr><td>The configuration per buffer is as follows.
Buffer control area: 8 words
Table data setting area: 16000 words</td></tr>
<tr><td>Reserved area for the system</td><td>UM63F00 - UM63F3F</td><td>64 words</td><td>Reserved area for the system</td></tr>
</table>

Name	Unit memory no. (Hex.)	No. of occupied words	Individual name of each area
Synchronous control setting area	UM63F40 – UM65B3F	7168 words	For (112 words for each axis) x (64 real axes) The configuration per axis is as follows. Synchronous control setting area: 16 words Common setting area: 16 words Clutch control area: 48 words Electronic cam setting area: 32 words
	UM65B40 - UM6693F	3584 words	Reserved area for the system
Reserved area for the system	UM66940 - UM66D47	1032 words	Reserved area for the system

■ Reading from unit memories (UM)

It is possible to read the areas which are shown with "Available" in the "R" column in the following table using transfer instructions or arithmetic instructions with user programs. The operand of an instruction is specified by the combination of the slot number where the slot is installed and a unit memory number (UM).

Example) Program to read the input control area (UM00086-UM00089) of the FP7 MC Unit installed in the slot no. 1 (S1) to an arbitrary internal relay area (WR106-WR109)



■ Writing to unit memories (UM)

- It is possible to write to the areas which are shown with "Available" in the "W" column in the following table using transfer instructions or arithmetic instructions with user programs. The operand of an instruction is specified by the combination of the slot number where the slot is installed and a unit memory number (UM).
- Be sure not to execute writing in the reserved areas for the system.

15.4 Unit Memories (Input and Output Control Areas)

15.4.1 Configuration of Input Control Area

Whole unit memory map

Address	Area	Size
UM 00000 – UM 0007F	System area	128 words
UM 00080 – UM 0017F	Input control area	256 words
UM 00180 – UM 0027F	Output control area	256 words
UM 00280 – UM 0260F	Common area	9,104 words
UM 02610 – UM 0263F	System area	48 words
UM 02640 – UM 0323F	Each axis information area	3,072 words
UM 03240 – UM 63EFF	Each axis setting area	396,480 words
UM 63F00 – UM 63F3F	System area	64 words
UM 63F40 – UM 6693F	Synchronous control setting area	10,752 words

Starting no.	Name	No. of words
UM 00080	Reserved area for the system	6 words
UM 00086	Each axis connection confirmation	4 words
UM 0008A	Servo lock annunciation	4 words
UM 0008E	Reserved area for the system	2 words
UM 00090	Busy annunciation	6 words
UM 00096	Operation done annunciation	6 words
UM 0009C	Home return done annunciation	6 words
UM 000A2	Near home input	4 words
UM 000A6	Reserved area for the system	6 words
UM 000AC	Auxiliary contact	6 words
UM 000B2	Limit + / Limit -	8 words
UM 000BA	Error annunciation	6 words
UM 000C0	Warning annunciation	6 words
UM 000C6	Synchronous setting done annunciation	4 words
UM 000CA	Reserved area for the system	2 words
UM 000CC	Synchronous cancel active announciation	4 words
UM 000D0	Reserved area for the system	2 words
UM 000D2	Slave axis gear ratio change annunciation	4 words
UM 000D6	Reserved area for the system	2 words
UM 000D8	Slave axis clutch operation annunciation	4 words
UM 000DC	Reserved area for the system	2 words
UM 000DE	General-purpose input	32 words
UM 000FE	Registered slave table	12 words
UM 0010A	Network participating slave table	12 words
UM 00116	Reserved area for the system	12 words
UM 00122	Normal slave table	12 words
UM 0012E	Abnormal slave table	12 words
UM 0013A	Reserved area for the system	70 words

15.4.2 Configuration of Output Control Area

Whole unit memory map

Start	End	Area	Size
UM 00000	UM 0007F	System area	128 words
UM 00080	UM 0017F	Input control area	256 words
UM 00180	UM 0027F	Output control area	256 words
UM 00280	UM 0260F	Common area	9,104 words
UM 02610	UM 0263F	System area	48 words
UM 02640	UM 0323F	Each axis information area	3,072 words
UM 03240	UM 63EFF	Each axis setting area	396,480 words
UM 63F00	UM 63F3F	System area	64 words
UM 63F40	UM 6693F	Synchronous control setting area	10,752 words

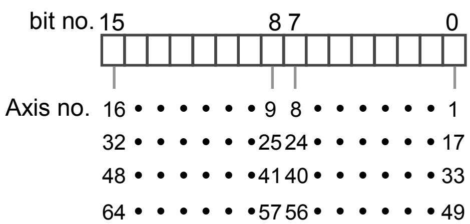
Starting no.	Name	No. of words
UM 00180	Reserved area for the system	6 words
UM 00186	Servo ON request	4 words
UM 0018A	Reserved area for the system	2 words
UM 0018C	Servo OFF request	4 words
UM 00190	Reserved area for the system	2 words
UM 00192	Positioning start request	6 words
UM 00198	Home return start request	6 words
UM 0019E	JOG operation Forward/Reverse request	12 words
UM 001AA	Inching operation request	6 words
UM 001B0	Emergency stop request	6 words
UM 001B6	Deceleration stop request	6 words
UM 001BC	J point speed change request	6 words
UM 001C2	J point positioning start request	6 words
UM 001C8	Error clear request	6 words
UM 001CE	Warning clear request	6 words
UM 001D4	Synchronous setting request	4 words
UM 001D8	Reserved area for the system	2 words
UM 001DA	Synchronous cancel request	4 words
UM 001DE	Reserved area for the system	2 words
UM 001E0	Slave axis gear ratio change request	4 words
UM 001E4	Reserved area for the system	2 words
UM 001E6	Slave axis clutch ON request	4 words
UM 001EA	Reserved area for the system	2 words
UM 001EC	Slave axis clutch OFF request	4 words
UM 001F0	Reserved area for the system	2 words
UM 001F2	General-purpose output	8 words
UM 001FA	Reserved area for the system	134 words

15.4.3 List of Input Control Area Functions

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
-	UM 00080 -UM 00085	Reserved for system	-	-	-	-
1-16	UM 00086	Each axis connection confirmation	H0	When corresponding axes exist, the bits corresponding to each axis number turn on.	●	-
17-32	UM 00087					
33-48	UM 00088					
49-64	UM 00089					
1-16	UM 0008A	Servo lock annunciation	H0	When corresponding axes are in the servo-locked state, the bits corresponding to each axis number turn on. [The update cycle is communication (EtherCAT communication) cycle.] 0 : Servo-free state 1 : Servo-locked state	●	-
17-32	UM 0008B					
33-48	UM 0008C					
49-64	UM 0008D					
-	UM 0008E -UM 0008F	Reserved for system	-	-	-	-
1-16	UM 00090	Busy annunciation	H0	When axes are operating by the start request of each control (positioning, JOG operation, home return), the bits corresponding to each axis number turn on.They turn off on completion of the operation.	●	-
17-32	UM 00091					
33-48	UM 00092					
49-64	UM 00093					
Virtual 1-16	UM 00094					
Virtual 17-32	UM 00095					
1-16	UM 00096	Operation done annunciation	H0	When the running operation of each control (positioning, JOG operation, home return) is completed, the bits corresponding to each axis number turn on. In the case of positioning control (P-, C-point control), they turn on when the execution of E-point table is completed. After this flag turns ON, the ON-state will continue until the next control is activated.	●	-
17-32	UM 00097					
33-48	UM 00098					
49-64	UM 00099					
Virtual 1-16	UM 0009A					
Virtual 17-32	UM 0009B					

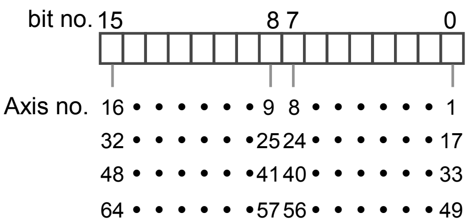
(Note 1): Flags for 16 axes are allocated to each area (1 word).



●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-16	UM 0009C	Home return done annunciation	H0	When the home return operation is completed, the bits corresponding to each axis number turn on. After this flag turns ON, the ON-state will continue until the next control is activated.	●	-
17-32	UM 0009D					
33-48	UM 0009E					
49-64	UM 0009F					
Virtual 1-16	UM 000A0					
Virtual 17-32	UM 000A1					
1-16	UM 000A2	Near home input	H0	Monitor flag for the near home input connected to the corresnponding AMP. [The update cycle is communication (EtherCAT communication) cycle.]	●	-
17-32	UM 000A3					
33-48	UM 000A4					
49-64	UM 000A5					
-	UM 000A6 -UM 000AB	Reserved for system	-	-	-	-
1-16	UM 000AC	Auxiliary contact	H0	This contact is enabled when the auxiliary output function has been set. When the positioning table is executed, the bits corresponding to each axis number turn on. The ON time and delay ratio depends on the contents specified in the axis parameter.	●	-
17-32	UM 000AD					
33-48	UM 000AE					
49-64	UM 000AF					
Virtual 1-16	UM 000B0					
Virtual 17-32	UM 000B1					

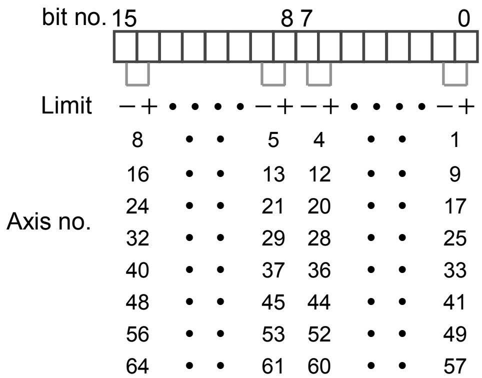
(Note 1): Flags for 16 axes are allocated to each area (1 word).



●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-8	UM 000B2	Limit + / Limit -	H0	Monitor flag of the limit + input and limit - input connected to the corresponding AMP. [The update cycle is communication (EtherCAT communication) cycle.] When "Limit switch" in the axis parameter is set to "Enabled", the following inputs of AMP are monitored. ･Limit switch +:SI-MON3 ･Limit switch: SI-MON4 When "Limit switch" in the axis parameter is set to "Disabled", the following inputs of AMP are monitored. ･Limit +: POT ･Limit: NOT When "Limit + input logic" and "Limit - input logic" in the axis parameter of FP7 MC Unit is set to "A contact", it is reflected by the same logic as the input of servo amplifier. When set to "B contact", it is reversed.	●	-
9-16	UM 000B3					
17-24	UM 000B4					
25-32	UM 000B5					
33-40	UM 000B6					
41-48	UM 000B7					
49-56	UM 000B8					
57-64	UM 000B8					

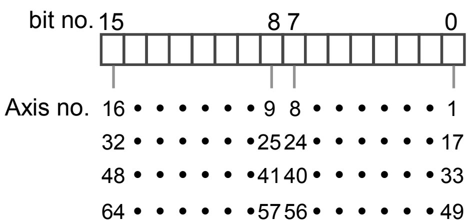
(Note 1): Flags for 16 axes are allocated to each area (1 word).



●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-16	UM 000BA	Error annunciation	H0	When an error occurs in FP7 MC Unit, the bits corresponding to each axis number turn on. The bits of all axes turn on if all axes have errors. The error contents are stored in the error annunciation buffer of the unit memory.	●	-
17-32	UM 000BB					
33-48	UM 000BC					
49-64	UM 000BD					
Virtual 1-16	UM 000BE					
Virtual 17-32	UM 000BF					
1-16	UM 000C0	Warning annunciation	H0	When a warning occurs in FP7 MC Unit, the bits corresponding to each axis number turn on. The bits of all axes turn on if all axes have warnings. The warning contents are stored in the warning buffer of the unit memory.	●	-
17-32	UM 000C1					
33-48	UM 000C2					
49-64	UM 000C3					
Virtual 1-16	UM 000C4					
Virtual 17-32	UM 000C5					
1-16	UM 000C6	Synchronous setting done annunciation	H0	Sets the synchronous setting in the unit by turning on the synchronous setting request of the output control area after setting the synchronous setting by the synchronous master axis selection for each axis. After the completion of the setting change, the bits corresponding to each axis number turnson.	●	-
17-32	UM 000C7					
33-48	UM 000C8					
49-64	UM 000C9					
-	UM 000CA -UM 000CB	Reserved for system	-	-	-	-
1-16	UM 000CC	Synchronous cancel active announciation	H0	When the synchronous operation is canceled by turning on the synchronous setting cancel request of the output control area after setting the synchronous setting by the synchronous master axis selection for each axis, the bits corresponding to each axis number turn on. Note) The synchronous operation cannot be executed for the axes for which this flag is on.	●	-
17-32	UM 000CD					
33-48	UM 000CE					
49-64	UM 000CF					
-	UM 000D0 -UM 000D1	Reserved for system	-	-	-	-

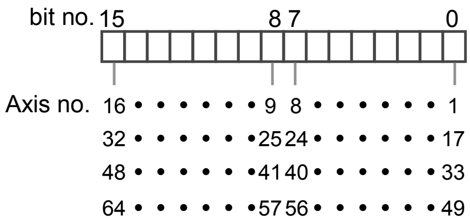
(Note 1): Flags for 16 axes are allocated to each area (1 word).



●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-16	UM 000D2	Slave axis gear ratio change annunciation	H0	Changes the gear ratio by the slave axis gear ratio change request of the output control area. After the completion of the change of gear ratio, the bits corresponding to each axis number turn on.	●	-
17-32	UM 000D3					
33-48	UM 000D4					
49-64	UM 000D5					
-	UM 000D6 -UM 000D7	Reserved for system	-	-	-	-
1-16	UM 000D8	Slave axis clutch operation annunciation	H0	Starts the clutch operation by turning on the slave axis clutch on request or clutch off request of the output control area. After the completion of the clutach operation, the bits corresponding to each axis number turn on.	●	-
17-32	UM 000D9					
33-48	UM 000DA					
49-64	UM 000DB					
-	UM 000DC -UM 000DD	Reserved for system	-	-	-	-

(Note 1): Flags for 16 axes are allocated to each area (1 word).



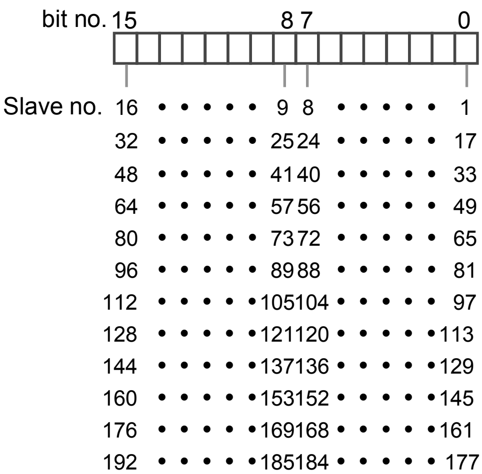
●: Available, -: Not available

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1-2</td><td>UM 000DE</td><td rowspan="32">General-purpose input</td><td rowspan="32">H0</td><td rowspan="32">Monitor flag for the general-purpose input connected to the corresnponding AMP. The input status of this flag does not affect on the operations of the motor and FP7 MC Unit.
<table>
<tr><th>bit</th><th>Signal name</th><th>Axis no.</th></tr>
<tr><td>0</td><td>NOT</td><td rowspan="8">1+2n</td></tr>
<tr><td>1</td><td>POT</td></tr>
<tr><td>2</td><td>HOME</td></tr>
<tr><td>3</td><td>SI-MON1 / EXT1</td></tr>
<tr><td>4</td><td>SI-MON2 / EXT2</td></tr>
<tr><td>5</td><td>SI-MON3</td></tr>
<tr><td>6</td><td>SI-MON4</td></tr>
<tr><td>7</td><td>SI-MON5/ E-STOP</td></tr>
<tr><td>8</td><td>NOT</td><td rowspan="8">2n</td></tr>
<tr><td>9</td><td>POT</td></tr>
<tr><td>10</td><td>HOME</td></tr>
<tr><td>11</td><td>SI-MON1 / EXT1</td></tr>
<tr><td>12</td><td>SI-MON2 / EXT2</td></tr>
<tr><td>13</td><td>SI-MON3</td></tr>
<tr><td>14</td><td>SI-MON4</td></tr>
<tr><td>15</td><td>SI-MON5/ E-STOP</td></tr>
</table></td><td rowspan="32">●</td><td rowspan="32">-</td></tr>
<tr><td>3-4</td><td>UM 000DF</td></tr>
<tr><td>5-6</td><td>UM 000E0</td></tr>
<tr><td>7-8</td><td>UM 000E1</td></tr>
<tr><td>9-10</td><td>UM 000E2</td></tr>
<tr><td>11-12</td><td>UM 000E3</td></tr>
<tr><td>13-14</td><td>UM 000E4</td></tr>
<tr><td>15-16</td><td>UM 000E5</td></tr>
<tr><td>17-18</td><td>UM 000E6</td></tr>
<tr><td>19-20</td><td>UM 000E7</td></tr>
<tr><td>21-22</td><td>UM 000E8</td></tr>
<tr><td>23-24</td><td>UM 000E9</td></tr>
<tr><td>25-26</td><td>UM 000EA</td></tr>
<tr><td>27-28</td><td>UM 000EB</td></tr>
<tr><td>29-30</td><td>UM 000EC</td></tr>
<tr><td>31-32</td><td>UM 000ED</td></tr>
<tr><td>33-34</td><td>UM 000EE</td></tr>
<tr><td>35-36</td><td>UM 000EF</td></tr>
<tr><td>3738</td><td>UM 000F0</td></tr>
<tr><td>39-40</td><td>UM 000F1</td></tr>
<tr><td>41-42</td><td>UM 000F2</td></tr>
<tr><td>43-44</td><td>UM 000F3</td></tr>
<tr><td>45-46</td><td>UM 000F4</td></tr>
<tr><td>47-48</td><td>UM 000F5</td></tr>
<tr><td>49-50</td><td>UM 000F6</td></tr>
<tr><td>51-52</td><td>UM 000F7</td></tr>
<tr><td>53-54</td><td>UM 000F8</td></tr>
<tr><td>55-56</td><td>UM 000F9</td></tr>
<tr><td>57-58</td><td>UM 000FA</td></tr>
<tr><td>59-60</td><td>UM 000FB</td></tr>
<tr><td>61-62</td><td>UM 000FC</td></tr>
<tr><td>63-64</td><td>UM 000FD</td></tr>
</table>

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-16	UM 000FE	Registered slave table	H0	Turns on bits corresponding to each station address (slave number) registered in ENI file.	●	-
17-32	UM 000FF					
33-48	UM 00100					
49-64	UM 00101					
65-80	UM 00102					
81-96	UM 00103					
97-112	UM 00104					
113-128	UM 00105					
129-144	UM 00106					
145-160	UM 00107					
161-176	UM 00108					
177-192	UM 00109					
1-16	UM 0010A	Network participating slave table	H0	Turns on the bits corresponding to each station address (slave number) in the OP mode out of the slaves participating in the network.	●	-
17-32	UM 0010B					
33-48	UM 0010C					
49-64	UM 0010D					
65-80	UM 0010E					
81-96	UM 0010F					
97-112	UM 00110					
113-128	UM 00111					
129-144	UM 00112					
145-160	UM 00113					
161-176	UM 00114					
177-192	UM 00115					
-	UM 00116 -UM 00121	Reserved for system	-	-	-	-

(Note 1): Sixteen slave numbers are allocated to each area (1 word).



●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-16	UM 00122	Normal slave table	H0	Turns on bits corresponding to each station address (slave number) in the OP mode out of the slaves registered in ENI file and participating in the network.	●	-
17-32	UM 00123					
33-48	UM 00124					
49-64	UM 00125					
65-80	UM 00126					
81-96	UM 00127					
97-112	UM 00128					
113-128	UM 00129					
129-144	UM 0012A					
145-160	UM 0012B					
161-176	UM 0012C					
177-192	UM 0012D					
1-16	UM 0012E	Abnormal slave table	H0	Turns on bits corresponding to each station address (slave number) in any modes other than the OP mode out of the slaves registered in ENI file and participating in the network.	●	-
17-32	UM 0012F					
33-48	UM 00130					
49-64	UM 00131					
65-80	UM 00132					
81-96	UM 00133					
97-112	UM 00134					
113-128	UM 00135					
129-144	UM 00136					
145-160	UM 00137					
161-176	UM 00138					
177-192	UM 00139					
-	UM 0013A -UM 0017F	Reserved for system	-	-	-	-

(Note 1): Sixteen slave numbers are allocated to each area (1 word).

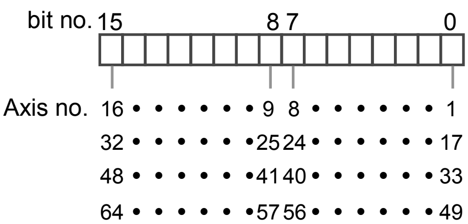
bit no.	15		8	7		0
Slave no.	16	• • • • • •	9	8	• • • • • •	1
	32	• • • • • •	25	24	• • • • • •	17
	48	• • • • • •	41	40	• • • • • •	33
	64	• • • • • •	57	56	• • • • • •	49
	80	• • • • • •	73	72	• • • • • •	65
	96	• • • • • •	89	88	• • • • • •	81
	112	• • • • •	105	104	• • • • •	97
	128	• • • • •	121	120	• • • • •	113
	144	• • • • •	137	136	• • • • •	129
	160	• • • • •	153	152	• • • • •	145
	176	• • • • •	169	168	• • • • •	161
	192	• • • • •	185	184	• • • • •	177

15.4.4 List of Output Control Area Function

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
-	UM 00180 -UM 00185	Reserved for system	-	-	-	-
1-16	UM 00186	Servo ON request	H0	Requests the servo lock for the corresponding AMP. This request signal is enabled when the bits corresponding to each axis number turn on. (The operation is the edge type.)	●	●
17-32	UM 00187					
33-48	UM 00188					
49-64	UM 00189					
-	UM 0018A -UM 0018B	Reserved for system	-	-	-	-
1-16	UM 0018C	Servo OFF request	H0	Requests the servo free for the corresponding AMP. This request signal is enabled when the bits corresponding to each axis number turn on. (The operation is the edge type.)	●	●
17-32	UM 0018D					
33-48	UM 0018E					
49-64	UM 0018F					
-	UM 00190 -UM 00191	Reserved for system	-	-	-	-
1-16	UM 00192	Positioning start contact	H0	Requests the positioning control start for the corresponding axis. The starting table is specified in the area for specifying the position control starting table number in the unit memory. This request signal is enabled when the bits corresponding to each axis number turn on. (The operation is the edge type.)	●	●
17-32	UM 00193					
33-48	UM 00194					
49-64	UM 00195					
Virtual 1-16	UM 00196					
Virtual 17-32	UM 00197					
1-16	UM 00198	Home return start request	H0	Requests the home return operation start for the corresponding axis. This request signal is enabled when the bits corresponding to each axis number turn on. (The operation is the edge type.)	●	●
17-32	UM 00199					
33-48	UM 0019A					
49-64	UM 0019B					
Virtual 1-16	UM 0019C					
Virtual 17-32	UM 0019D					

(Note 1): Request flags for 16 axes are allocated to each area (1 word).

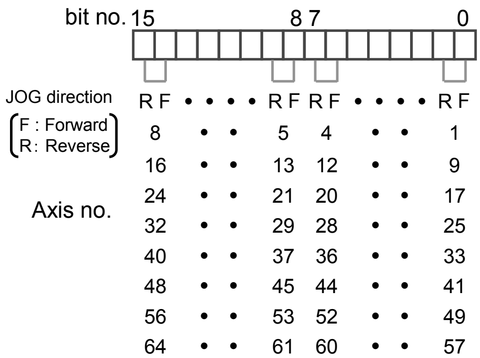


(Note 2): The servo cannot be free automatically even in the program mode. To make the servo free, turn on the servo OFF request contact.

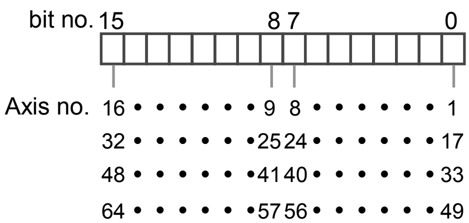
●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-8	UM 0019E	JOG operation forward/reverse request	H0	Requests the JOG forward or reverse operation for corresponding axes. In the case of In the case of JOG operation, this request signal is enabled when the bits corresponding to each axis number are on. (The operation is the level type.) When the inching operation request is enabled, it functions as the request for the JOG inching forward or reverse operation. In the case of JOG inching operation, this request signal is enabled when the bits corresponding to each axis number turn on from off (The operation is the edge type.)	●	●
9-16	UM 0019F					
17-24	UM 001A0					
25-32	UM 001A1					
33-40	UM 001A2					
41-48	UM 001A3					
49-56	UM 001A4					
57-64	UM 001A5					
Virtual 1-8	UM 001A6					
Virtual 9-16	UM 001A7					
Virtual 17-24	UM 001A8					
Virtual 25-32	UM 001A9					
1-16	UM 001AA	Inching operation request	H0	Turns on the bits corresponding to each axis number for performing the JOG inching operation. The inching operation is enabled when the bits corresponding to each axis number are on. (The operation is the level type.) When this request signal is on, the above "JOG operation forward/reverse request" functions as the start request for the JOG inching operation. When it is off, it functions as the normal request "JOG operation forward/reverse".	●	●
17-32	UM 001AB					
33-48	UM 001AC					
49-64	UM 001AD					
Virtual 1-16	UM 001AE					
Virtual 17-32	UM 001AF					

(Note 1): Request flags for 8 axes are allocated to each area (1 word) of the JOG operation forward/reverse request.



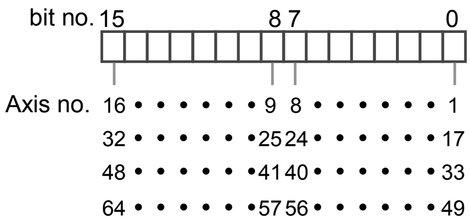
(Note 2): Request flags for 16 axes are allocated to each area (1 word) of the inching operation request.



●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-16	UM 001B0	Emergency stop request	H0	Requests the emergency stop for corresponding axes. This request signal is enabled when the bits corresponding to each axis number are on. (The operation is the level type.)	●	●
17-32	UM 001B1					
33-48	UM 001B2					
49-64	UM 001B3					
Virtual 1-16	UM 001B4					
Virtual 17-32	UM 001B5					
1-16	UM 001B6	Deceleration stop request	H0	Requests the deceleration stop for corresponding axes. It is switched between deceleration stop and pause by the "MC common" parameter setting. This request signal is enabled when the bits corresponding to each axis number are on. (The operation is the level type.)	●	●
17-32	UM 001B7					
33-48	UM 001B8					
49-64	UM 001B9					
Virtual 1-16	UM 001BA					
Virtual 17-32	UM 001BB					
1-16	UM 001BC	J-point speed change request	H0	Changes the speed up to the J-point target speed with a acceleration/deceleration time and pattern specified in the axis parameters by turning on this request during the J-point control operation. This request signal is enabled when the bits corresponding to each axis number are on. (The operation is the level type.)	●	●
17-32	UM 001BD					
33-48	UM 001BE					
49-64	UM 001BF					
Virtual 1-16	UM 001C0					
Virtual 17-32	UM 001C1					
1-16	UM 001C2	J-point positioning start request	H0	Transits to the process for the next table by turning on this request during the J-point control operation. This request signal is enabled when the bits corresponding to each axis number turn on.. (The operation is the edge type.)	●	●
17-32	UM 001C3					
33-48	UM 001C4					
49-64	UM 001C5					
Virtual 1-16	UM 001C6					
Virtual 17-32	UM 001C7					
1-16	UM 001C8	Error clear request	H0	Requests the error clear for FP7 MC Unit. The processing to recover from errors is performed and the error logs are cleared by turning on this request. Note) Unrecoverable errors cannot be recovered even if this request turned on.	●	●
17-32	UM 001C9					
33-48	UM 001CA					
49-64	UM 001CB					
Virtual 1-16	UM 001CC					
Virtual 17-32	UM 001CD					

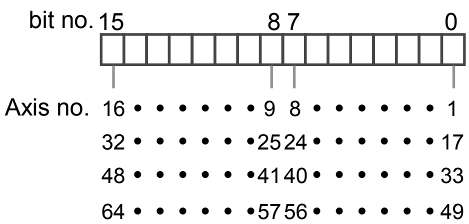
(Note 1): Request flags for 16 axes are allocated to each area (1 word).



●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-16	UM 001CE	Warning clear request	H0	Requests the warning clear for FP7 MC Unit. Clears warnings and warning logs by turning on this request.	●	●
17-32	UM 001CF					
33-48	UM 001D0					
49-64	UM 001D1					
Virtual 1-16	UM 001D2					
Virtual 17-32	UM 001D3					
1-16	UM 001D4	Synchronous setting request	H0	This contact turns on after changing the parameter setting of synchronous operation.	●	●
17-32	UM 001D5					
33-48	UM 001D6					
49-64	UM 001D7					
-	UM 001D8 -UM 001D9	Reserved for system	-	-	-	-
1-16	UM 001DA	Synchronous cancel request	H0	Turns on the request for the amplifier to cancel the synchronous operation.	●	●
17-32	UM 001DB					
33-48	UM 001DC					
49-64	UM 001DD					
-	UM 001DE -UM 001DF	Reserved for system	-	-	-	-
1-16	UM 001E0	Slave axis gear ratio change request	H0	Changes the gear ratio when the request flag for the corresponding axis during the synchronous operation turns on. (The operation is the edge type.)	●	●
17-32	UM 001E1					
33-48	UM 001E2					
49-64	UM 001E3					
-	UM 001E4 -UM 001E5	Reserved for system	-	-	-	-
1-16	UM 001E6	Slave axis clutch ON request	H0	Starts the clutch on operation when the request flag for the corresponding axis during the synchronous operation turns on. * Amplifiers that no clutch is used do not operate. (Set the operation to level type, rising edge, or falling edge.)	●	●
17-32	UM 001E7					
33-48	UM 001E8					
49-64	UM 001E9					
	UM 001EA -UM 001EB	Reserved for system	-	-	-	-

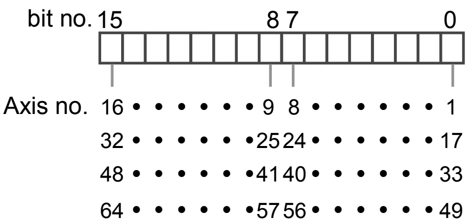
(Note 1): Request flags for 16 axes are allocated to each area (1 word).



●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-16	UM 001EC	Slave axis clutch OFF request	H0	Starts the clutch off operation when the request flag for the corresponding axis during the synchronous operation turns on. * Axes that no clutch is used do not operate. (Set the operation to rising edge, or falling edge.) These signals will be disabled while the slave axis clutch ON request signal is set to level type.	●	●
17-32	UM 001ED					
33-48	UM 001EE					
49-64	UM 001EF					
—	UM 001F0 -UM 001F1	Reserved for system	-	-	-	-

(Note 1): Request flags for 16 axes are allocated to each area (1 word).



●: Available, -: Not available

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1-8</td><td>UM 001F2</td><td rowspan="8">General-purpose output</td><td rowspan="8">H0</td><td rowspan="8">General-purpose outputs connected to the corresponding AMP.
<table>
<tr><th>bit</th><th>信号名</th><th>軸 No.</th></tr>
<tr><td>0</td><td>set-brake</td><td rowspan="2">1+2n</td></tr>
<tr><td>1</td><td>EX-OUT1</td></tr>
<tr><td>2</td><td>set-brake</td><td rowspan="2">2+2n</td></tr>
<tr><td>3</td><td>EX-OUT1</td></tr>
<tr><td>4</td><td>set-brake</td><td rowspan="2">3+2n</td></tr>
<tr><td>5</td><td>EX-OUT1</td></tr>
<tr><td>6</td><td>set-brake</td><td rowspan="2">4+2n</td></tr>
<tr><td>7</td><td>EX-OUT1</td></tr>
<tr><td>8</td><td>set-brake</td><td rowspan="2">5+2n</td></tr>
<tr><td>9</td><td>EX-OUT1</td></tr>
<tr><td>10</td><td>set-brake</td><td rowspan="2">6+2n</td></tr>
<tr><td>11</td><td>EX-OUT1</td></tr>
<tr><td>12</td><td>set-brake</td><td rowspan="2">7+2n</td></tr>
<tr><td>13</td><td>EX-OUT1</td></tr>
<tr><td>14</td><td>set-brake</td><td rowspan="2">8+2n</td></tr>
<tr><td>15</td><td>EX-OUT1</td></tr>
</table></td><td rowspan="8">●</td><td rowspan="8">●</td></tr>
<tr><td>9-16</td><td>UM 001F3</td></tr>
<tr><td>17-24</td><td>UM 001F4</td></tr>
<tr><td>25-32</td><td>UM 001F5</td></tr>
<tr><td>33-40</td><td>UM 001F6</td></tr>
<tr><td>41-48</td><td>UM 001F7</td></tr>
<tr><td>49-56</td><td>UM 001F8</td></tr>
<tr><td>57-64</td><td>UM 001F9</td></tr>
<tr><td>-</td><td>UM 001FA
-UM 0027F</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>

(Note): For details of the method of using "set-brake", refer to the technical data of A5B.

15.5 Unit Memories (Common Area)

15.5.1 Configuration of Common Area

Whole unit memory map

UM 00000	UM 0007F	System area	128 words
UM 00080	UM 0017F	Input control area	256 words
UM 00180	UM 0027F	Output control area	256 words
UM 00280	UM 0260F	Common area	9,104 words
UM 02610	UM 0263F	System area	48 words
UM 02640	UM 0323F	Each axis information area	3,072 words
UM 03240	UM 63EFF	Each axis setting area	396,480 words
UM 63F00	UM 63F3F	System area	64 words
UM 63F40	UM 6693F	Synchronous control setting area	10,752 words

Starting no.	Name	No. of words
UM 00280	Setting parameter control area	256 words
UM 00380	Operation speed rate area	128 words
UM 00400	Reserved area for the system	144 words
UM 00490	Axis group setting area	256 words
UM 00590	Current value update data area	256 words
UM 00690	Reserved area for the system	768 words
UM 00990	Positioning table setting area	96 words
UM 009F0	Positioning control area	96 words
UM 00A50	Reserved area for the system	64 words
UM 00A90	Error annunciation & clear area	3,200 words
UM 01710	Warning annunciation & clear area	3,200 words
UM 02390	Synchronous control monitor area	576 words
UM 025D0	Reserved area for the system	64 words

15.5.2 Setting Parameter Control Area

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
-	UM 00280 -UM 00281	Number of writing to FROM	U0	Announces the number of writing the positioning parameters and data in the unit memory into FROM.	●	—
-	UM 00282	Reserved for system	-	-	-	-
-	UM 00283	FROM write result	H0	FROM writing in progress : H5555 FROM writing ended normally : H0 FROM writing ended abnormally : HFFFF FROM writing by CMI in progress: HAAAA	●	—
1	UM 00284	Recalculation starting table number	U1	This is used to rewrite positioning data using a user program. Reconstructs the positioning data which starts with the table number specified in this area when the recalculation request (Y7) turns on. Range: 1-1000	●	●
1	UM 00285	Recalculation starting table size	U0	Reconstructs the positioning data of the table size specified in this area when the recalculation request (Y7) turns on. Range：1-500	●	●
（2-64 Virtual 1-32）	UM 00286 -UM 00343	The following areas are allocated to each axis. ● Recalculation starting table number: 1 word ● Recalculation starting table size: 1 word			●	●
-	UM 00344 -UM 0037F	Reserved for system	-	-	-	-

15.5.3 Operation Speed Rate Area

●: Available, -: Not available

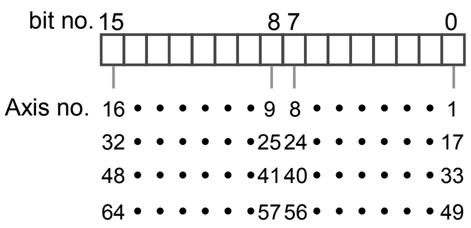
Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1	UM 00380	Operation speed rate	U1	All operations relating to axes (positioning, JOG operation, home return) can be performed at the specified rate. Range:0-500 [%] (For single axis control) Range:0-200 [%] (For interpolation control)	●	●
(2-64 Virtual 1-32)	UM 00381 -UM 003DF	The following areas are allocated to each axis. ● Operation speed rate: 1 word			●	●
-	UM 003E0 -UM 003FF	Reserved for system	-	-	-	-

15.5.4 Axis Group Setting Area

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-16	UM 00490	Interpolation group 1 setting	H0	Set either independent or interpolation for each axis in this area. In case of interpolation, each axis belongs to any group 1 to 32. For example, the axes 1, 2 and 3 belong to group 1 and are 3-axis interpolation, set the corresponding 3 bits to 1 in the interpolation axis setting of group 1. In case of single axis independent settimg, it does not belong to any group. Turn on the corresponding bits of the rest of the independent axis settings. Maximum number of interpolation axis per group is 3. The same axis cannot be set in more than one group.	●	●
17-32	UM 00491					
33-48	UM 00492					
49-64	UM 00493					
Virtual 1-16	UM 00494					
Virtual 17-32	UM 00495					
-	UM 00496 -UM 0053F	For interpolation groups 2 to 31, 6 words are allocated to each group.			●	●
1-16	UM 0054A	Interpolation group 32 setting	H0	Same as above.	●	●
17-32	UM 0054B					
33-48	UM 0054C					
49-64	UM 0054D					
Virtual 1-16	UM 0054E					
Virtual 17-32	UM 0054F					
1-16	UM 00550	Independent axis setting	H0	The bit corresponding to the axis is; 0: Belongs to interpolatino group or the axis is not set as a used axis. 1: Independent (Not belong to interpolation group) An error occurs when this overlaps with the setting of interpolation group.	●	●
17-32	UM 00551					
33-48	UM 00552					
49-64	UM 00553					
Virtual 1-16	UM 00554					
Virtual 17-32	UM 00555					
-	UM 00556 -UM 0058F	Reserved for system	-	-	-	-

(Note 1): Bits for 16 axes are allocated to each area (1 word).

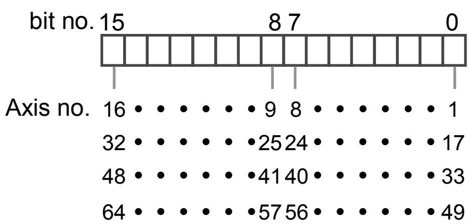


15.5.5 Current Value Update Data Area

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1-16	UM 00590	Current value update flag	H0	Changes "Unit system conversion current value" managed by FP7 MC Unit to the following "current value update coordinate" only when the bit corresponding to each axis number changes to 1 from 0. Afther the change, FP7 MC Unit clears the corresponding bits to 0 automatically.	●	●
17-32	UM 00591					
33-48	UM 00592					
49-64	UM 00593					
Virtual 1-16	UM 00594					
Virtual 17-32	UM 00595					
-	UM 00596 -UM 0059F	Reserved for system	-	-	-	-
1	UM 005A0 -UM 005A1	Current value update coordinate	K0	Stores the coordinate value to be preset as the current value after unit conversion. Range: -2147483648 to +2147483647 An integer equivalent to the current value after unit conversion is set to the unit memory. Example) When the unit is um (0.1 µm), set to "10000" for making it be 1,000.0 µm.	●	●
(2-64 Virtual 1-32)	UM 005A2 -UM 0065F	The following areas are allocated to each axis. ● Current value update coordinate: 2 words			●	●
-	UM 00660 -UM 0068F	Reserved for system	-	-	-	-

(Note 1): Bits for 16 axes are allocated to each current value update flag area (1 word).



15.5.6 Positioning Control Starting Table Number Setting Area

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1	UM 00990	Positioning control start table number	U0	Set the table number of each axis starting the position control. Range: 1 to 1000	●	●
(2-64 Virtual 1-32)	UM 00991 -UM 009EF	The following areas are allocated to each axis. ● Positioning control start table number: 1 word			●	●

15.5.7 Positioning Control Area

●: Available, -: Not available

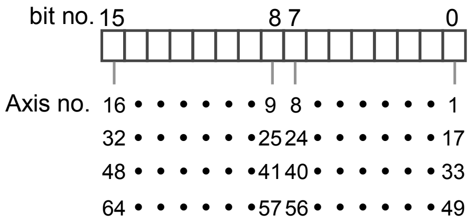
Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1	UM 009F0	Positioning repeat count	U0	Set the number of times for repeating the operation from the positioning control starting table number until the E-point control. Range: 0 to 255 When setting 0 or 1, the operation is executed only once. When setting 255, the operation is repeated unlimitedly until the operation is stopped.	●	●
(2-64 Virtual 1-32)	UM 009F1 -UM 00A4F	The following areas are allocated to each axis. ● Positioning repeat count: 1 word			●	●
-	UM 00A50 -UM 00A8F	Reserved for system	-	-	-	-

15.5.8 Error Annunciation and Clear Area

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
-	UM 00A90 -UM 00A95	Reserved for system	-	-	-	-
1-16	UM 00A96	Error clear individual axis setting	H0	Clears the error of the axis for the corresponding bit. After changing the corresponding bit to 1, FP7 MC Unit clears the corresponding bit to 0 automatically.	●	●
17-32	UM 00A97					
33-48	UM 00A98					
49-64	UM 00A99					
Virtual 1-16	UM 00A9A					
Virtual 17-32	UM 00A9B					
-	UM 00A9C -UM00ABF	Reserved for system	-	-	-	-

(Note 1): Bits for 16 axes are allocated to the error clear individual axis setting area (1 word).



●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1	UM 00AC0	No. of occurrences of errors	U0	Annunciates the number of occurrences of errors on the 1st axis.	●	-
1	UM 00AC1	Reserved for system	-	-	-	-
1	UM 00AC2 -UM 00AC3	Error code Buffer 1	U0	Stores the latest error code (8-digit hex) from the buffer 1 in order.	●	-
1	UM 00AC4 -UM 00AC5	Error code Buffer 2	U0			
1	UM 00AC6 -UM 00AC7	Error code Buffer 3	U0			
1	UM 00AC8 -UM 00AC9	Error code Buffer 4	U0			
1	UM 00ACA -UM 00ACB	Error code Buffer 5	U0			
1	UM 00ACC -UM 00ACD	Error code Buffer 6	U0			
1	UM 00ACE -UM 00ACF	Error code Buffer 7	U0			
1	UM 00AD0 -UM 00AD1	Error code Buffer 8	U0			
1	UM 00AD2 -UM 00ADF	Reserved for system	-	-	-	-
(2-64 virtual 1-32)	UM 00AE0 -UM 016BF	As well as the area for axis 1, 32-word area is allocated to each axis in the following configuration. ● Number of occurrences of errors: 1 word ● Reserved area for the system: 1 word ● Error code buffer: 2 words x 8 ● Reserved area for the system: 14 words			●	●
-	UM 016C0 -UM 0170F	Reserved for system	-	-	-	-

(Note 1): As for the unit memories in which error codes are stored, 2-word area is allocated for each axis.

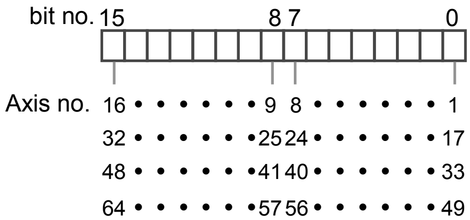
(Note 2): The difference between the unit memory number of the target axis number and the unit memory number of the adjacent axis number is H20 (for 32 words).

15.5.9 Warning Annunciation and Clear Area

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
-	UM 01710 -UM 01715	Reserved for system	-	-	-	-
1-16	UM 01716	Warning clear individual axis setting	H0	Clears the warning of the axis for the corresponding bit. After changing the corresponding bit to 1, FP7 MC Unit clears the corresponding bit to 0 automatically.	●	●
17-32	UM 01717					
33-48	UM 01718					
49-64	UM 01719					
Virtual 1-16	UM 0171A					
Virtual 17-32	UM 0171B					
-	UM 0171C -UM0173F	Reserved for system	-	-	-	-

(Note 1): Bits for 16 axes are allocated to the warning clear individual axis setting area (1 word).



●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1	UM 01740	No. of occurrences of warnings	U0	Annunciates the number of occurrences of warnings on the 1st axis.	●	-
1	UM 01741	Reserved for system	-	-	-	-
1	UM 01742 -UM 01743	Warning code Buffer 1	U0	Stores the latest warning code (8-digit hex) from the buffer 1 in order.	●	-
1	UM 01744 -UM 01745	Warning code Buffer 2	U0			
1	UM 01746 -UM 01747	Warning code Buffer 3	U0			
1	UM 01748 -UM 01749	Warning code Buffer 4	U0			
1	UM 0174A -UM 0174B	Warning code Buffer 5	U0			
1	UM 0174C -UM 0174D	Warning code Buffer 6	U0			
1	UM 0174E -UM 0174F	Warning code Buffer 7	U0			
1	UM 01750 -UM 01751	Warning code Buffer 8	U0			
1	UM 01752 -UM 0175F	Reserved for system	-	-	-	-
(2-64 virtual 1-32)	UM 01760 -UM 0233F	As well as the area for axis 1, 32-word area is allocated to each axis in the following configuration. ● Number of occurrences of warnings: 1 word ● Reserved area for the system: 1 word ● Warning code buffer: 2 words x 8 ● Reserved area for the system: 14 words			●	●
-	UM 02340 -UM 0238F	Reserved for system	-	-	-	-

(Note 1): As for the unit memories in which warning codes are stored, 2-word area is allocated for each axis.

(Note 2): The difference between the unit memory number of the target axis number and the unit memory number of the adjacent axis number is H20 (for 32 words).

15.5.10 Synchronous Control Monitor Area

●: Available, -: Not available

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1</td><td>UM 02390</td><td>Synchronous master axis information monitor</td><td>H0</td><td>Stores the information on the master axis of synchronous control.
<table>
<tr><td colspan="2">Value</td><td rowspan="2">Master axis</td></tr>
<tr><td>Under synchronous control</td><td>Synchronous control canceled</td></tr>
<tr><td>H FFFF</td><td>H FFFF</td><td>No synchronous setting</td></tr>
<tr><td>H 0000</td><td>H 0000</td><td>The target axis for monitoring is the master axis.
(For FP7 MC Unit, the value for the master axis does not change even when the synchronous control is canceled.)</td></tr>
<tr><td>H 0001</td><td>H 8001</td><td>Axis 1</td></tr>
<tr><td>H 0002</td><td>H 8002</td><td>Axis 2</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>H 0010</td><td>H 8010</td><td>Axis 16</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>H 0020</td><td>H 8020</td><td>Axis 32</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>H 0040</td><td>H 8040</td><td>Axis 64</td></tr>
<tr><td>H 0041</td><td>H 8041</td><td>Virtual axis 1</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>H 0060</td><td>H 8060</td><td>Virtual axis 32</td></tr>
</table></td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02391</td><td>Synchronous output function selected state monitor</td><td>H0</td><td>Stores the information on the master axis of synchronous control.
<table>
<tr><td>bit.</td><td>Name</td><td>Value</td></tr>
<tr><td>0</td><td>Electronic gear</td><td rowspan="3">0: Not use
1: Use</td></tr>
<tr><td>1</td><td>Clutch</td></tr>
<tr><td>2</td><td>Electronic cam</td></tr>
<tr><td>15-3</td><td>-</td><td>=</td></tr>
</table></td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02392
-UM 02395</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>(2-64 virtual 1-32)</td><td>UM 02396
-UM 025CF</td><td colspan="3">As well as the area for axis 1, 6-word area is allocated to each axis in the following configuration.
● Synchronous master axis information monitor area: 1 word
● Synchronous output function selected state monitor area: 1 word
● Reserved area for the system: 4 words</td><td>●</td><td>●</td></tr>
<tr><td>-</td><td>UM 025D0
-UM 0260F</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>

[MEMO]

15.6 Unit Memories (Each Axis Information Area)

15.6.1 Configuration of each axis information area

Whole unit memory map

Address	Area	No. of words
UM 00000 – UM 0007F	System area	128 words
UM 00080 – UM 0017F	Input control area	256 words
UM 00180 – UM 0027F	Output control area	256 words
UM 00280 – UM 0260F	Common area	9,104 words
UM 02610 – UM 0263F	System area	48 words
UM 02640 – UM 0323F	Each axis information area	3,072 words
UM 03240 – UM 63EFF	Each axis setting area	396,480 words
UM 63F00 – UM 63F3F	System area	64 words
UM 63F40 – UM 6693F	Synchronous control setting area	10,752 words

Starting no.	Name	No. of words
UM 02640	Information and monitor area of 1st axis	32 words
UM 02660	Information and monitor area of 2nd axis	32 words
	:	
UM 02820	Information and monitor area of 16th axis	32 words
	:	
UM 02A20	Information and monitor area of 32th axis	32 words
	:	
UM 02C20	Information and monitor area of 48th axis	32 words
	:	
UM 02E20	Information and monitor area of 64th axis	32 words
UM 02E40	Information and monitor area of virtual 1st axis	32 words
	:	
UM 03020	Information and monitor area of virtual 16th axis	32 words
	:	
UM 03220	Information and monitor area of virtual 32th axis	32 words

15.6.2 Each Axis Information & Monitor Area

●: Available, -: Not available

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1</td><td>UM 02640 -UM 02641</td><td>Vender ID</td><td>H0</td><td>Stores the ID code corresponding to brand name or vendor name. It is stored as 4 bytes.</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02642 -UM 02643</td><td>Product Code</td><td>H0</td><td>Stores the model code of AMP. It is stored as 4 bytes.</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02644 -UM 02645</td><td>Revision no.</td><td>H0</td><td>Stores the firmware version of AMP. It is stored as 4 bytes.</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02646 -UM 02647</td><td>Serial no.</td><td>H0</td><td>Stores the serial number of AMP.
It is stored as 4 bytes.</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02648</td><td>Station Address</td><td>H0</td><td>Stores the station address set to AMP. It is stored as 4 bytes.</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02649</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>UM 0264A</td><td>AMP status display</td><td>H0</td><td>Stores the status of AMP.
<table>
<tr><th>bit.</th><th>Name</th><th>Value</th></tr>
<tr><td>1-0</td><td>Reserved for system</td><td>-</td></tr>
<tr><td>2</td><td>Home return done</td><td>0: Home return not completed
1: Home return completed</td></tr>
<tr><td>3</td><td>Torque limit</td><td>0: Normal detection
1: Contact detection (Torque limit)</td></tr>
<tr><td>4</td><td>Warning</td><td>0: Normal
1: Warrning occurred</td></tr>
<tr><td>5</td><td>Alarm</td><td>0: Normal
1: Alarm occurred</td></tr>
<tr><td>6</td><td>Servo ready</td><td>0: Cannot shift to the servo on-state.
1: Servo ready</td></tr>
<tr><td>7</td><td>Servo active</td><td>0: Servo off
1: Servo on</td></tr>
<tr><td>15-8</td><td>Reserved for system</td><td>-</td></tr>
</table></td><td>●</td><td>-</td></tr>
</table>

●: Available, -: Not available

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1</td><td>UM 0264B</td><td>External input terminal monitor</td><td>H0</td><td>Stores the statuses of input terminals connected to each axis.
<table>
<tr><th>bit.</th><th>Name</th><th>Value</th></tr>
<tr><td>0</td><td>NOT</td><td rowspan="8">0: Non active
1: Active</td></tr>
<tr><td>1</td><td>POT</td></tr>
<tr><td>2</td><td>HOME</td></tr>
<tr><td>3</td><td>SI-MON1 / EXT1</td></tr>
<tr><td>4</td><td>SI-MON2 / EXT2</td></tr>
<tr><td>5</td><td>SI-MON3</td></tr>
<tr><td>6</td><td>SI-MON4</td></tr>
<tr><td>7</td><td>SI-MON5/ E-STOP</td></tr>
<tr><td>15-8</td><td>-</td><td>-</td></tr>
</table></td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 0264C</td><td>Torque monitor value</td><td>-</td><td>Stores the torque monitor value as integer.
Range: 0 to 5000 (0.0% to 500.0 [%])</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 0264D</td><td>Actual speed monitor value</td><td>-</td><td>Stores the actual speed monitor value.
Range: 0 to 5000 [rpm]</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 0264E
-UM 0264F</td><td>Position deviation</td><td>-</td><td>Stores the difference value between the value of the position specified in FP7 MC Unit and the value of the position fed back from the amplifier.</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02650</td><td>Active or execution done table</td><td>U1</td><td>Stores the number of active positioning table or when the operation completed.
Range: 1 to 1000</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02651</td><td>Auxiliary output code</td><td>U0</td><td>Stores the auxiliary output code when the auxiliary output function is enabled by the axis parameter.</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02652</td><td>Repeat count current value</td><td>U0</td><td>Stores the repeat count during the positioning operation. Stores 1 when no repeat operation is performed. Returns to 0 when the repeat count exceeds the upper limit.
Range: 0 to 65535 [times]</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02653</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>

●: Available, -: Not available

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1</td><td>UM 02654
-UM 02655</td><td>AMP current value [Absolute coordinate]</td><td>K0</td><td>Stores the current value based on a mechanical origin in pulse units. It will be reset to "0" on the completion of home return. The value will not be updated when the current value update function is executed.
Unit: pulse</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02656
-UM 02657</td><td>Current value after unit conversion [Logic system coordinate]</td><td>K0</td><td>Stores the current value based on a electric origin (value set as home position coordinate). Stores values converted with the unit system (pulse, µm, inch, degree) selected in the axis parameter as integer.
When the home return is completed, the value set as home position coordinate will be stored. When "0" is set as home position coordinate, it will be reset to "0".
This area is also updated when the current value update function is used.</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02658</td><td>Control mode current value</td><td>-</td><td>Stores the current control mode.
H0:Positioning control (E-point control / P-point control / C-point control)
H1: J-point control
H2: Home return
H3: JOG operation</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 02659
-UM 0265F</td><td>Reserved for system</td><td>-</td><td>-</td><td></td><td></td></tr>
<tr><td>(2-64
Virtual 1-32)</td><td>UM 2660
-UM 323F</td><td colspan="3">As well as the area for axis 1, 32-word area is allocated to each axis in the following configuration.
<table>
<tr><th>Item</th><th>No. of words</th><th>Item</th><th>No. of words</th></tr>
<tr><td>Vender ID</td><td>2 words</td><td>Position deviation</td><td>2 words</td></tr>
<tr><td>Product Code</td><td>2 words</td><td>Active or execution done table</td><td>1 word</td></tr>
<tr><td>Revision no.</td><td>2 words</td><td>Auxiliary output code</td><td>1 word</td></tr>
<tr><td>Serial no.</td><td>2 words</td><td>Repeat count current value</td><td>1 word</td></tr>
<tr><td>StationAddress</td><td>1 word</td><td>Reserved for system</td><td>1 word</td></tr>
<tr><td>Reserved for system</td><td>1 word</td><td>AMP current value</td><td>2 words</td></tr>
<tr><td>AMP status</td><td>1 word</td><td>Unit system conversion current value</td><td>2 words</td></tr>
<tr><td>External input terminal monitor</td><td>1 word</td><td>Control mode current value</td><td>1 word</td></tr>
<tr><td>Torque monitor value</td><td>1 word</td><td>Reserved area for the system</td><td>7 words</td></tr>
<tr><td>Actual speed monitor value</td><td>1 word</td><td></td><td></td></tr>
</table></td><td>●</td><td>-</td></tr>
</table>

15.7 Unit Memories (Each Axis Setting Area)

15.7.1 Configuration of Each Axis Setting Area

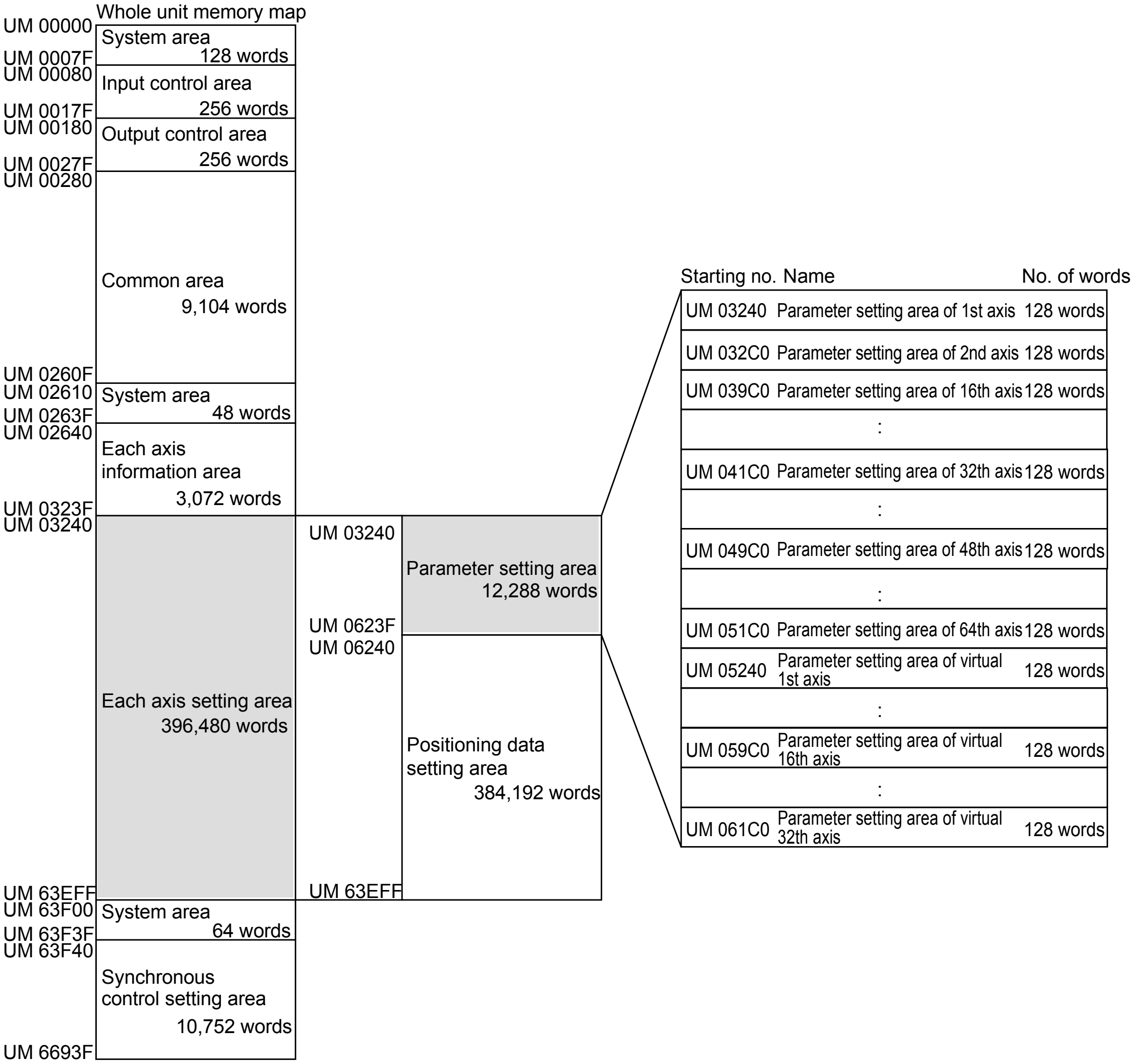
Whole unit memory map

UM 00000	UM 0007F	System area	128 words
UM 00080	UM 0017F	Input control area	256 words
UM 00180	UM 0027F	Output control area	256 words
UM 00280	UM 0260F	Common area	9,104 words
UM 02610	UM 0263F	System area	48 words
UM 02640	UM 0323F	Each axis information area	3,072 words
UM 03240	UM 63EFF	Each axis setting area	396,480 words
UM 63F00	UM 63F3F	System area	64 words
UM 63F40	UM 6693F	Synchronous control setting area	10,752 words

Each axis setting area:

Starting no.	Name	No. of words
UM 03240	Parameter setting area	12,288 words
UM 06240	Positioning data setting area	384,192 words

15.7.2 Configuration of Parameter Setting Area



15.7.3 Parameter Setting Area

The following table shows the unit memory numbers of axis number 1. 128-word area is allocated to each axis.

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1	UM 03240	Unit setting	H0	Set the unit system of movement amounts of the positioning control for each axis. The same unit system should be set for all interpolation axes. H0: pulse H100: μm（0.1 μm） H101: μm（1 μm） H200: inch（0.00001 inch） H201: inch（0.0001 inch） H300: degree（0.1 degree） H301: degree（1 degree） Any other settings will be errors.。	●	●
1	UM 03241	Reserved for system	-	-	-	-
1	UM 03242 -UM 03243	Pulse number per rotation	U1	Set the pulse number per rotation.It is necessary for the conversion of the pulse number when the unit is mm, inch or degree. Range: 1 to 32767000 Any other settings will be errors.。	●	●
1	UM 03244 -UM 03245	Movement amount per rotation	U1	Set the movement amount per rotation. It is necessary for the conversion of the pulse number when the unit is mm, inch or degree. Range: 1 to 32767000 Any other settings will be errors.。 The ranges vary depending on the unit settings as below. μm: 1 μm inch: 1/10,000 inch degree: 1 degree	●	●
1	UM 03246 -UM 03249	Reserved for system	-	-	-	-
1	UM 0324A	Movement amount automatic check operation	U2	Set the operation to be performd when the difference between the command value and feedback value exceeds the moving amount check value. 0: Error occurrence If the difference between the feedback value and the command moving amount exceeded the moving amount check value (threshold), an error occurs. 1: Warning occurrence If the difference between the feedback value and the command moving amount exceeded the moving amount check value (threshold), a warning occurs. 2: No The moving amount check is not performed.	●	●

●: Available, -: Not available

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1</td><td>UM 0324B</td><td>Software limit enabled/disabled</td><td>H0</td><td>Select whether to enable or disable the software limit for each control.<table><tr><th>bit</th><th>Name</th><th>Description</th></tr><tr><td>0</td><td>For positioning control</td><td rowspan="3">0: Disable
1: Enable</td></tr><tr><td>1</td><td>Fro home return</td></tr><tr><td>2</td><td>For JOG operation</td></tr><tr><td>15-3</td><td>-</td><td>-</td></tr></table></td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 0324C
-UM 0324D</td><td>Upper limit of software limit</td><td>2147483647</td><td rowspan="2">Set the upper limit value of the software limit for absolute coordinates.
The ranges vary depending on the unit settings as below.
pulse: -2147483648 to +2147483647 pulse
μm (0.1μm): -214748364.8 to +214748364.7 μm
μm (1μm): -2147483648 to +2147483647μm
inch (0.00001 inch):
-21474.83648 to +21474.83647 inch
inch (0.0001 inch):
-214748.3648 to +214748.3647 inch
degree (0.1 degree): 0.1 to 359.9 degree
degree (1 degree): 1 to 359 degree
Any other settings will be errors.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 0324E
-UM 0324F</td><td>Lower limit of software limit</td><td>-2147483648</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 03250
-UM 03251</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>UM 03252</td><td>Auxiliary output mode</td><td>HA00</td><td>Set the auxiliary output mode and the ON time of auxiliary output.<table><tr><th>bit</th><th>Name</th><th>Description</th></tr><tr><td>7-0</td><td>Auxiliary output mode</td><td>H0:Not use auxiliary output function
H1:Use With mode
H2:Use Delay mode</td></tr><tr><td>15-8</td><td>Auxiliary output ON time</td><td>Range:
H0(0 ms) to HFF(255 ms)</td></tr></table></td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 03253</td><td>Auxiliary output Delay ratio</td><td>U0</td><td>Set the ratio (%) to the movement amount for starting the output when using the delay mode for the auxiliary output.
Range: 0 to 100[%]
Example) When it is 50%, the auxiliary output turns ON when the movement amount exceeds 50%.</td><td>●</td><td>●</td></tr>
</table>

●: Available, -: Not available

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1</td><td>UM 03254</td><td>Operation setting</td><td>H31</td><td>Configure the settings of limit, moving direction and input logic.
<table>
<tr><th>bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>Limit enabled/disabled</td><td>0: Enable
1: Disable</td></tr>
<tr><td>1</td><td>Moving direction</td><td>0: Elapsed value + direction is CW
1: Elapsed value + direction is CCW</td></tr>
<tr><td>2</td><td>Limit connection</td><td>0: Standard connection
1: Reverse connection</td></tr>
<tr><td>3</td><td>Home position proximity logic</td><td rowspan="3">0: Normal Open
1: Normal Close</td></tr>
<tr><td>4</td><td>Limit + logic</td></tr>
<tr><td>5</td><td>Limit - logic</td></tr>
<tr><td>15-6</td><td>—</td><td>—</td></tr>
</table></td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 03255
-UM 03257</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>UM 03258</td><td>Movement check value</td><td>U10000</td><td>Set the threshold for using the movement automatic check function.
Range: 0 to 65536 [pulse]</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 03259
-UM 0325B</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>UM 0325C</td><td>Monitor value error setting</td><td>H0</td><td>Set the monitor error method.
<table>
<tr><th>bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>Torque judgement</td><td>0: Valid
1: Invalid</td></tr>
<tr><td>1</td><td>Torque judgement</td><td>0: Error when it is valid
1: Warning when it is valid</td></tr>
<tr><td>2</td><td>Actual speed judgement</td><td>0: Valid
1: Invalid</td></tr>
<tr><td>3</td><td>Actual speed judgement</td><td>0: Error when it is valid
1: Warning when it is valid</td></tr>
<tr><td>15-4</td><td>—</td><td>—</td></tr>
</table></td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 0325D</td><td>Torque monitor judgement value</td><td>U5000</td><td>Set the torque monitor judgement value as integer.
Range: 0 to 5000 (0.0% to 500.0 [%])</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 0325E</td><td>Actual speed monitor judgement value</td><td>U5000</td><td>Set the actual speed monitor value.
Range: 0 to 5000 [rpm]</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 0325F</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1	UM 03260	Home return setting code	H0	Set the pattern of home return. 0: DOGmethod 1 (Based on front end + Z phase) 1: DOG method 2 (Based on front end) 2: DOG method 3 (Based on back end + Z phase) 3: Limit method 1 (Limit signal + Z phase) 4: Limit method 2 (Limit signal) 5: Z phase method 6: Stop-on-contact method 1 7: Stop-on-contact method 2 (Stop-on-contact + Z phase) 8: Data set 9: DOG method 4 (Based on back end) Any other settings will be errors.	●	●
1	UM 03261	Home return direction	H0	Set the operation direction of home return. 0: Elapsed value decreasing direction (Limit - direction) 1: Elapsed value increasing direction (Limit + direction) Any other settings will be errors.	●	●
1	UM 03262	Home return acceleration time	U100	Set the acceleration/deceleration time when performing the home return. Range: 0 to 10,000 (ms) Any other settings will be errors.	●	●
1	UM 03263	Home return deceleration time	U100			
1	UM 03264 -UM 03265	Home return target speed	U1000	Set the target speed when performing the home return as integer. Range: 1 to 32767000 Any other settings will be errors. The ranges vary depending on the unit settings as below. pulse: 1 to 32,767,000 pps µm: 1 to 32,767,000 µm/s inch: 0.001 to 32,767.000 inch/s degree: 0.001 to 32,767.000 rev/s	●	●
1	UM 03266 -UM 03267	Home return creep speed	U1000	Set the speed to search the home position in the home return operation. Set the value lower than the home return target speed. Range: 1 to 32767000 Any other settings will be errors. The ranges vary depending on the unit settings as below. pulse: 1 to 32,767,000 pps µm: 1 to 32,767,000 µm/s inch: 0.001 to 32,767.000 inch/s degree: 0.001 to 32,767.000 rev/s	●	●
1	UM 03268	Reserved for system	-	-	-	-

●: Available, -: Not available

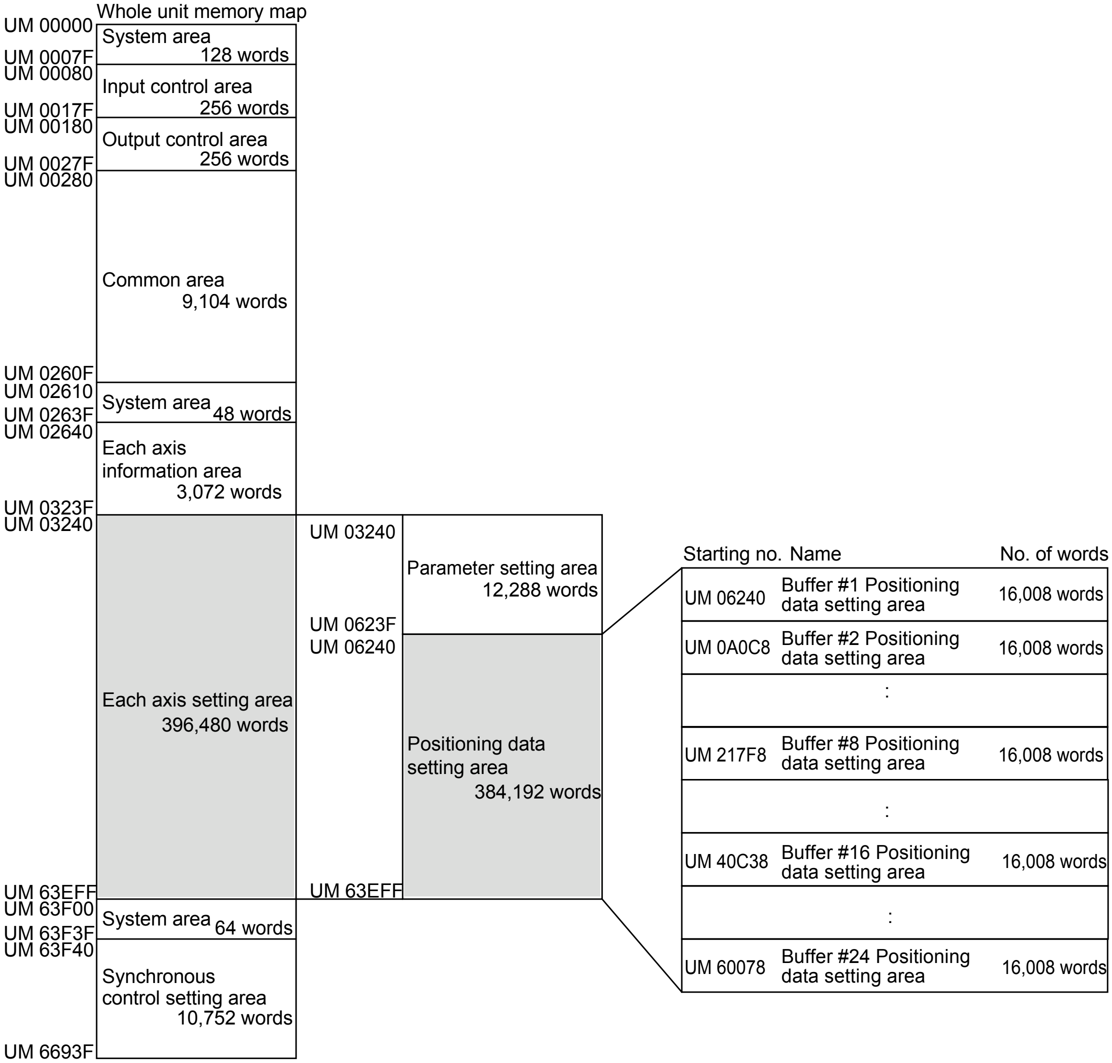
<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1</td><td>UM 03269</td><td>JOG operation setting code</td><td>H0</td><td>Sets the mode when performing the JOG operation.
<table><tr><th>bit</th><th>Name</th><th>Description</th></tr><tr><td>0</td><td>—</td><td>—</td></tr><tr><td>1</td><td>Acceleration/ deceleration pattern setting</td><td>0: Linear acceleration/deceleration
1: S-shaped acceleration/deceleration</td></tr><tr><td>15-2</td><td>—</td><td>—</td></tr></table></td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 0326A</td><td>JOG operation acceleration time</td><td>U100</td><td rowspan="2">Sets the acceleration/deceleration time when performing the JOG operation.
Range: 0 to 10,000 (ms)
Any other settings will be errors.</td><td rowspan="2">●</td><td rowspan="2">●</td></tr>
<tr><td>1</td><td>UM 0326B</td><td>JOG operation deceleration time</td><td>U100</td></tr>
<tr><td>1</td><td>UM 0326C
-UM 0326D</td><td>JOG operation target speed</td><td>U1000</td><td>Set the target speed for performing the JOG operation as integer.
Range: 1 to 32767000
Any other settings will be errors.
The ranges vary depending on the unit settings as below.
pulse: 1 to 32,767,000 pps
μm: 1 to 32,767,000 μm/s
inch: 0.001 to 32,767.000 inch/s
degree: 0.001 to 32,767.000 rev/s</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 0326E
-UM 0326F</td><td>Inching movement amount</td><td>U1</td><td>Set the inching movement amount as integer.
The ranges vary depending on the unit settings as below.
pulse: 1 to +2147483647 pulse
μm (0.1μm): 0.1 to +214748364.7 μm
μm (1μm): 1 to +2147483647μm
inch (0.00001 inch): 0.00001 to +2147483647 inch
inch (0.0001 inch): 0.0001 to +214748.3647 inch
degree (0.1 degree): 0.1 to 214748364.7 degree
degree (1 degree): 1 to 2147483647 degree
Any other settings will be errors. Also, the inching movement amount does not change when changing the operation speed rate.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 03270
-UM 03272</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>UM 03273</td><td>Emergency stop deceleration time</td><td>U100</td><td>Set the deceleration time at the time of emergency stop.
Range: 0 to 10,000 (ms)
Any other settings will be errors.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 03274</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>UM 03275</td><td>Limit stop deceleration time</td><td>U100</td><td>Set the deceleration time at the time of limit stop.
Range: 0 to 10,000 (ms)
Any other settings will be errors.</td><td>●</td><td>●</td></tr>
</table>

●: Available, -: Not available

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1</td><td>UM 03276</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>UM 03277</td><td>Error stop deceleration time</td><td>U100</td><td>Set the deceleration time at the time of error stop.
Range: 0 to 10,000 (ms)
Any other settings will be errors.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 03278
-UM 0327C</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>UM 0327D</td><td>Home return stop-on-cotnact torque value</td><td>U100</td><td>Set this item when specifying the home return stop-on-contact method.
Range: 0 to ～5000 (0.0% to 500.0 [%]）</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 0327E</td><td>Home return stop-on-contact judgment time</td><td>U100</td><td>Set this item when specifying the home return stop-on-contact method.
Range: 0 to 10,000 [ms]</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 0327F
-UM 03280</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>UM 03281</td><td>J-point control code</td><td>H0</td><td>Set the acceleration/deceleration pattern when performing the J-point control
<table>
<tr><th>bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>—</td><td>—</td></tr>
<tr><td>1</td><td>Acceleration/ deceleration pattern setting</td><td>0: Linear acceleration/deceleration
1: S-shaped acceleration/deceleration</td></tr>
<tr><td>15-2</td><td>—</td><td>—</td></tr>
</table></td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 03282</td><td>J-point control acceleration time</td><td>U100</td><td rowspan="2">Sets the acceleration/deceleration time when performing the J-point control.
Range: 0 to 10,000 (ms)
Any other settings will be errors.</td><td rowspan="2">●</td><td rowspan="2">●</td></tr>
<tr><td>1</td><td>UM 03283</td><td>J-point control deceleration time</td><td>U100</td></tr>
<tr><td>1</td><td>UM 03284
-UM 03285</td><td>J-point control target speed</td><td>U1000</td><td>Sets the target speed when performing the J-point control as integer.
Range: 1 to 32767000
Any other settings will be errors.
The ranges vary depending on the unit settings as below.
pulse: 1 to 32,767,000 pps
μm: 1 to 32,767,000 μm/s
inch: 0.001 to 32,767.000 inch/s
degree: 0.001 to 32,767.000 rev/s</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 03286
-UM 0328D</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>UM 0328E
-UM 0328F</td><td>Home coordinates</td><td>K0</td><td>Set the home coordinates after the completion of the home return. This is reflected in the area of the unit system conversion current values after the completion of the home return.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 03290
-UM032BF</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>

15.7.4 Configuration of Positioning Data Setting Area

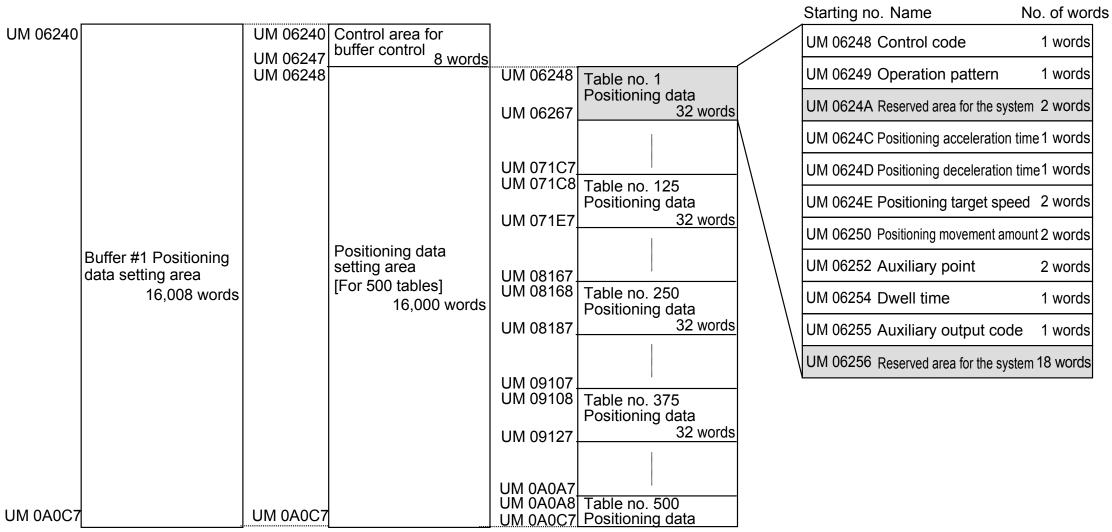
The positioning data setting area is used for reading or writing positioning data by user programs. It is constituted by 24 buffers (buffer no. 1 to buffer no.24).



■ Constitution of buffers

Each buffer is constituted by the "control area (8 words)" which specifies an operation to be executed and "positioning data setting area (16000 words)" which sets positioning data.

The following figure shows the constitution of buffer no. 1. Buffers no. 2 to 24 have the same constitution.



■ Buffers 1 to 8

	Buffer 1	Buffer 2	Buffer 3	Buffer 4	Buffer 5	Buffer 6	Buffer 7	Buffer 8
Request flag control	UM06240	UM0A0C8	UM0DF50	UM11DD8	UM15C60	UM19AE8	UM1D970	UM217F8
Request code control	UM06241	UM0A0C9	UM0DF51	UM11DD9	UM15C61	UM19AE9	UM1D971	UM217F9
Response code control	UM06242	UM0A0CA	UM0DF52	UM11DDA	UM15C62	UM19AEA	UM1D972	UM217FA
Axis number control	UM06243	UM0A0CB	UM0DF53	UM11DDB	UM15C63	UM19AEB	UM1D973	UM217FB
Starting table number	UM06244	UM0A0CC	UM0DF54	UM11DDC	UM15C64	UM19AEC	UM1D974	UM217FC
Table size	UM06245	UM0A0CD	UM0DF55	UM11DDD	UM15C65	UM19AED	UM1D975	UM217FD
Reserved for system	UM06246	UM0A0CE	UM0DF56	UM11DDE	UM15C66	UM19AEE	UM1D976	UM217FE
Reserved for system	UM06247	UM0A0CF	UM0DF57	UM11DDF	UM15C67	UM19AEF	UM1D977	UM217FF
Table no. 1	UM06248	UM0A0D0	UM0DF58	UM11DE0	UM15C68	UM19AF0	UM1D978	UM21800
Table no. 2	UM06268	UM0A0F0	UM0DF78	UM11E00	UM15C88	UM19B10	UM1D998	UM21820
Table no. 3	UM06288	UM0A110	UM0DF98	UM11E20	UM15CA8	UM19B30	UM1D9B8	UM21840
-	-	-	-	-	-	-	-	-
Table no. 100	UM06EA8	UM0AD30	UM0EBB8	UM12A40	UM168C8	UM1A750	UM1E5D8	UM22460
-	-	-	-	-	-	-	-	-
Table no. 200	UM07B28	UM0B9B0	UM0F838	UM136C0	UM17548	UM1B3D0	UM1F258	UM230E0
-	-	-	-	-	-	-	-	-
Table no. 300	UM087A8	UM0C630	UM104B8	UM14340	UM181C8	UM1C050	UM1FED8	UM23D60
-	-	-	-	-	-	-	-	-
Table no. 400	UM09428	UM0D2B0	UM11138	UM14FC0	UM18E48	UM1CCD0	UM20B58	UM249E0
-	-	-	-	-	-	-	-	-
Table no. 500	UM0A0A8	UM0DF30	UM11DB8	UM15C40	UM19AC8	UM1D950	UM217D8	UM25660

(Note): The difference between the starting number of adjacent tables is H20 (for 32 words).

■ Buffers 9 to 16

	Buffer 9	Buffer 10	Buffer 11	Buffer 12	Buffer 13	Buffer 14	Buffer 15	Buffer 16
Request flag control	UM25680	UM29508	UM2D390	UM31218	UM350A0	UM38F28	UM3CDB0	UM40C38
Request code control	UM25681	UM29509	UM2D391	UM31219	UM350A1	UM38F29	UM3CDB1	UM40C39
Response code control	UM25682	UM2950A	UM2D392	UM3121A	UM350A2	UM38F2A	UM3CDB2	UM40C3A
Axis number control	UM25683	UM2950B	UM2D393	UM3121B	UM350A3	UM38F2B	UM3CDB3	UM40C3B
Starting table number	UM25684	UM2950C	UM2D394	UM3121C	UM350A4	UM38F2C	UM3CDB4	UM40C3C
Table size	UM25685	UM2950D	UM2D395	UM3121D	UM350A5	UM38F2D	UM3CDB5	UM40C3D
Reserved for system	UM25686	UM2950E	UM2D396	UM3121E	UM350A6	UM38F2E	UM3CDB6	UM40C3E
Reserved for system	UM25687	UM2950F	UM2D397	UM3121F	UM350A7	UM38F2F	UM3CDB7	UM40C3F
Table no. 1	UM25688	UM29510	UM2D398	UM31220	UM350A8	UM38F30	UM3CDB8	UM40C40
Table no. 2	UM256A8	UM29530	UM2D3B8	UM31240	UM350C8	UM38F50	UM3CDD8	UM40C60
Table no. 3	UM256C8	UM29550	UM2D3D8	UM31260	UM350E8	UM38F70	UM3CDF8	UM40C80
-	-	-	-	-	-	-	-	-
Table no. 100	UM262E8	UM2A170	UM2DFF8	UM31E80	UM35D08	UM39B90	UM3DA18	UM418A0
-	-	-	-	-	-	-	-	-
Table no. 200	UM26F68	UM2A170	UM2DFF8	UM31E80	UM35D08	UM39B90	UM3DA18	UM418A0
-	-	-	-	-	-	-	-	-
Table no. 300	UM27BE8	UM2BA70	UM2F8F8	UM33780	UM37608	UM3B490	UM3F318	UM434A0
-	-	-	-	-	-	-	-	-
Table no. 400	UM28868	UM266F0	UM30578	UM34400	UM38288	UM3C110	UM3FF98	UM43E20
-	-	-	-	-	-	-	-	-
Table no. 500	UM284E8	UM2D370	UM311F8	UM35080	UM38F08	UM3CD90	UM40C18	UM44AA0

(Note): The difference between the starting numbers of adjacent tables is H20 (for 32 words).

■ Buffers 17 to 24

	Buffer 17	Buffer 18	Buffer 19	Buffer 20	Buffer 21	Buffer 22	Buffer 23	Buffer 24
Request flag control	UM44AC0	UM48948	UM4C7D0	UM50658	UM544E0	UM58368	UM5C1F0	UM60078
Request code control	UM44AC1	UM48949	UM4C7D1	UM50659	UM544E1	UM58369	UM5C1F1	UM60079
Response code control	UM44AC2	UM4894A	UM4C7D2	UM5065A	UM544E2	UM5836A	UM5C1F2	UM6007A
Axis number control	UM44AC3	UM4894B	UM4C7D3	UM5065B	UM544E3	UM5836B	UM5C1F3	UM6007B
Starting table number	UM44AC4	UM4894C	UM4C7D4	UM5065C	UM544E4	UM5836C	UM5C1F4	UM6007C
Table size	UM44AC5	UM4894D	UM4C7D5	UM5065D	UM544E5	UM5836D	UM5C1F5	UM6007D
Reserved for system	UM44AC6	UM4894E	UM4C7D6	UM5065E	UM544E6	UM5836E	UM5C1F6	UM6007E
Reserved for system	UM44AC7	UM4894F	UM4C7D7	UM5065F	UM544E7	UM5836F	UM5C1F7	UM6007F
Table no. 1	UM44AC8	UM48950	UM4C7D8	UM50660	UM544E8	UM58370	UM5C1F8	UM60080
Table no. 2	UM44AE8	UM48970	UM4C7F8	UM50680	UM54508	UM58390	UM5C218	UM600A0
Table no. 3	UM44B08	UM48990	UM4C818	UM506A0	UM54528	UM583B0	UM5C238	UM600C0
-	-	-	-	-	-	-	-	-
Table no. 100	UM45728	UM495B0	UM4D438	UM512C0	UM55148	UM58FD0	UM5CE58	UM60CE0
-	-	-	-	-	-	-	-	-
Table no. 200	UM463A8	UM4A210	UM4E098	UM51F20	UM55DA8	UM59C30	UM5DAB8	UM61940
-	-	-	-	-	-	-	-	-
Table no. 300	UM47028	UM4AEB0	UM4ED38	UM52BC0	UM56A48	UM5AD80	UM5E758	UM625E0
-	-	-	-	-	-	-	-	-
Table no. 400	UM47CA8	UM4BB30	UM4F9B8	UM53840	UM576C8	UM5B550	UM5F3D8	UM63260
-	-	-	-	-	-	-	-	-
Table no. 500	UM48928	UM4C7B0	UM50638	UM544C0	UM58348	UM5C1D0	UM60058	UM63EE0

(Note): The difference between the starting numbers of adjacent tables is H20 (for 32 words).

15.7.4.1 Control Area for Buffer Control

This area is used for reading or writing positioning data by user programs.

●: Available, -: Not available

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1</td><td>UM 06240</td><td>Request flag control</td><td>H0</td><td>Write data to this area for sending/receiving data of buffers for positioning data. After the completion of the execution, it is rewritten to H0 by FP7 MC Unit.
H0000: No request
H0001: Request
Any other settings will be errors.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 06241</td><td>Request code control</td><td>H0</td><td>Configure the control setting for sending/receiving data of buffers for positioning data.
H0080: Read request
H0081: Write request
Any other settings will be errors.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 06242</td><td>Response code control</td><td>H0</td><td>Stores the response code for the request of the buffer for positioning data.
H0000: Complete
H0001: In progress
HFF00: Setting value error</td><td>●</td><td>-</td></tr>
<tr><td>1</td><td>UM 06243</td><td>Axis number control</td><td>U1</td><td>Specify the axis number of positioning data to be transferred.<table><tr><th>Range</th><th>Corresponding axis no.</th></tr><tr><td>1-64</td><td>Corresponds to the existing axes 1 to 64.</td></tr><tr><td>65-96</td><td>Corresponds to the virtual axes 1 to 32.</td></tr></table>Any other settings will be errors.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 06244</td><td>Starting table number</td><td>U1</td><td>Specify the starting table number of positioning data to be transferred.
Range: 1 to 1000
Any other settings will be errors.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 06245</td><td>Table size</td><td>U1</td><td>Specify the table size of positioning data to be transferred.
Range: 1 to 500
Any other settings will be errors.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 06246 - UM 06247</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>

15.7.4.2 Positioning Data Setting Area

The positioning data setting area is used for reading or writing positioning data by user programs. The following table shows the offset addresses from the starting table of each buffer.

●: Available, -: Not available

<table>
<tr><th>Offset address</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>000H</td><td>Control code</td><td>H0</td><td>Set the position setting mode and acceleration/deceleration pattern for the positioning operation.
<table>
<tr><th>bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>Control method</td><td>0: Increment mode
1: Absolute mode</td></tr>
<tr><td>1</td><td>Acceleration/deceleration type</td><td>0: Linear acceleration/ deceleration
1: S-shaped acceleration/deceleration</td></tr>
<tr><td>15-2</td><td>—</td><td>—</td></tr>
</table></td><td>●</td><td>●</td></tr>
<tr><td>001H</td><td>Operation pattern</td><td>H0</td><td>Set the single and interpolation operation pattern for the positioning operation.
<table>
<tr><th>bit</th><th>Name</th><th>Description</th></tr>
<tr><td>7-0</td><td>Control pattern</td><td>H00: E-point control (End point control)
H01: P-point control (Pass point control)
H02: C-point control (Continuance point control)
H03: J-point control (Speed point control)
Any other settings will be errors.</td></tr>
<tr><td>15-8</td><td>Interpolation setting</td><td>H 00: Linear interpolation (Composite speed)
H 01: Linear interpolation (Long axis speed)
H 10: Circular interpolation (Center point/CW direction)
H 11: Circular interpolation (Center point/CCW direction)
H 20: Circular interpolation (Pass point):
H 50: Spiral interpolation (Center point/CW direction/1st axis movement)
H 51: Spiral interpolation (Center point/CCW direction/1st axis movement)
H 52: Spiral interpolation (Center point/CW direction/2nd axis movement)
H 53: Spiral interpolation (Center point/CCW direction/2nd axis movement)
H 54: Spiral interpolation (Center point/CW direction/3rd axis movement)
H 55: Spiral interpolation (Center point/CCW direction/3rd axis movement)
H 60: Spiral interpolation (Pass point/1st axis movement)
H 61: Spiral interpolation (Pass point/2nd axis movement)
H 62: Spiral interpolation (Pass point/3rd axis movement)
Any other settings will be errors.</td></tr>
</table>
In the interpolation control, the setting for the axis with the smallest number in an axis group is effective.</td><td>●</td><td>●</td></tr>
<tr><td>002H -003H</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>004H</td><td>Positioning acceleration time</td><td>U100</td><td rowspan="2">Set the acceleration and deceleration time for the positioning operation.
Range: 0 to 10,000 [ms]
Any other settings will be errors. In the interpolation control, the setting for the axis with the smallest number in an axis group is effective.</td><td>●</td><td>●</td></tr>
<tr><td>005H</td><td>Positioning deceleration time</td><td>U100</td><td>●</td><td>●</td></tr>
</table>

●: Available, -: Not available

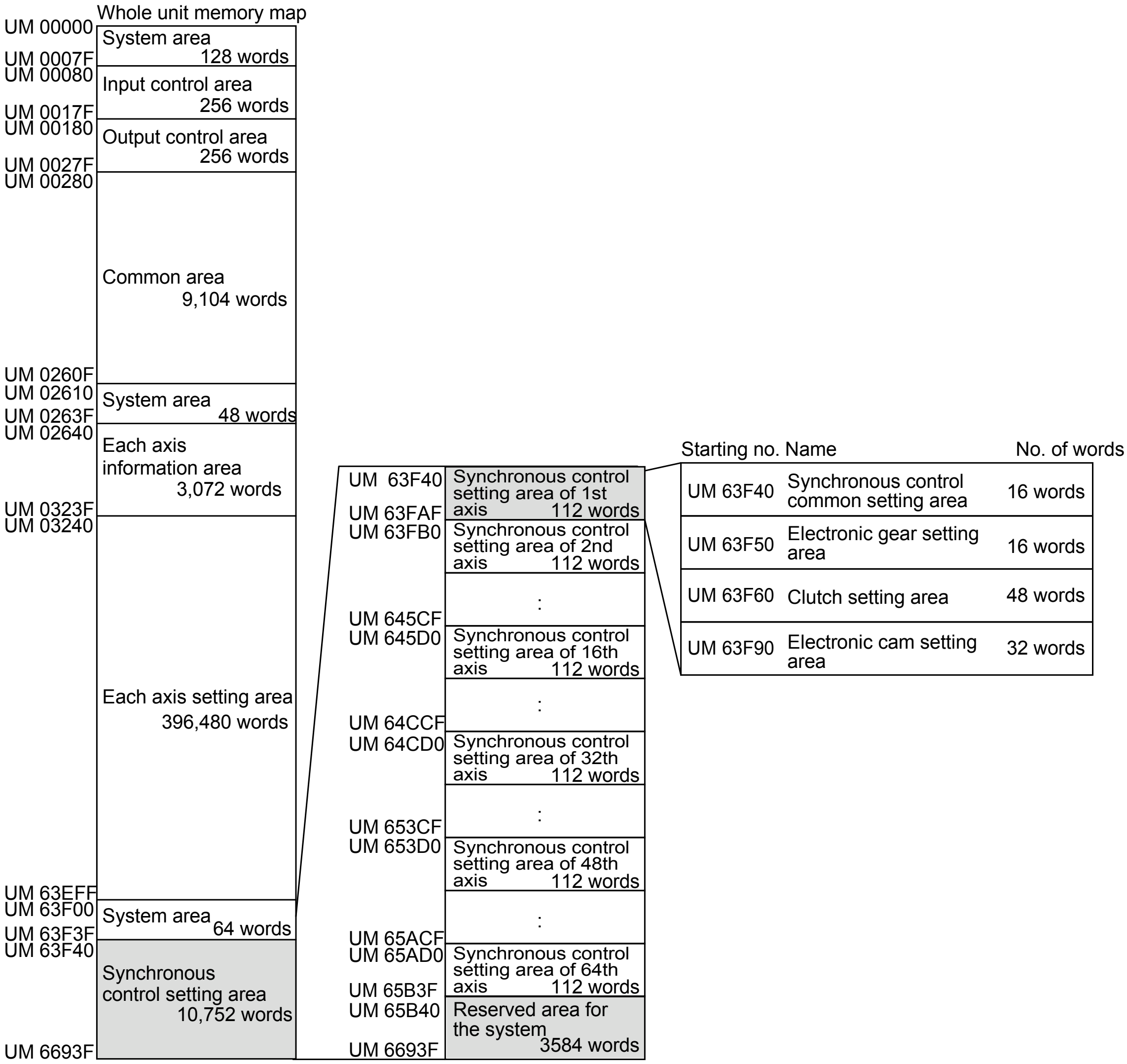
Offset address	Name	Default	Description	R	W
006H -007H	Positioning target speed (Interpolation speed)	U1000	In case of the individual operation (no interpolation), it is the target speed of the corresponding axis. In case of the interpolation operation, it is the target speed of the interpolation. In the interpolation operation, the setting for the axis with the smallest number in an axis group is effective. Range: 1 to 32,767,000 Any other settings will be errors. The ranges vary depending on the unit settings as below. pulse: 1 to 32,767,000 pps μm: 1 to 32,767,000 μm/s inch: 0.001 to 32,767.000 inch/s degree: 0.001 to 32,767.000 rev/s	●	●
008H -009H	Positioning movement amount	K0	Set the position command value for the positioning operation. It is the movement amount in the case of increment, and coordinate in the case of absolute depending on the control code setting. Range: -2147483648 to +2147483647 Any other settings will be errors. The ranges vary depending on the unit settings as below. pulse: -2147483648 to +2147483647 pulse μm (0.1μm): -214748364.8 to +214748364.7 μm μm (1μm): -2147483648～+2147483647 μ m inch (0.00001 inch): -2147483648 to +2147483647 inch inch (0.0001 inch): -214748.3648 to +214748.3647 inch degree (0.1 degree): -214748364.8 to +214748364.7 degree degree (1 degree): -2147483648 to +2147483647 degree	●	●
00AH -00BH	Auxiliary point	K0	Set the auxiliary point (coordinate of center or pass point) in the case of circular interpolation or sprial interpolation control. Range: -2147483648 to +2147483647 Any other settings will be errors. The ranges vary depending on the unit settings as below. pulse: -2147483648 to +2147483647 pulse μm (0.1μm): -214748364.8 to +214748364.7 μm μm (1μm): -2147483648 to +2147483647μm inch (0.00001 inch): -2147483648 to +2147483647 inch inch (0.0001 inch): -214748.3648 to +214748.3647 inch degree (0.1 degree): -214748364.8 to +214748364.7 degree degree (1 degree): -2147483648 to +2147483647 degree	●	●

●: Available, -: Not available

Offset address	Name	Default	Description	R	W
00CH	Dwell time	U0	Set the dwell time. Range: 0 to 32,767 [ms] Any other settings will be errors.	●	●
00DH	Auxiliary output code	U0	Set arbitrary data as auxiliary output codes when using the auxiliary output function.	●	●
00EH -00FH	Reserved for system	—	—	-	-

15.8 Unit Memories (Synchronous Control Setting Area)

15.8.1 Configuration of Synchronous Control Setting Area



15.8.2 Sychronous Control Setting Area

●: Available, -: Not available

<table>
<tr><th>Axis no.</th><th>Unit memory no. (Hex)</th><th>Name</th><th>Default</th><th>Description</th><th>R</th><th>W</th></tr>
<tr><td>1</td><td>UM 63F40</td><td>synchronous master axis selection</td><td>H0</td><td>Set the synchronous master axis for each axis.
<table>
<tr><th colspan="2">Value</th><th>Setting</th></tr>
<tr><td>H 0000</td><td>U0</td><td>The target axis is the master axis.</td></tr>
<tr><td>H 0001</td><td>U1</td><td>Axis 1</td></tr>
<tr><td>H 0002</td><td>U2</td><td>Axis 2</td></tr>
<tr><td>-----</td><td>-----</td><td>-----</td></tr>
<tr><td>H 0010</td><td>U16</td><td>Axis 16</td></tr>
<tr><td>-----</td><td>-----</td><td>-----</td></tr>
<tr><td>H 0020</td><td>U32</td><td>Axis 32</td></tr>
<tr><td>-----</td><td>-----</td><td>-----</td></tr>
<tr><td>H 0040</td><td>U64</td><td>Axis 64</td></tr>
<tr><td>H 0041</td><td>U65</td><td>Virtual axis 1</td></tr>
<tr><td>-----</td><td>-----</td><td>-----</td></tr>
<tr><td>H 0060</td><td>U96</td><td>Virtual axis 32</td></tr>
</table>
Any other settings will be errors.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 63F41</td><td>Synchronous output function selection</td><td>H0</td><td>Set the synchronous function for each axis.
<table>
<tr><th>bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>Electronic gear operation setting</td><td rowspan="3">0: Not use
1: Use</td></tr>
<tr><td>1</td><td>Clutch operation setting</td></tr>
<tr><td>2</td><td>Electronic operation setting</td></tr>
<tr><td>15-3</td><td>Area reserved for system</td><td>—</td></tr>
</table></td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 63F42</td><td>Synchronous slave single deceleration stop deceleration method</td><td>H0</td><td>
<table>
<tr><th>bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>Not used</td><td></td></tr>
<tr><td>1</td><td>Deceleration method</td><td>0: Linear
1 : -</td></tr>
<tr><td>15-3</td><td>Area reserved for system</td><td>—</td></tr>
</table></td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 63F43</td><td>Synchronous slave single deceleration stop deceleration time</td><td>U100</td><td>Set the deceleration time when performing the deceleration stop during the synchronous operation.
Range: 0 to 10,000 [ms]
Any other settings will be errors.</td><td>●</td><td>●</td></tr>
<tr><td>1</td><td>UM 63F44 -UM 63F4F</td><td>Reserved for system</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>

(Note): The above table shows the unit memory numbers of axis number 1. For details of the whole configuration, refer to "15.8.1 Configuration of Synchronous Control Setting Area".

15.8.3 Electronic Gear Setting Area

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1	UM 63F50 -UM 63F51	Gear ratio numerator of each axis	U1	Set the numerator and denominator for the gear ratio of electronic gear separately. Range: U1 to U2147483647 Electronic gear ratio is determined by the following formula. Output speed of electronic gear = Operating speed of master axis x (Gear ratio numerator/Gear ratio denominator)	●	●
1	UM 63F52 -UM 63F53	Gear ratio denominator of each axis	U1		●	●
1	UM 63F54	Gear ratio change time of each axis	U1	Set the time required to change the current gear ratio to a new gear ratio when the new gear ratio is set for the electronic gear in operation. 1 to 10000 [ms]	●	●
1	UM 63F55 -UM 63F5F	Reserved for system	-	-	-	-

(Note): The above table shows the unit memory numbers of axis number 1. For details of the whole configuration, refer to "15.8.1 Configuration of Synchronous Control Setting Area".

15.8.4 Clutch Setting Area

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1	UM 63F60	Clutch ON trigger type	H0	H0: I/O clutch ON request	●	●
1	UM 63F61	Clutch ON edge selection	H0	Set the valid condition of trigger signals. H0: Level H1: Leading edge H2: Trailing edge	●	●
1	UM 63F62 -UM 63F67	Reserved for system	-	-	-	-
1	UM 63F68	Clutch OFF trigger type	H0	H0: I/O clutch OFF request	●	●
1	UM 63F69	Clutch OFF edge selection	H0	Set the valid condition of trigger signals. This item is unavailable when the clutch ON edge selection is set to "H0: Level". H0: Disabled H1: Leading edge H2: Trailing edge	●	●
1	UM 63F6A -UM 63F6F	Reserved for system	-	-	-	-

(Note): The above table shows the unit memory numbers of axis number 1. For details of the whole configuration, refer to "15.8.1 Configuration of Synchronous Control Setting Area".

●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1	UM 63F70	Clutch ON method	H0	Select the clutch ON method. H0: Direct H1: Slip	●	●
1	UM 63F71	Reserved for system	-	-	-	-
1	UM 63F72	Clutch ON slip method	H0	H0: Slip time setting	●	●
1	UM 63F73	Clutch ON slip time	U1	Set a slip time when the clutch ON method is set to "H1: Slip". 1 to 10000 [ms]	●	●
1	UM 63F74 -UM 63F75	Reserved for system	-	-	-	-
1	UM 63F76	Clutch ON slip curve selection	H0	H0: Linear	●	●
1	UM 63F77 -UM 63F7F	Reserved for system	-	-	-	-
1	UM 63F80	Clutch OFF method	H0	Select the clutch OFF method. H0: Direct H1: Slip	●	●
1	UM 63F81	Reserved for system	-	-	-	-
1	UM 63F82	Clutch OFF slip method	H0	H0: Slip time setting	●	●
1	UM 63F83	Clutch OFF slip time	U1	Set a slip time when the clutch OFF method is set to "H1: Slip". 1 to 10000 [ms]	●	●
1	UM 63F84 -UM 63F85	Reserved for system	-	-	-	-
1	UM 63F86	Clutch OFF slip curve selection	H0	H0: Linear	●	●
1	UM 63F87 -UM 63F8F	Reserved for system	-	-	-	-

(Note): The above table shows the unit memory numbers of axis number 1. For details of the whole configuration, refer to "15.8.1 Configuration of Synchronous Control Setting Area".

15.8.5 Electronic Cam Setting Area

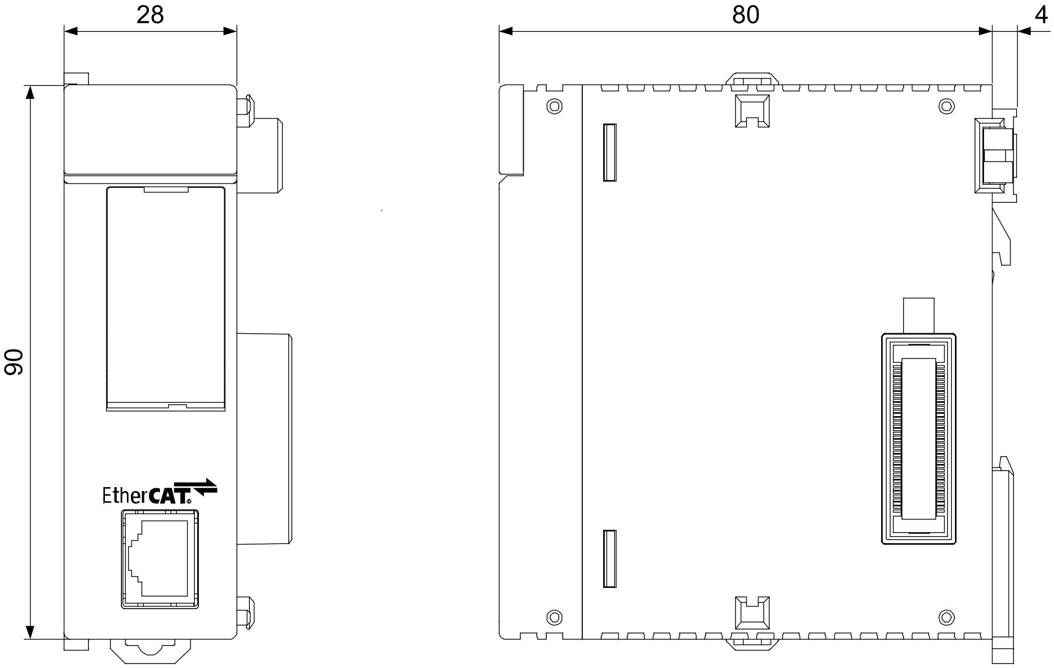
●: Available, -: Not available

Axis no.	Unit memory no. (Hex)	Name	Default	Description	R	W
1	UM 63F90 -UM 63F91	Cam control synchronous master axis cycle	U1	Set the cam control synchronous master cycle. U1 to U2147483647	●	●
1	UM 63F92	Reserved for system	-	-	-	-
1	UM 63F93	Cam pattern number	U1	Set the registered cam pattern number to be used. 1 to 256	●	●
1	UM 63F94 -UM 63F95	Cam stroke amount	U1	Displacement amount upper limit setting for cam control U1 to U2147483647	●	●
1	UM 63F96 -UM 63FAF	Reserved for system	-	-	-	-

(Note): The above table shows the unit memory numbers of axis number 1. For details of the whole configuration, refer to "15.8.1 Configuration of Synchronous Control Setting Area".

15.9 Dimensions

■ **AFP7MC16EC/ AFP7MC32EC/ AFP7MC64EC**



(Unit: mm)

Record of changes

Manual No.	Date	Record of Changes
WUME-FP7MCEC-01	Sep. 2016	1st Edition

Please contact ....

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